Verification Report

ILX Calcs v1.0.0 · calculation types covered: Steel beam, Steel column, Steel section selection, Steel joist, Steel deck (gravity), Steel deck diaphragm, Steel beam with torsion, Eccentric bolt group, Eccentric weld group, Member stability bracing, Cold-formed steel joist, Cold-formed steel header, Cold-formed steel bridging, Cold-formed steel strap braced wall, Cold-formed steel purlin, Cold-formed steel curtain wall, Cold-formed steel rafter, Cold-formed steel fastener connection, Concrete-filled HSS column, Steel stair, Steel lintel, Floor vibration, Beam with web openings, Crane runway beam, Castellated or cellular beam, Guard or barrier post, Monorail beam, Steel tension member / brace, Concentrated forces on beams, Steel fire resistance, Roof ponding, Seismic member checks, Encased composite column, Plate girder, Web-tapered member, Composite beam, Column base plate, Anchors in concrete, Rebar development and splices, Sawn lumber beam, Glulam and SCL beam, Wood column and post, Wood stud wall, CLT panel, Wood bearing and notches, Wood shear wall, Wood diaphragm, Wood fastener connection, Wood ledger, Continuous rod tie-down, CLT shear wall, Wood stair, Wood I-joist, Rafters and ceiling ties, Fire design of exposed wood, Wood deck framing, Split-ring and shear-plate connections, Wood design values, Wood shrinkage and moisture, Steel side and knife plate connections, Moment and eccentric fastener groups, Timber rivet connections, Notched and tapered member ends, Wood floor vibration, Built-up and spaced columns, Round timber poles and piles, Curved and tapered glulam, Concrete beam, Concrete column, One-way slab, Two-way slab, Concrete shear wall, Tilt-up wall panel, Corbel, Coupling beam, Dapped-end beam, Bearing on concrete, Joist and waffle slab, Continuous concrete beam, Prestressed concrete beam, Concrete stair, Concrete fire resistance, Spread footing, Pole footing, Wall footing, Combined footing, Mat foundation, Pile cap, Slab on grade point loads, Beam on elastic foundation, Pile group, Laterally loaded pile, Retaining wall, Basement (restrained) retaining wall, Gravity retaining wall, Gabion retaining wall, Segmental retaining wall, Soldier pile wall, Bearing capacity and settlement, Pile axial capacity, Masonry shear wall, Masonry column and pilaster, Masonry lintel and beam, Masonry wall out-of-plane, Masonry pilaster with wall, Masonry bearing, Masonry anchor bolts, Masonry wall at openings, Anchored veneer, Adhered veneer, Masonry lap splice, Masonry retaining wall, Unreinforced masonry wall, Masonry infill, Prestressed masonry wall, AAC masonry wall, Glass unit masonry, Freestanding masonry wall, Masonry fire resistance, Masonry strength f'm, Empirical masonry design, Corbelled masonry, Masonry parapet, Ledger to masonry wall, Masonry arch, Bond beam chord and collector, Movement joints, Masonry partition wall, Masonry chimney, Masonry beam and deep beam, Cold-formed steel stud, Cold-formed steel shear wall, Wind loads, Seismic base shear (ELF), Load takeoff, Snow loads, Wind on other structures, Rigid diaphragm torsion, Seismic nonstructural components, Seismic wall anchorage, Live load reduction, Atmospheric ice loads, Simplified seismic design, Nonbuilding structures (seismic), Continuous beam analysis, 2-D frame analysis, 2-D truss analysis, Wood truss, Steel truss, Cold-formed steel truss, Section properties, Unit converter, Flitch-plate beam, Post-tensioned slab strip, Beam-column joint, Sheet pile wall, Lateral pressure from surface loads, Tornado loads, Flood loads, Wall and pier rigidity, Plate bending, Effective length factor, Moving load, Dead load build-up, Embed plate, Concrete diaphragm, Deep beam (strut-and-tie), Shear friction, Punching shear, Post-installed anchors, Load combinations, Rain load, Load chasedown, Diaphragm forces, Story drift and P-delta, Seismic site parameters and spectrum, Wind loads, envelope procedure, Strap footing, Cold-formed steel clip angle, Cold-formed steel parapet, Cold-formed steel diaphragm, Cold-formed steel ceiling framing, Cold-formed steel girt, Built-up cold-formed steel member, Cold-formed steel jamb studs, Cold-formed steel track, Web holes in cold-formed members, Cold-formed steel track anchorage, Cold-formed steel floor vibration, Cold-formed steel soffit framing, Cold-formed steel bypass and infill framing, Sheathing-braced cold-formed steel stud, Cold-formed steel special bolted moment frame, Cold-formed steel shear wall chord studs, Cold-formed steel truss bracing, Cold-formed steel storage rack, Cold-formed steel sloped and mansard wall, Beam with varying stiffness, Cable and catenary, Natural frequency and dynamic response, Stress transformation, Custom calculation, Thermal movement, Quantity takeoff, Rebar tables, Roof geometry, Shape browser and comparison, Influence lines, Arch analysis, Beam grid (grillage), Laterally loaded pile (p-y), Drilled pier, Helical pile, Pile capacity from CPT, Braced excavation, Slope stability, Liquefaction triggering, Ground improvement, Modal response spectrum, Gust-effect factor, Impact and machinery loads, Fall-protection anchorage, Fluid and hydrostatic pressure, Special moment frame members, Ledge and inverted-tee beam, Hollow-core plank, Concrete deflection, Liquid-containing tank wall, Micropile, Ground anchor

Code basis

ACI 318-19 25.4.3.1 (by hand); ACI 318-19 Eq. 25.4.2.4a (by hand); ACI 318-19 Table 22.5.5.1(a); ACI 318-19 Table 25.4.2.3 (by hand); ACI E702.4 Example Problems; ACI MNL-17(21); ACI SP-17(14); AISC 360-22 Commentary; AISC 360-22 Commentary C2; AISC Design Examples v16.0; AISC Design Examples v16.0 (Companion to the Manual; AISC Design Guide 1; AISC Design Guide 11; AISC Design Guide 13 (1999); AISC Design Guide 19 (2003); AISC Design Guide 2 (1990; AISC Design Guide 25 (2nd Ed.; AISC Design Guide 28; AISC Design Guide 31 (2017); AISC Design Guide 34 (2018); AISC Design Guide 7; AISC Design Guide 9; AISC Manual 16th Ed.; AISC Shapes Database v16.0; AISC Shapes Database v16.0 (Manual Table 1-1); AISC Steel Construction Manual; AISI RP20-5 (2020); AISI S100-16 Commentary; AISI S100-16 J7.2.2 (printed constants) and hand calculations; AISI S240-20; AISI S240-20 Table B3.2-1 (printed) and hand calculations; AISI S310-20 with S1-22; AISI S400-15 w/S1-16 Table E1.3-1; AISI S400-15 w/S1-16 Table E1.3-1 and Eq. E1.3.1.1-2; AISI S400-15 w/S1-16 Table E1.3-1 and Section E1.3.1.1.2; AISI S400-15 w/S1-16 Table E2.3-1; AISI S400-20; ANSI/APA PRG 320-19 Table A2 (recalled; PRG 320 not on disk); APA Technical Note T555C; APA Z725H-2022; ASCE 7-22; ASCE 7-22 Commentary; ASCE 7-22 Table 3.2-1; ASCE 7-22 Table 32.10-1; ASCE 7-22 Tables C5.4-2; ASCE/SEI 7-22; ASCE/SEI 7-22 Commentary; ASCE/SEI 7-22 Commentary C7; ASCE/SEI 7-22 Commentary C8.2; ASCE/SEI 7-22 Commentary Table C26.11-1; ASCE/SEI 7-22 Fig. 26.8-1; ASCE/SEI 7-22 Fig. 30.3-1; ASCE/SEI 7-22 Fig. 30.3-2A; ASCE/SEI 7-22 Fig. 30.3-2B; ASCE/SEI 7-22 Fig. 30.3-2C; ASCE/SEI 7-22 Fig. 30.3-2D; ASCE/SEI 7-22 Fig. 30.3-2E; ASCE/SEI 7-22 Fig. 30.3-2F; ASCE/SEI 7-22 Fig. 30.3-2G; ASCE/SEI 7-22 Table 26.10-1; ASCE/SEI 7-22 Table C8.2-1; ASCE/SEI 7-22 Table C8.2-3; ASCE/SEI 7-22 Table C8.2-5; ASDIP; ASTM A615/A615M Table 1; AWC 2015/2018 Structural Wood Design Examples; AWC DCA 6-2015 Table 2; AWC DCA 6-2015 Table 3A; AWC DCA 6-2015 Table 4; AWC DCA 6-2015 Table 5; AWC NDS 2024; AWC NDS 2024 (National Design Specification for Wood Construction); AWC STJR-2024; AWC Structural Wood Design Examples 2015/2018; AWC Technical Report 12; AWC Technical Report 14; Aghayere & Vigil; ArcelorMittal catalog; ArcelorMittal catalog (published); BIA Technical Note 31B (1987); BIA Technical Note 3C (July 2026); Batista; Blevins; Breyer; CE-Ref.com; CFSEI Design Guide 8 (2000); CMACN Masonry Chronicles; CMHA CMU-TEC-002-23; CMHA TEK 12-03C; CMHA TEK 12-03C (2013 code); CMHA TEK 14-20A; CMHA TEK 14-23; CMHA TEK 15-07B; CRSI; CRSI Manual of Standard Practice; CalcBook; Caltrans Trenching and Shoring Manual (2025); Chopra; ClearCalcs; CodeCogs; Connecticut DAS; Das; DeStefano; Dlubal; F. Udoeyo; FCC Technical Report 65 (1974); FEMA P-1051; FEMA P-1051 (2015 NEHRP Provisions: Design Examples); FEMA P-1051 (2015); FEMA P-2192-V1 (2020 NEHRP Provisions Design Examples); FEMA P-2192-V1 (2020 NEHRP Recommended Seismic Provisions: Design Examples); FEMA P-2192-V1 (2020); FEMA P-55 Vol. II (2011); FHWA GEC 10; FHWA GEC 13; FHWA GEC 4 (FHWA-IF-99-015; FHWA HI-97-013 (1998); FHWA IF-02-054 (2002) GEC 6; FHWA NHI-18-024 (2018) GEC 10; FHWA-NHI-16-064 (2016); Gere and Goodno; HUD; HUD PDR-20490; HUD Residential Structural Design Guide; HUD Residential Structural Design Guide (2017); Hand; Hand addition of the commentary's values; Hand calculation; Hand calculation (NDS 2024 equations; Hand calculation (Terzaghi's expression as given by Bowles); Hand calculation (closed form; Hand calculation (closed form printed in AISC Design Guide 28; Hand calculation (closed form); Hand calculation (closed form) from AISI S310-20 and S100-16; Hand calculation (closed form); inputs on the basis of TEK 15-07B Table 1; Hand calculation (closed form: beam formulas; Hand calculation (closed form: shear-building modes; ASCE/SEI 7-22 12.8; Hand calculation (criteria from knowledge; Hand calculation (right-triangle trigonometry); Hand calculation (right-triangle trigonometry); framing-square rafter table (to confirm); Hand calculation from ACI 318-19 Table 15.4.2.3; Hand calculation from ACI 318-19 Table 18.8.4.3; Hand calculation from AISC 360-22 Commentary Eq. C-A-7-1 and C-A-7-2; Hand calculation from ASCE 7-22 5.4.2; Hand calculation from ASCE 7-22 Eq. 5.4-2; Hand calculation from ASCE 7-22 Eq. 5.4-7; Hand calculation from ASCE 7-22 Eq. 5.4-8; Hand calculation from ASCE 7-22 Eq. C5.4-3; Hand calculation from ASCE 7-22 and TMS 402; Hand calculation from Commentary Eq. C-A-7-5; Hand calculation from Commentary Eq. C-A-7-8; Hand calculation from IBC 2021 722.2; Hand calculation from IBC 2021 722.3 and 722.4; Hand calculation from NDS 2024; Hand calculation from TMS 402-16 13.3.3; Hand calculation from TMS 402-16 5.5 and 8.2; Hand calculation from TMS 402-16 Appendix A; Hand calculation from TMS 402-16 Chapter 11 (no published AAC wall example on disk); Hand calculation from TMS 602-16 Table 2 and its footnote; Hand calculation from UFS 3-220-10 Figure 7-4 data; Hand calculation from the cited equations; Hand calculation from the cited equations (no published example exists); Hand calculation from the cited equations (no published example); Hand calculation from the cited sections; Hand calculation of the Zia et al. (1979) expressions as written in calcs/prestress.py; Hand calculation on the basis of AWC DCA6-2015 Table 6; Hand calculation: Boulanger and Idriss (2014); Hand calculation: Heténi (1946) closed form; FHWA GEC 9 (2018) Eqs. A-1; Hand calculation: Iowa DOT TR-800 (2023) 4.6.1 to 4.6.3; IBC 2024 1810.3.3.1.9; Hand calculation: TMS 402-13 Commentary 9.3.3.5 equation (closed form); Hand calculation: UFS 3-220-20 (2026) 6-5.4.4; FHWA GEC 12 (2016) 7.2.1.3.6; Hand calculation: UFS 3-220-20 (2026) Figure 4-51; Heténi; Hilti PROFIS Engineering report; Huang; Hubbell / Chance; IAPMO UES ER-2018; IBC 2021 Table 722.2.1.1; IBC 2021 Table 722.2.2.1; IBC 2021 Table 722.2.4; IBC 2021 Table 722.3.2; IBC 2021 Table 722.4.1(1); IBC 2021 Tables 722.2.3(1) to (4); IRC 2018 Table R802.5.2; IRC 2021 Table R507.9.1.3(1) / AWC DCA 6-09 Prescriptive Residential Wood Deck Construction Guide; IRC 2021 Table R802.5.2(1); Intsel Steel; Ioannides; J. Encinas; Kouretzis; L. Yaw; MBMA Roof Framing Design Guide (2024); MDG Example 9.2-1; MDG Table 9.2.5; Maplesoft; NCMA / CMHA TEK 17-01D; NCMA TEK 14-03A; NCSEA Wind Engineering Committee; NDS 2024 Appendix E; NDS 2024 Figure 15C; NDS 2024 Figure 15D; NDS 2024 Supplement; NDS 2024 Supplement Table 6B; NDS 2024 Table 11.3.6B; NDS 2024 Table 12A; NDS 2024 Table 12N; NDS 2024 Table 13.2A; NDS 2024 Table 13.2B; NDS 2024 Table 13.2B footnote 2; Table 13.2.4; NDS 2024 Table 14.2.1A; NDS 2024 Table 14.2.1C; NDS 2024 Table 14.2.2A; NDS 2024 Table 14.2.3; NDS 2024 Table 14.3.2; NDS 2024 Table 16.3.1; NDS 2024 Table 16.3.2; NDS 2024 Table 6.3.11; NDS 2024 Table 6.3.5; NIST SP 811 (2008); NIST SP 811 (2008) Appendix B (exact definitions); NIST SP 811 (2008) Appendix B.8; Nucor / Vulcraft lecture; PCI Design Handbook 8th Ed.; PDHonline

	Course S235; PDHonline S235 (IBC Eq. 18-1); Pavement Interactive; Qaisar Ali; SEAOC 2018 IBC SDM Vol. 1; SJI 100-2020 Standard Specification: Tables 4.6-1; SJI Code of Standard Practice for Steel Joists and Joist Girders (COSP 2020); SJI webinar Properly Specifying Steel Joists (2019); SSMA 2022 Product Technical Guide; SSMA Product Technical Guide (2022); Simpson Strong-Tie SE Blog (2020); Steel Tube Institute; StructurePoint; StructurePoint DE-CNB-ACI14; StructurePoint DE-GF-ACI; StructurePoint DE-PSC-ACI; StructurePoint DE-SSO-ACI14; StructurePoint DE-STM-ACI14; StructurePoint DE-TWFP-ACI14; Structville (Uzodimma 2019); TM 5-809-3 / NAVFAC DM-2.9 (1992); TMS; TMS 402-16 Appendix A; TMS 402-16 Chapter 13; TMS 402-16 Figure 13.2-1; TMS 602-16 Table 1 (clay masonry units); TMS 602-16 Table 2 (concrete masonry units); TMS MDG-2022 Example 11.3-1 (sample examples on disk); TMS MDG-2022 Example 12.4-2A (sample examples on disk); TMS Masonry Designers' Guide 2022; TMS Night School handout; TMS webinar Anchor Bolt Design; TMS webinar SD Walls Axial and Out-of-Plane Loads; Tanner (1985); The Masonry Society; The Masonry Society webinar; Tucker; UFC 3-220-01A (2004); UFC 3-320-06 (2025); UFS 3-220-10 (DM7.1; UFS 3-220-20 (2026); UFS 3-220-20 (DM7.2; USACE ITL-89-3 (1989); Udoeyo; Udoeyo (2020); VCmaster US catalog; VCmaster US catalog (ACI 318-11); VCmaster US template catalog; Vulcraft; Vulcraft PunchLok II Roof Deck Design Guide and Catalog (Dec. 2016); W. McGuire; Westergaard (1926); WoodWorks; WoodWorks Carrigg 2023; WoodWorks DE-2025
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Printed	2026-11-13

Tests	tests/test_verify_aac_masonry.py, tests/test_verify_adhered_veneer.py, tests/test_verify_anchored_veneer.py, tests/test_verify_arch_analysis.py, tests/test_verify_basement_wall.py, tests/test_verify_beam_analysis.py, tests/test_verify_beam_variable_ei.py, tests/test_verify_beam_web_opening.py, tests/test_verify_bearing_capacity.py, tests/test_verify_bolt_group.py, tests/test_verify_braced_excavation.py, tests/test_verify_cable.py, tests/test_verify_castellated_beam.py, tests/test_verify_cfs_bridging.py, tests/test_verify_cfs_builtup_member.py, tests/test_verify_cfs_bypass.py, tests/test_verify_cfs_ceiling.py, tests/test_verify_cfs_chord_stud.py, tests/test_verify_cfs_clip.py, tests/test_verify_cfs_connection.py, tests/test_verify_cfs_curtain_wall.py, tests/test_verify_cfs_diaphragm.py, tests/test_verify_cfs_floor_vibration.py, tests/test_verify_cfs_girt.py, tests/test_verify_cfs_header.py, tests/test_verify_cfs_jamb.py, tests/test_verify_cfs_joist.py, tests/test_verify_cfs_mansard.py, tests/test_verify_cfs_moment_frame.py, tests/test_verify_cfs_parapet.py, tests/test_verify_cfs_purlin.py, tests/test_verify_cfs_rafter.py, tests/test_verify_cfs_shearwall.py, tests/test_verify_cfs_sheathing_braced.py, tests/test_verify_cfs_soffit.py, tests/test_verify_cfs_storage_rack.py, tests/test_verify_cfs_strap_wall.py, tests/test_verify_cfs_stud.py, tests/test_verify_cfs_track.py, tests/test_verify_cfs_track_anchorage.py, tests/test_verify_cfs_truss.py, tests/test_verify_cfs_truss_bracing.py, tests/test_verify_cfs_web_holes.py, tests/test_verify_clt_panel.py, tests/test_verify_clt_shearwall.py, tests/test_verify_combined_footing.py, tests/test_verify_composite_beam.py, tests/test_verify_composite_column.py, tests/test_verify_concrete_anchor.py, tests/test_verify_concrete_beam.py, tests/test_verify_concrete_bearing.py, tests/test_verify_concrete_column.py, tests/test_verify_concrete_continuous_beam.py, tests/test_verify_concrete_deflection.py, tests/test_verify_concrete_diaphragm.py, tests/test_verify_concrete_fire.py, tests/test_verify_concrete_smf.py, tests/test_verify_concrete_stair.py, tests/test_verify_concrete_tank_wall.py, tests/test_verify_concrete_wall.py, tests/test_verify_corbel.py, tests/test_verify_coupling_beam.py, tests/test_verify_cpt_pile.py, tests/test_verify_crane_runway.py, tests/test_verify_curved_glulam.py, tests/test_verify_custom_calc.py, tests/test_verify_dapped_end.py, tests/test_verify_dead_load_buildup.py, tests/test_verify_deck_diaphragm.py, tests/test_verify_deep_beam_stm.py, tests/test_verify_diaphragm_forces.py, tests/test_verify_diaphragm_torsion.py, tests/test_verify_drilled_pier.py, tests/test_verify_earth_surcharge.py, tests/test_verify_effective_length.py, tests/test_verify_elastic_foundation_beam.py, tests/test_verify_embed_plate.py, tests/test_verify_fall_protection.py, tests/test_verify_filled_hss_column.py, tests/test_verify_flitch_beam.py, tests/test_verify_flood_loads.py, tests/test_verify_floor_vibration.py, tests/test_verify_fluid_pressure.py, tests/test_verify_frame_2d.py, tests/test_verify_frame_2d_stability.py, tests/test_verify_gabion_wall.py, tests/test_verify_glass_unit_masonry.py, tests/test_verify_glulam_beam.py, tests/test_verify_gravity_wall.py, tests/test_verify_grillage.py, tests/test_verify_ground_anchor.py, tests/test_verify_ground_improvement.py, tests/test_verify_guard_post.py, tests/test_verify_helical_pile.py, tests/test_verify_hollow_core_plank.py, tests/test_verify_ice_loads.py, tests/test_verify_impact_loads.py, tests/test_verify_influence_lines.py, tests/test_verify_inverted_tee_ledge.py, tests/test_verify_joist_slab.py, tests/test_verify_lateral_pile.py, tests/test_verify_lateral_pile_py.py, tests/test_verify_liquefaction.py, tests/test_verify_live_load_reduction.py, tests/test_verify_load_chasedown.py, tests/test_verify_load_combinations.py, tests/test_verify_load_takeoff.py, tests/test_verify_masonry_anchor.py, tests/test_verify_masonry_arch.py, tests/test_verify_masonry_beam.py, tests/test_verify_masonry_bearing.py, tests/test_verify_masonry_bond_beam.py, tests/test_verify_masonry_chimney.py, tests/test_verify_masonry_column.py, tests/test_verify_masonry_corbel.py, tests/test_verify_masonry_empirical.py, tests/test_verify_masonry_fence.py, tests/test_verify_masonry_fire.py, tests/test_verify_masonry_fm.py, tests/test_verify_masonry_infill.py, tests/test_verify_masonry_jamb.py, tests/test_verify_masonry_lap_splice.py, tests/test_verify_masonry_ledger.py, tests/test_verify_masonry_lintel.py, tests/test_verify_masonry_movement.py, tests/test_verify_masonry_parapet.py, tests/test_verify_masonry_partition.py, tests/test_verify_masonry_pilaster.py, tests/test_verify_masonry_retaining.py, tests/test_verify_masonry_slender_wall.py, tests/test_verify_masonry_unreinforced.py, tests/test_verify_masonry_wall.py, tests/test_verify_mat_foundation.py, tests/test_verify_micropile.py, tests/test_verify_mohr_circle.py, tests/test_verify_monorail_beam.py, tests/test_verify_moving_load.py, tests/test_verify_one_way_slab.py, tests/test_verify_pile_cap.py, tests/test_verify_pile_capacity.py, tests/test_verify_pile_group.py, tests/test_verify_plate_bending.py, tests/test_verify_plate_girder.py, tests/test_verify_pole_footing.py, tests/test_verify_post_installed_anchor.py, tests/test_verify_prestressed_masonry.py, tests/test_verify_pt_beam.py, tests/test_verify_pt_slab_strip.py, tests/test_verify_punching_shear.py, tests/test_verify_quantity_takeoff.py, tests/test_verify_rain_load.py, tests/test_verify_rc_joint.py, tests/test_verify_rebar_development.py, tests/test_verify_rebar_tables.py, tests/test_verify_retaining_wall.py, tests/test_verify_rod_tiedown.py, tests/test_verify_roof_geometry.py, tests/test_verify_sdof_dynamics.py, tests/test_verify_section_properties.py, tests/test_verify_segmental_wall.py, tests/test_verify_seismic_elf.py, tests/test_verify_seismic_modal.py, tests/test_verify_seismic_nonbuilding.py, tests/test_verify_seismic_nonstructural.py, tests/test_verify_seismic_simplified.py, tests/test_verify_seismic_spectrum.py, tests/test_verify_shape_compare.py, tests/test_verify_shear_friction.py, tests/test_verify_sheet_pile.py, tests/test_verify_slab_on_grade.py, tests/test_verify_slope_stability.py, tests/test_verify_snow_loads.py, tests/test_verify_soldier_pile_wall.py, tests/test_verify_spread_footing.py, tests/test_verify_stability_bracing.py, tests/test_verify_steel_base_plate.py, tests/test_verify_steel_beam.py, tests/test_verify_steel_column.py, tests/test_verify_steel_deck.py, tests/test_verify_steel_fire.py, tests/test_verify_steel_joist.py, tests/test_verify_steel_lintel.py, tests/test_verify_steel_ponding.py, tests/test_verify_steel_seismic_member.py, tests/test_verify_steel_select.py, tests/test_verify_steel_stair.py, tests/test_verify_steel_tension_member.py, tests/test_verify_steel_torsion.py, tests/test_verify_steel_truss.py, tests/test_verify_steel_web_local.py, tests/test_verify_story_drift.py, tests/test_verify_strap_footing.py, tests/test_verify_stud_wall.py, tests/test_verify_tapered_member.py, tests/test_verify_thermal_movement.py, tests/test_verify_tilt_up_panel.py, tests/test_verify_timber_connector.py, tests/test_verify_timber_pole.py, tests/

test_verify_timber_rivet.py, tests/test_verify_tornado_loads.py, tests/test_verify_truss_2d.py, tests/test_verify_two_way_slab.py, tests/test_verify_unit_converter.py, tests/test_verify_wall_anchorage.py, tests/test_verify_wall_footing.py, tests/test_verify_wall_rigidity.py, tests/test_verify_weld_group.py, tests/test_verify_wind_envelope.py, tests/test_verify_wind_gust_flexible.py, tests/test_verify_wind_loads.py, tests/test_verify_wind_other.py, tests/test_verify_wood_beam.py, tests/test_verify_wood_bearing.py, tests/test_verify_wood_builtup_column.py, tests/test_verify_wood_column.py, tests/test_verify_wood_connection.py, tests/test_verify_wood_deck.py, tests/test_verify_wood_design_values.py, tests/test_verify_wood_diaphragm.py, tests/test_verify_wood_fire.py, tests/test_verify_wood_floor_vibration.py, tests/test_verify_wood_ijoist.py, tests/test_verify_wood_knife_plate.py, tests/test_verify_wood_ledger.py, tests/test_verify_wood_moment_connection.py, tests/test_verify_wood_notch.py, tests/test_verify_wood_rafter.py, tests/test_verify_wood_shearwall.py, tests/test_verify_wood_shrinkage.py, tests/test_verify_wood_stair.py, tests/test_verify_wood_truss.py: 9286 passed, 400 xfailed

Summary



limit states within tolerance

2143 published examples

698 hand calculations from the cited equations (3141 LRFD/ASD runs, both kinds)

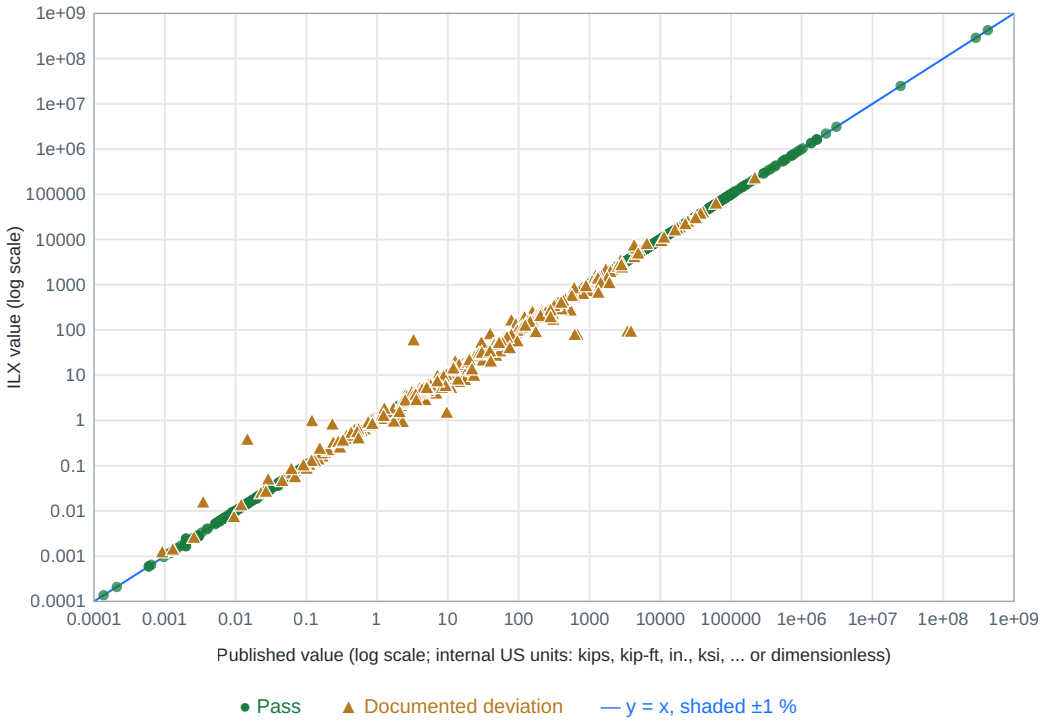
9654 limit-state comparisons

9254 pass

400 documented deviations

0 not checked (coverage gaps)

9254 of 9654 reference values (published or hand calculation) are reproduced within tolerance.



Results by example

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
HC-MAT	AAC masonry wall	—	2	2	0	0	–	–
HC-LEVEL	AAC masonry wall	—	1	1	0	0	–	–
HC-FLEX	AAC masonry wall	—	5	5	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
HC-URM	AAC masonry wall	—	4	4	0	0	–	–
HC-RHOMAX	AAC masonry wall	—	1	1	0	0	–	–
W-6D-30	Adhered veneer	LRFD	1	1	0	0	–	–
W-6D-50	Adhered veneer	LRFD	1	1	0	0	–	–
W-10D-1	Adhered veneer	LRFD	1	1	0	0	–	–
W-16D-15	Adhered veneer	LRFD	1	1	0	0	–	–
W-10D-2	Adhered veneer	LRFD	1	1	0	0	–	–
W-20D-25	Adhered veneer	LRFD	1	1	0	0	–	–
W-16D-25	Adhered veneer	LRFD	1	1	0	0	–	–
W-NEXT	Adhered veneer	LRFD	1	1	0	0	–	–
W-SDC	Adhered veneer	LRFD	1	1	0	0	–	–
S-8-1	Adhered veneer	LRFD	1	1	0	0	–	–
S-10-1	Adhered veneer	LRFD	1	1	0	0	–	–
S-8-15	Adhered veneer	LRFD	1	1	0	0	–	–
S-10-15	Adhered veneer	LRFD	1	1	0	0	–	–
S-8-2	Adhered veneer	LRFD	1	1	0	0	–	–
HO-LIMITS	Adhered veneer	LRFD	1	1	0	0	–	–
HC-ENG · Adhered veneer	Adhered veneer	LRFD	6	6	0	0	–	–
HC-ENG-ASD	Adhered veneer	ASD	4	4	0	0	–	–
TN3C-EX1	Anchored veneer	LRFD	6	6	0	0	–	–
TN3C-EX2	Anchored veneer	LRFD	4	4	0	0	–	–
TN3C-EX2-CORR	Anchored veneer	LRFD	1	1	0	0	–	–
TN3C-EX3	Anchored veneer	LRFD	1	1	0	0	–	–
TN3C-EX4	Anchored veneer	LRFD	3	3	0	0	–	–
TN3C-EX5	Anchored veneer	LRFD	3	3	0	0	–	–
TN3C-EX5-ASBUILT	Anchored veneer	LRFD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
T8-95-2.0-16x16	Anchored veneer	LRFD	1	1	0	0	–	–
T8-95-3.0-16x24	Anchored veneer	LRFD	1	1	0	0	–	–
T8-95-6.0-24x24	Anchored veneer	LRFD	1	1	0	0	–	–
T8-95-9.0-16x24	Anchored veneer	LRFD	1	1	0	0	–	–
T8-25-2.5-24x24	Anchored veneer	LRFD	1	1	0	0	–	–
T8-50-5.0-16x16	Anchored veneer	LRFD	1	1	0	0	–	–
T8-75-8.0-24x24	Anchored veneer	LRFD	1	1	0	0	–	–
HC-ASD · Anchored veneer	Anchored veneer	ASD	2	2	0	0	–	–
UDOEYO-6.2	Arch analysis	—	5	5	0	0	–	–
UDOEYO-6.3	Arch analysis	—	3	3	0	0	–	–
UDOEYO-6.4	Arch analysis	—	5	5	0	0	–	–
TWO-HINGED-UDL	Arch analysis	—	1	1	0	0	–	–
TWO-HINGED-HALF	Arch analysis	—	1	1	0	0	–	–
TWO-HINGED-CROWN	Arch analysis	—	2	2	0	0	–	–
FIXED-CROWN	Arch analysis	—	3	3	0	0	–	–
FIXED-UDL	Arch analysis	—	1	1	0	0	–	–
CIRCULAR	Arch analysis	—	2	2	0	0	–	–
E702.4	Basement (restrained) retaining wall	—	7	6	1	0	–	–
BW-HC1	Basement (restrained) retaining wall	—	4	4	0	0	–	–
BW-HC2	Basement (restrained) retaining wall	—	3	3	0	0	–	–
MNL17-RW1	Basement (restrained) retaining wall	—	11	8	3	0	–	–
BA-1	Continuous beam analysis	—	3	3	0	0	–	–
BA-2	Continuous beam analysis	—	3	3	0	0	–	–
BA-3	Continuous beam analysis	—	2	2	0	0	–	–
BA-4	Continuous beam analysis	—	4	4	0	0	–	–
BA-5	Continuous beam analysis	—	4	4	0	0	–	–
BA-6	Continuous beam analysis	—	2	2	0	0	–	–
BA-7	Continuous beam analysis	—	3	3	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
BA-8	Continuous beam analysis	—	3	3	0	0	–	–
AISC-7	Continuous beam analysis	—	3	3	0	0	–	–
AISC-8	Continuous beam analysis	—	4	4	0	0	–	–
AISC-9	Continuous beam analysis	—	3	3	0	0	–	–
AISC-16	Continuous beam analysis	—	3	3	0	0	–	–
AISC-17	Continuous beam analysis	—	4	4	0	0	–	–
AISC-37	Continuous beam analysis	—	8	8	0	0	–	–
AISC-39	Continuous beam analysis	—	6	6	0	0	–	–
AISC-41	Continuous beam analysis	—	8	8	0	0	–	–
AISC-42	Continuous beam analysis	—	8	8	0	0	–	–
T3-21c U3	Continuous beam analysis	—	4	4	0	0	–	–
T3-21c U4	Continuous beam analysis	—	5	5	0	0	–	–
T3-21c P2	Continuous beam analysis	—	4	4	0	0	–	–
T3-21c P3	Continuous beam analysis	—	4	4	0	0	–	–
T3-21c T2	Continuous beam analysis	—	4	4	0	0	–	–
UDOEYO-11.2	Beam with varying stiffness	LRFD	6	6	0	0	–	–
THREE-MOMENT	Beam with varying stiffness	LRFD	3	3	0	0	–	–
SS-STEP	Beam with varying stiffness	LRFD	2	2	0	0	–	–
CANT-STEP	Beam with varying stiffness	LRFD	1	1	0	0	–	–
CANT-HAUNCH	Beam with varying stiffness	LRFD	1	1	0	0	–	–
DG2-1-T4.6-1	Beam with web openings	LRFD	2	2	0	0	–	–
DG2-1-T4.6-1	Beam with web openings	ASD	1	1	0	0	–	–
DG2-1-T4.6-2	Beam with web openings	LRFD	1	1	0	0	–	–
DG2-1-T4.6-2	Beam with web openings	ASD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
DG2-1-T4.6-3	Beam with web openings	LRFD	10	10	0	0	–	–
DG2-1-T4.6-3	Beam with web openings	ASD	3	3	0	0	–	–
DG2-1-T4.6-4	Beam with web openings	LRFD	1	1	0	0	–	–
DG2-1-T4.6-4	Beam with web openings	ASD	1	1	0	0	–	–
DG2-1-T4.6-5	Beam with web openings	LRFD	1	1	0	0	–	–
DG2-1-T4.6-5	Beam with web openings	ASD	1	1	0	0	–	–
DG2-1-T4.6-6	Beam with web openings	LRFD	1	1	0	0	–	–
DG2-1-T4.6-6	Beam with web openings	ASD	1	1	0	0	–	–
DG2-2-A	Beam with web openings	LRFD	4	4	0	0	–	–
DG2-2-B	Beam with web openings	LRFD	7	7	0	0	–	–
DG2-3	Beam with web openings	LRFD	16	15	1	0	–	–
DG2-4-1A	Beam with web openings	LRFD	2	2	0	0	–	–
DG2-4-1B	Beam with web openings	LRFD	2	2	0	0	–	–
DG2-4-2A	Beam with web openings	LRFD	15	14	1	0	–	–
DG2-4-2B	Beam with web openings	LRFD	12	10	2	0	–	–
GEC6-B1	Bearing capacity and settlement	ASD	6	5	1	0	–	–
GEC6-T51	Bearing capacity and settlement	ASD	3	3	0	0	–	–
BC-UND	Bearing capacity and settlement	ASD	3	3	0	0	–	–
BC-TER	Bearing capacity and settlement	ASD	2	2	0	0	–	–
BC-MEY	Bearing capacity and settlement	ASD	1	1	0	0	–	–
BC-HAN	Bearing capacity and settlement	ASD	1	1	0	0	–	–
BC-ECC	Bearing capacity and settlement	ASD	3	3	0	0	–	–
BC-CONS	Bearing capacity and settlement	ASD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
II.A-24A	Eccentric bolt group	LRFD	4	4	0	0	–	–
II.A-24A	Eccentric bolt group	ASD	2	2	0	0	–	–
II.A-24B	Eccentric bolt group	LRFD	4	4	0	0	–	–
II.A-24B	Eccentric bolt group	ASD	1	1	0	0	–	–
II.A-25	Eccentric bolt group	LRFD	7	7	0	0	–	–
II.A-25	Eccentric bolt group	ASD	1	1	0	0	–	–
II.A-22	Eccentric bolt group	LRFD	5	5	0	0	–	–
II.A-22	Eccentric bolt group	ASD	4	4	0	0	–	–
II.A-20	Eccentric bolt group	LRFD	8	8	0	0	–	–
II.A-20	Eccentric bolt group	ASD	3	3	0	0	–	–
II.A-30	Eccentric bolt group	LRFD	3	3	0	0	–	–
II.A-30	Eccentric bolt group	ASD	2	2	0	0	–	–
II.A-17A	Eccentric bolt group	LRFD	1	1	0	0	–	–
II.A-17B	Eccentric bolt group	LRFD	2	2	0	0	–	–
II.A-17B	Eccentric bolt group	ASD	1	1	0	0	–	–
II.A-19A	Eccentric bolt group	LRFD	3	3	0	0	–	–
II.A-19A	Eccentric bolt group	ASD	1	1	0	0	–	–
II.A-19B	Eccentric bolt group	LRFD	3	3	0	0	–	–
II.A-19B	Eccentric bolt group	ASD	1	1	0	0	–	–
J.4A	Eccentric bolt group	LRFD	4	4	0	0	–	–
J.4A	Eccentric bolt group	ASD	3	3	0	0	–	–
J.4B	Eccentric bolt group	LRFD	1	1	0	0	–	–
J.4B	Eccentric bolt group	ASD	1	1	0	0	–	–
II.D-3	Eccentric bolt group	LRFD	1	1	0	0	–	–
II.D-3	Eccentric bolt group	ASD	1	1	0	0	–	–
T7-3-A	Eccentric bolt group	LRFD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
T7-3-A	Eccentric bolt group	ASD	1	1	0	0	–	–
T7-3-B	Eccentric bolt group	LRFD	1	1	0	0	–	–
T7-3-B	Eccentric bolt group	ASD	1	1	0	0	–	–
T7-3-C	Eccentric bolt group	LRFD	1	1	0	0	–	–
T7-3-C	Eccentric bolt group	ASD	1	1	0	0	–	–
T7-1-A	Eccentric bolt group	LRFD	1	1	0	0	–	–
T7-1-A	Eccentric bolt group	ASD	1	1	0	0	–	–
T7-1-B	Eccentric bolt group	LRFD	1	1	0	0	–	–
T7-1-B	Eccentric bolt group	ASD	1	1	0	0	–	–
T7-1-C	Eccentric bolt group	LRFD	1	1	0	0	–	–
T7-1-C	Eccentric bolt group	ASD	1	1	0	0	–	–
T7-1-D	Eccentric bolt group	LRFD	1	1	0	0	–	–
T7-1-D	Eccentric bolt group	ASD	1	1	0	0	–	–
T7-9-A	Eccentric bolt group	LRFD	1	1	0	0	–	–
T7-9-B	Eccentric bolt group	LRFD	1	1	0	0	–	–
T7-9-C	Eccentric bolt group	LRFD	1	1	0	0	–	–
T7-9-D	Eccentric bolt group	LRFD	1	1	0	0	–	–
T7-10-A	Eccentric bolt group	LRFD	1	1	0	0	–	–
T7-10-B	Eccentric bolt group	LRFD	1	1	0	0	–	–
T7-10-C	Eccentric bolt group	LRFD	1	1	0	0	–	–
T7-11-A	Eccentric bolt group	LRFD	1	1	0	0	–	–
T7-11-B	Eccentric bolt group	LRFD	1	1	0	0	–	–
T7-11-C	Eccentric bolt group	LRFD	1	1	0	0	–	–
T7-12-A	Eccentric bolt group	LRFD	1	1	0	0	–	–
T7-12-B	Eccentric bolt group	LRFD	1	1	0	0	–	–
T7-12-C	Eccentric bolt group	LRFD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
T7-13-A	Eccentric bolt group	LRFD	1	1	0	0	–	–
T7-13-B	Eccentric bolt group	LRFD	1	1	0	0	–	–
T7-13-C	Eccentric bolt group	LRFD	1	1	0	0	–	–
T7-10-D	Eccentric bolt group	LRFD	1	0	1	0	–	–
BX-DM72-4.55	Braced excavation	—	6	6	0	0	–	–
BX-SAND-HAND	Braced excavation	—	3	3	0	0	–	–
UDOEYO-6.6	Cable and catenary	LRFD	5	5	0	0	–	–
UDOEYO-6.8	Cable and catenary	LRFD	3	3	0	0	–	–
CATENARY	Cable and catenary	LRFD	4	4	0	0	–	–
STRETCH	Cable and catenary	LRFD	2	2	0	0	–	–
INCLINED	Cable and catenary	LRFD	3	3	0	0	–	–
THERMAL	Cable and catenary	LRFD	1	1	0	0	–	–
DG31-4.1-S	Castellated or cellular beam	LRFD	23	23	0	0	–	–
DG31-4.1	Castellated or cellular beam	LRFD	26	20	6	0	–	–
DG31-4.1	Castellated or cellular beam	ASD	16	14	2	0	–	–
DG31-4.2-S	Castellated or cellular beam	LRFD	20	19	1	0	–	–
DG31-4.2	Castellated or cellular beam	LRFD	23	16	7	0	–	–
DG31-4.2	Castellated or cellular beam	ASD	12	8	4	0	–	–
DG31-4.3-S	Castellated or cellular beam	LRFD	31	31	0	0	–	–
DG31-4.3	Castellated or cellular beam	LRFD	31	29	2	0	–	–
DG31-4.3	Castellated or cellular beam	ASD	15	15	0	0	–	–
DG31-4.3-D	Castellated or cellular beam	ASD	4	4	0	0	–	–
DG31-4.3-30	Castellated or cellular beam	LRFD	7	7	0	0	–	–
DG31-4.4-S	Castellated or cellular beam	LRFD	17	15	2	0	–	–
DG31-4.4	Castellated or cellular beam	LRFD	22	16	6	0	–	–
DG31-4.4	Castellated or cellular beam	ASD	13	11	2	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
DG31-4.4-D	Castellated or cellular beam	ASD	3	0	3	0	–	–
SSMA-M-600S162-54	Cold-formed steel bridging	ASD	1	1	0	0	–	–
SSMA-M-800S200-54	Cold-formed steel bridging	ASD	1	1	0	0	–	–
SSMA-M-600S200-43	Cold-formed steel bridging	ASD	1	1	0	0	–	–
HC-BRIDGE-AXIAL	Cold-formed steel bridging	ASD	2	2	0	0	–	–
HC-BRIDGE-WIND	Cold-formed steel bridging	ASD	1	1	0	0	–	–
HC-BRIDGE-STRAP	Cold-formed steel bridging	LRFD	1	1	0	0	–	–
HAND-BU-DEFAULT	Built-up cold-formed steel member	LRFD	5	5	0	0	–	–
HAND-BU-BOX	Built-up cold-formed steel member	LRFD	2	2	0	0	–	–
HAND-BYP-2SPAN	Cold-formed steel bypass and infill framing	LRFD	5	5	0	0	–	–
HAND-BYP-2SPAN	Cold-formed steel bypass and infill framing	ASD	2	2	0	0	–	–
HAND-BYP-INFILL	Cold-formed steel bypass and infill framing	LRFD	3	3	0	0	–	–
HAND-BYP-INFILL	Cold-formed steel bypass and infill framing	ASD	1	1	0	0	–	–
HC-CEIL-HAT	Cold-formed steel ceiling framing	LRFD	2	2	0	0	–	–
HC-CEIL-SIMPLE	Cold-formed steel ceiling framing	LRFD	3	3	0	0	–	–
HC-CEIL-TWO	Cold-formed steel ceiling framing	LRFD	2	2	0	0	–	–
HC-CEIL-EV	Cold-formed steel ceiling framing	LRFD	1	1	0	0	–	–
HC-CHORD-STACK	Cold-formed steel shear wall chord studs	LRFD	3	3	0	0	–	–
HC-CHORD-STACK	Cold-formed steel shear wall chord studs	ASD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
HC-CHORD-SEISMIC	Cold-formed steel shear wall chord studs	LRFD	1	1	0	0	–	–
HC-CLIP-A-SHEET	Cold-formed steel clip angle	LRFD	1	1	0	0	–	–
HC-CLIP-A-SHEET	Cold-formed steel clip angle	ASD	1	1	0	0	–	–
HC-CLIP-B-PULL	Cold-formed steel clip angle	LRFD	3	3	0	0	–	–
HC-CLIP-LEG-BEND	Cold-formed steel clip angle	LRFD	2	2	0	0	–	–
HC-CLIP-LEG-BEND	Cold-formed steel clip angle	ASD	1	1	0	0	–	–
HC-CLIP-LEG-PLASTIC	Cold-formed steel clip angle	LRFD	1	1	0	0	–	–
HC-CLIP-TENSION	Cold-formed steel clip angle	LRFD	1	1	0	0	–	–
HC-CLIP-RUPTURE	Cold-formed steel clip angle	LRFD	1	1	0	0	–	–
SSMA-S-18-33-no8	Cold-formed steel fastener connection	ASD	3	3	0	0	–	–
SSMA-S-33-33-no8	Cold-formed steel fastener connection	ASD	3	3	0	0	–	–
SSMA-S-43-33-no8	Cold-formed steel fastener connection	ASD	3	3	0	0	–	–
SSMA-S-54-33-no8	Cold-formed steel fastener connection	ASD	3	3	0	0	–	–
SSMA-S-97-33-no8	Cold-formed steel fastener connection	ASD	3	3	0	0	–	–
SSMA-S-33-33-no10	Cold-formed steel fastener connection	ASD	3	3	0	0	–	–
SSMA-S-43-33-no10	Cold-formed steel fastener connection	ASD	3	3	0	0	–	–
SSMA-S-54-33-no10	Cold-formed steel fastener connection	ASD	3	3	0	0	–	–
SSMA-S-68-33-no10	Cold-formed steel fastener connection	ASD	3	3	0	0	–	–
SSMA-S-54-50-no10	Cold-formed steel fastener connection	ASD	3	3	0	0	–	–
SSMA-S-68-50-no10	Cold-formed steel fastener connection	ASD	3	3	0	0	–	–
SSMA-S-33-33-no12	Cold-formed steel fastener connection	ASD	3	3	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
SSMA-S-43-33-no12	Cold-formed steel fastener connection	ASD	3	3	0	0	–	–
SSMA-S-54-50-no12	Cold-formed steel fastener connection	ASD	3	3	0	0	–	–
SSMA-S-97-50-no12	Cold-formed steel fastener connection	ASD	3	3	0	0	–	–
SSMA-S-118-50-quarter	Cold-formed steel fastener connection	ASD	3	3	0	0	–	–
SSMA-S-30-33-no6	Cold-formed steel fastener connection	ASD	3	3	0	0	–	–
SSMA-S-43-33-no6	Cold-formed steel fastener connection	ASD	3	3	0	0	–	–
SSMA-W-fillet-43-33-longitudinal	Cold-formed steel fastener connection	ASD	1	1	0	0	–	–
SSMA-W-fillet-43-33-transverse	Cold-formed steel fastener connection	ASD	1	1	0	0	–	–
SSMA-W-fillet-68-50-longitudinal	Cold-formed steel fastener connection	ASD	1	1	0	0	–	–
SSMA-W-fillet-68-50-transverse	Cold-formed steel fastener connection	ASD	1	1	0	0	–	–
SSMA-W-fillet-97-50-longitudinal	Cold-formed steel fastener connection	ASD	1	1	0	0	–	–
SSMA-W-fillet-97-33-transverse	Cold-formed steel fastener connection	ASD	1	1	0	0	–	–
SSMA-W-flare-43-33-longitudinal	Cold-formed steel fastener connection	ASD	1	1	0	0	–	–
SSMA-W-flare-43-33-transverse	Cold-formed steel fastener connection	ASD	1	1	0	0	–	–
SSMA-W-flare-54-50-longitudinal	Cold-formed steel fastener connection	ASD	1	1	0	0	–	–
SSMA-W-flare-68-50-transverse	Cold-formed steel fastener connection	ASD	1	1	0	0	–	–
HC-BOLT-1	Cold-formed steel fastener connection	LRFD	3	3	0	0	–	–
HC-SCREW-1	Cold-formed steel fastener connection	LRFD	1	1	0	0	–	–
SSMA-CW-SEC-362S162-54	Cold-formed steel curtain wall	ASD	2	2	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
SSMA-CW-single-400S162-54-16-15-240	Cold-formed steel curtain wall	ASD	1	1	0	0	–	–
SSMA-CW-single-400S162-54-16-15-360	Cold-formed steel curtain wall	ASD	1	1	0	0	–	–
SSMA-CW-single-400S162-54-16-15-600	Cold-formed steel curtain wall	ASD	1	1	0	0	–	–
SSMA-CW-single-400S162-54-16-20-240	Cold-formed steel curtain wall	ASD	1	1	0	0	–	–
SSMA-CW-single-400S162-54-16-20-360	Cold-formed steel curtain wall	ASD	1	1	0	0	–	–
SSMA-CW-single-400S162-54-16-20-600	Cold-formed steel curtain wall	ASD	1	1	0	0	–	–
SSMA-CW-single-400S162-54-16-5-240	Cold-formed steel curtain wall	ASD	1	1	0	0	–	–
SSMA-CW-single-400S162-54-16-5-360	Cold-formed steel curtain wall	ASD	1	1	0	0	–	–
SSMA-CW-single-600S162-43-16-15-240	Cold-formed steel curtain wall	ASD	1	1	0	0	–	–
SSMA-CW-single-600S162-43-16-15-360	Cold-formed steel curtain wall	ASD	1	1	0	0	–	–
SSMA-CW-single-600S162-43-16-15-600	Cold-formed steel curtain wall	ASD	1	1	0	0	–	–
SSMA-CW-single-600S162-43-16-20-360	Cold-formed steel curtain wall	ASD	1	1	0	0	–	–
SSMA-CW-single-800S162-54-16-15-240	Cold-formed steel curtain wall	ASD	1	1	0	0	–	–
SSMA-CW-single-800S162-54-16-15-360	Cold-formed steel curtain wall	ASD	1	1	0	0	–	–
SSMA-CW-single-800S162-54-16-15-600	Cold-formed steel curtain wall	ASD	1	1	0	0	–	–
SSMA-CW-single-800S162-54-16-20-600	Cold-formed steel curtain wall	ASD	1	1	0	0	–	–
SSMA-CW-double-362S162-54-16-15-240	Cold-formed steel curtain wall	ASD	1	1	0	0	–	–
SSMA-CW-double-362S162-54-16-15-360	Cold-formed steel curtain wall	ASD	1	1	0	0	–	–
SSMA-CW-double-362S162-54-16-15-600	Cold-formed steel curtain wall	ASD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
SSMA-CW-double-362S162-54-16-20-600	Cold-formed steel curtain wall	ASD	1	1	0	0	–	–
HC-CW-1	Cold-formed steel curtain wall	LRFD	1	1	0	0	–	–
HC-CW-2	Cold-formed steel curtain wall	LRFD	1	1	0	0	–	–
S240-T-SI-1532-B6	Cold-formed steel diaphragm	LRFD	2	2	0	0	–	–
S240-T-SI-1532-B6	Cold-formed steel diaphragm	ASD	1	1	0	0	–	–
S240-T-SI-716-B4	Cold-formed steel diaphragm	LRFD	2	2	0	0	–	–
S240-T-SI-716-B4	Cold-formed steel diaphragm	ASD	1	1	0	0	–	–
S240-T-OT-38-B2	Cold-formed steel diaphragm	LRFD	2	2	0	0	–	–
S240-T-OT-38-B2	Cold-formed steel diaphragm	ASD	1	1	0	0	–	–
S240-T-SI-1532-UP	Cold-formed steel diaphragm	LRFD	2	2	0	0	–	–
S240-T-SI-1532-UP	Cold-formed steel diaphragm	ASD	1	1	0	0	–	–
S240-T-OT-716-UO	Cold-formed steel diaphragm	LRFD	2	2	0	0	–	–
S240-T-OT-716-UO	Cold-formed steel diaphragm	ASD	1	1	0	0	–	–
S400-T-SI-1532-B25	Cold-formed steel diaphragm	LRFD	2	2	0	0	–	–
S400-T-SI-1532-B25	Cold-formed steel diaphragm	ASD	1	1	0	0	–	–
HC-DIAPH-STATICS	Cold-formed steel diaphragm	LRFD	2	2	0	0	–	–
HC-DIAPH-STATICS	Cold-formed steel diaphragm	ASD	1	1	0	0	–	–
HC-DIAPH-DEFL	Cold-formed steel diaphragm	LRFD	1	1	0	0	–	–
HC-DIAPH-DEFL-UB	Cold-formed steel diaphragm	LRFD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
HAND-CFV-SLAB	Cold-formed steel floor vibration	—	3	3	0	0	–	–
HAND-CFV-SHEATH	Cold-formed steel floor vibration	—	4	4	0	0	–	–
HAND-GIRT-DEFAULT	Cold-formed steel girt	LRFD	4	4	0	0	–	–
HAND-GIRT-DEFAULT	Cold-formed steel girt	ASD	2	2	0	0	–	–
HAND-GIRT-ASCE	Cold-formed steel girt	LRFD	3	3	0	0	–	–
HAND-GIRT-ROD	Cold-formed steel girt	LRFD	1	1	0	0	–	–
HAND-GIRT-CONT	Cold-formed steel girt	LRFD	2	2	0	0	–	–
SSMA-HDR-800S162-54-3	Cold-formed steel header	ASD	1	1	0	0	–	–
SSMA-HDR-800S162-54-6	Cold-formed steel header	ASD	1	1	0	0	–	–
SSMA-HDR-800S162-54-8	Cold-formed steel header	ASD	1	1	0	0	–	–
SSMA-HDR-800S162-54-10	Cold-formed steel header	ASD	1	1	0	0	–	–
SSMA-HDR-800S162-54-12	Cold-formed steel header	ASD	1	0	1	0	–	–
SSMA-HDR-800S162-43-6	Cold-formed steel header	ASD	1	1	0	0	–	–
SSMA-HDR-800S162-43-8	Cold-formed steel header	ASD	1	1	0	0	–	–
SSMA-HDR-800S162-43-12	Cold-formed steel header	ASD	1	1	0	0	–	–
SSMA-HDR-600S162-33-4	Cold-formed steel header	ASD	1	1	0	0	–	–
SSMA-HDR-600S162-33-6	Cold-formed steel header	ASD	1	1	0	0	–	–
SSMA-HDR-600S162-33-12	Cold-formed steel header	ASD	1	1	0	0	–	–
SSMA-HDR-800S200-54-8	Cold-formed steel header	ASD	1	1	0	0	–	–
SSMA-HDR-800S200-54-12	Cold-formed steel header	ASD	1	1	0	0	–	–
SSMA-HDR-800S162-68-8	Cold-formed steel header	ASD	1	1	0	0	–	–
SSMA-HDR-800S162-68-12	Cold-formed steel header	ASD	1	1	0	0	–	–
SSMA-WCB-600S162-54-N1	Cold-formed steel header	ASD	2	2	0	0	–	–
SSMA-WCB-600S162-54-N3.5	Cold-formed steel header	ASD	2	2	0	0	–	–
SSMA-WCB-800S162-54-N1	Cold-formed steel header	ASD	2	2	0	0	–	–
SSMA-WCB-800S162-54-N3.5	Cold-formed steel header	ASD	2	2	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
SSMA-WCB-800S162-54-N6	Cold-formed steel header	ASD	2	2	0	0	–	–
SSMA-WCB-800S162-68-N1	Cold-formed steel header	ASD	2	2	0	0	–	–
SSMA-WCB-800S162-68-N3.5	Cold-formed steel header	ASD	2	2	0	0	–	–
SSMA-WCB-800S162-68-N6	Cold-formed steel header	ASD	2	2	0	0	–	–
DG8-T3-600L150-43-16	Cold-formed steel header	ASD	1	1	0	0	–	–
DG8-T3-600L150-54-16	Cold-formed steel header	ASD	1	1	0	0	–	–
DG8-T3-600L150-68-16	Cold-formed steel header	ASD	1	0	1	0	–	–
DG8-T3-800L150-43-16	Cold-formed steel header	ASD	1	0	1	0	–	–
DG8-T3-800L150-54-16	Cold-formed steel header	ASD	1	0	1	0	–	–
DG8-T3-800L150-68-16	Cold-formed steel header	ASD	1	1	0	0	–	–
DG8-T3-1000L150-43-16	Cold-formed steel header	ASD	1	0	1	0	–	–
DG8-T3-1000L150-54-16	Cold-formed steel header	ASD	1	0	1	0	–	–
DG8-T3-1000L150-68-16	Cold-formed steel header	ASD	1	0	1	0	–	–
DG8-T3-600L150-43-70	Cold-formed steel header	ASD	1	0	1	0	–	–
DG8-T3-800L150-43-70	Cold-formed steel header	ASD	1	1	0	0	–	–
DG8-T3-800L150-54-70	Cold-formed steel header	ASD	1	0	1	0	–	–
HC-L-1	Cold-formed steel header	ASD	1	1	0	0	–	–
HC-L-1	Cold-formed steel header	LRFD	1	1	0	0	–	–
HC-L-2	Cold-formed steel header	ASD	1	1	0	0	–	–
HC-L-2	Cold-formed steel header	LRFD	1	1	0	0	–	–
HC-L-3	Cold-formed steel header	ASD	1	1	0	0	–	–
HAND-JAMB-DEFAULT	Cold-formed steel jamb studs	LRFD	5	5	0	0	–	–
HAND-JAMB-DEFAULT	Cold-formed steel jamb studs	ASD	2	2	0	0	–	–
HAND-JAMB-TRIB	Cold-formed steel jamb studs	LRFD	2	2	0	0	–	–
SSMA-600S162-33-33	Cold-formed steel joist	ASD	3	3	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
SSMA-600S200-54-50	Cold-formed steel joist	ASD	3	3	0	0	–	–
SSMA-800S162-43-33	Cold-formed steel joist	ASD	3	3	0	0	–	–
SSMA-800S162-54-50	Cold-formed steel joist	ASD	3	3	0	0	–	–
SSMA-800S162-68-50	Cold-formed steel joist	ASD	3	3	0	0	–	–
SSMA-800S200-54-50	Cold-formed steel joist	ASD	3	3	0	0	–	–
SSMA-1000S162-54-50	Cold-formed steel joist	ASD	3	3	0	0	–	–
SSMA-1000S162-68-50	Cold-formed steel joist	ASD	3	3	0	0	–	–
SSMA-1000S200-54-50	Cold-formed steel joist	ASD	3	3	0	0	–	–
SSMA-1200S162-68-50	Cold-formed steel joist	ASD	3	3	0	0	–	–
SSMA-800S162-54-PROPS	Cold-formed steel joist	—	5	5	0	0	–	–
SSMA-COLD-600S162-54	Cold-formed steel joist	ASD	3	1	2	0	–	–
SSMA-COLD-600S162-54-FYA	Cold-formed steel joist	ASD	2	2	0	0	–	–
SSMA-COLD-600S162-68-FYA	Cold-formed steel joist	ASD	1	1	0	0	–	–
SSMA-VANET-600S162-33-33	Cold-formed steel joist	ASD	1	1	0	0	–	–
SSMA-VANET-600S162-43-33	Cold-formed steel joist	ASD	1	1	0	0	–	–
SSMA-VANET-600S162-54-50	Cold-formed steel joist	ASD	1	1	0	0	–	–
SSMA-VANET-600S162-68-50	Cold-formed steel joist	ASD	1	1	0	0	–	–
SSMA-VANET-800S162-54-50	Cold-formed steel joist	ASD	1	1	0	0	–	–
SSMA-VANET-800S162-68-50	Cold-formed steel joist	ASD	1	1	0	0	–	–
SSMA-WC-600S162-54-50-N1	Cold-formed steel joist	ASD	2	2	0	0	–	–
SSMA-WC-600S162-54-50-N3.5	Cold-formed steel joist	ASD	2	2	0	0	–	–
SSMA-WC-600S162-54-50-N6	Cold-formed steel joist	ASD	2	2	0	0	–	–
SSMA-WC-800S162-54-50-N1	Cold-formed steel joist	ASD	2	2	0	0	–	–
SSMA-WC-800S162-54-50-N3.5	Cold-formed steel joist	ASD	2	2	0	0	–	–
SSMA-WC-800S162-54-50-N6	Cold-formed steel joist	ASD	2	2	0	0	–	–
SSMA-WC-600S162-43-33-N3.5	Cold-formed steel joist	ASD	2	2	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
SSMA-WC-800S162-68-50-N3.5	Cold-formed steel joist	ASD	2	2	0	0	–	–
SSMA-SPAN-600S162-54-12-L360	Cold-formed steel joist	ASD	1	1	0	0	–	–
SSMA-SPAN-600S162-54-16-L360	Cold-formed steel joist	ASD	1	1	0	0	–	–
SSMA-SPAN-600S162-54-12-L480	Cold-formed steel joist	ASD	1	1	0	0	–	–
SSMA-SPAN-600S162-54-16-L480	Cold-formed steel joist	ASD	1	1	0	0	–	–
SSMA-SPAN-800S162-54-12-L360	Cold-formed steel joist	ASD	1	1	0	0	–	–
SSMA-SPAN-800S162-54-16-L360	Cold-formed steel joist	ASD	1	1	0	0	–	–
SSMA-SPAN-800S162-54-12-L480	Cold-formed steel joist	ASD	1	1	0	0	–	–
SSMA-SPAN-800S162-54-16-L480	Cold-formed steel joist	ASD	1	1	0	0	–	–
HC-MANSARD-SPLIT	Cold-formed steel sloped and mansard wall	LRFD	5	5	0	0	–	–
HC-MANSARD-WIND	Cold-formed steel sloped and mansard wall	LRFD	1	1	0	0	–	–
HC-MANSARD-WIND	Cold-formed steel sloped and mansard wall	ASD	1	1	0	0	–	–
HC-MANSARD-KICKER	Cold-formed steel sloped and mansard wall	LRFD	2	2	0	0	–	–
HC-SBMF-EXPECTED	Cold-formed steel special bolted moment frame	LRFD	9	9	0	0	–	–
HC-SBMF-CAP	Cold-formed steel special bolted moment frame	LRFD	2	2	0	0	–	–
HC-PARAPET-WIND	Cold-formed steel parapet	LRFD	3	3	0	0	–	–
HC-PARAPET-STATICS	Cold-formed steel parapet	LRFD	2	2	0	0	–	–
HC-PARAPET-STATICS	Cold-formed steel parapet	ASD	1	1	0	0	–	–
MBMA-3311-SEC	Cold-formed steel purlin	ASD	17	17	0	0	–	–
MBMA-3311-MOM	Cold-formed steel purlin	ASD	17	17	0	0	–	–
MBMA-3311-FLEX	Cold-formed steel purlin	ASD	32	25	7	0	–	–
MBMA-3311-VWC	Cold-formed steel purlin	ASD	14	14	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
MBMA-3311-UP	Cold-formed steel purlin	ASD	4	4	0	0	–	–
MBMA-3321	Cold-formed steel purlin	ASD	8	8	0	0	–	–
MBMA-3322	Cold-formed steel purlin	LRFD	46	43	3	0	–	–
MBMA-3322-W16	Cold-formed steel purlin	LRFD	2	2	0	0	–	–
RP20-5-8ZS225	Cold-formed steel purlin	ASD	10	10	0	0	–	–
MBMA-541	Cold-formed steel purlin	LRFD	8	8	0	0	–	–
MBMA-542	Cold-formed steel purlin	LRFD	3	3	0	0	–	–
MBMA-543	Cold-formed steel purlin	ASD	22	22	0	0	–	–
SSMA-RAFT-800S200-54-50	Cold-formed steel rafter	ASD	3	3	0	0	–	–
SSMA-RAFT-800S162-54-50	Cold-formed steel rafter	ASD	3	3	0	0	–	–
SSMA-RAFT-600S200-43-33	Cold-formed steel rafter	ASD	3	3	0	0	–	–
HC-RAFT-1	Cold-formed steel rafter	ASD	3	3	0	0	–	–
HC-RAFT-2	Cold-formed steel rafter	ASD	3	3	0	0	–	–
HC-RAFT-3	Cold-formed steel rafter	ASD	2	2	0	0	–	–
SW-1 · Cold-formed steel shear wall	Cold-formed steel shear wall	LRFD	6	6	0	0	–	–
SW-1 · Cold-formed steel shear wall	Cold-formed steel shear wall	ASD	5	5	0	0	–	–
SW-2 · Cold-formed steel shear wall	Cold-formed steel shear wall	LRFD	3	3	0	0	–	–
SW-2 · Cold-formed steel shear wall	Cold-formed steel shear wall	ASD	3	3	0	0	–	–
S400-T1	Cold-formed steel shear wall	LRFD	1	1	0	0	–	–
S400-T1	Cold-formed steel shear wall	ASD	1	1	0	0	–	–
S400-T2	Cold-formed steel shear wall	LRFD	1	1	0	0	–	–
S400-T3	Cold-formed steel shear wall	LRFD	1	1	0	0	–	–
S400-T4	Cold-formed steel shear wall	LRFD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
S400-T5	Cold-formed steel shear wall	LRFD	2	2	0	0	–	–
S400-T5	Cold-formed steel shear wall	ASD	1	1	0	0	–	–
S400-T6	Cold-formed steel shear wall	LRFD	1	1	0	0	–	–
S400-T6	Cold-formed steel shear wall	ASD	1	1	0	0	–	–
S240-T-B3.2-1	Sheathing-braced cold-formed steel stud	LRFD	5	5	0	0	–	–
S240-T-B3.2-1	Sheathing-braced cold-formed steel stud	ASD	2	2	0	0	–	–
S240-T-B3.2-1b	Sheathing-braced cold-formed steel stud	LRFD	1	1	0	0	–	–
HAND-SOF-1	Cold-formed steel soffit framing	LRFD	8	8	0	0	–	–
HAND-SOF-1	Cold-formed steel soffit framing	ASD	2	2	0	0	–	–
HC-RACK-DEFAULT	Cold-formed steel storage rack	LRFD	7	7	0	0	–	–
S400-A32-33	Cold-formed steel strap braced wall	LRFD	2	2	0	0	–	–
S400-A32-38	Cold-formed steel strap braced wall	LRFD	2	2	0	0	–	–
S400-A32-45	Cold-formed steel strap braced wall	LRFD	2	2	0	0	–	–
S400-A32-50	Cold-formed steel strap braced wall	LRFD	2	2	0	0	–	–
HC-STRAP-VN	Cold-formed steel strap braced wall	LRFD	1	1	0	0	–	–
HC-STRAP-VN	Cold-formed steel strap braced wall	ASD	1	1	0	0	–	–
HC-STRAP-OE	Cold-formed steel strap braced wall	LRFD	1	1	0	0	–	–
HC-STRAP-CP	Cold-formed steel strap braced wall	LRFD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
HC-STRAP-CP2	Cold-formed steel strap braced wall	LRFD	1	1	0	0	–	–
HC-STRAP-C	Cold-formed steel strap braced wall	LRFD	2	2	0	0	–	–
HC-STRAP-C	Cold-formed steel strap braced wall	ASD	1	1	0	0	–	–
HC-STRAP-T	Cold-formed steel strap braced wall	LRFD	1	1	0	0	–	–
SSMA-STRAP-CHORD	Cold-formed steel strap braced wall	LRFD	1	1	0	0	–	–
SSMA-STRAP-CHORD	Cold-formed steel strap braced wall	ASD	1	1	0	0	–	–
CS-1	Cold-formed steel stud	—	8	8	0	0	–	–
CS-2	Cold-formed steel stud	LRFD	4	4	0	0	–	–
CS-2	Cold-formed steel stud	ASD	1	1	0	0	–	–
CS-3	Cold-formed steel stud	LRFD	5	5	0	0	–	–
CS-3	Cold-formed steel stud	ASD	2	2	0	0	–	–
CS-4	Cold-formed steel stud	LRFD	2	2	0	0	–	–
CS-5	Cold-formed steel stud	LRFD	1	1	0	0	–	–
CS-5	Cold-formed steel stud	ASD	1	1	0	0	–	–
CS-6	Cold-formed steel stud	LRFD	1	1	0	0	–	–
CS-6	Cold-formed steel stud	ASD	1	1	0	0	–	–
C-2.2.2-2a	Cold-formed steel stud	—	2	2	0	0	–	–
SSMA-600S162-54	Cold-formed steel stud	ASD	15	13	2	0	–	–
SSMA-600S162-33	Cold-formed steel stud	ASD	13	13	0	0	–	–
SSMA-800S162-54	Cold-formed steel stud	ASD	7	7	0	0	–	–
SSMA-1000S162-54	Cold-formed steel stud	ASD	5	5	0	0	–	–
SSMA-800S162-43	Cold-formed steel stud	ASD	3	3	0	0	–	–
SSMA-600S200-33	Cold-formed steel stud	ASD	2	2	0	0	–	–
SSMA-WC-600-54-N1	Cold-formed steel stud	ASD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
SSMA-WC-600-54-N3.5	Cold-formed steel stud	ASD	1	1	0	0	–	–
SSMA-WC-600-54-N6	Cold-formed steel stud	ASD	1	1	0	0	–	–
SSMA-WC-600-33-N3.5	Cold-formed steel stud	ASD	1	1	0	0	–	–
SSMA-WC-600-33-N6	Cold-formed steel stud	ASD	1	1	0	0	–	–
SSMA-AX-800S162-54-8-12	Cold-formed steel stud	ASD	1	1	0	0	–	–
SSMA-AX-800S162-54-8-16	Cold-formed steel stud	ASD	1	1	0	0	–	–
SSMA-AX-800S162-54-8-24	Cold-formed steel stud	ASD	1	1	0	0	–	–
SSMA-AX-800S162-54-12-16	Cold-formed steel stud	ASD	1	1	0	0	–	–
SSMA-AX-800S162-54-16-16	Cold-formed steel stud	ASD	1	1	0	0	–	–
SSMA-AX-800S162-43-8-16	Cold-formed steel stud	ASD	1	1	0	0	–	–
SSMA-AX-800S162-43-12-16	Cold-formed steel stud	ASD	1	1	0	0	–	–
SSMA-AX-800S162-43-16-24	Cold-formed steel stud	ASD	1	1	0	0	–	–
SSMA-AX-800S162-68-8-16	Cold-formed steel stud	ASD	1	1	0	0	–	–
SSMA-AX-800S162-68-16-16	Cold-formed steel stud	ASD	1	1	0	0	–	–
SSMA-AX-800S162-97-8-16	Cold-formed steel stud	ASD	1	1	0	0	–	–
SSMA-AX-800S162-97-16-16	Cold-formed steel stud	ASD	1	1	0	0	–	–
SSMA-MAD-800S162-54	Cold-formed steel stud	ASD	1	1	0	0	–	–
SSMA-MAD-800S162-43	Cold-formed steel stud	ASD	1	1	0	0	–	–
SSMA-MAD-600S162-33	Cold-formed steel stud	ASD	1	1	0	0	–	–
HAND-TRK-DT	Cold-formed steel track	LRFD	3	3	0	0	–	–
HAND-TRK-DT	Cold-formed steel track	ASD	2	2	0	0	–	–
HAND-TRK-STD	Cold-formed steel track	LRFD	1	1	0	0	–	–
HAND-TRK-STD	Cold-formed steel track	ASD	1	1	0	0	–	–
HAND-TRK-OPEN	Cold-formed steel track	LRFD	1	1	0	0	–	–
HAND-TRK-JAMB	Cold-formed steel track	LRFD	2	2	0	0	–	–
S100-J7.2.2	Cold-formed steel track anchorage	LRFD	6	6	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
S100-J7.2.2	Cold-formed steel track anchorage	ASD	2	2	0	0	–	–
HAND-TA-PAF-STEEL	Cold-formed steel track anchorage	LRFD	2	2	0	0	–	–
HAND-TA-PAF-STEEL	Cold-formed steel track anchorage	ASD	1	1	0	0	–	–
HAND-TA-SCREW	Cold-formed steel track anchorage	LRFD	2	2	0	0	–	–
HAND-TA-SCREW	Cold-formed steel track anchorage	ASD	1	1	0	0	–	–
HAND-TA-ANCHOR	Cold-formed steel track anchorage	LRFD	1	1	0	0	–	–
HAND-TA-ANCHOR	Cold-formed steel track anchorage	ASD	1	1	0	0	–	–
SSMA-T-800S162-54	Cold-formed steel truss	ASD	2	2	0	0	–	–
SSMA-T-1000S162-54	Cold-formed steel truss	ASD	2	2	0	0	–	–
SSMA-T-600S162-33	Cold-formed steel truss	ASD	2	2	0	0	–	–
CT-D1	Cold-formed steel truss	LRFD	2	2	0	0	–	–
CT-D1	Cold-formed steel truss	ASD	1	1	0	0	–	–
CT-H1	Cold-formed steel truss	LRFD	1	1	0	0	–	–
CT-H1	Cold-formed steel truss	ASD	1	1	0	0	–	–
CT-H2	Cold-formed steel truss	LRFD	2	2	0	0	–	–
CT-H2	Cold-formed steel truss	ASD	1	1	0	0	–	–
CT-H3	Cold-formed steel truss	LRFD	2	2	0	0	–	–
CT-H4	Cold-formed steel truss	LRFD	1	1	0	0	–	–
CT-H4	Cold-formed steel truss	ASD	1	1	0	0	–	–
HC-TRUSSBR-C23	Cold-formed steel truss bracing	LRFD	5	5	0	0	–	–
HC-TRUSSBR-C23	Cold-formed steel truss bracing	ASD	1	1	0	0	–	–
HC-TRUSSBR-ROWS	Cold-formed steel truss bracing	LRFD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
SSMA-WH-600S162-33-33	Web holes in cold-formed members	ASD	3	3	0	0	–	–
SSMA-WH-600S200-54-50	Web holes in cold-formed members	ASD	3	3	0	0	–	–
SSMA-WH-800S162-54-50	Web holes in cold-formed members	ASD	3	3	0	0	–	–
SSMA-WH-800S162-68-50	Web holes in cold-formed members	ASD	3	3	0	0	–	–
SSMA-WH-1000S162-68-50	Web holes in cold-formed members	ASD	3	3	0	0	–	–
SSMA-WH-VANET-600S162-33-33	Web holes in cold-formed members	ASD	1	1	0	0	–	–
SSMA-WH-VANET-600S162-43-33	Web holes in cold-formed members	ASD	1	1	0	0	–	–
SSMA-WH-VANET-600S162-54-50	Web holes in cold-formed members	ASD	1	1	0	0	–	–
SSMA-WH-VANET-600S162-68-50	Web holes in cold-formed members	ASD	1	1	0	0	–	–
SSMA-WH-VANET-800S162-54-50	Web holes in cold-formed members	ASD	1	1	0	0	–	–
SSMA-WH-VANET-800S162-68-50	Web holes in cold-formed members	ASD	1	1	0	0	–	–
SSMA-WH-WC-600S162-54-end-N1	Web holes in cold-formed members	ASD	1	1	0	0	–	–
SSMA-WH-WC-600S162-54-interior-N3.5	Web holes in cold-formed members	ASD	1	1	0	0	–	–
HAND-WH-CIRC	Web holes in cold-formed members	LRFD	3	3	0	0	–	–
HAND-WH-G6	Web holes in cold-formed members	LRFD	1	1	0	0	–	–
WW-V3-5	CLT panel	ASD	6	6	0	0	–	–
WW-V3-5d	CLT panel	ASD	2	2	0	0	–	–
WW-V1-5	CLT panel	ASD	6	6	0	0	–	–
WW-V1-5d	CLT panel	ASD	2	2	0	0	–	–
WW-V1-3	CLT panel	ASD	1	1	0	0	–	–
HAND-1 · CLT panel	CLT panel	ASD	7	7	0	0	–	–
HAND-1 · CLT panel	CLT panel	LRFD	2	2	0	0	–	–
PRG-E1-3	CLT panel	ASD	4	4	0	0	–	–
PRG-V1-3	CLT panel	ASD	4	4	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
FEMA-65	CLT shear wall	LRFD	12	12	0	0	–	–
FEMA-PANEL	CLT shear wall	LRFD	3	3	0	0	–	–
FEMA-66	CLT shear wall	LRFD	8	8	0	0	–	–
FEMA-68	CLT shear wall	LRFD	8	8	0	0	–	–
FEMA-69	CLT shear wall	LRFD	19	15	4	0	–	–
WW-CG	CLT shear wall	LRFD	1	1	0	0	–	–
HC-ASD · CLT shear wall	CLT shear wall	ASD	4	4	0	0	–	–
SP-CF	Combined footing	—	4	4	0	0	–	–
SP-CF-40	Combined footing	—	2	1	1	0	–	–
CF-1	Combined footing	—	6	6	0	0	–	–
I.1	Composite beam	LRFD	13	13	0	0	–	–
I.1	Composite beam	ASD	13	13	0	0	–	–
I.2	Composite beam	LRFD	13	13	0	0	–	–
I.2	Composite beam	ASD	13	13	0	0	–	–
I.2-D	Composite beam	—	4	4	0	0	–	–
T3-18 W21X50 TFL	Composite beam	LRFD	3	3	0	0	–	–
T3-18 W21X50 TFL	Composite beam	ASD	2	2	0	0	–	–
T3-18 W21X50 PNA7	Composite beam	LRFD	3	3	0	0	–	–
T3-18 W21X50 PNA7	Composite beam	ASD	2	2	0	0	–	–
T3-18 W21X44 BFL	Composite beam	LRFD	3	3	0	0	–	–
T3-18 W21X44 BFL	Composite beam	ASD	2	2	0	0	–	–
T3-18 W18X60 TFL	Composite beam	LRFD	3	3	0	0	–	–
T3-18 W18X60 TFL	Composite beam	ASD	2	2	0	0	–	–
I.9	Encased composite column	LRFD	6	6	0	0	–	–
I.9	Encased composite column	ASD	1	1	0	0	–	–
I.10	Encased composite column	LRFD	2	2	0	0	–	–
I.10	Encased composite column	ASD	2	2	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
I.11-L	Encased composite column	LRFD	7	7	0	0	–	–
I.11-L1	Encased composite column	LRFD	1	1	0	0	–	–
I.11-A	Encased composite column	ASD	3	3	0	0	–	–
I.8	Encased composite column	LRFD	2	2	0	0	–	–
I.8	Encased composite column	ASD	2	2	0	0	–	–
I.8-S	Encased composite column	LRFD	1	1	0	0	–	–
I.8-S	Encased composite column	ASD	1	1	0	0	–	–
DG1 4.7-3 · Anchors in concrete	Anchors in concrete	LRFD	7	7	0	0	–	–
DG1 4.7-3 hook	Anchors in concrete	LRFD	1	1	0	0	–	–
DG1 4.7-4	Anchors in concrete	LRFD	4	4	0	0	–	–
DG1 4.7-9 · Anchors in concrete	Anchors in concrete	LRFD	6	6	0	0	–	–
DG1 4.7-15	Anchors in concrete	LRFD	6	6	0	0	–	–
DG1 4.7-7	Anchors in concrete	LRFD	13	13	0	0	–	–
MNL-17 Anch-2	Anchors in concrete	LRFD	8	8	0	0	–	–
MNL-17 Anch-6	Anchors in concrete	LRFD	11	11	0	0	–	–
MNL-17 Anch-10	Anchors in concrete	LRFD	18	17	1	0	–	–
MNL-17 Anch-11	Anchors in concrete	LRFD	9	8	1	0	–	–
MNL-17 Anch-21a	Anchors in concrete	LRFD	13	13	0	0	–	–
MNL-17 Anch-21b	Anchors in concrete	LRFD	14	12	2	0	–	–
SP-SSB	Concrete beam	—	15	12	3	0	–	–
SP-CB	Concrete beam	—	11	9	2	0	–	–
SP-TOR	Concrete beam	—	14	14	0	0	–	–
SP-CNB+	Concrete beam	—	3	3	0	0	–	–
SP-CNB-neg	Concrete beam	—	2	2	0	0	–	–
B-1 · Concrete beam	Concrete beam	—	13	13	0	0	–	–
B-2 · Concrete beam	Concrete beam	—	3	3	0	0	–	–
B-3 · Concrete beam	Concrete beam	—	5	5	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
SP-WMSJ	Concrete beam	—	5	5	0	0	–	–
B-4 · Concrete beam	Concrete beam	—	2	2	0	0	–	–
B-5 · Concrete beam	Concrete beam	—	2	2	0	0	–	–
B-6 · Concrete beam	Concrete beam	—	1	1	0	0	–	–
MNL17-B1+	Concrete beam	—	10	9	1	0	–	–
MNL17-B1-I+	Concrete beam	—	3	2	1	0	–	–
MNL17-B1-E2	Concrete beam	—	2	2	0	0	–	–
MNL17-B1-I-	Concrete beam	—	1	1	0	0	–	–
MNL17-B1-E1	Concrete beam	—	1	1	0	0	–	–
MNL17-B1-cc	Concrete beam	—	1	0	1	0	–	–
MNL17-B2	Concrete beam	—	8	8	0	0	–	–
MNL17-B3-defl	Concrete beam	—	4	4	0	0	–	–
MNL17-B4	Concrete beam	—	19	17	2	0	–	–
MNL17-B4-I+	Concrete beam	—	3	3	0	0	–	–
MNL17-B4-E2	Concrete beam	—	1	1	0	0	–	–
MNL17-B4-I-	Concrete beam	—	1	1	0	0	–	–
MNL17-B7	Concrete beam	—	8	8	0	0	–	–
MNL17-B8	Concrete beam	—	12	12	0	0	–	–
MNL17-B9	Concrete beam	—	10	9	1	0	–	–
MNL17-D2	Concrete beam	—	7	6	1	0	–	–
MNL17-D3	Concrete beam	—	1	1	0	0	–	–
MNL17-D6	Concrete beam	—	4	4	0	0	–	–
MNL17-D7+	Concrete beam	—	1	1	0	0	–	–
MNL17-D7-	Concrete beam	—	1	0	1	0	–	–
J.6 · Bearing on concrete	Bearing on concrete	—	3	3	0	0	–	–
SP-SF-5.1	Bearing on concrete	—	1	1	0	0	–	–
SP-SF-5.2	Bearing on concrete	—	1	1	0	0	–	–
BRG-OFFSET	Bearing on concrete	—	2	2	0	0	–	–
BRG-DEPTH	Bearing on concrete	—	2	2	0	0	–	–
BRG-CAP	Bearing on concrete	—	1	1	0	0	–	–
BRG-ENTERED	Bearing on concrete	—	1	1	0	0	–	–
SP-IDT	Concrete column	—	2	2	0	0	–	–
SP-IDT fs = 0	Concrete column	—	2	2	0	0	–	–
SP-IDT fs = 0.5fy	Concrete column	—	2	2	0	0	–	–
SP-IDT balanced point	Concrete column	—	2	2	0	0	–	–
SP-IDT tension control (εt = εty + 0.003)	Concrete column	—	2	2	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
SP-IDT pure bending	Concrete column	—	1	1	0	0	–	–
SP-IDS	Concrete column	—	2	2	0	0	–	–
SP-IDS fs = 0	Concrete column	—	2	2	0	0	–	–
SP-IDS fs = 0.5fy	Concrete column	—	2	2	0	0	–	–
SP-IDS balanced point	Concrete column	—	2	2	0	0	–	–
SP-IDS tension control (εt = εty + 0.003)	Concrete column	—	2	2	0	0	–	–
SP-IDS pure bending	Concrete column	—	1	1	0	0	–	–
SP-SNS	Concrete column	—	2	1	1	0	–	–
C-1	Concrete column	—	1	1	0	0	–	–
C-2	Concrete column	—	1	1	0	0	–	–
C-3 · Concrete column	Concrete column	—	4	4	0	0	–	–
C-4 · Concrete column	Concrete column	—	2	2	0	0	–	–
MNL17-C1	Concrete column	—	8	5	3	0	–	–
MNL17-C2	Concrete column	—	6	6	0	0	–	–
MNL17-C3	Concrete column	—	2	1	1	0	–	–
MNL17-C4	Concrete column	—	2	1	1	0	–	–
MNL17-C5	Concrete column	—	2	2	0	0	–	–
SP-CNB-1	Continuous concrete beam	—	3	3	0	0	–	–
CB-2SPAN	Continuous concrete beam	—	4	4	0	0	–	–
CB-COEF	Continuous concrete beam	—	5	5	0	0	–	–
SP-CNB-NEG-RECT	Concrete deflection	—	4	4	0	0	–	–
SP-CNB-T	Concrete deflection	—	3	3	0	0	–	–
CD-UNCRACKED	Concrete deflection	—	2	2	0	0	–	–
CD-CRACKED	Concrete deflection	—	5	5	0	0	–	–
SP17-E1-EW	Concrete diaphragm	—	6	6	0	0	–	–
SP17-E1-NS	Concrete diaphragm	—	8	8	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
P1051-WWR	Concrete diaphragm	—	1	1	0	0	–	–
HC-DEF · Concrete diaphragm	Concrete diaphragm	—	4	4	0	0	–	–
HC-OPEN	Concrete diaphragm	—	4	4	0	0	–	–
MNL-D1-EW	Concrete diaphragm	—	6	6	0	0	–	–
MNL-D1-NS	Concrete diaphragm	—	8	8	0	0	–	–
T722.2.1.1-CARB	Concrete fire resistance	—	1	1	0	0	–	–
T722.2.1.1-LW	Concrete fire resistance	—	1	1	0	0	–	–
T722.2.2.1-SIL	Concrete fire resistance	—	2	2	0	0	–	–
T722.2.3-2	Concrete fire resistance	—	1	1	0	0	–	–
T722.2.3-3	Concrete fire resistance	—	1	1	0	0	–	–
T722.2.3-4	Concrete fire resistance	—	1	1	0	0	–	–
T722.2.4-SIL	Concrete fire resistance	—	2	2	0	0	–	–
T722.2.4-NOTE-A	Concrete fire resistance	—	1	1	0	0	–	–
HC-WIDTH	Concrete fire resistance	—	1	1	0	0	–	–
HC-PS-WIDTH	Concrete fire resistance	—	1	1	0	0	–	–
HC-FINISH · Concrete fire resistance	Concrete fire resistance	—	3	3	0	0	–	–
SMF-BEAM	Special moment frame members	—	6	6	0	0	–	–
SMF-LO	Special moment frame members	—	3	3	0	0	–	–
SMF-ASH	Special moment frame members	—	4	4	0	0	–	–
ST-1	Concrete stair	—	6	6	0	0	–	–
ST-2	Concrete stair	—	2	2	0	0	–	–
ST-3	Concrete stair	—	3	3	0	0	–	–
TW-CANT	Liquid-containing tank wall	—	3	3	0	0	–	–
TW-PROPPED	Liquid-containing tank wall	—	1	1	0	0	–	–
TW-PINNED	Liquid-containing tank wall	—	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
TW-FREE	Liquid-containing tank wall	—	1	1	0	0	–	–
TW-FIXED	Liquid-containing tank wall	—	1	1	0	0	–	–
SP-BW	Concrete shear wall	—	12	12	0	0	–	–
SP-TU · Concrete shear wall	Concrete shear wall	—	4	4	0	0	–	–
SP-TU-svc	Concrete shear wall	—	5	5	0	0	–	–
SP-SW	Concrete shear wall	—	7	7	0	0	–	–
W-1	Concrete shear wall	—	2	2	0	0	–	–
W-2	Concrete shear wall	—	1	1	0	0	–	–
W-3	Concrete shear wall	—	1	1	0	0	–	–
W-4	Concrete shear wall	—	2	2	0	0	–	–
W-5	Concrete shear wall	—	1	1	0	0	–	–
W-6	Concrete shear wall	—	6	6	0	0	–	–
W-7	Concrete shear wall	—	1	1	0	0	–	–
W-8	Concrete shear wall	—	1	1	0	0	–	–
W-9	Concrete shear wall	—	1	1	0	0	–	–
W-10	Concrete shear wall	—	1	1	0	0	–	–
MNL17-W1	Concrete shear wall	—	9	7	2	0	–	–
MNL17-W2	Concrete shear wall	—	8	4	4	0	–	–
MNL17-W2-PM	Concrete shear wall	—	1	0	1	0	–	–
VC-CORBEL	Corbel	—	8	7	1	0	–	–
MP-CORBEL	Corbel	—	9	6	3	0	–	–
CB-1	Corbel	—	7	7	0	0	–	–
CB-2	Corbel	—	2	2	0	0	–	–
CB-3	Corbel	—	2	2	0	0	–	–
FEMA-4.5.3	Coupling beam	—	8	8	0	0	–	–
CB-DIAG	Coupling beam	—	4	4	0	0	–	–
CB-CAP	Coupling beam	—	1	1	0	0	–	–
CPT-LCPC-SAND	Pile capacity from CPT	—	2	2	0	0	–	–
CPT-EF-SAND	Pile capacity from CPT	—	2	2	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
CPT-LCPC-CLAY	Pile capacity from CPT	—	2	2	0	0	–	–
CPT-LCPC-CLAY-CAREFUL	Pile capacity from CPT	—	1	1	0	0	–	–
CPT-EF-CLAY	Pile capacity from CPT	—	2	2	0	0	–	–
DG7-14.1.1 · Crane runway beam	Crane runway beam	ASD	14	12	2	0	–	–
DG7-14.1.2	Crane runway beam	LRFD	11	11	0	0	–	–
DG7-14.1.3	Crane runway beam	ASD	28	23	5	0	–	–
DG7-14.1.4	Crane runway beam	LRFD	7	6	1	0	–	–
HC-WT-1	Crane runway beam	ASD	2	2	0	0	–	–
HC-CURVED	Curved and tapered glulam	ASD	9	9	0	0	–	–
HC-PITCHED	Curved and tapered glulam	ASD	8	8	0	0	–	–
F.1-1A · Custom calculation	Custom calculation	—	4	4	0	0	–	–
ACI-22.5.5.1	Custom calculation	—	1	1	0	0	–	–
SP811-sheet	Custom calculation	—	3	3	0	0	–	–
DAP-1	Dapped-end beam	—	9	9	0	0	–	–
DAP-PCI	Dapped-end beam	—	2	2	0	0	–	–
T-c_gypsum	Dead load build-up	—	1	1	0	0	–	–
T-r_deck20	Dead load build-up	—	1	1	0	0	–	–
T-i_poly	Dead load build-up	—	1	1	0	0	–	–
T-r_ply	Dead load build-up	—	1	1	0	0	–	–
T-w_single	Dead load build-up	—	1	1	0	0	–	–
T-f_stone	Dead load build-up	—	1	1	0	0	–	–
T-n_tile_one	Dead load build-up	—	1	1	0	0	–	–
T-j_2x10_16	Dead load build-up	—	1	1	0	0	–	–
T-e_brick	Dead load build-up	—	1	1	0	0	–	–
T-b_8	Dead load build-up	—	1	1	0	0	–	–
T-cmu_105_4_none	Dead load build-up	—	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
T-cmu_105_8_full	Dead load build-up	—	1	1	0	0	–	–
T-cmu_125_8_32	Dead load build-up	—	1	1	0	0	–	–
T-cmu_135_12_16	Dead load build-up	—	1	1	0	0	–	–
T-cmu_135_12_solid	Dead load build-up	—	1	1	0	0	–	–
T-cmu_125_6_solid	Dead load build-up	—	1	1	0	0	–	–
T-slate	Dead load build-up	—	1	1	0	0	–	–
D-conc	Dead load build-up	—	1	1	0	0	–	–
D-grout	Dead load build-up	—	1	1	0	0	–	–
H-total	Dead load build-up	—	1	1	0	0	–	–
H-slope	Dead load build-up	—	1	1	0	0	–	–
H-line	Dead load build-up	—	1	1	0	0	–	–
VC-G-EX	Steel deck diaphragm	LRFD	4	3	1	0	–	–
VC-G-EX	Steel deck diaphragm	ASD	1	1	0	0	–	–
VC-A-36-4	Steel deck diaphragm	LRFD	1	1	0	0	–	–
VC-A-24-4	Steel deck diaphragm	LRFD	1	1	0	0	–	–
VC-T32-S3	Steel deck diaphragm	LRFD	3	3	0	0	–	–
VC-T32-S3	Steel deck diaphragm	ASD	1	1	0	0	–	–
VC-T32-S4	Steel deck diaphragm	LRFD	2	2	0	0	–	–
VC-T32-S4	Steel deck diaphragm	ASD	1	1	0	0	–	–
VC-T32-L3	Steel deck diaphragm	LRFD	2	2	0	0	–	–
VC-T32-B	Steel deck diaphragm	LRFD	1	1	0	0	–	–
VC-T32-B	Steel deck diaphragm	ASD	1	1	0	0	–	–
VC-T24-S3	Steel deck diaphragm	LRFD	2	2	0	0	–	–
VC-T60-S3	Steel deck diaphragm	LRFD	3	3	0	0	–	–
VC-T60-L	Steel deck diaphragm	LRFD	2	2	0	0	–	–
VC-T42-W	Steel deck diaphragm	LRFD	4	4	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
VC-T42-B	Steel deck diaphragm	LRFD	1	1	0	0	–	–
VC-T1-W18	Steel deck diaphragm	LRFD	1	1	0	0	–	–
VC-SF-20	Steel deck diaphragm	LRFD	2	2	0	0	–	–
VC-SF-22	Steel deck diaphragm	LRFD	2	2	0	0	–	–
VC-SF-18	Steel deck diaphragm	LRFD	2	2	0	0	–	–
VC-T2-W	Steel deck diaphragm	LRFD	1	0	1	0	–	–
VC-T33-U60	Steel deck diaphragm	ASD	1	0	1	0	–	–
VC-D-36-7	Steel deck diaphragm	LRFD	1	1	0	0	–	–
VC-D-36-4	Steel deck diaphragm	LRFD	1	1	0	0	–	–
VC-D-24-4	Steel deck diaphragm	LRFD	1	1	0	0	–	–
VC-D-20	Steel deck diaphragm	LRFD	1	1	0	0	–	–
S310-C12-WR-0.0295-1	Steel deck diaphragm	LRFD	1	1	0	0	–	–
S310-C12-WR-0.0295-2	Steel deck diaphragm	LRFD	1	1	0	0	–	–
S310-C12-WR-0.0295-3	Steel deck diaphragm	LRFD	1	1	0	0	–	–
S310-C12-WR-0.0295-4	Steel deck diaphragm	LRFD	1	1	0	0	–	–
S310-C12-WR-0.0598-1	Steel deck diaphragm	LRFD	1	1	0	0	–	–
S310-C12-IR-0.0358-1	Steel deck diaphragm	LRFD	1	1	0	0	–	–
S310-C12-IR-0.0358-2	Steel deck diaphragm	LRFD	1	1	0	0	–	–
S310-C12-NR-0.0474-1	Steel deck diaphragm	LRFD	1	1	0	0	–	–
S310-C12-NR-0.0474-3	Steel deck diaphragm	LRFD	1	1	0	0	–	–
S310-C12-DR-0.0295-1	Steel deck diaphragm	LRFD	1	1	0	0	–	–
S310-N-COMMON	Steel deck diaphragm	LRFD	1	1	0	0	–	–
S310-N-EACH	Steel deck diaphragm	LRFD	1	1	0	0	–	–
HC-SCREW-PNF	Steel deck diaphragm	LRFD	1	1	0	0	–	–
HC-FACT-SC	Steel deck diaphragm	LRFD	2	2	0	0	–	–
HC-FACT-SC	Steel deck diaphragm	ASD	2	2	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
HC-FACT-WE	Steel deck diaphragm	LRFD	2	2	0	0	–	–
HC-FACT-WE	Steel deck diaphragm	ASD	2	2	0	0	–	–
HC-SNP	Steel deck diaphragm	LRFD	1	1	0	0	–	–
HC-SNE	Steel deck diaphragm	LRFD	1	1	0	0	–	–
SP17-STM1	Deep beam (strut-and-tie)	—	15	14	1	0	–	–
SP17-STM1-B	Deep beam (strut-and-tie)	—	1	0	1	0	–	–
DE-STM	Deep beam (strut-and-tie)	—	11	10	1	0	–	–
HC-ASYM	Deep beam (strut-and-tie)	—	2	2	0	0	–	–
HC-BETA	Deep beam (strut-and-tie)	—	1	1	0	0	–	–
HC-234	Deep beam (strut-and-tie)	—	1	1	0	0	–	–
MNL-STM1	Deep beam (strut-and-tie)	—	15	14	1	0	–	–
DF-7.4-T	Diaphragm forces	—	5	5	0	0	–	–
DF-7.4-L	Diaphragm forces	—	3	3	0	0	–	–
DF-7.4-A	Diaphragm forces	—	3	3	0	0	–	–
DF-7.5-T	Diaphragm forces	—	15	15	0	0	–	–
DF-7.5-T5	Diaphragm forces	—	3	3	0	0	–	–
DF-7.5-A	Diaphragm forces	—	19	17	2	0	–	–
DF-7.6-T	Diaphragm forces	—	9	9	0	0	–	–
DF-7.6-TL	Diaphragm forces	—	2	2	0	0	–	–
DF-7.6-R	Diaphragm forces	—	11	11	0	0	–	–
DF-7.6-RL	Diaphragm forces	—	3	3	0	0	–	–
DF-H1	Diaphragm forces	—	2	2	0	0	–	–
YAW-CM-CR	Rigid diaphragm torsion	—	8	8	0	0	–	–
YAW-VX	Rigid diaphragm torsion	—	11	11	0	0	–	–
YAW-VY	Rigid diaphragm torsion	—	10	10	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
SEAOC-DE33	Rigid diaphragm torsion	—	8	8	0	0	–	–
FEMA-13.2-B	Rigid diaphragm torsion	—	5	5	0	0	–	–
FEMA-13.2-D	Rigid diaphragm torsion	—	3	3	0	0	–	–
FEMA-11.2	Rigid diaphragm torsion	—	3	3	0	0	–	–
HC-1 · Rigid diaphragm torsion	Rigid diaphragm torsion	—	5	5	0	0	–	–
HC-2 · Rigid diaphragm torsion	Rigid diaphragm torsion	—	6	6	0	0	–	–
HC-3 · Rigid diaphragm torsion	Rigid diaphragm torsion	—	3	3	0	0	–	–
DS-GEC10-10.1	Drilled pier	—	4	4	0	0	–	–
DS-GEC10-10.2	Drilled pier	—	3	3	0	0	–	–
DS-GEC10-10.3	Drilled pier	—	2	2	0	0	–	–
DS-GEC10-10.5	Drilled pier	—	2	2	0	0	–	–
DS-GEC10-10.4	Drilled pier	—	3	3	0	0	–	–
F18-0.1	Lateral pressure from surface loads	—	2	2	0	0	–	–
F18-0.4	Lateral pressure from surface loads	—	2	2	0	0	–	–
F18-0.45	Lateral pressure from surface loads	—	2	2	0	0	–	–
F18-0.5	Lateral pressure from surface loads	—	2	2	0	0	–	–
F18-0.55	Lateral pressure from surface loads	—	2	2	0	0	–	–
F18-0.6	Lateral pressure from surface loads	—	2	2	0	0	–	–
F19-0.4	Lateral pressure from surface loads	—	2	1	1	0	–	–
F19-0.45	Lateral pressure from surface loads	—	2	2	0	0	–	–
F19-0.5	Lateral pressure from surface loads	—	2	2	0	0	–	–
F19-0.55	Lateral pressure from surface loads	—	2	2	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
F19-0.6	Lateral pressure from surface loads	—	2	2	0	0	–	–
F19-0.65	Lateral pressure from surface loads	—	2	2	0	0	–	–
F19-0.7	Lateral pressure from surface loads	—	2	2	0	0	–	–
F17-0.6	Lateral pressure from surface loads	—	1	1	0	0	–	–
F17-1.0	Lateral pressure from surface loads	—	1	1	0	0	–	–
F17-2.0	Lateral pressure from surface loads	—	1	0	1	0	–	–
F17-3.0	Lateral pressure from surface loads	—	1	1	0	0	–	–
F17-6.0	Lateral pressure from surface loads	—	1	1	0	0	–	–
T32-SP	Lateral pressure from surface loads	—	1	1	0	0	–	–
T32-SM	Lateral pressure from surface loads	—	1	1	0	0	–	–
T32-SC	Lateral pressure from surface loads	—	1	1	0	0	–	–
T32-CL	Lateral pressure from surface loads	—	1	1	0	0	–	–
T32-SP-R	Lateral pressure from surface loads	—	1	1	0	0	–	–
T32-SC-R	Lateral pressure from surface loads	—	1	1	0	0	–	–
E.4A-BC	Effective length factor	LRFD	3	3	0	0	–	–
E.4A-BC-A	Effective length factor	ASD	2	2	0	0	–	–
E.4A-AB	Effective length factor	ASD	3	3	0	0	–	–
E.4B · Effective length factor	Effective length factor	ASD	2	2	0	0	–	–
T-a	Effective length factor	—	1	1	0	0	–	–
T-b	Effective length factor	—	1	1	0	0	–	–
T-c	Effective length factor	—	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
T-d	Effective length factor	—	1	1	0	0	–	–
T-e	Effective length factor	—	1	1	0	0	–	–
T-f	Effective length factor	—	1	1	0	0	–	–
T-a-R	Effective length factor	—	1	1	0	0	–	–
T-b-R	Effective length factor	—	1	1	0	0	–	–
T-c-R	Effective length factor	—	1	1	0	0	–	–
T-d-R	Effective length factor	—	1	1	0	0	–	–
T-e-R	Effective length factor	—	1	1	0	0	–	–
T-f-R	Effective length factor	—	1	1	0	0	–	–
H-S11	Effective length factor	—	1	1	0	0	–	–
H-S00	Effective length factor	—	1	1	0	0	–	–
H-S0P	Effective length factor	—	1	1	0	0	–	–
H-B00	Effective length factor	—	1	1	0	0	–	–
H-B0P	Effective length factor	—	1	1	0	0	–	–
H-BPP	Effective length factor	—	1	1	0	0	–	–
H-K2S	Effective length factor	—	1	1	0	0	–	–
H-K2SL	Effective length factor	—	1	1	0	0	–	–
H-K2B	Effective length factor	—	1	1	0	0	–	–
H-K2BL	Effective length factor	—	1	1	0	0	–	–
HET-18	Beam on elastic foundation	—	8	8	0	0	–	–
HET-12-1	Beam on elastic foundation	—	1	1	0	0	–	–
HET-12-1b	Beam on elastic foundation	—	2	2	0	0	–	–
CC-RAIL	Beam on elastic foundation	—	3	3	0	0	–	–
SV-BEF	Beam on elastic foundation	—	3	1	2	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
EFB-1	Beam on elastic foundation	—	2	2	0	0	–	–
EFB-KS	Beam on elastic foundation	—	1	1	0	0	–	–
SP17-E14	Embed plate	—	13	8	5	0	–	–
SP17-E16	Embed plate	—	4	4	0	0	–	–
HC-DEF · Embed plate	Embed plate	—	4	4	0	0	–	–
HC-TENSION · Embed plate	Embed plate	—	1	1	0	0	–	–
MNL-17 Anch-15	Embed plate	—	11	11	0	0	–	–
MNL-17 Anch-17	Embed plate	—	25	18	7	0	–	–
MNL-17 Anch-19	Embed plate	—	15	14	1	0	–	–
FP-1	Fall-protection anchorage	LRFD	10	10	0	0	–	–
FP-1	Fall-protection anchorage	ASD	2	2	0	0	–	–
FP-QP	Fall-protection anchorage	LRFD	2	2	0	0	–	–
FP-HLL	Fall-protection anchorage	LRFD	3	3	0	0	–	–
I.3-a	Concrete-filled HSS column	LRFD	7	7	0	0	–	–
I.3-a	Concrete-filled HSS column	ASD	2	2	0	0	–	–
I.3-b	Concrete-filled HSS column	LRFD	1	1	0	0	–	–
I.3-b	Concrete-filled HSS column	ASD	1	1	0	0	–	–
I.3-bearing	Concrete-filled HSS column	LRFD	2	2	0	0	–	–
I.3-bearing	Concrete-filled HSS column	ASD	1	1	0	0	–	–
I.4	Concrete-filled HSS column	LRFD	12	12	0	0	–	–
I.4	Concrete-filled HSS column	ASD	3	3	0	0	–	–
I.5	Concrete-filled HSS column	LRFD	2	2	0	0	–	–
I.5	Concrete-filled HSS column	ASD	2	2	0	0	–	–
I.6-M1-LRFD	Concrete-filled HSS column	LRFD	6	6	0	0	–	–
I.6-M1-ASD	Concrete-filled HSS column	ASD	4	4	0	0	–	–
I.6-M2-LRFD	Concrete-filled HSS column	LRFD	9	9	0	0	–	–
I.6-M2-ASD	Concrete-filled HSS column	ASD	1	1	0	0	–	–
I.7-1/2-LRFD	Concrete-filled HSS column	LRFD	23	22	1	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
I.7-1/2-ASD	Concrete-filled HSS column	ASD	3	3	0	0	–	–
I.7-1/4-LRFD	Concrete-filled HSS column	LRFD	21	20	1	0	–	–
I.7-1/4-ASD	Concrete-filled HSS column	ASD	4	4	0	0	–	–
STI-1	Concrete-filled HSS column	LRFD	12	12	0	0	–	–
STI-T1-4	Concrete-filled HSS column	LRFD	2	2	0	0	–	–
STI-T1-6	Concrete-filled HSS column	LRFD	1	1	0	0	–	–
STI-T2-4	Concrete-filled HSS column	LRFD	2	2	0	0	–	–
STI-T2-6	Concrete-filled HSS column	LRFD	1	1	0	0	–	–
STI-T3-4	Concrete-filled HSS column	LRFD	2	2	0	0	–	–
STI-T3-6	Concrete-filled HSS column	LRFD	1	1	0	0	–	–
STI-T4-4	Concrete-filled HSS column	LRFD	2	2	0	0	–	–
STI-T4-6	Concrete-filled HSS column	LRFD	1	1	0	0	–	–
STI-T5-4	Concrete-filled HSS column	LRFD	2	2	0	0	–	–
STI-T5-6	Concrete-filled HSS column	LRFD	1	1	0	0	–	–
STI-T6-4	Concrete-filled HSS column	LRFD	2	2	0	0	–	–
STI-T6-6	Concrete-filled HSS column	LRFD	1	1	0	0	–	–
STI-T7-4	Concrete-filled HSS column	LRFD	2	2	0	0	–	–
STI-T7-6	Concrete-filled HSS column	LRFD	1	1	0	0	–	–
STI-T8-4	Concrete-filled HSS column	LRFD	2	2	0	0	–	–
STI-T8-6	Concrete-filled HSS column	LRFD	1	1	0	0	–	–
STI-T9-4	Concrete-filled HSS column	LRFD	2	1	1	0	–	–
STI-T9-6	Concrete-filled HSS column	LRFD	1	1	0	0	–	–
T5-6-16.000X0.625	Concrete-filled HSS column	LRFD	1	1	0	0	–	–
T5-6-16.000X0.625	Concrete-filled HSS column	ASD	1	1	0	0	–	–
T5-6-14.000X0.375	Concrete-filled HSS column	LRFD	1	1	0	0	–	–
T5-6-14.000X0.375	Concrete-filled HSS column	ASD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
T5-6-10.000X0.375	Concrete-filled HSS column	LRFD	1	1	0	0	–	–
T5-6-10.000X0.375	Concrete-filled HSS column	ASD	1	1	0	0	–	–
T5-6-8.625X0.322	Concrete-filled HSS column	LRFD	1	1	0	0	–	–
T5-6-8.625X0.322	Concrete-filled HSS column	ASD	1	1	0	0	–	–
DESTEFANO-T1-2x10	Flitch-plate beam	ASD	6	6	0	0	–	–
DESTEFANO-T1-3x2x10	Flitch-plate beam	ASD	5	5	0	0	–	–
DESTEFANO-T1-2x12	Flitch-plate beam	ASD	5	5	0	0	–	–
DESTEFANO-T1-2x8	Flitch-plate beam	ASD	5	5	0	0	–	–
DESTEFANO-EX	Flitch-plate beam	ASD	5	3	2	0	–	–
HAND-1 · Flitch-plate beam	Flitch-plate beam	ASD	5	5	0	0	–	–
HAND-1 · Flitch-plate beam	Flitch-plate beam	LRFD	2	2	0	0	–	–
HAND-1B	Flitch-plate beam	LRFD	1	1	0	0	–	–
HAND-2 · Flitch-plate beam	Flitch-plate beam	ASD	3	3	0	0	–	–
HAND-2 · Flitch-plate beam	Flitch-plate beam	LRFD	1	1	0	0	–	–
HAND-3 · Flitch-plate beam	Flitch-plate beam	ASD	5	5	0	0	–	–
8.4	Flood loads	LRFD	7	7	0	0	–	–
8.4-a	Flood loads	LRFD	2	2	0	0	–	–
8.4-low	Flood loads	LRFD	1	1	0	0	–	–
8.3-a	Flood loads	LRFD	1	1	0	0	–	–
8.3-b	Flood loads	LRFD	2	2	0	0	–	–
H-W	Flood loads	LRFD	4	4	0	0	–	–
H-W2	Flood loads	LRFD	1	1	0	0	–	–
H-W3	Flood loads	LRFD	1	1	0	0	–	–
H-HS	Flood loads	LRFD	3	3	0	0	–	–
H-C5	Flood loads	LRFD	1	1	0	0	–	–
T-C5	Flood loads	LRFD	1	1	0	0	–	–
DG11-4.1	Floor vibration	—	16	16	0	0	–	–
DG11-4.2	Floor vibration	—	12	12	0	0	–	–
DG11-4.3	Floor vibration	—	3	3	0	0	–	–
DG11-4.4	Floor vibration	—	8	8	0	0	–	–
DG11-4.5	Floor vibration	—	5	5	0	0	–	–
DG11-4.6	Floor vibration	—	7	7	0	0	–	–
DG11-5.1	Floor vibration	—	3	3	0	0	–	–
DG11-5.2	Floor vibration	—	4	4	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
DG11-6.1	Floor vibration	—	14	14	0	0	–	–
DG11-6.2	Floor vibration	—	10	10	0	0	–	–
DG11-6.3-VS	Floor vibration	—	1	0	1	0	–	–
DG11-6.3-S	Floor vibration	—	1	1	0	0	–	–
DG11-6.3-M	Floor vibration	—	1	1	0	0	–	–
DG11-6.3-F	Floor vibration	—	1	1	0	0	–	–
DG11-6.4-VS	Floor vibration	—	1	1	0	0	–	–
DG11-6.4-F	Floor vibration	—	1	1	0	0	–	–
FP-CANT	Fluid and hydrostatic pressure	LRFD	3	3	0	0	–	–
FP-CANT	Fluid and hydrostatic pressure	ASD	1	1	0	0	–	–
FP-PROP	Fluid and hydrostatic pressure	LRFD	4	4	0	0	–	–
FP-SOIL	Fluid and hydrostatic pressure	LRFD	1	1	0	0	–	–
FP-SOIL	Fluid and hydrostatic pressure	ASD	1	1	0	0	–	–
FP-FLOAT	Fluid and hydrostatic pressure	LRFD	4	4	0	0	–	–
FP-FLOAT	Fluid and hydrostatic pressure	ASD	2	2	0	0	–	–
FP-237	Fluid and hydrostatic pressure	LRFD	1	1	0	0	–	–
FR-1	2-D frame analysis	—	3	3	0	0	–	–
FR-2	2-D frame analysis	—	3	3	0	0	–	–
FR-3	2-D frame analysis	—	3	3	0	0	–	–
FR-4	2-D frame analysis	—	4	4	0	0	–	–
FR-5	2-D frame analysis	—	3	3	0	0	–	–
UD-11.5	2-D frame analysis	—	7	7	0	0	–	–
UD-12.3	2-D frame analysis	—	5	3	2	0	–	–
UD-12.5	2-D frame analysis	—	3	3	0	0	–	–
AISC-17F	2-D frame analysis	—	4	4	0	0	–	–
AISC-39F	2-D frame analysis	—	5	5	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
C.1A	2-D frame analysis	LRFD	11	9	2	0	–	–
C.1A	2-D frame analysis	ASD	11	9	2	0	–	–
C.1B	2-D frame analysis	LRFD	11	9	2	0	–	–
C.1B	2-D frame analysis	ASD	11	9	2	0	–	–
C.1C	2-D frame analysis	LRFD	13	12	1	0	–	–
C.1C	2-D frame analysis	ASD	10	9	1	0	–	–
BENCH-1-P0	2-D frame analysis	—	2	2	0	0	–	–
BENCH-1-P0-noshear	2-D frame analysis	—	2	2	0	0	–	–
BENCH-1-P150	2-D frame analysis	—	2	2	0	0	–	–
BENCH-1-P150-noshear	2-D frame analysis	—	2	2	0	0	–	–
BENCH-1-P300	2-D frame analysis	—	2	2	0	0	–	–
BENCH-1-P300-noshear	2-D frame analysis	—	2	2	0	0	–	–
BENCH-1-P450	2-D frame analysis	—	2	2	0	0	–	–
BENCH-1-P450-noshear	2-D frame analysis	—	2	2	0	0	–	–
BENCH-2-P0	2-D frame analysis	—	2	2	0	0	–	–
BENCH-2-P0-noshear	2-D frame analysis	—	2	2	0	0	–	–
BENCH-2-P100	2-D frame analysis	—	2	2	0	0	–	–
BENCH-2-P100-noshear	2-D frame analysis	—	2	2	0	0	–	–
BENCH-2-P150	2-D frame analysis	—	2	2	0	0	–	–
BENCH-2-P150-noshear	2-D frame analysis	—	2	2	0	0	–	–
BENCH-2-P200	2-D frame analysis	—	2	2	0	0	–	–
BENCH-2-P200-noshear	2-D frame analysis	—	2	2	0	0	–	–
DG28-3.2-Comb7	2-D frame analysis	LRFD	3	3	0	0	–	–
DG28-3.2-Comb8	2-D frame analysis	LRFD	3	1	2	0	–	–
DG28-3.2-Comb11	2-D frame analysis	LRFD	3	2	1	0	–	–
DG28-3.2-Comb12	2-D frame analysis	LRFD	3	1	2	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
DG28-3.2-Comb15	2-D frame analysis	LRFD	3	2	1	0	–	–
DG28-3.2-Comb16	2-D frame analysis	LRFD	3	1	2	0	–	–
DG28-3.2-drift-Comb3	2-D frame analysis	LRFD	2	0	2	0	–	–
DG28-3.2-drift-Comb7	2-D frame analysis	LRFD	2	1	1	0	–	–
DG28-3.2-drift-Comb11	2-D frame analysis	LRFD	2	2	0	0	–	–
DG28-3.2-drift-Comb15	2-D frame analysis	LRFD	2	1	1	0	–	–
DG28-3.2-drift-Comb19	2-D frame analysis	LRFD	2	2	0	0	–	–
DG28-D4	2-D frame analysis	LRFD	5	5	0	0	–	–
E.1A · 2-D frame analysis	2-D frame analysis	LRFD	1	1	0	0	–	–
E.1A · 2-D frame analysis	2-D frame analysis	ASD	1	1	0	0	–	–
F.1-3	2-D frame analysis	LRFD	1	1	0	0	–	–
F.1-3	2-D frame analysis	ASD	1	1	0	0	–	–
G.1A	2-D frame analysis	LRFD	1	1	0	0	–	–
G.1A	2-D frame analysis	ASD	1	1	0	0	–	–
D.1 · 2-D frame analysis	2-D frame analysis	LRFD	1	1	0	0	–	–
D.1 · 2-D frame analysis	2-D frame analysis	ASD	1	1	0	0	–	–
HAND-CANT-P100	2-D frame analysis	—	2	2	0	0	–	–
HAND-CANT-P200	2-D frame analysis	—	2	2	0	0	–	–
HAND-PIN-P150	2-D frame analysis	—	2	2	0	0	–	–
HAND-PIN-P450	2-D frame analysis	—	2	2	0	0	–	–
GB-HC1	Gabion retaining wall	—	7	7	0	0	–	–
GB-HC2	Gabion retaining wall	—	3	3	0	0	–	–
F13.2-1-80	Glass unit masonry	—	1	1	0	0	–	–
F13.2-1-64	Glass unit masonry	—	1	1	0	0	–	–
F13.2-1-48	Glass unit masonry	—	1	1	0	0	–	–
F13.2-1-32	Glass unit masonry	—	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
F13.2-1-16	Glass unit masonry	—	1	1	0	0	–	–
13.2.2	Glass unit masonry	—	4	4	0	0	–	–
13.2.3	Glass unit masonry	—	3	3	0	0	–	–
13.2.4	Glass unit masonry	—	1	1	0	0	–	–
HC-SUPPORT	Glass unit masonry	—	1	1	0	0	–	–
HC-SUPPORT-HIGH	Glass unit masonry	—	1	1	0	0	–	–
AWC-E1.3 · Glulam and SCL beam	Glulam and SCL beam	ASD	14	14	0	0	–	–
TR14-3.1	Glulam and SCL beam	ASD	5	3	2	0	–	–
HAND-1 · Glulam and SCL beam	Glulam and SCL beam	ASD	7	7	0	0	–	–
HAND-1 · Glulam and SCL beam	Glulam and SCL beam	LRFD	2	2	0	0	–	–
HAND-2 · Glulam and SCL beam	Glulam and SCL beam	ASD	2	2	0	0	–	–
HAND-3 · Glulam and SCL beam	Glulam and SCL beam	ASD	3	3	0	0	–	–
GW-HC1	Gravity retaining wall	—	6	6	0	0	–	–
GW-HC2	Gravity retaining wall	—	5	5	0	0	–	–
CROSSING	Beam grid (grillage)	—	3	3	0	0	–	–
TORSION	Beam grid (grillage)	—	5	5	0	0	–	–
SINGLE	Beam grid (grillage)	—	3	3	0	0	–	–
GEC4-DE1-UPPER	Ground anchor	—	3	3	0	0	–	–
GEC4-DE1-LOWER	Ground anchor	—	3	3	0	0	–	–
GEC4-T9-1	Ground anchor	—	2	2	0	0	–	–
GEC4-T9-175	Ground anchor	—	2	2	0	0	–	–
GEC4-T9-138-160	Ground anchor	—	2	2	0	0	–	–
GEC4-T10-1	Ground anchor	—	1	1	0	0	–	–
GA-BOND	Ground anchor	—	3	3	0	0	–	–
GA-OVERBURDEN	Ground anchor	—	1	1	0	0	–	–
GI-GEC13-RAP	Ground improvement	—	5	5	0	0	–	–
GI-GEC13-SC	Ground improvement	—	3	3	0	0	–	–
DG34-10.1.7 · Guard or barrier post	Guard or barrier post	LRFD	9	9	0	0	–	–
DG34-10.1.7 · Guard or barrier post	Guard or barrier post	ASD	6	6	0	0	–	–
DG34-10.1.8	Guard or barrier post	LRFD	6	6	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
DG34-10.1.8	Guard or barrier post	ASD	2	2	0	0	–	–
HP-CLAY-1	Helical pile	—	2	2	0	0	–	–
HP-SAND-1	Helical pile	—	1	1	0	0	–	–
HP-CYL	Helical pile	—	2	2	0	0	–	–
HP-TORQUE	Helical pile	—	1	1	0	0	–	–
HP-BUCKLE	Helical pile	—	1	1	0	0	–	–
PCI-3.7-dyn4	Hollow-core plank	—	2	2	0	0	–	–
PCI-3.7-dyn6	Hollow-core plank	—	2	2	0	0	–	–
PCI-3.7-dyn8	Hollow-core plank	—	2	2	0	0	–	–
PCI-3.7-dyn10	Hollow-core plank	—	2	2	0	0	–	–
HC-FPS	Hollow-core plank	—	4	4	0	0	–	–
ICE-PIPE	Atmospheric ice loads	—	7	7	0	0	–	–
ICE-RECT	Atmospheric ice loads	—	5	5	0	0	–	–
ICE-CABLE	Atmospheric ice loads	—	3	3	0	0	–	–
ICE-CHIMNEY	Atmospheric ice loads	—	3	3	0	0	–	–
ICE-PLATE	Atmospheric ice loads	—	1	1	0	0	–	–
ICE-DOME	Atmospheric ice loads	—	1	1	0	0	–	–
DG7-14.1.1 · Impact and machinery loads	Impact and machinery loads	—	2	2	0	0	–	–
CR-722-B	Impact and machinery loads	—	5	5	0	0	–	–
CR-MONO	Impact and machinery loads	—	1	1	0	0	–	–
CR-HAND	Impact and machinery loads	—	3	3	0	0	–	–
MACH	Impact and machinery loads	—	1	1	0	0	–	–
MACH-R	Impact and machinery loads	—	1	1	0	0	–	–
MACH-M	Impact and machinery loads	—	1	1	0	0	–	–
HOIST	Impact and machinery loads	—	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
ELEV	Impact and machinery loads	—	1	1	0	0	–	–
UDOEYO-13.1	Influence lines	—	5	5	0	0	–	–
UDOEYO-13.2	Influence lines	—	4	4	0	0	–	–
TRAIN	Influence lines	—	4	4	0	0	–	–
LANE-SUPPORT	Influence lines	—	2	2	0	0	–	–
LANE-SPAN	Influence lines	—	2	2	0	0	–	–
LEDGE-DEFAULT	Ledge and inverted-tee beam	—	6	6	0	0	–	–
LEDGE-INVERTED	Ledge and inverted-tee beam	—	1	1	0	0	–	–
LEDGE-CLOSE	Ledge and inverted-tee beam	—	1	1	0	0	–	–
JS-30	Joist and waffle slab	—	9	9	0	0	–	–
JS-INT	Joist and waffle slab	—	3	3	0	0	–	–
JS-UNR	Joist and waffle slab	—	2	2	0	0	–	–
JS-SIMPLE	Joist and waffle slab	—	2	2	0	0	–	–
LP-HUB-5.1	Laterally loaded pile	—	3	3	0	0	–	–
LP-KOU-6.12	Laterally loaded pile	—	5	4	1	0	–	–
LP-KOU-6.13	Laterally loaded pile	—	4	4	0	0	–	–
LP-FHWA-EX8	Laterally loaded pile	—	3	1	2	0	–	–
PY-HET-FREE	Laterally loaded pile (p-y)	—	2	2	0	0	–	–
PY-HET-FIXED	Laterally loaded pile (p-y)	—	2	2	0	0	–	–
PY-MATLOCK-PU	Laterally loaded pile (p-y)	—	2	2	0	0	–	–
LQ-BI-SPT	Liquefaction triggering	—	6	6	0	0	–	–
LQ-BI-CPT	Liquefaction triggering	—	1	1	0	0	–	–
LQ-YOUD-SPT	Liquefaction triggering	—	3	3	0	0	–	–
III-26	Live load reduction	—	1	1	0	0	–	–
III-31	Live load reduction	—	1	1	0	0	–	–
III-40	Live load reduction	—	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
III-43	Live load reduction	—	1	1	0	0	–	–
III-50 2A	Live load reduction	—	3	3	0	0	–	–
III-51 1B	Live load reduction	—	2	2	0	0	–	–
III-51 1A	Live load reduction	—	3	3	0	0	–	–
III-52 1C	Live load reduction	—	3	3	0	0	–	–
III-53 2C	Live load reduction	—	3	3	0	0	–	–
LLR-HEAVY	Live load reduction	—	1	1	0	0	–	–
LLR-HEAVY-1	Live load reduction	—	1	1	0	0	–	–
LLR-GARAGE	Live load reduction	—	1	1	0	0	–	–
LLR-ASSEMBLY	Live load reduction	—	1	1	0	0	–	–
LLR-ONEWAY	Live load reduction	—	2	2	0	0	–	–
LLR-ARCH	Live load reduction	—	4	4	0	0	–	–
LLR-OCCROOF	Live load reduction	—	3	3	0	0	–	–
T4.7-1 int_col · Live load reduction	Live load reduction	—	1	1	0	0	–	–
T4.7-1 ext_col · Live load reduction	Live load reduction	—	1	1	0	0	–	–
T4.7-1 edge_col_cant · Live load reduction	Live load reduction	—	1	1	0	0	–	–
T4.7-1 corner_col_cant · Live load reduction	Live load reduction	—	1	1	0	0	–	–
T4.7-1 edge_beam · Live load reduction	Live load reduction	—	1	1	0	0	–	–
T4.7-1 int_beam · Live load reduction	Live load reduction	—	1	1	0	0	–	–
T4.7-1 other · Live load reduction	Live load reduction	—	1	1	0	0	–	–
LCD-AISC-2C	Load chasedown	—	3	3	0	0	–	–
LCD-H1	Load chasedown	—	4	4	0	0	–	–
LCD-H2	Load chasedown	—	2	2	0	0	–	–
LCD-H3	Load chasedown	—	2	2	0	0	–	–
LCD-H4	Load chasedown	—	1	1	0	0	–	–
LCD-H5	Load chasedown	—	3	3	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
LCD-H6	Load chasedown	LRFD	1	1	0	0	–	–
LCD-H6	Load chasedown	ASD	1	1	0	0	–	–
LC-F.1-1A	Load combinations	LRFD	1	1	0	0	–	–
LC-F.1-1A	Load combinations	ASD	1	1	0	0	–	–
LC-P2192-4.8	Load combinations	LRFD	5	4	1	0	–	–
LC-P2192-7.4	Load combinations	ASD	1	1	0	0	–	–
LC-H1	Load combinations	LRFD	9	9	0	0	–	–
LC-H2	Load combinations	ASD	8	8	0	0	–	–
LC-H3	Load combinations	LRFD	2	2	0	0	–	–
LC-H3	Load combinations	ASD	2	2	0	0	–	–
LC-H4	Load combinations	LRFD	2	2	0	0	–	–
LC-H4	Load combinations	ASD	3	3	0	0	–	–
LC-H5	Load combinations	LRFD	2	2	0	0	–	–
LC-H5	Load combinations	ASD	1	1	0	0	–	–
LC-H6	Load combinations	LRFD	4	4	0	0	–	–
LC-H6	Load combinations	ASD	4	4	0	0	–	–
LC-H7	Load combinations	LRFD	2	2	0	0	–	–
LC-H7	Load combinations	ASD	1	1	0	0	–	–
LC-H8	Load combinations	LRFD	1	1	0	0	–	–
LC-H8	Load combinations	ASD	1	1	0	0	–	–
LC-H9	Load combinations	LRFD	2	2	0	0	–	–
LC-H10	Load combinations	LRFD	1	1	0	0	–	–
LT-1	Load takeoff	—	3	3	0	0	–	–
LT-2	Load takeoff	—	3	3	0	0	–	–
LT-3	Load takeoff	—	2	2	0	0	–	–
LT-4	Load takeoff	—	1	1	0	0	–	–
T4.7-1 int_col · Load takeoff	Load takeoff	—	1	1	0	0	–	–
T4.7-1 ext_col · Load takeoff	Load takeoff	—	1	1	0	0	–	–
T4.7-1 edge_col_cant · Load takeoff	Load takeoff	—	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
T4.7-1 corner_col_cant · Load takeoff	Load takeoff	—	1	1	0	0	–	–
T4.7-1 edge_beam · Load takeoff	Load takeoff	—	1	1	0	0	–	–
T4.7-1 int_beam · Load takeoff	Load takeoff	—	1	1	0	0	–	–
T4.7-1 other · Load takeoff	Load takeoff	—	1	1	0	0	–	–
AISC-III-B45	Load takeoff	—	4	4	0	0	–	–
AISC-III-B30	Load takeoff	—	2	2	0	0	–	–
AISC-III-G30	Load takeoff	—	1	1	0	0	–	–
AISC-III-C2C	Load takeoff	—	6	6	0	0	–	–
AISC-III-C2A	Load takeoff	—	5	5	0	0	–	–
AISC-III-C1A	Load takeoff	—	6	6	0	0	–	–
AISC-III-C1B	Load takeoff	—	5	5	0	0	–	–
AISC-III-C1C	Load takeoff	—	6	6	0	0	–	–
MDG-9.3-6	Masonry anchor bolts	LRFD	3	3	0	0	–	–
MDG-9.3-6a	Masonry anchor bolts	LRFD	4	4	0	0	–	–
TMS18-BENT	Masonry anchor bolts	LRFD	4	3	1	0	–	–
TMS18-HEAD	Masonry anchor bolts	LRFD	2	2	0	0	–	–
TMS18-EDGE	Masonry anchor bolts	LRFD	2	2	0	0	–	–
TMS18-SHEAR	Masonry anchor bolts	LRFD	3	2	1	0	–	–
TMS18-COMB	Masonry anchor bolts	LRFD	5	4	1	0	–	–
TEK-12-03C	Masonry anchor bolts	LRFD	8	7	1	0	–	–
HC-1 · Masonry anchor bolts	Masonry anchor bolts	LRFD	1	1	0	0	–	–
HC-2 · Masonry anchor bolts	Masonry anchor bolts	LRFD	1	1	0	0	–	–
HC-3 · Masonry anchor bolts	Masonry anchor bolts	LRFD	2	2	0	0	–	–
HC-4 · Masonry anchor bolts	Masonry anchor bolts	LRFD	1	1	0	0	–	–
HC-JACK	Masonry arch	—	5	5	0	0	–	–
HC-SEGMENTAL	Masonry arch	—	4	4	0	0	–	–
HC-TIE	Masonry arch	—	1	1	0	0	–	–
12.4-2A	Masonry beam and deep beam	LRFD	7	7	0	0	–	–
12.4-2A-R	Masonry beam and deep beam	LRFD	5	5	0	0	–	–
HC-ASD · Masonry beam and deep beam	Masonry beam and deep beam	ASD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
HC-DEEP	Masonry beam and deep beam	LRFD	5	5	0	0	–	–
B-1 · Masonry bearing	Masonry bearing	—	7	7	0	0	–	–
B-2 · Masonry bearing	Masonry bearing	—	2	2	0	0	–	–
B-3 · Masonry bearing	Masonry bearing	—	4	4	0	0	–	–
B-4 · Masonry bearing	Masonry bearing	—	2	2	0	0	–	–
B-5 · Masonry bearing	Masonry bearing	—	2	2	0	0	–	–
B-6 · Masonry bearing	Masonry bearing	—	2	2	0	0	–	–
B-7	Masonry bearing	—	2	2	0	0	–	–
B-8	Masonry bearing	—	2	2	0	0	–	–
B-9	Masonry bearing	—	2	2	0	0	–	–
HC-CHORD	Bond beam chord and collector	LRFD	3	3	0	0	–	–
HC-CHORD	Bond beam chord and collector	ASD	2	2	0	0	–	–
HC-COLL	Bond beam chord and collector	LRFD	1	1	0	0	–	–
HC-COLL	Bond beam chord and collector	ASD	1	1	0	0	–	–
HC-LAP · Bond beam chord and collector	Bond beam chord and collector	LRFD	1	1	0	0	–	–
HC-WIND · Masonry chimney	Masonry chimney	LRFD	3	3	0	0	–	–
HC-SEIS	Masonry chimney	LRFD	3	3	0	0	–	–
HC-BRACE	Masonry chimney	LRFD	3	3	0	0	–	–
TMS21-COL-PN	Masonry column and pilaster	—	3	2	1	0	–	–
TMS21-COL-BAL	Masonry column and pilaster	—	4	3	1	0	–	–
TMS21-COL-FLEX	Masonry column and pilaster	—	2	2	0	0	–	–
FEMA-13.1.6	Masonry column and pilaster	—	6	5	1	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
TMS-SD-1-COL	Masonry column and pilaster	—	2	2	0	0	–	–
MC-1	Masonry column and pilaster	—	4	4	0	0	–	–
MC-2	Masonry column and pilaster	—	4	4	0	0	–	–
MC-3	Masonry column and pilaster	—	4	4	0	0	–	–
MC-5	Masonry column and pilaster	—	5	5	0	0	–	–
MC-6	Masonry column and pilaster	—	5	5	0	0	–	–
MC-7	Masonry column and pilaster	—	4	4	0	0	–	–
HC-LIMITS	Corbelled masonry	—	3	3	0	0	–	–
HC-CORBEL	Corbelled masonry	—	4	4	0	0	–	–
HC-WALL	Corbelled masonry	—	3	3	0	0	–	–
TA.4.2-HOLLOW	Empirical masonry design	—	1	1	0	0	–	–
TA.4.2-BRICK	Empirical masonry design	—	1	1	0	0	–	–
TA.4.2-HOLLOW10	Empirical masonry design	—	1	1	0	0	–	–
TA.5.1	Empirical masonry design	—	1	1	0	0	–	–
TA.5.1-SOLID	Empirical masonry design	—	1	1	0	0	–	–
TA.6.3.1-HOLLOW	Empirical masonry design	—	1	1	0	0	–	–
TA.6.3.1-GROUTED	Empirical masonry design	—	1	1	0	0	–	–
FIG-CC-A.3-1	Empirical masonry design	—	1	1	0	0	–	–
HC-DEFAULT · Empirical masonry design	Empirical masonry design	—	2	2	0	0	–	–
HC-OPENING	Empirical masonry design	—	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
HC-PARAPET	Empirical masonry design	—	1	1	0	0	–	–
HC-WIND · Freestanding masonry wall	Freestanding masonry wall	LRFD	3	3	0	0	–	–
HC-FOOTING	Freestanding masonry wall	ASD	3	3	0	0	–	–
HC-STEM · Freestanding masonry wall	Freestanding masonry wall	LRFD	2	2	0	0	–	–
T722.3.2-SHALE	Masonry fire resistance	—	1	1	0	0	–	–
T722.3.2-SHALE-3H	Masonry fire resistance	—	1	1	0	0	–	–
T722.3.2-GRAVEL	Masonry fire resistance	—	1	1	0	0	–	–
T722.3.2-PUMICE	Masonry fire resistance	—	1	1	0	0	–	–
T722.3.2-LIMESTONE	Masonry fire resistance	—	1	1	0	0	–	–
T722.4.1-SOLID	Masonry fire resistance	—	1	1	0	0	–	–
T722.4.1-HOLLOW	Masonry fire resistance	—	2	2	0	0	–	–
T722.4.1-FILLED	Masonry fire resistance	—	1	1	0	0	–	–
HC-INTERP · Masonry fire resistance	Masonry fire resistance	—	2	2	0	0	–	–
HC-FINISH · Masonry fire resistance	Masonry fire resistance	—	3	3	0	0	–	–
HC-PLASTER	Masonry fire resistance	—	1	1	0	0	–	–
HC-WYTHES	Masonry fire resistance	—	2	2	0	0	–	–
T2-N-2650	Masonry strength f′m	—	3	3	0	0	–	–
T2-MS-3250	Masonry strength f′m	—	2	2	0	0	–	–
T2-MS-4500	Masonry strength f′m	—	1	1	0	0	–	–
T1-MS-4950	Masonry strength f′m	—	2	2	0	0	–	–
T1-N-10300	Masonry strength f′m	—	2	2	0	0	–	–
HC-SHORT	Masonry strength f′m	—	2	2	0	0	–	–
HC-INTERP · Masonry strength f′m	Masonry strength f′m	—	1	1	0	0	–	–
TEK-1	Masonry infill	LRFD	8	8	0	0	–	–
TEK-2	Masonry infill	LRFD	4	4	0	0	–	–
TUC-1	Masonry infill	LRFD	6	6	0	0	–	–
TUC-2	Masonry infill	LRFD	1	1	0	0	–	–
GUIDE-6.3.3.12	Masonry wall at openings	LRFD	14	11	3	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
GUIDE-LAYER2	Masonry wall at openings	LRFD	1	1	0	0	–	–
FEMA-13.1.6.3	Masonry wall at openings	LRFD	5	1	4	0	–	–
HC-UNI	Masonry wall at openings	LRFD	1	1	0	0	–	–
HC-WIND · Masonry wall at openings	Masonry wall at openings	LRFD	1	1	0	0	–	–
MDG-9.2-1	Masonry lap splice	—	4	4	0	0	–	–
MDG-T925-2000-#3-8c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2000-#3-12c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2000-#3-2c	Masonry lap splice	—	1	0	1	0	–	–
MDG-T925-2000-#4-8c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2000-#4-12c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2000-#4-2c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2000-#5-8c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2000-#5-12c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2000-#5-2c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2000-#6-8c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2000-#6-12c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2000-#6-2c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2000-#7-8c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2000-#7-12c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2000-#7-2c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2000-#8-8c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2000-#8-12c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2000-#8-2c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2000-#9-12c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2000-#9-2c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2000-#10-12c	Masonry lap splice	—	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
MDG-T925-2000-#10-2c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2000-#11-12c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2000-#11-2c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2500-#3-8c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2500-#3-12c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2500-#3-2c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2500-#4-8c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2500-#4-12c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2500-#4-2c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2500-#5-8c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2500-#5-12c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2500-#5-2c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2500-#6-8c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2500-#6-12c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2500-#6-2c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2500-#7-8c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2500-#7-12c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2500-#7-2c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2500-#8-8c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2500-#8-12c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2500-#8-2c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2500-#9-12c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2500-#9-2c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2500-#10-12c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2500-#10-2c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-2500-#11-12c	Masonry lap splice	—	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
MDG-T925-2500-#11-2c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-3000-#3-8c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-3000-#3-12c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-3000-#3-2c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-3000-#4-8c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-3000-#4-12c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-3000-#4-2c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-3000-#5-8c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-3000-#5-12c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-3000-#5-2c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-3000-#6-8c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-3000-#6-12c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-3000-#6-2c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-3000-#7-8c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-3000-#7-12c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-3000-#7-2c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-3000-#8-8c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-3000-#8-12c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-3000-#8-2c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-3000-#9-12c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-3000-#9-2c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-3000-#10-12c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-3000-#10-2c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-3000-#11-12c	Masonry lap splice	—	1	1	0	0	–	–
MDG-T925-3000-#11-2c	Masonry lap splice	—	1	1	0	0	–	–
HC-EPOXY	Masonry lap splice	—	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
HC-SPACING	Masonry lap splice	—	2	2	0	0	–	–
HC-HOOK	Masonry lap splice	—	1	1	0	0	–	–
HC-CONF	Masonry lap splice	—	2	2	0	0	–	–
HC-36DB	Masonry lap splice	—	1	1	0	0	–	–
HC-NONCONTACT	Masonry lap splice	—	1	1	0	0	–	–
TEK12-03C	Ledger to masonry wall	LRFD	1	1	0	0	–	–
HC-WOOD	Ledger to masonry wall	LRFD	2	2	0	0	–	–
HC-LEDGER	Ledger to masonry wall	LRFD	4	4	0	0	–	–
HC-BOLTS	Ledger to masonry wall	LRFD	4	4	0	0	–	–
SDG-6.3.1.8	Masonry lintel and beam	—	11	10	1	0	–	–
SDG-6.3.1.8-5	Masonry lintel and beam	—	2	2	0	0	–	–
SDG-6.3.1.9	Masonry lintel and beam	—	18	18	0	0	–	–
MDG-12.4-2A	Masonry lintel and beam	—	12	11	1	0	–	–
MDG-12.4-2A-5	Masonry lintel and beam	—	2	2	0	0	–	–
MDG-12.4-2A-R	Masonry lintel and beam	—	13	12	1	0	–	–
TMS-2017-BEAM	Masonry lintel and beam	—	15	14	1	0	–	–
TEK-17-1D-1	Masonry lintel and beam	—	9	4	5	0	–	–
TEK-17-1D-2	Masonry lintel and beam	—	4	3	1	0	–	–
ML-H1	Masonry lintel and beam	—	5	5	0	0	–	–
ML-H2	Masonry lintel and beam	—	5	5	0	0	–	–
ML-H3	Masonry lintel and beam	—	1	1	0	0	–	–
ML-H4	Masonry lintel and beam	—	2	2	0	0	–	–
ML-H5	Masonry lintel and beam	—	1	1	0	0	–	–
ML-H6	Masonry lintel and beam	—	2	2	0	0	–	–
TEK-T4-8X8-4	Masonry lintel and beam	ASD	1	1	0	0	–	–
TEK-T4-8X8-5	Masonry lintel and beam	ASD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
TEK-T4-8X8-6	Masonry lintel and beam	ASD	1	1	0	0	–	–
TEK-T4-8X16-4	Masonry lintel and beam	ASD	1	1	0	0	–	–
TEK-T4-8X16-5	Masonry lintel and beam	ASD	1	1	0	0	–	–
TEK-T4-8X16-6	Masonry lintel and beam	ASD	1	1	0	0	–	–
TEK-T4-12X8-3	Masonry lintel and beam	ASD	1	1	0	0	–	–
TEK-T4-12X24-3	Masonry lintel and beam	ASD	1	1	0	0	–	–
TEK-T3-8X8	Masonry lintel and beam	ASD	1	1	0	0	–	–
TEK-T3-8X16	Masonry lintel and beam	ASD	1	1	0	0	–	–
TEK-T3-12X8-3	Masonry lintel and beam	ASD	1	1	0	0	–	–
TEK-T3-12X24-3	Masonry lintel and beam	ASD	1	1	0	0	–	–
TEK-T3-6X16	Masonry lintel and beam	ASD	1	1	0	0	–	–
TEK-T3-10X16-2	Masonry lintel and beam	ASD	1	1	0	0	–	–
HC-CLAY	Movement joints	LRFD	6	6	0	0	–	–
HC-CMU	Movement joints	LRFD	5	5	0	0	–	–
HC-WIND · Masonry parapet	Masonry parapet	LRFD	3	3	0	0	–	–
HC-SEISMIC	Masonry parapet	LRFD	2	2	0	0	–	–
HC-STEM · Masonry parapet	Masonry parapet	LRFD	2	2	0	0	–	–
HC-ANCHOR	Masonry parapet	LRFD	4	4	0	0	–	–
HC-ENTERED	Masonry parapet	LRFD	2	2	0	0	–	–
11.3-1	Masonry partition wall	ASD	10	10	0	0	–	–
HC-FP	Masonry partition wall	LRFD	6	6	0	0	–	–
TMS-2017-PIL	Masonry pilaster with wall	—	6	6	0	0	–	–
TEK-14-03A	Masonry pilaster with wall	—	3	3	0	0	–	–
FEMA-13.1.6-P	Masonry pilaster with wall	—	11	10	1	0	–	–
TMS-2021-COL-P	Masonry pilaster with wall	—	3	3	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
HC-1 · Masonry pilaster with wall	Masonry pilaster with wall	—	3	3	0	0	–	–
HC-2 · Masonry pilaster with wall	Masonry pilaster with wall	—	2	2	0	0	–	–
HC-3 · Masonry pilaster with wall	Masonry pilaster with wall	—	2	2	0	0	–	–
HC-4 · Masonry pilaster with wall	Masonry pilaster with wall	—	3	3	0	0	–	–
HC-5 · Masonry pilaster with wall	Masonry pilaster with wall	—	3	3	0	0	–	–
TEK-15-07B	Masonry retaining wall	—	18	11	7	0	–	–
TEK-15-07B-KEY	Masonry retaining wall	—	2	0	2	0	–	–
MDG-17.2-5	Masonry retaining wall	—	13	12	1	0	–	–
HC-STEM · Masonry retaining wall	Masonry retaining wall	—	3	3	0	0	–	–
HC-STAB	Masonry retaining wall	—	9	9	0	0	–	–
HC-SURCHARGE	Masonry retaining wall	—	2	2	0	0	–	–
HC-LAP · Masonry retaining wall	Masonry retaining wall	—	1	1	0	0	–	–
HC-ASD-STEM	Masonry retaining wall	—	1	1	0	0	–	–
FEMA-13.1.5.2-IT	Masonry wall out-of-plane	—	13	12	1	0	–	–
FEMA-13.1.5.2-MM	Masonry wall out-of-plane	—	2	2	0	0	–	–
FEMA-13.1.5.2-DEF	Masonry wall out-of-plane	—	2	2	0	0	–	–
FEMA-13.1.5.2-DEV	Masonry wall out-of-plane	—	1	0	1	0	–	–
CMHA-2A-FULL	Masonry wall out-of-plane	—	3	3	0	0	–	–
CMHA-2A-16	Masonry wall out-of-plane	—	3	3	0	0	–	–
CMHA-2A-24	Masonry wall out-of-plane	—	3	3	0	0	–	–
CMHA-2A-48	Masonry wall out-of-plane	—	3	3	0	0	–	–
CMHA-2A-96	Masonry wall out-of-plane	—	3	3	0	0	–	–
HC-1 · Masonry wall out-of-plane	Masonry wall out-of-plane	—	5	5	0	0	–	–
HC-1M	Masonry wall out-of-plane	—	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
HC-2 · Masonry wall out-of-plane	Masonry wall out-of-plane	—	2	2	0	0	–	–
HC-3 · Masonry wall out-of-plane	Masonry wall out-of-plane	—	1	1	0	0	–	–
HC-4 · Masonry wall out-of-plane	Masonry wall out-of-plane	—	3	3	0	0	–	–
HC-5 · Masonry wall out-of-plane	Masonry wall out-of-plane	—	1	1	0	0	–	–
HC-6 · Masonry wall out-of-plane	Masonry wall out-of-plane	—	6	6	0	0	–	–
HC-7 · Masonry wall out-of-plane	Masonry wall out-of-plane	—	3	3	0	0	–	–
HC-8 · Masonry wall out-of-plane	Masonry wall out-of-plane	—	3	3	0	0	–	–
HC-8A	Masonry wall out-of-plane	—	3	3	0	0	–	–
MAJOR-S19-8-4-48	Masonry wall out-of-plane	—	1	1	0	0	–	–
MAJOR-S19-8-5-48	Masonry wall out-of-plane	—	1	1	0	0	–	–
MAJOR-S19-8-4-24	Masonry wall out-of-plane	—	1	1	0	0	–	–
MAJOR-S19-8-5-24	Masonry wall out-of-plane	—	1	1	0	0	–	–
MAJOR-S19-8-6-24	Masonry wall out-of-plane	—	1	1	0	0	–	–
MAJOR-S19-8-4-16	Masonry wall out-of-plane	—	1	1	0	0	–	–
MAJOR-S19-8-6-40	Masonry wall out-of-plane	—	1	1	0	0	–	–
MAJOR-S19-8-4-8	Masonry wall out-of-plane	—	1	1	0	0	–	–
MAJOR-S19-12-4-48	Masonry wall out-of-plane	—	1	1	0	0	–	–
MAJOR-S19-12-5-24	Masonry wall out-of-plane	—	1	1	0	0	–	–
MDG-11.3-1	Unreinforced masonry wall	ASD	13	13	0	0	–	–
HC-SD	Unreinforced masonry wall	LRFD	5	5	0	0	–	–
HC-SD-BED	Unreinforced masonry wall	LRFD	1	1	0	0	–	–
HC-CANT	Unreinforced masonry wall	ASD	3	3	0	0	–	–
HC-AXIAL	Unreinforced masonry wall	ASD	3	3	0	0	–	–
HC-AXIAL	Unreinforced masonry wall	LRFD	1	1	0	0	–	–
HC-HORIZ	Unreinforced masonry wall	ASD	2	2	0	0	–	–
MW-1	Masonry shear wall	—	8	8	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
MW-2	Masonry shear wall	—	4	4	0	0	–	–
MW-3	Masonry shear wall	—	3	3	0	0	–	–
MW-4	Masonry shear wall	—	3	3	0	0	–	–
MW-5	Masonry shear wall	—	2	2	0	0	–	–
MW-6	Masonry shear wall	—	5	5	0	0	–	–
MW-7	Masonry shear wall	—	4	4	0	0	–	–
MW-8	Masonry shear wall	—	3	3	0	0	–	–
MW-9	Masonry shear wall	—	2	2	0	0	–	–
MW-10	Masonry shear wall	—	1	1	0	0	–	–
MW-11	Masonry shear wall	—	1	1	0	0	–	–
FEMA-13.2-W1	Masonry shear wall	—	5	3	2	0	–	–
FEMA-13.2-W5	Masonry shear wall	—	5	2	3	0	–	–
FEMA-13.2-PM0	Masonry shear wall	—	3	3	0	0	–	–
FEMA-13.2-PM2	Masonry shear wall	—	4	4	0	0	–	–
FEMA-13.2-DUC	Masonry shear wall	—	2	2	0	0	–	–
TMS-SD-1	Masonry shear wall	—	2	2	0	0	–	–
TMS-SD-2	Masonry shear wall	—	6	3	3	0	–	–
TMS-SD-3	Masonry shear wall	—	8	6	2	0	–	–
TMS-2017-ORD	Masonry shear wall	—	4	3	1	0	–	–
DAS-MAT	Mat foundation	—	6	6	0	0	–	–
MF-1	Mat foundation	—	5	5	0	0	–	–
MP-BOND	Micropile	—	1	1	0	0	–	–
MP-CASED	Micropile	—	1	1	0	0	–	–
MP-UNCASED	Micropile	—	2	2	0	0	–	–
MP-FY-CAP	Micropile	—	1	1	0	0	–	–
MP-JOINT	Micropile	—	1	1	0	0	–	–
MP-EULER	Micropile	—	1	1	0	0	–	–
MP-CAP	Micropile	—	1	1	0	0	–	–
GG-7-1	Stress transformation	LRFD	9	9	0	0	–	–
METRIC-30	Stress transformation	LRFD	3	3	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
SHEAR	Stress transformation	LRFD	5	5	0	0	–	–
MIXED	Stress transformation	LRFD	4	4	0	0	–	–
UNIAXIAL	Stress transformation	LRFD	4	4	0	0	–	–
TANNER-T1	Monorail beam	ASD	11	11	0	0	–	–
TANNER-EX	Monorail beam	ASD	5	5	0	0	–	–
DG7-P	Moving load	—	1	1	0	0	–	–
DG7-I	Moving load	ASD	1	1	0	0	–	–
DG7-N	Moving load	ASD	1	1	0	0	–	–
M3-43	Moving load	—	3	3	0	0	–	–
M3-44A	Moving load	—	2	2	0	0	–	–
M3-44B	Moving load	—	1	1	0	0	–	–
M3-45A	Moving load	—	2	2	0	0	–	–
M3-45B	Moving load	—	1	1	0	0	–	–
U-9.8	Moving load	—	7	7	0	0	–	–
H-2S	Moving load	—	4	4	0	0	–	–
H-2SN	Moving load	—	1	1	0	0	–	–
H-FF	Moving load	—	2	2	0	0	–	–
H-D	Moving load	—	3	3	0	0	–	–
SP-OWS	One-way slab	—	9	8	1	0	–	–
ACI-HB-OW1	One-way slab	—	7	7	0	0	–	–
OW-1	One-way slab	—	8	8	0	0	–	–
OW-2	One-way slab	—	4	4	0	0	–	–
MNL-PC-STM5	Pile cap	—	4	4	0	0	–	–
SP-PC	Pile cap	—	6	5	1	0	–	–
SP-PC-1W	Pile cap	—	1	0	1	0	–	–
PC-1	Pile cap	—	6	6	0	0	–	–
GEC10-10-1	Pile axial capacity	ASD	2	2	0	0	–	–
GEC10-10-2	Pile axial capacity	ASD	1	1	0	0	–	–
GEC10-10-3	Pile axial capacity	ASD	2	2	0	0	–	–
DRV-AB	Pile axial capacity	ASD	4	4	0	0	–	–
DRV-AB	Pile axial capacity	LRFD	1	1	0	0	–	–
DRV-CLAY	Pile axial capacity	ASD	2	2	0	0	–	–
PG-UFC-2-1	Pile group	—	2	2	0	0	–	–
PG-GEC12-P2	Pile group	—	3	3	0	0	–	–
PG-GEC12-NA-S	Pile group	—	2	2	0	0	–	–
PG-GEC12-NA-U	Pile group	—	1	1	0	0	–	–
PG-CPGA-1	Pile group	—	10	10	0	0	–	–
SSSS-1	Plate bending	ASD	3	3	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
SSSS-2	Plate bending	ASD	3	3	0	0	–	–
SSSS-5	Plate bending	ASD	3	3	0	0	–	–
SSCC-1	Plate bending	ASD	4	4	0	0	–	–
SSCC-2	Plate bending	ASD	4	4	0	0	–	–
SSFF-1	Plate bending	ASD	5	5	0	0	–	–
SSFF-2	Plate bending	ASD	5	5	0	0	–	–
CCCC-1	Plate bending	ASD	5	5	0	0	–	–
CCCC-2	Plate bending	ASD	5	5	0	0	–	–
F.14 · Plate girder	Plate girder	LRFD	5	5	0	0	–	–
F.14 · Plate girder	Plate girder	ASD	3	3	0	0	–	–
G.8B · Plate girder	Plate girder	LRFD	3	3	0	0	–	–
G.8B · Plate girder	Plate girder	ASD	2	2	0	0	–	–
HAND-PG-STIFF	Plate girder	LRFD	3	3	0	0	–	–
PF-PDH-8.00	Pole footing	—	3	3	0	0	–	–
PF-PDH-7.50	Pole footing	—	3	3	0	0	–	–
PF-PDH-7.31	Pole footing	—	7	7	0	0	–	–
PF-CALCBOOK	Pole footing	—	5	5	0	0	–	–
PF-MAPLE	Pole footing	—	5	5	0	0	–	–
PF-CT	Pole footing	—	3	3	0	0	–	–
SP-17 Anch-3	Post-installed anchors	LRFD	6	6	0	0	–	–
SP-17 Anch-4A	Post-installed anchors	LRFD	6	6	0	0	–	–
SP-17 Anch-4B	Post-installed anchors	LRFD	6	6	0	0	–	–
SP-17 Anch-6	Post-installed anchors	LRFD	8	8	0	0	–	–
SP-17 Anch-10	Post-installed anchors	LRFD	16	15	1	0	–	–
SP-17 Anch-11	Post-installed anchors	LRFD	13	12	1	0	–	–
SP-17 Anch-13	Post-installed anchors	LRFD	15	15	0	0	–	–
SP-17 Anch-17	Post-installed anchors	LRFD	17	17	0	0	–	–
PROFIS KB1	Post-installed anchors	LRFD	8	8	0	0	–	–
PROFIS HY200	Post-installed anchors	LRFD	12	12	0	0	–	–
MNL-17 Anch-3	Post-installed anchors	LRFD	6	6	0	0	–	–
MNL-17 Anch-4	Post-installed anchors	LRFD	5	4	1	0	–	–
MNL-17 Anch-5A	Post-installed anchors	LRFD	6	6	0	0	–	–
MNL-17 Anch-5B	Post-installed anchors	LRFD	6	3	3	0	–	–
MNL-17 Anch-7	Post-installed anchors	LRFD	11	11	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
MNL-17 Anch-8	Post-installed anchors	LRFD	11	11	0	0	–	–
MNL-17 Anch-9	Post-installed anchors	LRFD	16	14	2	0	–	–
MNL-17 Anch-12	Post-installed anchors	LRFD	16	15	1	0	–	–
MNL-17 Anch-13	Post-installed anchors	LRFD	14	12	2	0	–	–
MNL-17 Anch-14	Post-installed anchors	LRFD	15	11	4	0	–	–
MNL-17 Anch-16	Post-installed anchors	LRFD	15	15	0	0	–	–
MNL-17 Anch-18	Post-installed anchors	LRFD	18	18	0	0	–	–
MNL-17 Anch-20	Post-installed anchors	LRFD	17	15	2	0	–	–
MNL-17 Anch-22	Post-installed anchors	LRFD	26	24	2	0	–	–
TEK-EX	Prestressed masonry wall	LRFD	12	12	0	0	–	–
PB-1	Prestressed concrete beam	—	12	12	0	0	–	–
PB-ZIA	Prestressed concrete beam	—	5	5	0	0	–	–
PB-UNB	Prestressed concrete beam	—	2	2	0	0	–	–
MNL-OW-3	Post-tensioned slab strip	—	8	8	0	0	–	–
OW-3	Post-tensioned slab strip	—	15	12	3	0	–	–
GF-INT	Punching shear	—	4	4	0	0	–	–
GF-EDGE	Punching shear	—	5	5	0	0	–	–
GF-EDGE-GF	Punching shear	—	1	1	0	0	–	–
TW-EDGE	Punching shear	—	2	2	0	0	–	–
TW-INT	Punching shear	—	1	1	0	0	–	–
TW-CORNER	Punching shear	—	2	2	0	0	–	–
PSC-M1-EXT	Punching shear	—	5	5	0	0	–	–
PSC-M1-INT	Punching shear	—	1	1	0	0	–	–
PSC-M2	Punching shear	—	3	3	0	0	–	–
PSC-M3	Punching shear	—	3	3	0	0	–	–
SSO-NO	Punching shear	—	3	3	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
SSO-OPEN	Punching shear	—	3	3	0	0	–	–
DL-STUD	Punching shear	—	8	8	0	0	–	–
MNL17-TW1-INT	Punching shear	—	10	10	0	0	–	–
MNL17-TW3-EDGE	Punching shear	—	10	6	4	0	–	–
MNL17-TW3-INT	Punching shear	—	11	10	1	0	–	–
QT-1	Quantity takeoff	—	1	1	0	0	–	–
QT-2	Quantity takeoff	—	1	1	0	0	–	–
QT-3	Quantity takeoff	—	1	1	0	0	–	–
QT-4	Quantity takeoff	—	1	1	0	0	–	–
QT-5	Quantity takeoff	—	2	2	0	0	–	–
RN-PONDING	Rain load	—	7	7	0	0	–	–
RN-EX1	Rain load	—	2	2	0	0	–	–
RN-EX2	Rain load	—	2	2	0	0	–	–
RN-BETA	Rain load	—	1	1	0	0	–	–
RN-T1	Rain load	—	1	1	0	0	–	–
RN-T2	Rain load	—	1	1	0	0	–	–
RN-T3	Rain load	—	1	1	0	0	–	–
RN-T4	Rain load	—	1	1	0	0	–	–
RN-T5	Rain load	—	1	1	0	0	–	–
RN-H1	Rain load	—	3	3	0	0	–	–
RN-H2	Rain load	—	1	1	0	0	–	–
RN-H3	Rain load	—	1	1	0	0	–	–
MNL-C2	Beam-column joint	—	7	7	0	0	–	–
MNL-C3	Beam-column joint	—	6	6	0	0	–	–
MNL-C3-M	Beam-column joint	—	1	0	1	0	–	–
MNL-C4	Beam-column joint	—	6	4	2	0	–	–
C-3 · Beam-column joint	Beam-column joint	—	5	4	1	0	–	–
C-3-M	Beam-column joint	—	1	0	1	0	–	–
C-4 · Beam-column joint	Beam-column joint	—	5	5	0	0	–	–
T-15-True-True-True	Beam-column joint	—	1	1	0	0	–	–
T-15-True-True-False	Beam-column joint	—	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
T-15-True-False-True	Beam-column joint	—	1	1	0	0	–	–
T-15-True-False-False	Beam-column joint	—	1	1	0	0	–	–
T-15-False-True-True	Beam-column joint	—	1	1	0	0	–	–
T-15-False-True-False	Beam-column joint	—	1	1	0	0	–	–
T-15-False-False-True	Beam-column joint	—	1	1	0	0	–	–
T-15-False-False-False	Beam-column joint	—	1	1	0	0	–	–
T-18-True-True-True	Beam-column joint	—	1	1	0	0	–	–
T-18-True-True-False	Beam-column joint	—	1	1	0	0	–	–
T-18-True-False-True	Beam-column joint	—	1	1	0	0	–	–
T-18-True-False-False	Beam-column joint	—	1	1	0	0	–	–
T-18-False-True-True	Beam-column joint	—	1	1	0	0	–	–
T-18-False-True-False	Beam-column joint	—	1	1	0	0	–	–
T-18-False-False-True	Beam-column joint	—	1	1	0	0	–	–
T-18-False-False-False	Beam-column joint	—	1	1	0	0	–	–
CRSI-4k-#8-c1.5	Rebar development and splices	—	2	2	0	0	–	–
CRSI-4k-#8-c1.5-top	Rebar development and splices	—	2	2	0	0	–	–
CRSI-4k-#8-c0.75	Rebar development and splices	—	2	2	0	0	–	–
CRSI-4k-#8-c0.75-top	Rebar development and splices	—	2	2	0	0	–	–
CRSI-4k-#5-c0.75	Rebar development and splices	—	2	2	0	0	–	–
CRSI-4k-#5-c0.75-top	Rebar development and splices	—	2	2	0	0	–	–
CRSI-4k-#5-c1.5	Rebar development and splices	—	2	2	0	0	–	–
CRSI-4k-#5-c1.5-top	Rebar development and splices	—	2	2	0	0	–	–
CRSI-4k-#6-c1	Rebar development and splices	—	2	2	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
CRSI-4k-#6-c1-top	Rebar development and splices	—	2	2	0	0	–	–
CRSI-4k-#11-c2	Rebar development and splices	—	2	2	0	0	–	–
CRSI-4k-#11-c2-top	Rebar development and splices	—	2	2	0	0	–	–
CRSI-4k-#9-c3	Rebar development and splices	—	2	2	0	0	–	–
CRSI-4k-#9-c3-top	Rebar development and splices	—	2	2	0	0	–	–
CRSI-3k-#5-c0.75	Rebar development and splices	—	2	2	0	0	–	–
CRSI-3k-#5-c0.75-top	Rebar development and splices	—	2	2	0	0	–	–
CRSI-3k-#3-c0.75	Rebar development and splices	—	2	2	0	0	–	–
CRSI-3k-#3-c0.75-top	Rebar development and splices	—	2	2	0	0	–	–
CRSI-3k-#8-c0.75	Rebar development and splices	—	2	2	0	0	–	–
CRSI-3k-#8-c1	Rebar development and splices	—	2	2	0	0	–	–
CRSI-3k-#8-c1.5	Rebar development and splices	—	2	2	0	0	–	–
CRSI-3k-#8-c2	Rebar development and splices	—	2	2	0	0	–	–
CRSI-3k-#10-c1.5	Rebar development and splices	—	2	2	0	0	–	–
CRSI-3k-#10-c1.5-top	Rebar development and splices	—	2	2	0	0	–	–
CRSI-5k-#8-c0.75	Rebar development and splices	—	2	2	0	0	–	–
CRSI-5k-#8-c1	Rebar development and splices	—	2	2	0	0	–	–
CRSI-5k-#8-c1.5	Rebar development and splices	—	2	2	0	0	–	–
CRSI-5k-#8-c2	Rebar development and splices	—	2	2	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
CRSI-C1-#5-3k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#5-4k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#5-5k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#5-6k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#5-7k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#5-8k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#5-9k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#5-10k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#8-3k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#8-4k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#8-5k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#8-6k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#8-7k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#8-8k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#8-9k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#8-10k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#11-3k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#11-4k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#11-5k	Rebar development and splices	—	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
CRSI-C1-#11-6k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#11-7k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#11-8k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#11-9k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#11-10k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#18-3k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#18-4k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#18-5k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#18-6k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#18-7k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#18-8k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#18-9k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-C1-#18-10k	Rebar development and splices	—	1	1	0	0	–	–
CRSI-4k-#14-c2	Rebar development and splices	—	1	1	0	0	–	–
CRSI-4k-#18-c3-top	Rebar development and splices	—	1	1	0	0	–	–
SST-1	Rebar development and splices	—	3	3	0	0	–	–
VCM-LD	Rebar development and splices	—	3	3	0	0	–	–
HC-HEAD-1	Rebar development and splices	—	2	2	0	0	–	–
HC-HEAD-2	Rebar development and splices	—	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
HC-COMP-1	Rebar development and splices	—	1	1	0	0	–	–
HC-LAPC-60	Rebar development and splices	—	1	1	0	0	–	–
HC-LAPC-80	Rebar development and splices	—	1	1	0	0	–	–
HC-KTR	Rebar development and splices	—	2	2	0	0	–	–
HC-G80 · Rebar development and splices	Rebar development and splices	—	1	1	0	0	–	–
HC-G100	Rebar development and splices	—	1	1	0	0	–	–
HC-EXCESS	Rebar development and splices	—	1	1	0	0	–	–
HC-HOOK-CONF	Rebar development and splices	—	1	1	0	0	–	–
MNL17-LD-OW1	Rebar development and splices	—	4	2	2	0	–	–
MNL17-LDH-OW1	Rebar development and splices	—	4	4	0	0	–	–
MNL17-LD-TW1	Rebar development and splices	—	2	2	0	0	–	–
MNL17-LDH-B4	Rebar development and splices	—	3	3	0	0	–	–
MNL17-LD-C2	Rebar development and splices	—	6	6	0	0	–	–
MNL17-LD-C4	Rebar development and splices	—	6	6	0	0	–	–
MNL17-LD-C5	Rebar development and splices	—	1	0	1	0	–	–
MNL17-LDH-W2	Rebar development and splices	—	4	3	1	0	–	–
MNL17-LDC-F1	Rebar development and splices	—	3	3	0	0	–	–
MNL17-LD-F1	Rebar development and splices	—	2	2	0	0	–	–
MNL17-LD-F5-TOP	Rebar development and splices	—	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
MNL17-LD-F5-BOT	Rebar development and splices	—	1	1	0	0	–	–
MNL17-LDH-F5	Rebar development and splices	—	4	4	0	0	–	–
MNL17-LDC-F5	Rebar development and splices	—	2	2	0	0	–	–
RT-A1	Rebar tables	—	1	1	0	0	–	–
RT-A2	Rebar tables	—	1	1	0	0	–	–
RT-D1	Rebar tables	—	2	2	0	0	–	–
RT-D2	Rebar tables	—	1	1	0	0	–	–
RT-D3	Rebar tables	—	1	1	0	0	–	–
RT-D4	Rebar tables	—	1	1	0	0	–	–
RT-D5	Rebar tables	—	1	1	0	0	–	–
RT-H1	Rebar tables	—	1	1	0	0	–	–
SP-RW	Retaining wall	—	6	5	1	0	–	–
RW-1	Retaining wall	—	6	6	0	0	–	–
MNL17-RW2	Retaining wall	—	32	27	5	0	–	–
MNL17-RW3	Retaining wall	—	20	12	8	0	–	–
MNL17-RW4	Retaining wall	—	21	18	3	0	–	–
MNL17-RW5	Retaining wall	—	14	12	2	0	–	–
MNL17-RW6	Retaining wall	—	19	17	2	0	–	–
WW-T36	Continuous rod tie-down	ASD	25	25	0	0	–	–
WW-T311	Continuous rod tie-down	ASD	5	5	0	0	–	–
WW-T312	Continuous rod tie-down	ASD	19	19	0	0	–	–
WW-T39	Continuous rod tie-down	ASD	22	22	0	0	–	–
WW-T213	Continuous rod tie-down	ASD	10	10	0	0	–	–
WW-PLATFORM	Continuous rod tie-down	ASD	1	1	0	0	–	–
WW-T313	Continuous rod tie-down	ASD	20	20	0	0	–	–
WW-T314	Continuous rod tie-down	ASD	35	35	0	0	–	–
WW-T317A	Continuous rod tie-down	ASD	5	5	0	0	–	–
WW-T317B	Continuous rod tie-down	ASD	10	9	1	0	–	–
WW-T318	Continuous rod tie-down	ASD	30	30	0	0	–	–
HC-LRFD	Continuous rod tie-down	LRFD	3	3	0	0	–	–
HC-WIND · Continuous rod tie-down	Continuous rod tie-down	ASD	1	1	0	0	–	–
HIP-6	Roof geometry	—	12	12	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
SQUARE-12	Roof geometry	—	2	2	0	0	–	–
UNEQUAL	Roof geometry	—	4	4	0	0	–	–
OVERHANG	Roof geometry	—	3	3	0	0	–	–
GABLE	Roof geometry	—	3	3	0	0	–	–
VALLEY	Roof geometry	—	1	1	0	0	–	–
METRIC	Roof geometry	—	2	2	0	0	–	–
SDOF	Natural frequency and dynamic response	—	6	6	0	0	–	–
BEAM-SS	Natural frequency and dynamic response	—	5	5	0	0	–	–
BEAM-CANT	Natural frequency and dynamic response	—	2	2	0	0	–	–
BEAM-FF	Natural frequency and dynamic response	—	1	1	0	0	–	–
BEAM-FP	Natural frequency and dynamic response	—	2	2	0	0	–	–
PULSE-RECT	Natural frequency and dynamic response	—	1	1	0	0	–	–
PULSE-SINE	Natural frequency and dynamic response	—	1	1	0	0	–	–
PULSE-SINE-1	Natural frequency and dynamic response	—	1	1	0	0	–	–
SP-1	Section properties	—	6	6	0	0	–	–
SP-2	Section properties	—	5	5	0	0	–	–
SP-3	Section properties	—	2	2	0	0	–	–
SP-4	Section properties	—	3	3	0	0	–	–
SP-5	Section properties	—	3	3	0	0	–	–
SP-6	Section properties	—	5	5	0	0	–	–
SP-7	Section properties	—	6	6	0	0	–	–
SP-8	Section properties	—	6	6	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
SP-9	Section properties	—	7	7	0	0	–	–
SP-10	Section properties	—	6	6	0	0	–	–
SP-11	Section properties	—	6	6	0	0	–	–
SP-12	Section properties	—	5	5	0	0	–	–
SP-13	Section properties	—	6	6	0	0	–	–
SP-14	Section properties	—	5	5	0	0	–	–
SP-15	Section properties	—	5	5	0	0	–	–
SP-16	Section properties	—	5	5	0	0	–	–
SP-17	Section properties	—	15	15	0	0	–	–
SP-18	Section properties	—	6	5	1	0	–	–
SP-19	Section properties	—	14	14	0	0	–	–
SP-20	Section properties	—	1	1	0	0	–	–
SP-21	Section properties	—	1	1	0	0	–	–
SP-22	Section properties	—	1	1	0	0	–	–
SP-23	Section properties	—	3	3	0	0	–	–
SP-24	Section properties	—	4	4	0	0	–	–
SP-25	Section properties	—	3	3	0	0	–	–
SP-26	Section properties	—	2	1	1	0	–	–
SP-27	Section properties	—	1	0	1	0	–	–
SP-28	Section properties	—	1	0	1	0	–	–
SP-29	Section properties	—	1	0	1	0	–	–
SP-30	Section properties	—	1	0	1	0	–	–
SP-31	Section properties	—	1	0	1	0	–	–
SP-32	Section properties	—	1	0	1	0	–	–
SP-33	Section properties	—	1	0	1	0	–	–
SRW-HC1	Segmental retaining wall	—	7	7	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
EQ-1	Seismic base shear (ELF)	—	8	8	0	0	–	–
EQ-2	Seismic base shear (ELF)	—	7	7	0	0	–	–
EQ-3	Seismic base shear (ELF)	—	3	3	0	0	–	–
T12.2-1 B.1	Seismic base shear (ELF)	—	3	3	0	0	–	–
T12.2-1 B.2	Seismic base shear (ELF)	—	3	3	0	0	–	–
T12.2-1 B.3	Seismic base shear (ELF)	—	3	3	0	0	–	–
T12.2-1 B.4	Seismic base shear (ELF)	—	3	3	0	0	–	–
T12.2-1 A.1	Seismic base shear (ELF)	—	3	3	0	0	–	–
T12.2-1 A.8	Seismic base shear (ELF)	—	3	3	0	0	–	–
T12.2-1 A.10	Seismic base shear (ELF)	—	3	3	0	0	–	–
T12.2-1 A.16	Seismic base shear (ELF)	—	3	3	0	0	–	–
T12.2-1 A.17	Seismic base shear (ELF)	—	3	3	0	0	–	–
T12.2-1 B.26	Seismic base shear (ELF)	—	3	3	0	0	–	–
T12.2-1 C.1	Seismic base shear (ELF)	—	3	3	0	0	–	–
T12.2-1 C.3	Seismic base shear (ELF)	—	3	3	0	0	–	–
T12.2-1 C.4	Seismic base shear (ELF)	—	3	3	0	0	–	–
T12.2-1 C.5	Seismic base shear (ELF)	—	3	3	0	0	–	–
T12.2-1 H	Seismic base shear (ELF)	—	3	3	0	0	–	–
T12.8-1 SD1=0.4	Seismic base shear (ELF)	—	1	1	0	0	–	–
T12.8-1 SD1=0.3	Seismic base shear (ELF)	—	1	1	0	0	–	–
T12.8-1 SD1=0.2	Seismic base shear (ELF)	—	1	1	0	0	–	–
T12.8-1 SD1=0.15	Seismic base shear (ELF)	—	1	1	0	0	–	–
T12.8-1 SD1=0.1	Seismic base shear (ELF)	—	1	1	0	0	–	–
T12.8-2 steel_mf	Seismic base shear (ELF)	—	2	2	0	0	–	–
T12.8-2 conc_mf	Seismic base shear (ELF)	—	2	2	0	0	–	–
T12.8-2 ebf	Seismic base shear (ELF)	—	2	2	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
T12.8-2 other	Seismic base shear (ELF)	—	2	2	0	0	–	–
T1.5-2 I	Seismic base shear (ELF)	—	1	1	0	0	–	–
T1.5-2 II	Seismic base shear (ELF)	—	1	1	0	0	–	–
T1.5-2 III	Seismic base shear (ELF)	—	1	1	0	0	–	–
T1.5-2 IV	Seismic base shear (ELF)	—	1	1	0	0	–	–
AISC-III-seismic	Seismic base shear (ELF)	—	16	16	0	0	–	–
P2192-4.5	Seismic base shear (ELF)	—	14	13	1	0	–	–
P2192-5.5	Seismic base shear (ELF)	—	14	11	3	0	–	–
P2192-6.4	Seismic base shear (ELF)	—	1	1	0	0	–	–
P2192-7.4	Seismic base shear (ELF)	—	5	5	0	0	–	–
P2192-7.5	Seismic base shear (ELF)	—	11	11	0	0	–	–
P2192-7.6	Seismic base shear (ELF)	—	4	4	0	0	–	–
WW-seismic	Seismic base shear (ELF)	—	12	12	0	0	–	–
MRSA-2DOF-CQC	Modal response spectrum	—	10	10	0	0	–	–
MRSA-2DOF-SRSS	Modal response spectrum	—	4	4	0	0	–	–
MRSA-UNIFORM-5	Modal response spectrum	—	4	4	0	0	–	–
MRSA-SDOF	Modal response spectrum	—	4	4	0	0	–	–
MRSA-EQ12.8-7	Modal response spectrum	—	4	4	0	0	–	–
P1051-17.2-T	Nonbuilding structures (seismic)	—	5	5	0	0	–	–
P1051-17.2-L	Nonbuilding structures (seismic)	—	3	3	0	0	–	–
P1051-17.4	Nonbuilding structures (seismic)	—	3	3	0	0	–	–
P1051-17.7	Nonbuilding structures (seismic)	—	5	5	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
NB-RIGID	Nonbuilding structures (seismic)	—	1	1	0	0	–	–
NB-15.4-2	Nonbuilding structures (seismic)	—	2	2	0	0	–	–
NB-15.4-4	Nonbuilding structures (seismic)	—	1	1	0	0	–	–
NB-MIN03	Nonbuilding structures (seismic)	—	1	1	0	0	–	–
NB-RAYLEIGH	Nonbuilding structures (seismic)	—	1	1	0	0	–	–
T15.4-1 rack	Nonbuilding structures (seismic)	—	3	3	0	0	–	–
T15.4-1 ocbf	Nonbuilding structures (seismic)	—	3	3	0	0	–	–
T15.4-1 ocbf_inc	Nonbuilding structures (seismic)	—	3	3	0	0	–	–
T15.4-1 omf	Nonbuilding structures (seismic)	—	3	3	0	0	–	–
T15.4-1 omf_unl	Nonbuilding structures (seismic)	—	3	3	0	0	–	–
T15.4-1 rc_imf_unl	Nonbuilding structures (seismic)	—	3	3	0	0	–	–
T15.4-2 elev_braced	Nonbuilding structures (seismic)	—	3	3	0	0	–	–
T15.4-2 tank_steel_self	Nonbuilding structures (seismic)	—	3	3	0	0	–	–
T15.4-2 tank_conc_anchored	Nonbuilding structures (seismic)	—	3	3	0	0	–	–
T15.4-2 silo_cip	Nonbuilding structures (seismic)	—	3	3	0	0	–	–
T15.4-2 chimney_conc	Nonbuilding structures (seismic)	—	3	3	0	0	–	–
T15.4-2 tower_trussed	Nonbuilding structures (seismic)	—	3	3	0	0	–	–
T15.4-2 sign	Nonbuilding structures (seismic)	—	3	3	0	0	–	–
T15.4-2 cantilever_wall	Nonbuilding structures (seismic)	—	3	3	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
T15.4-2 other	Nonbuilding structures (seismic)	—	3	3	0	0	–	–
8.3-PANEL	Seismic nonstructural components	—	10	10	0	0	–	–
8.3-PANEL-HF5	Seismic nonstructural components	—	1	1	0	0	–	–
8.3-FASTENERS	Seismic nonstructural components	—	3	3	0	0	–	–
8.4-FLIGHT	Seismic nonstructural components	—	9	9	0	0	–	–
8.4-SCBF	Seismic nonstructural components	—	1	1	0	0	–	–
8.4-LANDING	Seismic nonstructural components	—	2	2	0	0	–	–
8.4-FAST-FLIGHT	Seismic nonstructural components	—	2	2	0	0	–	–
8.4-FAST-LANDING	Seismic nonstructural components	—	1	1	0	0	–	–
8.5-FAN	Seismic nonstructural components	—	12	12	0	0	–	–
8.5-ISOLATED	Seismic nonstructural components	—	8	8	0	0	–	–
8.6-PIPE4	Seismic nonstructural components	—	6	6	0	0	–	–
8.6-PIPE6	Seismic nonstructural components	—	1	1	0	0	–	–
8.6-SUPPORT	Seismic nonstructural components	—	2	2	0	0	–	–
8.7-VESSEL	Seismic nonstructural components	—	7	7	0	0	–	–
8.7-PLATFORM	Seismic nonstructural components	—	2	2	0	0	–	–
HC-GRADE	Seismic nonstructural components	—	4	4	0	0	–	–
HC-UNKNOWN	Seismic nonstructural components	—	3	3	0	0	–	–
HC-ASD-ANCHOR	Seismic nonstructural components	—	3	3	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
P1051-14.1	Simplified seismic design	—	7	7	0	0	–	–
SS-SOIL	Simplified seismic design	—	2	2	0	0	–	–
SS-CAP	Simplified seismic design	—	2	2	0	0	–	–
SS-2STORY	Simplified seismic design	—	5	5	0	0	–	–
T12.14-1 A.1	Simplified seismic design	—	1	1	0	0	–	–
T12.14-1 A.2	Simplified seismic design	—	1	1	0	0	–	–
T12.14-1 A.5	Simplified seismic design	—	1	1	0	0	–	–
T12.14-1 A.8	Simplified seismic design	—	1	1	0	0	–	–
T12.14-1 A.13	Simplified seismic design	—	1	1	0	0	–	–
T12.14-1 A.15	Simplified seismic design	—	1	1	0	0	–	–
T12.14-1 A.16	Simplified seismic design	—	1	1	0	0	–	–
T12.14-1 A.17	Simplified seismic design	—	1	1	0	0	–	–
T12.14-1 B.1	Simplified seismic design	—	1	1	0	0	–	–
T12.14-1 B.3	Simplified seismic design	—	1	1	0	0	–	–
T12.14-1 B.13	Simplified seismic design	—	1	1	0	0	–	–
T12.14-1 B.16	Simplified seismic design	—	1	1	0	0	–	–
T12.14-1 B.22	Simplified seismic design	—	1	1	0	0	–	–
T12.14-1 B.24	Simplified seismic design	—	1	1	0	0	–	–
T12.14-1 B.25	Simplified seismic design	—	1	1	0	0	–	–
T12.14-1 B.26	Simplified seismic design	—	1	1	0	0	–	–
SP-3-2	Seismic site parameters and spectrum	—	38	35	3	0	–	–
SP-3-3	Seismic site parameters and spectrum	—	26	26	0	0	–	–
T1-1-W21X50	Shape browser and comparison	—	10	10	0	0	–	–
T3-2-ZX100	Shape browser and comparison	—	2	2	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
T3-2-ZX90	Shape browser and comparison	—	2	2	0	0	–	–
T3-3-IX800	Shape browser and comparison	—	2	2	0	0	–	–
DEPTH-18	Shape browser and comparison	—	2	2	0	0	–	–
HSS-8X8X1/2	Shape browser and comparison	—	4	4	0	0	–	–
P1051-J1	Shear friction	—	1	1	0	0	–	–
P1051-J4	Shear friction	—	1	1	0	0	–	–
P1051-J5	Shear friction	—	1	1	0	0	–	–
P1051-T4	Shear friction	—	1	1	0	0	–	–
P1051-T5	Shear friction	—	1	1	0	0	–	–
P1051-COLL	Shear friction	—	1	1	0	0	–	–
VC-65	Shear friction	—	2	2	0	0	–	–
VC-73	Shear friction	—	1	1	0	0	–	–
VC-90	Shear friction	—	2	2	0	0	–	–
HC-DEFAULT · Shear friction	Shear friction	—	4	4	0	0	–	–
HC-INCLINED	Shear friction	—	2	2	0	0	–	–
HC-TENSION · Shear friction	Shear friction	—	2	2	0	0	–	–
HC-COMP	Shear friction	—	1	1	0	0	–	–
HC-G80 · Shear friction	Shear friction	—	2	2	0	0	–	–
HC-LESSER	Shear friction	—	1	1	0	0	–	–
HC-LW	Shear friction	—	2	2	0	0	–	–
HC-H-A	Shear friction	—	2	2	0	0	–	–
HC-H-B	Shear friction	—	1	1	0	0	–	–
HC-H-D	Shear friction	—	1	1	0	0	–	–
HC-H-ALT	Shear friction	—	2	2	0	0	–	–
B-2 · Sheet pile wall	Sheet pile wall	ASD	10	10	0	0	–	–
F4-43	Sheet pile wall	ASD	2	1	1	0	–	–
F4-45	Sheet pile wall	ASD	2	2	0	0	–	–
W26-h6-k100-a2	Slab on grade point loads	—	3	3	0	0	–	–
W26-h6-k100-a4	Slab on grade point loads	—	3	3	0	0	–	–
W26-h6-k100-a6	Slab on grade point loads	—	3	3	0	0	–	–
W26-h10-k100-a2	Slab on grade point loads	—	2	2	0	0	–	–
W26-h10-k100-a6	Slab on grade point loads	—	2	2	0	0	–	–
W26-SUPER	Slab on grade point loads	—	2	2	0	0	–	–
W26-SUPER4	Slab on grade point loads	—	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
HUANG-1-3	Slab on grade point loads	—	4	4	0	0	–	–
HUANG-3	Slab on grade point loads	—	1	1	0	0	–	–
HUANG-4	Slab on grade point loads	—	3	3	0	0	–	–
HUANG-4E	Slab on grade point loads	—	1	1	0	0	–	–
PI-9	Slab on grade point loads	—	4	4	0	0	–	–
IO84-C001	Slab on grade point loads	—	1	1	0	0	–	–
IO84-C002	Slab on grade point loads	—	1	1	0	0	–	–
IO84-C003	Slab on grade point loads	—	1	0	1	0	–	–
IO84-C004	Slab on grade point loads	—	1	1	0	0	–	–
IO84-C005	Slab on grade point loads	—	1	1	0	0	–	–
IO84-C006	Slab on grade point loads	—	1	0	1	0	–	–
IO84-C007	Slab on grade point loads	—	1	1	0	0	–	–
UFC-T5-3	Slab on grade point loads	—	1	1	0	0	–	–
UFC-T5-3b	Slab on grade point loads	—	1	1	0	0	–	–
UFC-T5-3c	Slab on grade point loads	—	1	1	0	0	–	–
UFC-B-1.1	Slab on grade point loads	—	1	1	0	0	–	–
PCA-T5-5a	Slab on grade point loads	—	2	2	0	0	–	–
PCA-T5-5b	Slab on grade point loads	—	2	2	0	0	–	–
PCA-T5-5c	Slab on grade point loads	—	2	2	0	0	–	–
SOG-1	Slab on grade point loads	—	3	3	0	0	–	–
SOG-2	Slab on grade point loads	—	1	1	0	0	–	–
SL-DM71-7.4	Slope stability	—	2	2	0	0	–	–
SL-DM71-OMS	Slope stability	—	1	1	0	0	–	–
AISC-III-ROOF	Snow loads	—	6	6	0	0	–	–
AISC-III-1-SIDE	Snow loads	—	3	3	0	0	–	–
AISC-III-1-END	Snow loads	—	3	3	0	0	–	–
AISC-III-1-SCREEN	Snow loads	—	3	3	0	0	–	–
C7-EX1	Snow loads	—	7	7	0	0	–	–
C7-EX2	Snow loads	—	4	4	0	0	–	–
C7-ROS	Snow loads	—	3	3	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
C7-EX3-HIGH	Snow loads	—	3	3	0	0	–	–
C7-EX3-LOW	Snow loads	—	9	5	4	0	–	–
H1	Snow loads	—	4	4	0	0	–	–
H2	Snow loads	—	4	4	0	0	–	–
H3	Snow loads	—	2	2	0	0	–	–
H4	Snow loads	—	4	4	0	0	–	–
H5	Snow loads	—	4	4	0	0	–	–
CT-7-1B	Soldier pile wall	—	6	6	0	0	–	–
CT-6-5	Soldier pile wall	—	6	6	0	0	–	–
SP-HC1	Soldier pile wall	—	2	2	0	0	–	–
MNL-F1	Spread footing	—	8	7	1	0	–	–
SP-SF	Spread footing	—	10	7	3	0	–	–
SP-STF	Spread footing	—	7	6	1	0	–	–
SF-1	Spread footing	—	9	9	0	0	–	–
SF-2	Spread footing	—	2	2	0	0	–	–
SF-3	Spread footing	—	1	1	0	0	–	–
A-6.1	Member stability bracing	LRFD	2	2	0	0	–	–
A-6.1	Member stability bracing	ASD	2	2	0	0	–	–
A-6.1 Lc	Member stability bracing	LRFD	1	1	0	0	–	–
A-6.2	Member stability bracing	LRFD	2	2	0	0	–	–
A-6.2	Member stability bracing	ASD	2	2	0	0	–	–
A-6.2 n	Member stability bracing	LRFD	1	1	0	0	–	–
A-6.3	Member stability bracing	LRFD	6	6	0	0	–	–
A-6.3 ASD	Member stability bracing	ASD	5	5	0	0	–	–
A-6.4	Member stability bracing	LRFD	2	2	0	0	–	–
A-6.5	Member stability bracing	LRFD	3	3	0	0	–	–
A-6.5 ASD	Member stability bracing	ASD	3	3	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
A-6.6	Member stability bracing	LRFD	6	6	0	0	–	–
A-6.6 ASD	Member stability bracing	ASD	3	3	0	0	–	–
J.6 · Column base plate	Column base plate	LRFD	2	2	0	0	–	–
J.6 · Column base plate	Column base plate	ASD	2	2	0	0	–	–
K.9	Column base plate	LRFD	4	4	0	0	–	–
K.9	Column base plate	ASD	2	2	0	0	–	–
DG1 4.7-1	Column base plate	LRFD	6	6	0	0	–	–
DG1 4.7-1 ASD	Column base plate	ASD	3	3	0	0	–	–
DG1 4.7-2	Column base plate	LRFD	3	3	0	0	–	–
DG1 4.7-2 ASD	Column base plate	ASD	2	2	0	0	–	–
DG1 4.7-3 · Column base plate	Column base plate	LRFD	7	7	0	0	–	–
DG1 4.7-3 ASD	Column base plate	ASD	3	3	0	0	–	–
DG1 4.7-5	Column base plate	LRFD	13	13	0	0	–	–
DG1 4.7-5 ASD	Column base plate	ASD	8	8	0	0	–	–
DG1 4.7-6	Column base plate	LRFD	6	6	0	0	–	–
DG1 4.7-6 ASD	Column base plate	ASD	3	3	0	0	–	–
DG1 4.7-6b	Column base plate	LRFD	3	3	0	0	–	–
DG1 4.7-8	Column base plate	LRFD	1	1	0	0	–	–
DG1 4.7-8 bearing	Column base plate	LRFD	6	6	0	0	–	–
DG1 4.7-8 bearing ASD	Column base plate	ASD	3	3	0	0	–	–
DG1 4.7-9 · Column base plate	Column base plate	LRFD	11	11	0	0	–	–
DG1 4.7-9 ASD	Column base plate	ASD	6	6	0	0	–	–
DG1 4.7-10	Column base plate	LRFD	6	6	0	0	–	–
DG1 4.7-10	Column base plate	ASD	5	5	0	0	–	–
DG1 4.7-11	Column base plate	LRFD	7	7	0	0	–	–
DG1 4.7-11	Column base plate	ASD	5	5	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
DG1 4.7-12	Column base plate	LRFD	3	1	2	0	–	–
DG1 4.7-12 ASD	Column base plate	ASD	3	1	2	0	–	–
DG1 4.7-13	Column base plate	LRFD	1	1	0	0	–	–
DG1 4.7-13 ASD	Column base plate	ASD	1	1	0	0	–	–
MNL-17 Anch-21 lug	Column base plate	LRFD	8	8	0	0	–	–
F.1-1A · Steel beam	Steel beam	LRFD	5	5	0	0	–	–
F.1-1A · Steel beam	Steel beam	ASD	3	3	0	0	–	–
F.1-2B	Steel beam	LRFD	4	4	0	0	–	–
F.1-2B	Steel beam	ASD	3	3	0	0	–	–
F.1-3B	Steel beam	LRFD	4	4	0	0	–	–
F.1-3B	Steel beam	ASD	3	3	0	0	–	–
F.3B	Steel beam	LRFD	3	3	0	0	–	–
F.3B	Steel beam	ASD	3	3	0	0	–	–
G.1B · Steel beam	Steel beam	LRFD	2	2	0	0	–	–
G.1B · Steel beam	Steel beam	ASD	2	2	0	0	–	–
T3-2 W21X55	Steel beam	LRFD	4	4	0	0	–	–
T3-2 W21X55	Steel beam	ASD	2	2	0	0	–	–
T3-2 W21X55 Lr	Steel beam	LRFD	1	1	0	0	–	–
T3-2 W21X55 Lr	Steel beam	ASD	1	1	0	0	–	–
T3-2 W18X40	Steel beam	LRFD	4	4	0	0	–	–
T3-2 W18X40	Steel beam	ASD	2	2	0	0	–	–
T3-2 W18X40 Lr	Steel beam	LRFD	1	1	0	0	–	–
T3-2 W18X40 Lr	Steel beam	ASD	1	1	0	0	–	–
T3-2 W16X40	Steel beam	LRFD	4	4	0	0	–	–
T3-2 W16X40	Steel beam	ASD	2	2	0	0	–	–
T3-2 W16X40 Lr	Steel beam	LRFD	1	1	0	0	–	–
T3-2 W16X40 Lr	Steel beam	ASD	1	1	0	0	–	–
T3-2 W14X43	Steel beam	LRFD	4	4	0	0	–	–
T3-2 W14X43	Steel beam	ASD	2	2	0	0	–	–
T3-2 W14X43 Lr	Steel beam	LRFD	1	1	0	0	–	–
T3-2 W14X43 Lr	Steel beam	ASD	1	1	0	0	–	–
T3-2 W12X65	Steel beam	LRFD	3	3	0	0	–	–
T3-2 W12X65	Steel beam	ASD	2	2	0	0	–	–
T3-2 W12X65 Lr	Steel beam	LRFD	1	1	0	0	–	–
T3-2 W12X65 Lr	Steel beam	ASD	1	1	0	0	–	–
F.2-1B	Steel beam	LRFD	2	2	0	0	–	–
F.2-1B	Steel beam	ASD	2	2	0	0	–	–
F.2-2B	Steel beam	LRFD	2	2	0	0	–	–
F.2-2B	Steel beam	ASD	2	2	0	0	–	–
F.5 · Steel beam	Steel beam	LRFD	2	2	0	0	–	–
F.5 · Steel beam	Steel beam	ASD	2	2	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
F.6 · Steel beam	Steel beam	LRFD	2	2	0	0	–	–
F.6 · Steel beam	Steel beam	ASD	2	2	0	0	–	–
F.7B · Steel beam	Steel beam	LRFD	2	2	0	0	–	–
F.7B · Steel beam	Steel beam	ASD	2	2	0	0	–	–
F.8B	Steel beam	LRFD	3	2	1	0	–	–
F.8B	Steel beam	ASD	2	1	1	0	–	–
F.9B · Steel beam	Steel beam	LRFD	2	2	0	0	–	–
F.9B · Steel beam	Steel beam	ASD	2	2	0	0	–	–
F.10 · Steel beam	Steel beam	LRFD	2	2	0	0	–	–
F.10 · Steel beam	Steel beam	ASD	2	2	0	0	–	–
F.11A · Steel beam	Steel beam	LRFD	2	2	0	0	–	–
F.11A · Steel beam	Steel beam	ASD	2	2	0	0	–	–
F.11B · Steel beam	Steel beam	LRFD	3	2	1	0	–	–
F.11B · Steel beam	Steel beam	ASD	1	0	1	0	–	–
F.11C z	Steel beam	LRFD	1	1	0	0	–	–
F.11C z	Steel beam	ASD	1	1	0	0	–	–
F.11C w	Steel beam	LRFD	1	1	0	0	–	–
F.11C w	Steel beam	ASD	1	1	0	0	–	–
F.12	Steel beam	LRFD	2	2	0	0	–	–
F.12	Steel beam	ASD	2	2	0	0	–	–
F.14 · Steel beam	Steel beam	LRFD	8	8	0	0	–	–
F.14 · Steel beam	Steel beam	ASD	4	4	0	0	–	–
G.2B	Steel beam	LRFD	2	2	0	0	–	–
G.2B	Steel beam	ASD	2	2	0	0	–	–
G.3	Steel beam	LRFD	2	2	0	0	–	–
G.3	Steel beam	ASD	2	2	0	0	–	–
G.4 · Steel beam	Steel beam	LRFD	2	2	0	0	–	–
G.4 · Steel beam	Steel beam	ASD	2	2	0	0	–	–
G.5 · Steel beam	Steel beam	LRFD	2	2	0	0	–	–
G.5 · Steel beam	Steel beam	ASD	2	2	0	0	–	–
G.6 · Steel beam	Steel beam	LRFD	2	2	0	0	–	–
G.6 · Steel beam	Steel beam	ASD	2	2	0	0	–	–
G.7	Steel beam	LRFD	2	2	0	0	–	–
G.7	Steel beam	ASD	2	2	0	0	–	–
G.8A	Steel beam	LRFD	2	2	0	0	–	–
G.8A	Steel beam	ASD	2	2	0	0	–	–
G.8B · Steel beam	Steel beam	LRFD	4	4	0	0	–	–
G.8B · Steel beam	Steel beam	ASD	4	4	0	0	–	–
E.1C	Steel column	LRFD	1	1	0	0	–	–
E.1C	Steel column	ASD	1	1	0	0	–	–
E.1D	Steel column	LRFD	2	2	0	0	–	–
E.1D	Steel column	ASD	1	1	0	0	–	–
E.1E-a	Steel column	LRFD	2	2	0	0	–	–
E.1E-a	Steel column	ASD	1	1	0	0	–	–
E.1E-b	Steel column	LRFD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
E.1E-b	Steel column	ASD	1	1	0	0	–	–
E.1E-c	Steel column	LRFD	1	1	0	0	–	–
E.1E-c	Steel column	ASD	1	1	0	0	–	–
E.9	Steel column	LRFD	1	1	0	0	–	–
E.9	Steel column	ASD	1	1	0	0	–	–
E.10	Steel column	LRFD	2	2	0	0	–	–
E.10	Steel column	ASD	1	1	0	0	–	–
E.10-18	Steel column	LRFD	2	2	0	0	–	–
E.10-18	Steel column	ASD	1	1	0	0	–	–
E.10-40	Steel column	LRFD	1	1	0	0	–	–
E.10-40	Steel column	ASD	1	1	0	0	–	–
E.11	Steel column	LRFD	1	1	0	0	–	–
E.11	Steel column	ASD	1	1	0	0	–	–
D.1 · Steel column	Steel column	LRFD	2	2	0	0	–	–
D.1 · Steel column	Steel column	ASD	2	2	0	0	–	–
F.5 · Steel column	Steel column	LRFD	1	1	0	0	–	–
F.5 · Steel column	Steel column	ASD	1	1	0	0	–	–
F.7B · Steel column	Steel column	LRFD	2	2	0	0	–	–
F.7B · Steel column	Steel column	ASD	1	1	0	0	–	–
F.8A	Steel column	LRFD	1	1	0	0	–	–
F.8A	Steel column	ASD	1	1	0	0	–	–
F.9B · Steel column	Steel column	LRFD	1	1	0	0	–	–
F.9B · Steel column	Steel column	ASD	1	1	0	0	–	–
G.1B · Steel column	Steel column	LRFD	1	1	0	0	–	–
G.1B · Steel column	Steel column	ASD	1	1	0	0	–	–
G.4 · Steel column	Steel column	LRFD	1	1	0	0	–	–
G.4 · Steel column	Steel column	ASD	1	1	0	0	–	–
G.5 · Steel column	Steel column	LRFD	1	1	0	0	–	–
G.5 · Steel column	Steel column	ASD	1	1	0	0	–	–
G.6 · Steel column	Steel column	LRFD	1	1	0	0	–	–
G.6 · Steel column	Steel column	ASD	1	1	0	0	–	–
H.1B	Steel column	LRFD	4	4	0	0	–	–
H.1B-ASD	Steel column	ASD	4	4	0	0	–	–
H.3	Steel column	LRFD	5	5	0	0	–	–
H.3	Steel column	ASD	5	5	0	0	–	–
H.4	Steel column	LRFD	8	8	0	0	–	–
H.4	Steel column	ASD	6	6	0	0	–	–
D.4 · Steel column	Steel column	LRFD	2	2	0	0	–	–
D.4 · Steel column	Steel column	ASD	2	2	0	0	–	–
D.5 · Steel column	Steel column	LRFD	2	2	0	0	–	–
D.5 · Steel column	Steel column	ASD	2	2	0	0	–	–
E.1B	Steel column	LRFD	1	1	0	0	–	–
E.1B	Steel column	ASD	1	1	0	0	–	–
E.4B · Steel column	Steel column	LRFD	1	1	0	0	–	–
E.4B · Steel column	Steel column	ASD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
F.6 · Steel column	Steel column	LRFD	1	1	0	0	–	–
F.6 · Steel column	Steel column	ASD	1	1	0	0	–	–
T4-1a W14X145 20	Steel column	LRFD	1	1	0	0	–	–
T4-1a W14X145 20	Steel column	ASD	1	1	0	0	–	–
T4-1a W14X145 40	Steel column	LRFD	1	1	0	0	–	–
T4-1a W14X145 40	Steel column	ASD	1	1	0	0	–	–
T4-1a W14X120 10	Steel column	LRFD	1	1	0	0	–	–
T4-1a W14X120 10	Steel column	ASD	1	1	0	0	–	–
T4-1a W14X120 30	Steel column	LRFD	1	1	0	0	–	–
T4-1a W14X120 30	Steel column	ASD	1	1	0	0	–	–
T4-1a W14X109 16	Steel column	LRFD	1	1	0	0	–	–
T4-1a W14X109 16	Steel column	ASD	1	1	0	0	–	–
T4-1a W14X99 26	Steel column	LRFD	1	1	0	0	–	–
T4-1a W14X99 26	Steel column	ASD	1	1	0	0	–	–
T4-4 HSS8X8X1/4 12	Steel column	LRFD	1	1	0	0	–	–
T4-4 HSS8X8X1/4 12	Steel column	ASD	1	1	0	0	–	–
T4-4 HSS8X8X3/16 10	Steel column	LRFD	1	1	0	0	–	–
T4-4 HSS8X8X3/16 10	Steel column	ASD	1	1	0	0	–	–
T4-4 HSS8X8X3/16 20	Steel column	LRFD	1	1	0	0	–	–
T4-4 HSS8X8X3/16 20	Steel column	ASD	1	1	0	0	–	–
T4-4 HSS8X8X1/8 15	Steel column	LRFD	1	1	0	0	–	–
T4-4 HSS8X8X1/8 15	Steel column	ASD	1	1	0	0	–	–
T4-4 HSS7X7X1/2 16	Steel column	LRFD	1	1	0	0	–	–
T4-4 HSS7X7X1/2 16	Steel column	ASD	1	1	0	0	–	–
T4-4 HSS7X7X1/2 30	Steel column	LRFD	1	1	0	0	–	–
T4-4 HSS7X7X1/2 30	Steel column	ASD	1	1	0	0	–	–
T4-6 PIPE12STD 20	Steel column	LRFD	1	1	0	0	–	–
T4-6 PIPE12STD 20	Steel column	ASD	1	1	0	0	–	–
T4-6 PIPE10XS 14	Steel column	LRFD	1	1	0	0	–	–
T4-6 PIPE10XS 14	Steel column	ASD	1	1	0	0	–	–
T4-6 PIPE8XS 30	Steel column	LRFD	1	1	0	0	–	–
T4-6 PIPE8XS 30	Steel column	ASD	1	1	0	0	–	–
D.2 · Steel column	Steel column	LRFD	3	3	0	0	–	–
D.2 · Steel column	Steel column	ASD	2	2	0	0	–	–
D.3 · Steel column	Steel column	LRFD	2	2	0	0	–	–
D.3 · Steel column	Steel column	ASD	2	2	0	0	–	–
D.6 · Steel column	Steel column	LRFD	3	3	0	0	–	–
D.6 · Steel column	Steel column	ASD	2	2	0	0	–	–
D.7	Steel column	LRFD	4	4	0	0	–	–
D.7	Steel column	ASD	4	4	0	0	–	–
D.8	Steel column	LRFD	1	1	0	0	–	–
D.8	Steel column	ASD	1	1	0	0	–	–
D.9 · Steel column	Steel column	LRFD	2	2	0	0	–	–
E.2	Steel column	LRFD	3	3	0	0	–	–
E.2	Steel column	ASD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
E.3	Steel column	LRFD	2	2	0	0	–	–
E.3	Steel column	ASD	1	1	0	0	–	–
E.5 · Steel column	Steel column	LRFD	5	5	0	0	–	–
E.5 · Steel column	Steel column	ASD	1	1	0	0	–	–
E.6 · Steel column	Steel column	LRFD	4	4	0	0	–	–
E.6 · Steel column	Steel column	ASD	1	1	0	0	–	–
E.7 · Steel column	Steel column	LRFD	4	4	0	0	–	–
E.7 · Steel column	Steel column	ASD	1	1	0	0	–	–
E.8	Steel column	LRFD	3	3	0	0	–	–
E.8	Steel column	ASD	1	1	0	0	–	–
E.12	Steel column	LRFD	3	3	0	0	–	–
E.12	Steel column	ASD	1	1	0	0	–	–
E.13	Steel column	LRFD	4	4	0	0	–	–
E.13	Steel column	ASD	1	1	0	0	–	–
E.14A	Steel column	LRFD	2	1	1	0	–	–
E.14A	Steel column	ASD	1	1	0	0	–	–
E.14B	Steel column	LRFD	5	5	0	0	–	–
E.14B-ASD	Steel column	ASD	4	4	0	0	–	–
T4-11 L12X12X1-1/4 10	Steel column	LRFD	1	1	0	0	–	–
T4-11 L12X12X1-1/4 10	Steel column	ASD	1	1	0	0	–	–
T4-11 L12X12X1-1/4 20	Steel column	LRFD	1	1	0	0	–	–
T4-11 L12X12X1-1/4 20	Steel column	ASD	1	1	0	0	–	–
T4-11 L12X12X1 10	Steel column	LRFD	1	1	0	0	–	–
T4-11 L12X12X1 10	Steel column	ASD	1	1	0	0	–	–
T4-11 L12X12X1 20	Steel column	LRFD	1	1	0	0	–	–
T4-11 L12X12X1 20	Steel column	ASD	1	1	0	0	–	–
T4-11 L6X6X9/16 10	Steel column	LRFD	1	1	0	0	–	–
T4-11 L6X6X9/16 10	Steel column	ASD	1	1	0	0	–	–
T4-11 L6X6X5/16 1	Steel column	LRFD	1	1	0	0	–	–
T4-11 L6X6X5/16 1	Steel column	ASD	1	1	0	0	–	–
T4-11 L6X6X5/16 3	Steel column	LRFD	1	1	0	0	–	–
T4-11 L6X6X5/16 3	Steel column	ASD	1	1	0	0	–	–
T4-11 L6X6X5/16 5	Steel column	LRFD	1	1	0	0	–	–
T4-11 L6X6X5/16 5	Steel column	ASD	1	1	0	0	–	–
T4-11 L6X6X5/16 8	Steel column	LRFD	1	1	0	0	–	–
T4-11 L6X6X5/16 8	Steel column	ASD	1	1	0	0	–	–
T4-11 L6X6X5/16 10	Steel column	LRFD	1	1	0	0	–	–
T4-11 L6X6X5/16 10	Steel column	ASD	1	1	0	0	–	–
T4-11 L6X6X5/16 15	Steel column	LRFD	1	1	0	0	–	–
T4-11 L6X6X5/16 15	Steel column	ASD	1	1	0	0	–	–
VUL-EX	Steel deck (gravity)	ASD	7	4	3	0	–	–
VUL-T1	Steel deck (gravity)	ASD	3	3	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
VUL-T2	Steel deck (gravity)	ASD	3	3	0	0	–	–
VUL-T3	Steel deck (gravity)	ASD	1	1	0	0	–	–
VUL-T4	Steel deck (gravity)	ASD	3	3	0	0	–	–
LEC-EX	Steel deck (gravity)	ASD	2	2	0	0	–	–
VER-22	Steel deck (gravity)	ASD	3	3	0	0	–	–
VER-20	Steel deck (gravity)	ASD	3	3	0	0	–	–
VER-18	Steel deck (gravity)	ASD	3	3	0	0	–	–
VER-16	Steel deck (gravity)	ASD	3	3	0	0	–	–
INT-S22	Steel deck (gravity)	ASD	1	1	0	0	–	–
INT-S20	Steel deck (gravity)	ASD	1	1	0	0	–	–
INT-S18	Steel deck (gravity)	ASD	1	1	0	0	–	–
INT-D22	Steel deck (gravity)	ASD	1	1	0	0	–	–
INT-D20	Steel deck (gravity)	ASD	1	1	0	0	–	–
INT-D18	Steel deck (gravity)	ASD	1	1	0	0	–	–
INT-D16	Steel deck (gravity)	ASD	1	1	0	0	–	–
HAND-FIRE-BEAM	Steel fire resistance	LRFD	3	3	0	0	–	–
HAND-FIRE-K900	Steel fire resistance	LRFD	3	3	0	0	–	–
HAND-FIRE-LTB	Steel fire resistance	LRFD	1	1	0	0	–	–
HAND-FIRE-COL	Steel fire resistance	LRFD	1	1	0	0	–	–
HAND-FIRE-COOL	Steel fire resistance	LRFD	1	1	0	0	–	–
VI-2	Steel fire resistance	LRFD	2	2	0	0	–	–
VI-3	Steel fire resistance	LRFD	1	1	0	0	–	–
VII-1	Steel fire resistance	LRFD	1	1	0	0	–	–
VII-2a	Steel fire resistance	LRFD	1	1	0	0	–	–
VII-2b	Steel fire resistance	LRFD	1	1	0	0	–	–
COSP-O4-1	Steel joist	ASD	6	6	0	0	–	–
COSP-O4-2	Steel joist	ASD	4	4	0	0	–	–
COSP-O4-3	Steel joist	ASD	3	3	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
COSP-O4-3A	Steel joist	ASD	4	4	0	0	–	–
SJI-OPT1	Steel joist	ASD	2	2	0	0	–	–
SJI-DLH	Steel joist	ASD	4	3	1	0	–	–
SJI-TBL	Steel joist	LRFD	5	5	0	0	–	–
F.11A · Steel lintel	Steel lintel	LRFD	2	2	0	0	–	–
F.11A · Steel lintel	Steel lintel	ASD	2	2	0	0	–	–
F.11B · Steel lintel	Steel lintel	LRFD	1	1	0	0	–	–
F.11B · Steel lintel	Steel lintel	ASD	1	1	0	0	–	–
F.1-1A · Steel lintel	Steel lintel	LRFD	2	2	0	0	–	–
F.1-1A · Steel lintel	Steel lintel	ASD	2	2	0	0	–	–
TN31B-T1-A	Steel lintel	ASD	1	1	0	0	–	–
TN31B-T1-B	Steel lintel	ASD	1	1	0	0	–	–
TN31B-T1-C	Steel lintel	ASD	1	1	0	0	–	–
TN31B-T1-D	Steel lintel	ASD	1	1	0	0	–	–
TN31B-T1-E	Steel lintel	ASD	1	1	0	0	–	–
TN31B-T1-F	Steel lintel	ASD	1	1	0	0	–	–
TN31B-T3	Steel lintel	ASD	1	1	0	0	–	–
TN31B-TRI	Steel lintel	ASD	2	2	0	0	–	–
HC-2L	Steel lintel	ASD	1	1	0	0	–	–
HC-PLATE · Steel lintel	Steel lintel	ASD	1	1	0	0	–	–
HAND-POND-1	Roof ponding	—	6	6	0	0	–	–
HAND-POND-SIMPLE	Roof ponding	—	1	1	0	0	–	–
HAND-POND-WALL	Roof ponding	—	1	1	0	0	–	–
HAND-SM-COL	Seismic member checks	LRFD	5	5	0	0	–	–
HAND-SM-COL-MD	Seismic member checks	LRFD	2	2	0	0	–	–
HAND-SM-BEAM	Seismic member checks	LRFD	2	2	0	0	–	–
F.1-1A · Steel section selection	Steel section selection	LRFD	2	2	0	0	–	–
F.1-1A · Steel section selection	Steel section selection	ASD	2	2	0	0	–	–
F.4	Steel section selection	LRFD	2	2	0	0	–	–
F.4	Steel section selection	ASD	2	2	0	0	–	–
E.1A · Steel section selection	Steel section selection	LRFD	2	2	0	0	–	–
E.1A · Steel section selection	Steel section selection	ASD	2	2	0	0	–	–
T3-2 select	Steel section selection	LRFD	2	2	0	0	–	–
T3-2 select	Steel section selection	ASD	2	2	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
T4-1a select 20	Steel section selection	LRFD	2	2	0	0	–	–
T4-1a select 20	Steel section selection	ASD	2	2	0	0	–	–
T4-1a select 16	Steel section selection	LRFD	2	2	0	0	–	–
T4-1a select 16	Steel section selection	ASD	2	2	0	0	–	–
DG34-4.1	Steel stair	ASD	2	2	0	0	–	–
DG34-10.1.2	Steel stair	LRFD	7	7	0	0	–	–
DG34-10.1.2	Steel stair	ASD	8	8	0	0	–	–
DG34-10.1.3	Steel stair	LRFD	5	5	0	0	–	–
DG34-10.1.3	Steel stair	ASD	6	6	0	0	–	–
DG34-10.1.4	Steel stair	LRFD	3	3	0	0	–	–
DG34-10.1.4	Steel stair	ASD	3	3	0	0	–	–
DG34-10.1.5	Steel stair	LRFD	2	1	1	0	–	–
DG34-10.1.5	Steel stair	ASD	2	1	1	0	–	–
DG34-10.1.6	Steel stair	LRFD	3	2	1	0	–	–
DG34-10.1.6	Steel stair	ASD	3	2	1	0	–	–
DG34-10.1.7 · Steel stair	Steel stair	LRFD	16	16	0	0	–	–
DG34-10.1.7 · Steel stair	Steel stair	ASD	13	13	0	0	–	–
DG34-10.2.2	Steel stair	LRFD	8	8	0	0	–	–
DG34-10.2.2	Steel stair	ASD	6	6	0	0	–	–
DG34-10.2.3	Steel stair	LRFD	10	8	2	0	–	–
DG34-10.2.3	Steel stair	ASD	10	9	1	0	–	–
D.1 · Steel tension member / brace	Steel tension member / brace	LRFD	4	4	0	0	–	–
D.1 · Steel tension member / brace	Steel tension member / brace	ASD	2	2	0	0	–	–
D.2 · Steel tension member / brace	Steel tension member / brace	LRFD	4	4	0	0	–	–
D.2 · Steel tension member / brace	Steel tension member / brace	ASD	2	2	0	0	–	–
D.3 · Steel tension member / brace	Steel tension member / brace	LRFD	4	4	0	0	–	–
D.3 · Steel tension member / brace	Steel tension member / brace	ASD	2	2	0	0	–	–
D.4 · Steel tension member / brace	Steel tension member / brace	LRFD	5	5	0	0	–	–
D.4 · Steel tension member / brace	Steel tension member / brace	ASD	2	2	0	0	–	–
D.5 · Steel tension member / brace	Steel tension member / brace	LRFD	4	4	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
D.5 · Steel tension member / brace	Steel tension member / brace	ASD	2	2	0	0	–	–
D.6 · Steel tension member / brace	Steel tension member / brace	LRFD	5	5	0	0	–	–
D.6 · Steel tension member / brace	Steel tension member / brace	ASD	2	2	0	0	–	–
D.9 · Steel tension member / brace	Steel tension member / brace	LRFD	2	2	0	0	–	–
HAND-TM-BLOCK	Steel tension member / brace	LRFD	2	2	0	0	–	–
HAND-TM-BLOCK	Steel tension member / brace	ASD	2	2	0	0	–	–
HAND-TM-ROD	Steel tension member / brace	LRFD	2	2	0	0	–	–
HAND-TM-ROD	Steel tension member / brace	ASD	1	1	0	0	–	–
HAND-TM-CASE6	Steel tension member / brace	LRFD	1	1	0	0	–	–
DG9-5.1	Steel beam with torsion	LRFD	16	15	1	0	–	–
DG9-5.2	Steel beam with torsion	LRFD	4	2	2	0	–	–
DG9-5.4	Steel beam with torsion	LRFD	28	24	4	0	–	–
DG9-5.5	Steel beam with torsion	LRFD	30	20	10	0	–	–
H.5A	Steel beam with torsion	LRFD	1	1	0	0	–	–
H.5A	Steel beam with torsion	ASD	1	1	0	0	–	–
H.5B	Steel beam with torsion	LRFD	1	1	0	0	–	–
H.5B	Steel beam with torsion	ASD	1	1	0	0	–	–
H.5C	Steel beam with torsion	LRFD	5	5	0	0	–	–
H.5C	Steel beam with torsion	ASD	5	5	0	0	–	–
H.6	Steel beam with torsion	LRFD	16	14	2	0	–	–
H.6	Steel beam with torsion	ASD	14	13	1	0	–	–
UD-8.7-G	Steel truss	LRFD	5	5	0	0	–	–
UD-8.12-G	Steel truss	LRFD	4	4	0	0	–	–
D.3 · Steel truss	Steel truss	LRFD	2	2	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
D.3 · Steel truss	Steel truss	ASD	2	2	0	0	–	–
D.6 · Steel truss	Steel truss	LRFD	2	2	0	0	–	–
D.6 · Steel truss	Steel truss	ASD	2	2	0	0	–	–
E.5 · Steel truss	Steel truss	LRFD	5	5	0	0	–	–
E.5 · Steel truss	Steel truss	ASD	1	1	0	0	–	–
E.6 · Steel truss	Steel truss	LRFD	3	3	0	0	–	–
E.6 · Steel truss	Steel truss	ASD	1	1	0	0	–	–
E.7 · Steel truss	Steel truss	LRFD	4	4	0	0	–	–
E.7 · Steel truss	Steel truss	ASD	1	1	0	0	–	–
F.10 · Steel truss	Steel truss	LRFD	1	1	0	0	–	–
F.10 · Steel truss	Steel truss	ASD	1	1	0	0	–	–
TS-H1	Steel truss	LRFD	5	5	0	0	–	–
J.7	Concentrated forces on beams	LRFD	3	3	0	0	–	–
J.7	Concentrated forces on beams	ASD	3	3	0	0	–	–
II.B-1-T	Concentrated forces on beams	LRFD	2	2	0	0	–	–
II.B-1-T	Concentrated forces on beams	ASD	2	2	0	0	–	–
II.B-1-C	Concentrated forces on beams	LRFD	2	2	0	0	–	–
II.B-1-C	Concentrated forces on beams	ASD	2	2	0	0	–	–
DG13-6-1	Concentrated forces on beams	LRFD	2	2	0	0	–	–
HAND-WL-WCB	Concentrated forces on beams	LRFD	1	1	0	0	–	–
HAND-WL-WCB	Concentrated forces on beams	ASD	1	1	0	0	–	–
HAND-WL-STIFF	Concentrated forces on beams	LRFD	4	4	0	0	–	–
SD-10-12A	Story drift and P-delta	—	31	30	1	0	–	–
SD-10-12B	Story drift and P-delta	—	12	12	0	0	–	–
SD-9.1	Story drift and P-delta	—	4	3	1	0	–	–
SD-4-7-X	Story drift and P-delta	—	23	23	0	0	–	–
SD-4-7-Y	Story drift and P-delta	—	22	22	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
SD-4-7-E	Story drift and P-delta	—	5	5	0	0	–	–
SD-5-5	Story drift and P-delta	—	5	5	0	0	–	–
SD-5-5M	Story drift and P-delta	—	1	1	0	0	–	–
ST-ASDIP	Strap footing	—	4	0	4	0	–	–
AV-5.9 · Wood stud wall	Wood stud wall	ASD	9	9	0	0	–	–
HAND-1 · Wood stud wall	Wood stud wall	ASD	5	5	0	0	–	–
HAND-1 · Wood stud wall	Wood stud wall	LRFD	1	1	0	0	–	–
HUD-5.4	Wood stud wall	ASD	4	2	2	0	–	–
HUD-5.4B	Wood stud wall	ASD	1	1	0	0	–	–
HUD-5.5J	Wood stud wall	ASD	3	3	0	0	–	–
HUD-5.6	Wood stud wall	ASD	2	2	0	0	–	–
HAND-OPEN	Wood stud wall	ASD	8	8	0	0	–	–
DG25-A1	Web-tapered member	LRFD	3	3	0	0	–	–
DG25-5.2a	Web-tapered member	LRFD	5	5	0	0	–	–
DG25-5.2a-ASD	Web-tapered member	ASD	2	2	0	0	–	–
DG25-5.2b	Web-tapered member	LRFD	5	5	0	0	–	–
DG25-5.2b-ASD	Web-tapered member	ASD	2	2	0	0	–	–
TH-1	Thermal movement	—	3	3	0	0	–	–
TH-2	Thermal movement	—	1	1	0	0	–	–
TH-3	Thermal movement	—	1	1	0	0	–	–
TR65-1	Thermal movement	—	1	1	0	0	–	–
TR65-2	Thermal movement	—	1	1	0	0	–	–
SP-TU · Tilt-up wall panel	Tilt-up wall panel	—	16	16	0	0	–	–
SP-TUO-L	Tilt-up wall panel	—	21	21	0	0	–	–
SP-TUO-R	Tilt-up wall panel	—	18	18	0	0	–	–
TU-1	Tilt-up wall panel	—	7	7	0	0	–	–
TU-2	Tilt-up wall panel	—	4	4	0	0	–	–
T13.2A-4in-2m	Split-ring and shear-plate connections	—	3	3	0	0	–	–
T13.2A-4in-3m	Split-ring and shear-plate connections	—	2	2	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
T13.2A-2.5in	Split-ring and shear-plate connections	—	2	2	0	0	–	–
T13.2B-2.625	Split-ring and shear-plate connections	—	2	2	0	0	–	–
T13.2B-limit	Split-ring and shear-plate connections	—	2	2	0	0	–	–
T11.3.6B-a	Split-ring and shear-plate connections	—	1	1	0	0	–	–
T11.3.6B-b	Split-ring and shear-plate connections	—	1	1	0	0	–	–
T11.3.6B-c	Split-ring and shear-plate connections	—	1	1	0	0	–	–
T11.3.6B-d	Split-ring and shear-plate connections	—	1	1	0	0	–	–
HC-INTERP · Split-ring and shear-plate connections	Split-ring and shear-plate connections	—	2	2	0	0	–	–
HC-ANGLE · Split-ring and shear-plate connections	Split-ring and shear-plate connections	—	1	1	0	0	–	–
HC-CDELTA	Split-ring and shear-plate connections	—	3	3	0	0	–	–
T6B	Round timber poles and piles	—	3	3	0	0	–	–
T6B-WRC	Round timber poles and piles	—	1	1	0	0	–	–
T6.3.5	Round timber poles and piles	—	1	1	0	0	–	–
T6.3.11	Round timber poles and piles	—	2	2	0	0	–	–
PDH-S235	Round timber poles and piles	—	1	1	0	0	–	–
CALCBOOK	Round timber poles and piles	—	1	1	0	0	–	–
HC-COLUMN · Round timber poles and piles	Round timber poles and piles	—	3	3	0	0	–	–
HC-BENDING	Round timber poles and piles	—	2	2	0	0	–	–
HC-CCS	Round timber poles and piles	—	1	1	0	0	–	–
T14.2.1C	Timber rivet connections	—	2	2	0	0	–	–
T14.2.1A	Timber rivet connections	—	2	2	0	0	–	–
HC-INTERP · Timber rivet connections	Timber rivet connections	—	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
T14.2.2	Timber rivet connections	—	3	3	0	0	–	–
T14.2.3	Timber rivet connections	—	2	2	0	0	–	–
T14.3.2	Timber rivet connections	—	1	1	0	0	–	–
HC-ANGLE · Timber rivet connections	Timber rivet connections	—	4	4	0	0	–	–
HC-DEFAULT · Timber rivet connections	Timber rivet connections	ASD	1	1	0	0	–	–
HC-DEFAULT · Timber rivet connections	Timber rivet connections	LRFD	1	1	0	0	–	–
SCHOOL	Tornado loads	—	28	27	1	0	–	–
HOSPITAL	Tornado loads	—	23	23	0	0	–	–
KZ-100	Tornado loads	—	1	1	0	0	–	–
KZ-250	Tornado loads	—	1	1	0	0	–	–
KZ-300	Tornado loads	—	1	1	0	0	–	–
KZ-400	Tornado loads	—	1	1	0	0	–	–
MGZ-2.1	2-D truss analysis	—	4	4	0	0	–	–
MGZ-3.2	2-D truss analysis	—	9	9	0	0	–	–
MGZ-3.3	2-D truss analysis	—	7	7	0	0	–	–
MGZ-3.5	2-D truss analysis	—	13	13	0	0	–	–
MGZ-3.6	2-D truss analysis	—	3	3	0	0	–	–
UD-5.2	2-D truss analysis	—	7	7	0	0	–	–
UD-5.3	2-D truss analysis	—	4	4	0	0	–	–
UD-8.6	2-D truss analysis	—	6	6	0	0	–	–
UD-8.7	2-D truss analysis	—	3	3	0	0	–	–
UD-8.11	2-D truss analysis	—	5	5	0	0	–	–
UD-10.8	2-D truss analysis	—	5	5	0	0	–	–
UD-10.9	2-D truss analysis	—	1	1	0	0	–	–
SP-TWFP	Two-way slab	—	15	15	0	0	–	–
SP-TWDP	Two-way slab	—	6	4	2	0	–	–
SP-TWB	Two-way slab	—	3	2	1	0	–	–
ACI-HB-TW1	Two-way slab	—	10	10	0	0	–	–
TW-1	Two-way slab	—	9	9	0	0	–	–
SP-TWFP-EFM	Two-way slab	—	16	16	0	0	–	–
SP-TWDP-EFM	Two-way slab	—	10	10	0	0	–	–
UC-1	Unit converter	—	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
UC-2	Unit converter	—	1	1	0	0	–	–
UC-3	Unit converter	—	1	1	0	0	–	–
UC-4	Unit converter	—	1	1	0	0	–	–
UC-5	Unit converter	—	1	1	0	0	–	–
UC-6	Unit converter	—	1	1	0	0	–	–
UC-7	Unit converter	—	1	1	0	0	–	–
UC-8	Unit converter	—	1	1	0	0	–	–
UC-9	Unit converter	—	1	1	0	0	–	–
UC-10	Unit converter	—	1	1	0	0	–	–
UC-11	Unit converter	—	1	1	0	0	–	–
UC-12	Unit converter	—	1	1	0	0	–	–
SP811-1	Unit converter	—	1	1	0	0	–	–
SP811-2	Unit converter	—	1	1	0	0	–	–
SP811-3	Unit converter	—	1	1	0	0	–	–
SP811-4	Unit converter	—	1	1	0	0	–	–
SP811-5	Unit converter	—	1	1	0	0	–	–
SP811-6	Unit converter	—	1	1	0	0	–	–
SP811-7	Unit converter	—	1	1	0	0	–	–
SP811-8	Unit converter	—	1	1	0	0	–	–
SP811-9	Unit converter	—	1	1	0	0	–	–
SP811-10	Unit converter	—	1	1	0	0	–	–
SP811-11	Unit converter	—	1	1	0	0	–	–
SP811-12	Unit converter	—	1	1	0	0	–	–
SP811-13	Unit converter	—	1	1	0	0	–	–
SP811-14	Unit converter	—	1	1	0	0	–	–
SP811-15	Unit converter	—	1	1	0	0	–	–
SP811-16	Unit converter	—	1	1	0	0	–	–
SP811-17	Unit converter	—	1	1	0	0	–	–
SP811-18	Unit converter	—	1	1	0	0	–	–
SP811-19	Unit converter	—	1	1	0	0	–	–
SP811-20	Unit converter	—	1	1	0	0	–	–
SP811-21	Unit converter	—	1	1	0	0	–	–
SP811-22	Unit converter	—	1	1	0	0	–	–
14.2-SIDE	Seismic wall anchorage	—	6	6	0	0	–	–
14.2-END	Seismic wall anchorage	—	6	6	0	0	–	–
14.2-END-16	Seismic wall anchorage	—	1	1	0	0	–	–
11.1-PLANK-C	Seismic wall anchorage	—	2	1	1	0	–	–
11.1-PLANK-D	Seismic wall anchorage	—	2	2	0	0	–	–
13.1-WALL	Seismic wall anchorage	—	1	1	0	0	–	–
13.2-WALL-B	Seismic wall anchorage	—	2	2	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
13.2-WALL-C	Seismic wall anchorage	—	1	1	0	0	–	–
HC-MIN	Seismic wall anchorage	—	1	1	0	0	–	–
HC-REDUCE	Seismic wall anchorage	—	2	2	0	0	–	–
HC-STEEL	Seismic wall anchorage	—	3	3	0	0	–	–
HC-SDC-A	Seismic wall anchorage	—	1	1	0	0	–	–
MNL-F2	Wall footing	LRFD	7	4	3	0	–	–
WF-SP-13	Wall footing	LRFD	13	11	2	0	–	–
WF-SP-12	Wall footing	LRFD	5	4	1	0	–	–
WF-UET-9.1	Wall footing	LRFD	9	8	1	0	–	–
WF-ASDIP-W	Wall footing	LRFD	10	9	1	0	–	–
WF-ASDIP-G	Wall footing	LRFD	10	7	3	0	–	–
WF-CE-10	Wall footing	LRFD	8	4	4	0	–	–
WF-H1	Wall footing	LRFD	7	7	0	0	–	–
WF-H2	Wall footing	LRFD	2	2	0	0	–	–
WF-H3	Wall footing	LRFD	1	1	0	0	–	–
WF-H4	Wall footing	LRFD	1	1	0	0	–	–
WF-H5	Wall footing	LRFD	1	1	0	0	–	–
WF-H6	Wall footing	LRFD	4	4	0	0	–	–
TM-1	Wall and pier rigidity	—	4	4	0	0	–	–
TM-2	Wall and pier rigidity	—	11	11	0	0	–	–
TM-F-fixed-rect	Wall and pier rigidity	—	1	1	0	0	–	–
TM-F-cantilever-rect	Wall and pier rigidity	—	1	1	0	0	–	–
TM-F-fixed-corner	Wall and pier rigidity	—	1	1	0	0	–	–
TM-F-cantilever-corner	Wall and pier rigidity	—	1	1	0	0	–	–
CM-1	Wall and pier rigidity	—	3	3	0	0	–	–
CM-2	Wall and pier rigidity	—	4	4	0	0	–	–
YAW-T2	Wall and pier rigidity	—	3	3	0	0	–	–
CS-T1	Wall and pier rigidity	—	5	5	0	0	–	–
II.A-26A	Eccentric weld group	LRFD	6	6	0	0	–	–
II.A-26A	Eccentric weld group	ASD	1	1	0	0	–	–
II.A-26B	Eccentric weld group	LRFD	3	3	0	0	–	–
II.A-26B	Eccentric weld group	ASD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
II.A-27	Eccentric weld group	LRFD	5	5	0	0	–	–
II.A-27	Eccentric weld group	ASD	1	1	0	0	–	–
II.A-2A	Eccentric weld group	LRFD	2	2	0	0	–	–
II.A-2B	Eccentric weld group	LRFD	4	3	1	0	–	–
II.A-10	Eccentric weld group	LRFD	4	4	0	0	–	–
II.A-11B	Eccentric weld group	LRFD	1	1	0	0	–	–
II.A-21	Eccentric weld group	LRFD	4	4	0	0	–	–
II.A-23	Eccentric weld group	LRFD	2	2	0	0	–	–
II.A-29	Eccentric weld group	LRFD	5	4	1	0	–	–
II.C-1	Eccentric weld group	LRFD	4	4	0	0	–	–
Table 8-4 0 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-4 0 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-4 0 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-4 0 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-4 45 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-4 45 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-4 45 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-4 45 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-4 75 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-4 75 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-4 75 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-4 75 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-5 0 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-5 0 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-5 0 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-5 0 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
Table 8-5 45 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-5 45 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-5 45 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-5 45 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-5 75 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-5 75 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-5 75 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-5 75 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-6 0 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-6 0 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-6 0 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-6 0 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-6 45 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-6 45 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-6 45 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-6 45 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-6 75 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-6 75 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-6 75 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-6 75 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-7 0 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-7 0 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-7 0 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-7 0 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-7 45 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-7 45 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
Table 8-7 45 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-7 45 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-7 75 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-7 75 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-7 75 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-7 75 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-8 0 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-8 0 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-8 0 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-8 0 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-8 45 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-8 45 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-8 45 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-8 45 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-8 75 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-8 75 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-8 75 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-8 75 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-9 0 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-9 0 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-9 0 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-9 0 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-9 45 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-9 45 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-9 45 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-9 45 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
Table 8-9 75 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-9 75 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-9 75 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-9 75 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-10 0 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-10 0 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-10 0 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-10 0 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-10 45 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-10 45 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-10 45 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-10 45 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-10 75 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-10 75 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-10 75 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-10 75 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-10a 15 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-10a 15 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-10a 15 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-10a 15 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-10a 45 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-10a 45 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-10a 45 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-10a 45 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-10a 75 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-10a 75 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
Table 8-10a 75 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-10a 75 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-11 0 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-11 0 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-11 0 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-11 0 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-11 45 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-11 45 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-11 45 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-11 45 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-11 75 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-11 75 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-11 75 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-11 75 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-11a 15 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-11a 15 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-11a 15 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-11a 15 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-11a 45 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-11a 45 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-11a 45 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-11a 45 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-11a 75 k0.5 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-11a 75 k0.5 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-11a 75 k1.0 a0.2	Eccentric weld group	LRFD	1	1	0	0	–	–
Table 8-11a 75 k1.0 a1.0	Eccentric weld group	LRFD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
Table 8-11a 75 k1.2 a0.1 (deviation)	Eccentric weld group	LRFD	1	0	1	0	–	–
Table 8-10 0 k2.0 a0.1 (deviation)	Eccentric weld group	LRFD	1	0	1	0	–	–
Table 8-4 0 k2.0 a2.4 (deviation)	Eccentric weld group	LRFD	1	0	1	0	–	–
WE-F1-0	Wind loads, envelope procedure	—	8	8	0	0	–	–
WE-F1-20	Wind loads, envelope procedure	—	8	8	0	0	–	–
WE-F1-30	Wind loads, envelope procedure	—	8	8	0	0	–	–
WE-F1-LC2	Wind loads, envelope procedure	—	12	12	0	0	–	–
WE-F2-0	Wind loads, envelope procedure	—	6	6	0	0	–	–
WE-F2-30	Wind loads, envelope procedure	—	4	4	0	0	–	–
C26.11-1 · Gust-effect factor	Gust-effect factor	—	17	16	1	0	–	–
C26.11-2	Gust-effect factor	—	8	6	2	0	–	–
NA-STEEL	Gust-effect factor	—	1	1	0	0	–	–
NA-CONC	Gust-effect factor	—	1	1	0	0	–	–
NA-OTHER	Gust-effect factor	—	1	1	0	0	–	–
W1	Wind loads	—	9	9	0	0	–	–
W2-B	Wind loads	—	1	1	0	0	–	–
W2-D	Wind loads	—	1	1	0	0	–	–
W2-Ke	Wind loads	—	2	2	0	0	–	–
W3	Wind loads	—	1	1	0	0	–	–
W4	Wind loads	—	1	1	0	0	–	–
W5	Wind loads	—	5	5	0	0	–	–
T26.10-1-B	Wind loads	—	6	6	0	0	–	–
T26.10-1-C	Wind loads	—	6	6	0	0	–	–
T26.10-1-D	Wind loads	—	6	6	0	0	–	–
F26.8-1-ridge	Wind loads	—	3	3	0	0	–	–
F26.8-1-escarpment	Wind loads	—	3	3	0	0	–	–
F26.8-1-hill	Wind loads	—	3	3	0	0	–	–
F30.3-1	Wind loads	—	6	6	0	0	–	–
F30.3-2A	Wind loads	—	10	10	0	0	–	–
F30.3-2B	Wind loads	—	8	8	0	0	–	–
F30.3-2C	Wind loads	—	8	8	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
F30.3-2D	Wind loads	—	8	8	0	0	–	–
F30.3-2E	Wind loads	—	8	8	0	0	–	–
F30.3-2F	Wind loads	—	6	6	0	0	–	–
F30.3-2G	Wind loads	—	8	8	0	0	–	–
C26.11-1 · Wind loads	Wind loads	—	5	4	1	0	–	–
AISC-III-wind	Wind loads	—	16	16	0	0	–	–
WW-wind-T	Wind loads	—	17	17	0	0	–	–
WW-wind-L	Wind loads	—	9	9	0	0	–	–
F30.4-1	Wind loads	—	7	7	0	0	–	–
F30.4-1-N7	Wind loads	—	1	1	0	0	–	–
W-P2	Wind loads	—	4	4	0	0	–	–
W-ENC	Wind loads	—	1	1	0	0	–	–
W-ENC-RI	Wind loads	—	2	2	0	0	–	–
F29.3-1-AB	Wind on other structures	—	1	1	0	0	–	–
F29.3-1-AB2	Wind on other structures	—	1	1	0	0	–	–
F29.3-1-AB3	Wind on other structures	—	1	1	0	0	–	–
F29.3-1-AB4	Wind on other structures	—	1	1	0	0	–	–
F29.3-1-C5	Wind on other structures	—	4	4	0	0	–	–
F29.3-1-C5LR	Wind on other structures	—	1	1	0	0	–	–
F29.3-1-C13	Wind on other structures	—	7	7	0	0	–	–
F29.4-1-SQ	Wind on other structures	—	2	2	0	0	–	–
F29.4-1-RD	Wind on other structures	—	2	2	0	0	–	–
F29.4-1-HX	Wind on other structures	—	2	2	0	0	–	–
F29.4-1-RL	Wind on other structures	—	1	1	0	0	–	–
F29.4-2-FL	Wind on other structures	—	1	1	0	0	–	–
F29.4-2-FL05	Wind on other structures	—	1	1	0	0	–	–
F29.4-2-RL	Wind on other structures	—	1	1	0	0	–	–
F29.4-2-RH	Wind on other structures	—	1	1	0	0	–	–
F29.4-3-SQ	Wind on other structures	—	2	2	0	0	–	–
F29.4-3-TR	Wind on other structures	—	1	1	0	0	–	–
O1	Wind on other structures	—	5	5	0	0	–	–
O2	Wind on other structures	—	3	3	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
O2-R	Wind on other structures	—	2	2	0	0	–	–
O3	Wind on other structures	—	3	3	0	0	–	–
O4	Wind on other structures	—	4	4	0	0	–	–
BREYER-6-18 · Sawn lumber beam	Sawn lumber beam	ASD	5	5	0	0	–	–
BREYER-6-18 · Sawn lumber beam	Sawn lumber beam	LRFD	5	5	0	0	–	–
HAND-1 · Sawn lumber beam	Sawn lumber beam	ASD	8	8	0	0	–	–
HAND-1 · Sawn lumber beam	Sawn lumber beam	LRFD	4	4	0	0	–	–
HAND-2 · Sawn lumber beam	Sawn lumber beam	ASD	4	4	0	0	–	–
HAND-2 · Sawn lumber beam	Sawn lumber beam	LRFD	2	2	0	0	–	–
HUD-5.8	Sawn lumber beam	ASD	5	3	2	0	–	–
HUD-5.5A	Sawn lumber beam	ASD	9	7	2	0	–	–
HUD-5.5B	Sawn lumber beam	ASD	2	1	1	0	–	–
HAND-HIP	Sawn lumber beam	ASD	5	5	0	0	–	–
HAND-HIP	Sawn lumber beam	LRFD	1	1	0	0	–	–
HAND-OVERHANG	Sawn lumber beam	ASD	5	5	0	0	–	–
AWC-E1.3 · Wood bearing and notches	Wood bearing and notches	ASD	3	3	0	0	–	–
BREYER-6-18 · Wood bearing and notches	Wood bearing and notches	ASD	1	1	0	0	–	–
BREYER-6-18 · Wood bearing and notches	Wood bearing and notches	LRFD	1	1	0	0	–	–
AV-5.9 · Wood bearing and notches	Wood bearing and notches	ASD	2	2	0	0	–	–
HAND-1 · Wood bearing and notches	Wood bearing and notches	ASD	2	2	0	0	–	–
HAND-1 · Wood bearing and notches	Wood bearing and notches	LRFD	2	2	0	0	–	–
HAND-2 · Wood bearing and notches	Wood bearing and notches	ASD	1	1	0	0	–	–
HAND-3 · Wood bearing and notches	Wood bearing and notches	ASD	1	1	0	0	–	–
HAND-4 · Wood bearing and notches	Wood bearing and notches	ASD	1	1	0	0	–	–
HAND-5	Wood bearing and notches	ASD	1	1	0	0	–	–
HAND-6	Wood bearing and notches	ASD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
F15C	Built-up and spaced columns	—	1	1	0	0	–	–
F15D	Built-up and spaced columns	—	1	1	0	0	–	–
HC-NAILED	Built-up and spaced columns	ASD	3	3	0	0	–	–
HC-NAILED	Built-up and spaced columns	LRFD	2	2	0	0	–	–
HC-BOLTED	Built-up and spaced columns	ASD	2	2	0	0	–	–
HC-SPACED	Built-up and spaced columns	ASD	4	4	0	0	–	–
HC-SPACED-NOKX	Built-up and spaced columns	ASD	1	1	0	0	–	–
AWC-E1.4a · Wood column and post	Wood column and post	ASD	5	5	0	0	–	–
AWC-E1.4b · Wood column and post	Wood column and post	ASD	5	5	0	0	–	–
AV-5.6	Wood column and post	ASD	4	4	0	0	–	–
AV-5.6	Wood column and post	LRFD	3	3	0	0	–	–
NDS-E.6	Wood column and post	ASD	2	2	0	0	–	–
NDS-E.6m	Wood column and post	ASD	1	1	0	0	–	–
NDS-E.6v	Wood column and post	ASD	1	1	0	0	–	–
NDS-E.8	Wood column and post	ASD	2	2	0	0	–	–
NDS-E.8v	Wood column and post	ASD	1	1	0	0	–	–
NDS-E.9	Wood column and post	ASD	1	1	0	0	–	–
NDS-E.9v	Wood column and post	ASD	1	1	0	0	–	–
HAND-1 · Wood column and post	Wood column and post	ASD	2	2	0	0	–	–
HAND-1 · Wood column and post	Wood column and post	LRFD	2	2	0	0	–	–
HAND-2 · Wood column and post	Wood column and post	ASD	1	1	0	0	–	–
HAND-3 · Wood column and post	Wood column and post	ASD	2	2	0	0	–	–
HAND-3 · Wood column and post	Wood column and post	LRFD	2	2	0	0	–	–
NDS24-12A-1	Wood fastener connection	ASD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
NDS24-12A-2	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-3	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-4	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-5	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-6	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-7	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-8	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-9	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-10	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-11	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-12	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-13	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-14	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-15	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-16	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-17	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-18	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-19	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-20	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-21	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-22	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-23	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-24	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-25	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-26	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-27	Wood fastener connection	ASD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
NDS24-12A-28	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-29	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-30	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12A-31	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12B-32	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12B-33	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12B-34	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12B-35	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12B-36	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12B-37	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12B-38	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12B-39	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12B-40	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12B-41	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12F-42	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12F-43	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12F-44	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12F-45	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12F-46	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12F-47	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12F-48	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12F-49	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12F-50	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12F-51	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12F-52	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12F-53	Wood fastener connection	ASD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
NDS24-12F-54	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12F-55	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12J-56	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12J-57	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12J-58 · Wood fastener connection	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12J-59	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12J-60	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12J-61	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12J-62	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12J-63	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12J-64	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12J-65	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12J-66	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12J-67	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12J-68	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12J-69	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12J-70	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12J-71	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12J-72	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12K-73	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12K-74	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12K-75	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12K-76	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12K-77	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12K-78	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12K-79	Wood fastener connection	ASD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
NDS24-12K-80	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12K-81	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12L-82	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12L-83	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12L-84	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12L-85	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12L-86	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12L-87	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12M-88	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12M-89	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12M-90	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12M-91	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12N-92	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12N-93	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12N-94	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12N-95	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12N-96	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12N-97	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12N-98	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12N-99	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12N-100	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12N-101	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12P-102	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12P-103	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12P-104	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12P-105	Wood fastener connection	ASD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
NDS24-12.2A-106	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12.2A-107	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12.2A-108	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12.2B-109	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12.2B-110	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12.2C-111	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12.2C-112	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12.2C-113	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12.2C-114	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12.2F-1	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-12.2F-2	Wood fastener connection	ASD	1	1	0	0	–	–
NDS-B1	Wood fastener connection	ASD	8	8	0	0	–	–
NDS-B1	Wood fastener connection	LRFD	1	1	0	0	–	–
NDS-B2	Wood fastener connection	ASD	7	7	0	0	–	–
NDS-B3	Wood fastener connection	ASD	3	3	0	0	–	–
NDS-L1	Wood fastener connection	ASD	7	7	0	0	–	–
NDS-N1	Wood fastener connection	ASD	8	8	0	0	–	–
NDS-N2	Wood fastener connection	ASD	2	2	0	0	–	–
NDS-N3	Wood fastener connection	ASD	1	1	0	0	–	–
NDS-S1	Wood fastener connection	ASD	4	4	0	0	–	–
NDS-G1	Wood fastener connection	ASD	4	4	0	0	–	–
TR12-3.1-0-0	Wood fastener connection	ASD	7	7	0	0	–	–
TR12-3.1-0-90	Wood fastener connection	ASD	7	7	0	0	–	–
TR12-3.1-90-90	Wood fastener connection	ASD	7	7	0	0	–	–
TR12-3.2-1-0	Wood fastener connection	ASD	7	7	0	0	–	–
TR12-3.2-1-90	Wood fastener connection	ASD	7	7	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
TR12-3.4	Wood fastener connection	ASD	2	2	0	0	–	–
AWC-E2.5	Wood fastener connection	ASD	8	8	0	0	–	–
AWC-E2.2	Wood fastener connection	ASD	7	7	0	0	–	–
NDS24-11.3.6A-0.5-5-2	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-11.3.6A-0.5-5-6	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-11.3.6A-0.5-5-12	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-11.3.6A-0.5-20-4	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-11.3.6A-0.5-20-8	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-11.3.6A-0.5-64-10	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-11.3.6A-1-5-3	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-11.3.6A-1-5-7	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-11.3.6A-1-5-11	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-11.3.6A-1-12-5	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-11.3.6A-1-40-9	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-11.3.6A-1-64-12	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-11.3.6C-12-5-2	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-11.3.6C-12-5-6	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-11.3.6C-12-5-12	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-11.3.6C-12-16-5	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-11.3.6C-12-40-4	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-11.3.6C-12-40-8	Wood fastener connection	ASD	1	1	0	0	–	–
NDS24-11.3.6C-12-64-10	Wood fastener connection	ASD	1	1	0	0	–	–
DCA6-T2-SP	Wood deck framing	—	2	2	0	0	–	–
DCA6-T2-DFL	Wood deck framing	—	2	2	0	0	–	–
DCA6-T3A	Wood deck framing	—	1	1	0	0	–	–
DCA6-T3A-DFL	Wood deck framing	—	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
DCA6-T4	Wood deck framing	—	4	4	0	0	–	–
DCA6-T4-HF	Wood deck framing	—	2	2	0	0	–	–
DCA6-T5	Wood deck framing	—	1	1	0	0	–	–
HC-DECK	Wood deck framing	—	9	9	0	0	–	–
AWC-E1.4a · Wood design values	Wood design values	—	3	3	0	0	–	–
AWC-E1.4b · Wood design values	Wood design values	—	3	3	0	0	–	–
AWC-E1.3 · Wood design values	Wood design values	—	4	4	0	0	–	–
SUPP-4B	Wood design values	—	2	2	0	0	–	–
SUPP-4C	Wood design values	—	5	5	0	0	–	–
SUPP-5AX	Wood design values	—	3	3	0	0	–	–
HC-1 · Wood design values	Wood design values	—	6	6	0	0	–	–
HC-2 · Wood design values	Wood design values	—	5	5	0	0	–	–
HC-3 · Wood design values	Wood design values	—	3	3	0	0	–	–
HC-4 · Wood design values	Wood design values	—	3	3	0	0	–	–
HC-5 · Wood design values	Wood design values	—	1	1	0	0	–	–
HC-6 · Wood design values	Wood design values	—	1	1	0	0	–	–
HC-7 · Wood design values	Wood design values	—	1	1	0	0	–	–
HC-8 · Wood design values	Wood design values	—	1	1	0	0	–	–
HC-9	Wood design values	—	2	2	0	0	–	–
WW25-DIA	Wood diaphragm	ASD	12	12	0	0	–	–
WW24-DIA	Wood diaphragm	ASD	2	2	0	0	–	–
WWC3-DIA	Wood diaphragm	ASD	2	2	0	0	–	–
WWC3-T4.2A-2-4	Wood diaphragm	ASD	1	1	0	0	–	–
WWC3-T4.2A-2-2.5	Wood diaphragm	ASD	1	1	0	0	–	–
WWC3-T4.2A-2-2	Wood diaphragm	ASD	1	1	0	0	–	–
WWC3-T4.2A-3-6	Wood diaphragm	ASD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
WWC3-T4.2A-3-4	Wood diaphragm	ASD	1	1	0	0	–	–
WWC3-T4.2A-3-2.5	Wood diaphragm	ASD	1	1	0	0	–	–
WWC3-T4.2A-3-2	Wood diaphragm	ASD	1	1	0	0	–	–
WWDE-ASD	Wood diaphragm	ASD	5	5	0	0	–	–
WWDE-STR	Wood diaphragm	LRFD	7	7	0	0	–	–
HUD-6.4	Wood diaphragm	ASD	5	5	0	0	–	–
DIA-CANT	Wood diaphragm	LRFD	6	6	0	0	–	–
DIA-TRIB	Wood diaphragm	LRFD	3	3	0	0	–	–
DIA-OPEN	Wood diaphragm	LRFD	5	5	0	0	–	–
DIA-1	Wood diaphragm	LRFD	10	10	0	0	–	–
DIA-1	Wood diaphragm	ASD	3	3	0	0	–	–
DIA-2	Wood diaphragm	LRFD	2	2	0	0	–	–
DIA-3	Wood diaphragm	LRFD	2	2	0	0	–	–
T16.3.1	Fire design of exposed wood	—	2	2	0	0	–	–
T16.3.1-1.5	Fire design of exposed wood	—	2	2	0	0	–	–
T16.3.1-2	Fire design of exposed wood	—	2	2	0	0	–	–
T16.3.2-a	Fire design of exposed wood	—	1	1	0	0	–	–
T16.3.2-b	Fire design of exposed wood	—	1	1	0	0	–	–
T16.3.2-c	Fire design of exposed wood	—	1	1	0	0	–	–
T16.3.2-d	Fire design of exposed wood	—	1	1	0	0	–	–
T16.3.2-e	Fire design of exposed wood	—	1	1	0	0	–	–
HC-BEAM	Fire design of exposed wood	—	6	6	0	0	–	–
HC-COLUMN · Fire design of exposed wood	Fire design of exposed wood	—	2	2	0	0	–	–
APA-Z725	Wood floor vibration	—	1	1	0	0	–	–
HC-SAWN	Wood floor vibration	—	4	4	0	0	–	–
HC-HU	Wood floor vibration	—	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
HC-IJOIST	Wood floor vibration	—	2	2	0	0	–	–
HAND-1 · Wood I-joist	Wood I-joist	ASD	9	9	0	0	–	–
HAND-1 · Wood I-joist	Wood I-joist	LRFD	4	4	0	0	–	–
HAND-2 · Wood I-joist	Wood I-joist	ASD	2	2	0	0	–	–
HAND-3 · Wood I-joist	Wood I-joist	ASD	1	1	0	0	–	–
HAND-4 · Wood I-joist	Wood I-joist	ASD	1	1	0	0	–	–
APA-T1-1	Wood I-joist	ASD	1	1	0	0	–	–
APA-T1-2	Wood I-joist	ASD	1	1	0	0	–	–
APA-T1-3	Wood I-joist	ASD	1	1	0	0	–	–
APA-T1-4	Wood I-joist	ASD	1	1	0	0	–	–
APA-T2-1	Wood I-joist	ASD	1	1	0	0	–	–
NDS-E.7	Steel side and knife plate connections	—	6	6	0	0	–	–
HC-KNIFE	Steel side and knife plate connections	—	4	4	0	0	–	–
HC-SIDE2	Steel side and knife plate connections	—	2	2	0	0	–	–
HC-PLATE · Steel side and knife plate connections	Steel side and knife plate connections	—	4	4	0	0	–	–
NDS24-12E-0.55-12	Wood ledger	ASD	1	1	0	0	–	–
NDS24-12E-0.55-58	Wood ledger	ASD	1	1	0	0	–	–
NDS24-12E-0.55-34	Wood ledger	ASD	1	1	0	0	–	–
NDS24-12E-0.50-12	Wood ledger	ASD	1	1	0	0	–	–
NDS24-12E-0.50-58	Wood ledger	ASD	1	1	0	0	–	–
NDS24-12E-0.50-34	Wood ledger	ASD	1	1	0	0	–	–
NDS24-12E-0.46-12	Wood ledger	ASD	1	1	0	0	–	–
NDS24-12E-0.46-58	Wood ledger	ASD	1	1	0	0	–	–
NDS24-12E-0.46-34	Wood ledger	ASD	1	1	0	0	–	–
NDS24-12A-1.5-12-0.50	Wood ledger	ASD	1	1	0	0	–	–
NDS24-12A-1.5-12-0.37	Wood ledger	ASD	1	1	0	0	–	–
NDS24-12A-3.5-12-0.50	Wood ledger	ASD	1	1	0	0	–	–
NDS24-12A-3.5-34-0.55	Wood ledger	ASD	1	1	0	0	–	–
NDS24-12A-3.5-34-0.43	Wood ledger	ASD	1	1	0	0	–	–
NDS24-12A-2.5-58-0.46	Wood ledger	ASD	1	1	0	0	–	–
NDS24-12J-12	Wood ledger	ASD	1	1	0	0	–	–
NDS24-12J-58 · Wood ledger	Wood ledger	ASD	1	1	0	0	–	–
TR12-3.1-g0	Wood ledger	ASD	7	7	0	0	–	–
TR12-3.1-g0.25	Wood ledger	ASD	7	7	0	0	–	–
TR12-3.1-g0.5	Wood ledger	ASD	7	7	0	0	–	–
IRC21-R507.9.1.3-lag	Wood ledger	ASD	1	1	0	0	–	–
IRC21-R507.9.1.3-lag-8	Wood ledger	ASD	1	1	0	0	–	–
IRC21-R507.9.1.3-lag-10	Wood ledger	ASD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
IRC21-R507.9.1.3-lag-12	Wood ledger	ASD	1	1	0	0	–	–
IRC21-R507.9.1.3-lag-14	Wood ledger	ASD	1	1	0	0	–	–
IRC21-R507.9.1.3-lag-16	Wood ledger	ASD	1	1	0	0	–	–
IRC21-R507.9.1.3-lag-18	Wood ledger	ASD	1	1	0	0	–	–
IRC21-R507.9.1.3-bolt	Wood ledger	ASD	1	1	0	0	–	–
IRC21-R507.9.1.3-bolt-8	Wood ledger	ASD	1	1	0	0	–	–
IRC21-R507.9.1.3-bolt-10	Wood ledger	ASD	1	1	0	0	–	–
IRC21-R507.9.1.3-bolt-12	Wood ledger	ASD	1	1	0	0	–	–
IRC21-R507.9.1.3-bolt-14	Wood ledger	ASD	1	1	0	0	–	–
IRC21-R507.9.1.3-bolt-16	Wood ledger	ASD	1	1	0	0	–	–
IRC21-R507.9.1.3-bolt-18	Wood ledger	ASD	1	1	0	0	–	–
IRC21-R507.9.1.3-bolt_washers	Wood ledger	ASD	1	1	0	0	–	–
IRC21-R507.9.1.3-bolt_washers-8	Wood ledger	ASD	1	1	0	0	–	–
IRC21-R507.9.1.3-bolt_washers-10	Wood ledger	ASD	1	1	0	0	–	–
IRC21-R507.9.1.3-bolt_washers-12	Wood ledger	ASD	1	1	0	0	–	–
IRC21-R507.9.1.3-bolt_washers-14	Wood ledger	ASD	1	1	0	0	–	–
IRC21-R507.9.1.3-bolt_washers-16	Wood ledger	ASD	1	1	0	0	–	–
IRC21-R507.9.1.3-bolt_washers-18	Wood ledger	ASD	1	1	0	0	–	–
HAND-LEDGER-DEFAULT	Wood ledger	ASD	4	4	0	0	–	–
HAND-LEDGER-LRFD	Wood ledger	LRFD	2	2	0	0	–	–
HAND-LEDGER-CONC2000	Wood ledger	ASD	1	1	0	0	–	–
HAND-TMS-ANCHOR	Wood ledger	ASD	5	5	0	0	–	–
HAND-TMS-ANCHOR	Wood ledger	LRFD	4	4	0	0	–	–
HAND-LEDGER-PAIRED-CG	Wood ledger	ASD	1	1	0	0	–	–
T12A-1	Moment and eccentric fastener groups	—	1	1	0	0	–	–
T12A-2	Moment and eccentric fastener groups	—	1	1	0	0	–	–
T12A-3	Moment and eccentric fastener groups	—	1	1	0	0	–	–
T12A-4	Moment and eccentric fastener groups	—	1	1	0	0	–	–
T12A-5	Moment and eccentric fastener groups	—	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
HC-MOMENT	Moment and eccentric fastener groups	—	2	2	0	0	–	–
HC-KNEE	Moment and eccentric fastener groups	—	3	3	0	0	–	–
HC-TENSION · Notched and tapered member ends	Notched and tapered member ends	LRFD	4	4	0	0	–	–
HC-TENSION · Notched and tapered member ends	Notched and tapered member ends	ASD	1	1	0	0	–	–
HC-COMP-SHORT	Notched and tapered member ends	—	2	2	0	0	–	–
HC-COMP-LONG	Notched and tapered member ends	—	1	1	0	0	–	–
HC-GLULAM	Notched and tapered member ends	—	1	1	0	0	–	–
HC-CONN-NEAR	Notched and tapered member ends	—	1	1	0	0	–	–
HC-CONN-FAR	Notched and tapered member ends	—	1	1	0	0	–	–
HC-INT-T	Notched and tapered member ends	—	3	3	0	0	–	–
HC-INT-C	Notched and tapered member ends	—	1	1	0	0	–	–
STJR-EX2	Rafters and ceiling ties	ASD	2	2	0	0	–	–
STJR-R1-2x8	Rafters and ceiling ties	ASD	2	2	0	0	–	–
STJR-R1-2x10	Rafters and ceiling ties	ASD	2	2	0	0	–	–
STJR-R5-2x8	Rafters and ceiling ties	ASD	2	2	0	0	–	–
STJR-R13-2x6	Rafters and ceiling ties	ASD	2	2	0	0	–	–
STJR-R13-2x10	Rafters and ceiling ties	ASD	2	2	0	0	–	–
STJR-EX2-FCP	Rafters and ceiling ties	ASD	1	1	0	0	–	–
STJR-T91-A	Rafters and ceiling ties	ASD	1	1	0	0	–	–
STJR-T91-B	Rafters and ceiling ties	ASD	1	1	0	0	–	–
CC-GRAV	Rafters and ceiling ties	ASD	6	6	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
CC-UPL	Rafters and ceiling ties	ASD	9	9	0	0	–	–
IRC21-A	Rafters and ceiling ties	ASD	1	1	0	0	–	–
IRC21-B	Rafters and ceiling ties	ASD	1	1	0	0	–	–
IRC21-C	Rafters and ceiling ties	ASD	1	1	0	0	–	–
IRC21-D	Rafters and ceiling ties	ASD	1	1	0	0	–	–
IRC21-E	Rafters and ceiling ties	ASD	1	1	0	0	–	–
IRC18-A	Rafters and ceiling ties	ASD	1	1	0	0	–	–
IRC18-B	Rafters and ceiling ties	ASD	1	1	0	0	–	–
IRC18-C	Rafters and ceiling ties	ASD	1	1	0	0	–	–
IRC18-D	Rafters and ceiling ties	ASD	1	1	0	0	–	–
IRC18-E	Rafters and ceiling ties	ASD	1	1	0	0	–	–
IRC-HC-1-3	Rafters and ceiling ties	ASD	1	1	0	0	–	–
IRC-HC-1-4	Rafters and ceiling ties	ASD	1	1	0	0	–	–
IRC-HC-1-5	Rafters and ceiling ties	ASD	1	1	0	0	–	–
IRC-HC-1-6	Rafters and ceiling ties	ASD	1	1	0	0	–	–
IRC-HC-1-10	Rafters and ceiling ties	ASD	1	1	0	0	–	–
NDS-12N-16d-50	Rafters and ceiling ties	ASD	1	1	0	0	–	–
NDS-12N-16d-55	Rafters and ceiling ties	ASD	1	1	0	0	–	–
NDS-12N-16d-43	Rafters and ceiling ties	ASD	1	1	0	0	–	–
NDS-12N-16d-42	Rafters and ceiling ties	ASD	1	1	0	0	–	–
NDS-12N-10d-50	Rafters and ceiling ties	ASD	1	1	0	0	–	–
NDS-12N-10d-43	Rafters and ceiling ties	ASD	1	1	0	0	–	–
HUD-7.3	Rafters and ceiling ties	ASD	2	1	1	0	–	–
HAND-1 · Rafters and ceiling ties	Rafters and ceiling ties	ASD	17	17	0	0	–	–
HAND-1 · Rafters and ceiling ties	Rafters and ceiling ties	LRFD	5	5	0	0	–	–
HAND-2 · Rafters and ceiling ties	Rafters and ceiling ties	ASD	2	2	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
HAND-2 · Rafters and ceiling ties	Rafters and ceiling ties	LRFD	2	2	0	0	–	–
WW25-SW-L1	Wood shear wall	ASD	6	6	0	0	–	–
WW25-SW-L2	Wood shear wall	ASD	4	4	0	0	–	–
WW25-SW-D	Wood shear wall	ASD	5	5	0	0	–	–
AWC-E3.1	Wood shear wall	ASD	4	4	0	0	–	–
AWC-E3.2	Wood shear wall	ASD	3	3	0	0	–	–
AWC-E3.4	Wood shear wall	ASD	3	3	0	0	–	–
WW5S-SW-Roof	Wood shear wall	ASD	9	9	0	0	–	–
WW5S-SW-6th	Wood shear wall	ASD	9	9	0	0	–	–
WW5S-SW-5th	Wood shear wall	ASD	9	9	0	0	–	–
WW5S-SW-4th	Wood shear wall	ASD	9	9	0	0	–	–
WW5S-SW-3rd	Wood shear wall	ASD	9	9	0	0	–	–
WW5S-SW-W3	Wood shear wall	ASD	4	4	0	0	–	–
SW-1 · Wood shear wall	Wood shear wall	LRFD	9	9	0	0	–	–
SW-1 · Wood shear wall	Wood shear wall	ASD	3	3	0	0	–	–
SW-2 · Wood shear wall	Wood shear wall	LRFD	3	3	0	0	–	–
SW-2b	Wood shear wall	LRFD	2	2	0	0	–	–
SW-3	Wood shear wall	LRFD	4	4	0	0	–	–
SW-3b	Wood shear wall	LRFD	2	2	0	0	–	–
SW-4	Wood shear wall	LRFD	3	3	0	0	–	–
SW-5	Wood shear wall	LRFD	3	3	0	0	–	–
SW-6	Wood shear wall	LRFD	1	1	0	0	–	–
SW-7	Wood shear wall	LRFD	3	3	0	0	–	–
SW-8	Wood shear wall	LRFD	3	3	0	0	–	–
SW-9	Wood shear wall	LRFD	1	1	0	0	–	–
MALONE-1	Wood shear wall	LRFD	15	15	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
MALONE-2	Wood shear wall	LRFD	10	10	0	0	–	–
T555-MALONE	Wood shear wall	LRFD	12	12	0	0	–	–
T555C-2024	Wood shear wall	—	38	36	2	0	–	–
HC-TANG	Wood shrinkage and moisture	—	1	1	0	0	–	–
HC-RAD	Wood shrinkage and moisture	—	1	1	0	0	–	–
HC-TOTAL	Wood shrinkage and moisture	—	1	1	0	0	–	–
HC-GREEN	Wood shrinkage and moisture	—	1	1	0	0	–	–
HC-STACK	Wood shrinkage and moisture	—	3	3	0	0	–	–
HC-ENG · Wood shrinkage and moisture	Wood shrinkage and moisture	—	1	1	0	0	–	–
HC-SP	Wood shrinkage and moisture	—	1	1	0	0	–	–
HC-SWELL	Wood shrinkage and moisture	—	1	1	0	0	–	–
HC-STRINGER	Wood stair	ASD	6	6	0	0	–	–
HC-STRINGER	Wood stair	LRFD	2	2	0	0	–	–
HC-TREAD	Wood stair	—	4	4	0	0	–	–
HC-CUT	Wood stair	—	2	2	0	0	–	–
PB-AWC-E1.4a	Wood truss	ASD	1	1	0	0	–	–
PB-AWC-E1.4b	Wood truss	ASD	1	1	0	0	–	–
PB-AV-5.6	Wood truss	ASD	1	1	0	0	–	–
PB-AV-5.9a	Wood truss	ASD	1	1	0	0	–	–
PB-AV-5.9b	Wood truss	ASD	1	1	0	0	–	–
PB-WW-3.3.5	Wood truss	ASD	1	1	0	0	–	–
PB-HUD-5.6	Wood truss	ASD	1	1	0	0	–	–
WT-H1	Wood truss	ASD	1	1	0	0	–	–
WT-H2	Wood truss	ASD	1	1	0	0	–	–
WT-H3	Wood truss	ASD	1	1	0	0	–	–
WT-G1	Wood truss	ASD	1	1	0	0	–	–
WT-G2	Wood truss	ASD	1	1	0	0	–	–
WT-G3	Wood truss	ASD	1	1	0	0	–	–
WT-G4	Wood truss	ASD	1	1	0	0	–	–
WT-H4	Wood truss	ASD	1	1	0	0	–	–
WT-H5	Wood truss	ASD	1	1	0	0	–	–
WT-H6	Wood truss	ASD	1	1	0	0	–	–

Example	Calculation	Method	Limit states	Pass	Deviation	Not checked	ILX	Published
WT-H7	Wood truss	ASD	1	1	0	0	–	–

Acceptance tolerances

Quantity	Relative	Absolute (at least)
Force (kips)	±1 %	±0.5
Moment (kip-ft)	±1 %	±0.5
Length (in.)	±1 %	±0.005
Length_ft (ft)	±1 %	±0.01
Length_ft_1dp (ft)	±1 %	±0.05
Stress (ksi)	±1 %	±0.05
Stress_psi (psi)	±1 %	±1
Pressure (psf)	±1 %	±0.1
Line_load (kip/ft)	±1 %	±0.001
Area (in.²)	±1 %	±0.005
Coef	±1 %	–
Ratio	±2 %	±0.005
Force_per_length (kip/in.)	±1 %	±0.01
Inertia (in.⁴)	±1 %	±0.01
Force_lb (lb)	±1 %	±1
Force_lb_table (lb)	±2 %	±5
Moment_lbft (lb-ft)	±1 %	±1
Line_load_plf (plf)	±1 %	±0.1
Moment_per_ft (lb-ft/ft)	±1 %	±1
Force_per_ft (lb/ft)	±1 %	±1
Ei_per_ft (10^6 lb-in²/ft)	±1 %	±0.05
Ga_per_ft (10^6 lb/ft)	±1 %	±0.005
Ga_per_ft_2sf (10^6 lb/ft)	±1 %	±0.05
Unit_shear (plf)	±1 %	±1
Moment_small (kip-ft)	±1 %	±0.005
Force_small (kips)	±1 %	±0.005
Pressure_k (ksf)	±1 %	±0.005
Moment_ft (kip-ft)	±1 %	±0.05
Modulus (in.³)	±1 %	±0.005
Warping (in.⁶)	±1 %	±0.01
Force_plf (plf)	±1 %	±1
Moment_lbin (lb-in)	±1 %	±1
Time (s)	±1 %	±0.002
Accel (g)	±1 %	±0.0005
Area_ft (ft²)	±1 %	±0.05
Rotation (rad)	±1 %	±1e-06
Speed (mph)	±1 %	±0.1
Unit_weight (pcf)	±1 %	±0.05
Force_1dp (kips)	±1 %	±0.05
Moment_1dp (kip-ft)	±1 %	±0.05
Pressure_1dp (ksf)	±1 %	±0.05

Quantity	Relative	Absolute (at least)
Area_1dp (in.²)	±1 %	±0.05
Head_1dp (in.)	±1 %	±0.05
Ratio_5pct	±5 %	–
Chart_k	–	±0.05
Exact	±1e-07 %	±1e-12
Nist7	±0.0001 %	–
Moment_in (kip-in.)	±1 %	±0.5
Stress_dg9 (ksi)	±3 %	±0.05
Rotation_dg9 (rad)	±3 %	±1e-05
Time_2dp (s)	±1 %	±0.005
Area_per_ft (in.²/ft)	±1 %	±0.05
Inertia_per_ft (in.⁴/ft)	±1 %	±0.05
Modulus_per_ft (in.³/ft)	±1 %	±0.05
Hz (Hz)	±1 %	±0.005
Pct_g (%g)	±1 %	±0.005
Pct_g_1dp (%g)	±1 %	±0.05
Mips (mips)	±1 %	±5
Mips_chart (mips)	±5 %	±5
Force_kip_lb (lb)	±1 %	±500
Stiffness_printed (kip/in.)	±1 %	±0.5
Area_ft_chart (ft²)	±5 %	±2
Length_1dp (in.)	–	±0.05

HC-MAT: AAC-4 material properties

Source: Hand calculation from TMS 402-16 Chapter 11 (no published AAC wall example on disk), pp. Table 4.2.2, Eq. 11-1, 11.1.8.3. Calculation: AAC masonry wall.

HC-MAT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
EAAC = 6500 × 580^0.6	psi	295,781	295,781	-0.00		Pass
fr = 4.8 √580 capped at 80 psi (thin bed)	psi	80.00	80.00	+0.00		Pass

HC-LEVEL: Leveling bed cap

Source: Hand calculation from TMS 402-16 Chapter 11 (no published AAC wall example on disk), pp. 11.1.8.3. Calculation: AAC masonry wall.

HC-LEVEL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
fr capped at 50 psi (leveling bed)	psi	50.00	50.00	+0.00		Pass

HC-FLEX: Reinforced wall, #5 at 24 in., 30 psf, 12 ft

Source: Hand calculation from TMS 402-16 Chapter 11 (no published AAC wall example on disk), pp. Eqs. 11-16, 11-27, 11-28, 11-14.
Calculation: AAC masonry wall.

HC-FLEX · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mu = wu h²/8 (no axial load)	lb-in	6,480	6,480	+0.00		Pass
φ Mn	lb-in	26,901	26,901	+0.00		Pass
a = As fy / (0.85 f'AAC b)	in.	1.572	1.572	+0.00		Pass
φ VnAAC = 0.8 × 0.8 √580 × 12 × 4	lb/ft	739.8	739.8	+0.00		Pass
Vu = wu h / 2	lb/ft	180.0	180.0	+0.00		Pass

HC-URM: Unreinforced wall, 10 ft, 15 psf

Source: Hand calculation from TMS 402-16 Chapter 11 (no published AAC wall example on disk), pp. 11.2, ψ with 0.75 In; 0.9D + 1.0W.
Calculation: AAC masonry wall.

HC-URM · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Net tension Mu/Sn − Pu/An	psi	16.29	16.29	+0.03		Pass
φ fr = 0.60 × 80	psi	48.00	48.00	+0.00		Pass
Pn = 0.80 × 0.85 f'AAC An (1 − (h/140r)²)	lb/ft	32,647	32,647	-0.00		Pass
h/r		51.96	51.96	+0.00		Pass

HC-RHOMAX: Maximum reinforcement, no axial load

Source: Hand calculation from TMS 402-16 Chapter 11 (no published AAC wall example on disk), pp. c = 0.003 / (0.003 + 1.5 × 60/29,000) × 4; 0.85 f'AAC × 0.67 c b / fy. Calculation: AAC masonry wall.

HC-RHOMAX · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
As,max per foot	in.²	0.130	0.130	+0.00		Pass

W-6D-30: wood, 6d, cavity 0.5 in., 30 psf, category B

Source: TMS Night School handout, Masonry Veneer Requirement Changes in TMS 402/602-22, November 2022, pp. p. 28. Calculation: Adhered veneer.

W-6D-30 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing allowed	in.	6.500	6.500	+0.00		Pass

W-6D-50: wood, 6d, cavity 0.5 in., 50 psf, category B

Source: TMS Night School handout, Masonry Veneer Requirement Changes in TMS 402/602-22, November 2022, pp. p. 28. Calculation: Adhered veneer.

W-6D-50 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing allowed	in.	4.500	4.500	+0.00		Pass

W-10D-1: wood, 10d, cavity 1.0 in., 45 psf, category B

Source: TMS Night School handout, Masonry Veneer Requirement Changes in TMS 402/602-22, November 2022, pp. p. 28. Calculation: Adhered veneer.

W-10D-1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing allowed	in.	6.100	6.100	+0.00		Pass

W-16D-15: wood, 16d, cavity 1.5 in., 40 psf, category B

Source: TMS Night School handout, Masonry Veneer Requirement Changes in TMS 402/602-22, November 2022, pp. p. 28. Calculation: Adhered veneer.

W-16D-15 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing allowed	in.	6.100	6.100	+0.00		Pass

W-10D-2: wood, 10d, cavity 2.0 in., 20 psf, category B

Source: TMS Night School handout, Masonry Veneer Requirement Changes in TMS 402/602-22, November 2022, pp. p. 28. Calculation: Adhered veneer.

W-10D-2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing allowed	in.	6.800	6.800	+0.00		Pass

W-20D-25: wood, 20d, cavity 2.5 in., 50 psf, category B

Source: TMS Night School handout, Masonry Veneer Requirement Changes in TMS 402/602-22, November 2022, pp. p. 28. Calculation: Adhered veneer.

W-20D-25 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing allowed	in.	4.900	4.900	+0.00		Pass

W-16D-25: wood, 16d, cavity 2.5 in., 25 psf, category B

Source: TMS Night School handout, Masonry Veneer Requirement Changes in TMS 402/602-22, November 2022, pp. p. 28. Calculation: Adhered veneer.

W-16D-25 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing allowed	in.	5.900	5.900	+0.00		Pass

W-NEXT: wood, 10d, cavity 0.8 in., 42 psf, category B

Source: TMS Night School handout, Masonry Veneer Requirement Changes in TMS 402/602-22, November 2022, pp. p. 28. Calculation: Adhered veneer.

W-NEXT · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing allowed	in.	6.100	6.100	+0.00		Pass

W-SDC: wood, 6d, cavity 0.5 in., 50 psf, category D

Source: TMS Night School handout, Masonry Veneer Requirement Changes in TMS 402/602-22, November 2022, pp. p. 28. Calculation: Adhered veneer.

W-SDC · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing allowed	in.	3.600	3.600	+0.00		Pass

S-8-1: steel, #8, cavity 1.0 in., 30 psf, category B

Source: TMS Night School handout, Masonry Veneer Requirement Changes in TMS 402/602-22, November 2022, pp. p. 29. Calculation: Adhered veneer.

S-8-1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing allowed	in.	6.500	6.500	+0.00		Pass

S-10-1: steel, #10, cavity 1.0 in., 50 psf, category B

Source: TMS Night School handout, Masonry Veneer Requirement Changes in TMS 402/602-22, November 2022, pp. p. 29. Calculation: Adhered veneer.

S-10-1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing allowed	in.	6.400	6.400	+0.00		Pass

S-8-15: steel, #8, cavity 1.5 in., 35 psf, category B

Source: TMS Night School handout, Masonry Veneer Requirement Changes in TMS 402/602-22, November 2022, pp. p. 29. Calculation: Adhered veneer.

S-8-15 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing allowed	in.	4.000	4.000	+0.00		Pass

S-10-15: steel, #10, cavity 1.5 in., 45 psf, category B

Source: TMS Night School handout, Masonry Veneer Requirement Changes in TMS 402/602-22, November 2022, pp. p. 29. Calculation: Adhered veneer.

S-10-15 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing allowed	in.	4.800	4.800	+0.00		Pass

S-8-2: steel, #8, cavity 2.0 in., 50 psf, category B

Source: TMS Night School handout, Masonry Veneer Requirement Changes in TMS 402/602-22, November 2022, pp. p. 29. Calculation: Adhered veneer.

S-8-2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing allowed	in.	2.100	2.100	+0.00		Pass

HO-LIMITS: Backing deflection limits

Source: TMS Night School handout, Masonry Veneer Requirement Changes in TMS 402/602-22, November 2022, pp. p. 24. Calculation: Adhered veneer.

HO-LIMITS · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
h/360	in.	0.333	0.333	+0.01		Pass

HC-ENG · Adhered veneer: Engineered path, LRFD, by hand

Source: Hand calculation (closed form). Calculation: Adhered veneer.

HC-ENG · Adhered veneer · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ft = 72 / 144	psi	0.500	0.500	+0.00		Pass
Design flexural tension	psi	100.0	100.0	+0.00		Pass
fv = 1.2 x 36 / 144	psi	0.300	0.300	+0.00		Pass
Design shear	psi	50.00	50.00	+0.00		Pass
Withdrawal = 72 x 16 x 6 / 144	lb	48.00	48.00	+0.00		Pass
Lateral = 1.2 x 36 x 16 x 6 / 144	lb	28.80	28.80	-0.00		Pass

HC-ENG-ASD: Engineered path, allowable stress, seismic, by hand

Source: Hand calculation (closed form). Calculation: Adhered veneer.

HC-ENG-ASD · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable tension	psi	60.00	60.00	+0.00		Pass
Allowable shear	psi	30.00	30.00	+0.00		Pass
Withdrawal = 0.7 x 50 x 16 x 6 / 144	lb	23.33	23.33	+0.01		Pass
h/150	in.	0.800	0.800	+0.00		Pass

TN3C-EX1: Example 1, corrugated ties on wood, Basic

Source: BIA Technical Note 3C (July 2026), pp. pp. 18-19. Calculation: Anchored veneer.

TN3C-EX1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
hb / t		39.70	39.72	+0.06		Pass
Stability limit	in.	0.600	0.600	+0.00		Pass
Tributary area, 16 x 24 in.	ft²	2.670	2.667	-0.12		Pass
Limit on cavity	in.	1.000	1.000	+0.00		Pass
Basic permitted (1 = yes)		1.000	1.000	+0.00		Pass
Height on corrugated ties passes (1 = yes)		1.000	1.000	+0.00		Pass

TN3C-EX2: Example 2, wood, 48 ft, Enhanced

Source: BIA Technical Note 3C (July 2026), pp. pp. 19-21. Calculation: Anchored veneer.

TN3C-EX2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Stability limit	in.	0.600	0.600	+0.00		Pass
Tributary area, 16 x 16 in.	ft²	1.780	1.778	-0.12		Pass
Cavity	in.	2.000	2.000	+0.00		Pass
Enhanced permitted (1 = yes)		1.000	1.000	+0.00		Pass

TN3C-EX2-CORR: Example 2: corrugated ties refused at 48 ft

Source: BIA Technical Note 3C (July 2026), pp. p. 20. Calculation: Anchored veneer.

TN3C-EX2-CORR · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Height limit fails (1 = yes)		1.000	1.000	+0.00		Pass

TN3C-EX3: Example 3: 6-5/8 in. cavity needs the Modeling Analysis method

Source: BIA Technical Note 3C (July 2026), pp. pp. 21-22. Calculation: Anchored veneer.

TN3C-EX3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Refused, not modelled (1 = yes)		1.000	1.000	+0.00		Pass

TN3C-EX4: Example 4, CMU, Enhanced, 4-1/2 in. cavity

Source: BIA Technical Note 3C (July 2026), pp. pp. 23-24. Calculation: Anchored veneer.

TN3C-EX4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cavity	in.	4.500	4.500	+0.00		Pass
Limit with two W2.8 pintle legs	in.	6.000	6.000	+0.00		Pass
Enhanced permitted (1 = yes)		1.000	1.000	+0.00		Pass

TN3C-EX5: Example 5, Tributary Area: tie at the limit of 1.375 ft²

Source: BIA Technical Note 3C (July 2026), pp. pp. 24-26. Calculation: Anchored veneer.

TN3C-EX5 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Force at 16.5 x 12 in., 1.375 ft²	lb	330.0	330.0	+0.00		Pass
Tie design strength	lb	330.0	330.0	+0.00		Pass
Stability limit, seismic hb/100	in.	1.440	1.440	+0.00		Pass

TN3C-EX5-ASBUILT: Example 5: the as-built 16 x 24 in. spacing

Source: BIA Technical Note 3C (July 2026), pp. p. 26. Calculation: Anchored veneer.

TN3C-EX5-ASBUILT · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Force in the tie	lb	633.3	633.3	+0.01		Pass

T8-95-2.0-16x16: Table 8, 95 psf, 16 x 16 in.

Source: BIA Technical Note 3C (July 2026), pp. p. 10. Calculation: Anchored veneer.

T8-95-2.0-16x16 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Force in the tie	lb	338.0	337.8	-0.07		Pass

T8-95-3.0-16x24: Table 8, 95 psf, 16 x 24 in.

Source: BIA Technical Note 3C (July 2026), pp. p. 10. Calculation: Anchored veneer.

T8-95-3.0-16x24 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Force in the tie	lb	633.0	633.3	+0.05		Pass

T8-95-6.0-24x24: Table 8, 95 psf, 24 x 24 in.

Source: BIA Technical Note 3C (July 2026), pp. p. 10. Calculation: Anchored veneer.

T8-95-6.0-24x24 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Force in the tie	lb	1,140	1,140	+0.00		Pass

T8-95-9.0-16x24: Table 8, 95 psf, 16 x 24 in.

Source: BIA Technical Note 3C (July 2026), pp. p. 10. Calculation: Anchored veneer.

T8-95-9.0-16x24 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Force in the tie	lb	1,013	1,013	+0.03		Pass

T8-25-2.5-24x24: Table 8, 25 psf, 24 x 24 in.

Source: BIA Technical Note 3C (July 2026), pp. p. 10. Calculation: Anchored veneer.

T8-25-2.5-24x24 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Force in the tie	lb	200.0	200.0	+0.00		Pass

T8-50-5.0-16x16: Table 8, 50 psf, 16 x 16 in.

Source: BIA Technical Note 3C (July 2026), pp. p. 10. Calculation: Anchored veneer.

T8-50-5.0-16x16 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Force in the tie	lb	222.0	222.2	+0.10		Pass

T8-75-8.0-24x24: Table 8, 75 psf, 24 x 24 in.

Source: BIA Technical Note 3C (July 2026), pp. p. 10. Calculation: Anchored veneer.

T8-75-8.0-24x24 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Force in the tie	lb	900.0	900.0	+0.00		Pass

HC-ASD · Anchored veneer: Allowable stress level, by hand

Source: Hand calculation (closed form). Calculation: Anchored veneer.

HC-ASD · Anchored veneer · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Force = 2.5 x 0.6 x 50 x 1.778	lb	133.3	133.3	+0.03		Pass
Allowable load of the slotted tie	lb	200.0	200.0	+0.00		Pass

UDOEYO-6.2: Three-hinged parabolic arch, point and partial load (metric)

Source: Udoeyo, Structural Analysis (2020), Example 6.2, pp. 142-144. Calculation: Arch analysis.

UDOEYO-6.2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ay (140 kN)	kips	31.47	31.47	-0.00		Pass
By (90 kN)	kips	20.23	20.23	-0.00		Pass
Horizontal thrust (83.33 kN)	kips	18.73	18.73	+0.00		Pass
Normal thrust left of the load (149.42 kN)	kips	33.59	33.59	+0.01		Pass
Radial shear left of the load (64.93 kN)	kips	14.60	14.60	-0.01		Pass

UDOEYO-6.3: Three-hinged parabolic arch, uniform load

Source: Udoeyo, Structural Analysis (2020), Example 6.3, pp. 144-145. Calculation: Arch analysis.

UDOEYO-6.3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ay	kips	30.00	30.00	+0.00		Pass
Horizontal thrust	kips	37.50	37.50	+0.00		Pass
Moment at 18 ft (prints −0.075 kip-ft from rounding)	kip-ft	0.000	-0.000	+0.00		Pass

UDOEYO-6.4: Three-hinged parabolic arch, two point loads

Source: Udoeyo, Structural Analysis (2020), Example 6.4, pp. 146-147. Calculation: Arch analysis.

UDOEYO-6.4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ey	kips	27.50	27.50	+0.00		Pass
Ay	kips	42.50	42.50	+0.00		Pass
Horizontal thrust	kips	25.00	25.00	+0.00		Pass
Moment at B, 8 ft	kip-ft	180.0	180.0	+0.00		Pass
Moment at D, 35 ft	kip-ft	28.12	28.12	+0.00		Pass

TWO-HINGED-UDL: Two-hinged parabolic arch, full uniform load

Source: Hand calculation (closed form), I = I0 sec θ. Calculation: Arch analysis.

TWO-HINGED-UDL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Horizontal thrust wL²/8f	kips	62.50	62.51	+0.02		Pass

TWO-HINGED-HALF: Two-hinged parabolic arch, half span loaded

Source: Hand calculation (closed form), I = I0 sec θ. Calculation: Arch analysis.

TWO-HINGED-HALF · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Horizontal thrust wL²/16f	kips	31.25	31.26	+0.02		Pass

TWO-HINGED-CROWN: Two-hinged parabolic arch, load at the crown

Source: Hand calculation (closed form), I = I0 sec θ. Calculation: Arch analysis.

TWO-HINGED-CROWN · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Horizontal thrust 25PL/128f	kips	9.766	9.768	+0.02		Pass
Crown moment PL/4 − Hf	kip-ft	54.69	54.65	-0.08		Pass

FIXED-CROWN: Fixed parabolic arch, load at the crown

Source: Hand calculation (closed form), I = I0 sec θ, elastic equations. Calculation: Arch analysis.

FIXED-CROWN · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Horizontal thrust 15PL/64f	kips	11.72	11.72	-0.00		Pass
End moment PL/32	kip-ft	31.25	31.21	-0.12		Pass
Crown moment 3PL/64	kip-ft	46.88	46.84	-0.08		Pass

FIXED-UDL: Fixed parabolic arch, full uniform load

Source: Hand calculation (closed form), I = I0 sec θ. Calculation: Arch analysis.

FIXED-UDL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Horizontal thrust wL²/8f	kips	62.50	62.50	-0.00		Pass

CIRCULAR: Three-hinged circular arch, uniform load

Source: Hand calculation (closed form). Calculation: Arch analysis.

CIRCULAR · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Horizontal thrust	kips	20.00	20.00	+0.00		Pass
Moment at the quarter point	kip-ft	-8.258	-8.258	-0.00		Pass

E702.4: Buried concrete basement wall, fixed base, pinned top

Source: ACI E702.4 Example Problems, Buried Concrete Basement Wall Design (Taber, 2013), after ACI 318-11; spColumn P-M check quoted in the example, pp. pp. 2-7. Calculation: Basement (restrained) retaining wall.

E702.4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Diaphragm reaction, earth + surcharge (service)	kip/ft	2.020	2.025	+0.25		Pass
Shear at the base (service)	kip/ft	6.530	6.525	-0.08		Pass
Moment at the base (service)	kip-ft	16.90	16.88	-0.15		Pass
Maximum span moment (service)	kip-ft	7.880	7.882	+0.02		Pass
Factored moment at the base Mu = 1.6 × 16.9	kip-ft	27.00	27.00	-0.00		Pass
Factored shear at the base Vu = 1.6 × 6.53	kip/ft	10.40	10.44	+0.38		Pass
Design moment strength at Pu (spColumn)	kip-ft	31.60	30.37	-3.89		Deviation BW-E702-COMBO

BW-E702-COMBO: the program checks every ASCE 7 combination; 0.9D + 1.6H, with less axial compression, governs the base and gives 30.4 kip-ft/ft (the example checked 1.2D + 1.6L + 1.6H only)

BW-HC1: Simple span under at-rest pressure

Source: Hand calculation (closed form). Calculation: Basement (restrained) retaining wall.

BW-HC1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Top reaction W/3	kip/ft	1.000	1.000	+0.00		Pass
Base reaction 2W/3	kip/ft	2.000	2.000	-0.00		Pass
Maximum moment 2 W L / (9√3)	kip-ft	3.849	3.849	-0.00		Pass
Factored moment 1.6 × 2 W L / (9√3)	kip-ft	6.158	6.158	-0.00		Pass

BW-HC2: Propped wall under an eccentric top load (carry-over)

Source: Hand calculation (closed form). Calculation: Basement (restrained) retaining wall.

BW-HC2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Top reaction (Mb − Mt) / L	kip/ft	0.625	0.625	+0.00		Pass
Factored base moment 1.4 × 2.5 (carry-over)	kip-ft	3.500	3.500	+0.00		Pass
Factored top moment 1.4 × 5.0	kip-ft	7.000	7.000	+0.00		Pass

MNL17-RW1: Basement wall pinned at the floor and the footing, eccentric top load

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 2, Chapter 12, Retaining Walls Example 1, pp. Vol. 2 pp. 16-31 (PDF 587-602). Calculation: Basement (restrained) retaining wall.

MNL17-RW1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Lateral earth force H = Ca γ h²/2 p. 18	kip/ft	2.000	2.000	+0.00		Pass
Top (diaphragm) reaction, service, with the 475 ft-lb/ft end moment p. 19 (714 lb/ft, rounded to 710)	kip/ft	0.714	0.714	+0.02		Pass
Base reaction, service p. 19 (2000 − 710 lb/ft)	kip/ft	1.290	1.286	-0.32		Pass
Factored span moment Mu = 1.6 × 2.35 p. 20	kip-ft	3.760	4.018	+6.85		Deviation MNL17-RW1-COMBO
MNL17-RW1-COMBO: the handbook multiplies the whole service span moment (soil less the relieving end moment from the dead and live slab load) by 1.6; the program checks the ASCE 7 combinations, and 0.9D + 1.6H with no live load relieves less (about 4.0 kip-ft/ft, with the 6.6.4 magnifier near 1.01)						
Shear: ρw = 0.267 / (12 × 7.75) p. 29		0.003	0.003	-0.09		Pass
Shear: λs (d = 7.75 in.) p. 29		1.000	1.000	+0.00		Pass
Shear: Vc with Nu = 0 p. 29	kip/ft	7.090	7.456	+5.17		Deviation MNL17-RW1-NU
MNL17-RW1-NU: the handbook takes Nu = 0 (conservative); the program adds Nu/(6Ag) of the factored axial load at the section (Table 22.5.5.1(c))						
Shear: φVc p. 29	kip/ft	5.300	5.592	+5.51		Deviation MNL17-RW1-NU
MNL17-RW1-NU: Nu = 0 in the handbook, Nu/(6Ag) included in the program						
Minimum horizontal steel 0.0020 × 12 × 10 pp. 23, 30	in.²	0.240	0.240	+0.00		Pass
Maximum vertical bar spacing min(3h, 18 in.) p. 30	in.	18.00	18.00	+0.00		Pass
Maximum horizontal bar spacing min(3h, 18 in.) p. 30	in.	18.00	18.00	+0.00		Pass

BA-1: Simple span, uniform load

Source: Hand calculation (closed form), pp. $wL^2/8$, $5wL^4/384EI$. Calculation: Continuous beam analysis.

BA-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Largest moment	kip-ft	50.00	50.00	+0.00		Pass
Largest shear	kips	10.00	10.00	+0.00		Pass
Midspan deflection	in.	0.124	0.124	-0.00		Pass

BA-2: Fixed-fixed beam, uniform load

Source: Hand calculation (closed form), pp. wL²/12, wL²/24, wL⁴/384EI. Calculation: Continuous beam analysis.

BA-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
End moment	kip-ft	-33.33	-33.33	+0.00		Pass
Midspan moment	kip-ft	16.67	16.67	-0.00		Pass
Midspan deflection	in.	0.025	0.025	-0.00		Pass

BA-3: Propped cantilever, uniform load

Source: Hand calculation (closed form), pp. wL²/8, 3wL/8. Calculation: Continuous beam analysis.

BA-3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fixed-end moment	kip-ft	-50.00	-50.00	+0.00		Pass
Pin reaction	kips	7.500	7.500	+0.00		Pass

BA-4: Two equal continuous spans, uniform load

Source: Hand calculation (closed form), pp. wL²/8, 1.25wL, 9wL²/128. Calculation: Continuous beam analysis.

BA-4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Interior support moment	kip-ft	-50.00	-50.00	+0.00		Pass
Interior reaction	kips	25.00	25.00	+0.00		Pass
End reaction	kips	7.500	7.500	+0.00		Pass
Largest span moment	kip-ft	28.12	28.11	-0.05		Pass

BA-5: Two equal spans, pattern live load

Source: Hand calculation (closed form), pp. 49wL²/512, 7wL/16, −wL/16. Calculation: Continuous beam analysis.

BA-5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Largest span moment (one span loaded)	kip-ft	38.28	38.28	-0.01		Pass
Interior support moment (both spans loaded)	kip-ft	-50.00	-50.00	+0.00		Pass
End reaction, max	kips	8.750	8.750	+0.00		Pass
End reaction, min (uplift)	kips	-1.250	-1.250	+0.00		Pass

BA-6: Cantilever, point load at the tip

Source: Hand calculation (closed form), pp. PL, PL³/3EI. Calculation: Continuous beam analysis.

BA-6 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fixed-end moment	kip-ft	-100.0	-100.0	+0.00		Pass
Tip deflection	in.	0.199	0.199	+0.00		Pass

BA-7: Simple span with an overhang, uniform load

Source: Hand calculation (closed form), pp. wa²/2, statics. Calculation: Continuous beam analysis.

BA-7 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Moment at the overhang support	kip-ft	-12.50	-12.50	-0.00		Pass
Reaction at the overhang support	kips	15.62	15.62	-0.00		Pass
Reaction at the far support	kips	9.375	9.375	+0.00		Pass

BA-8: Simple span, end moment (sign convention)

Source: Hand calculation (closed form), pp. R = M0/L. Calculation: Continuous beam analysis.

BA-8 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Moment next to the end	kip-ft	10.00	10.00	-0.00		Pass
Right reaction	kips	0.500	0.500	+0.00		Pass
Left reaction	kips	-0.500	-0.500	-0.00		Pass

AISC-7: Case 7: simple beam, concentrated load at center

Source: AISC Steel Construction Manual, 16th Ed., Table 3-22, pp. p. 3-217 (PDF 441). Calculation: Continuous beam analysis.

AISC-7 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mmax = Pl/4	kip-ft	50.00	50.00	+0.00		Pass
R = P/2	kips	5.000	5.000	+0.00		Pass
Δmax = Pl³/48EI	in.	0.099	0.099	+0.00		Pass

AISC-8: Case 8: simple beam, concentrated load at any point (a = 15 ft, b = 5 ft)

Source: AISC Steel Construction Manual, 16th Ed., Table 3-22, pp. p. 3-217 (PDF 441). Calculation: Continuous beam analysis.

AISC-8 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mmax = Pab/l	kip-ft	37.50	37.50	+0.00		Pass
R1 = Pb/l	kips	2.500	2.500	+0.00		Pass
R2 = Pa/l	kips	7.500	7.500	+0.00		Pass
Δmax = Pab(a + 2b)√(3a(a + 2b))/(27EIl)	in.	0.069	0.069	-0.03		Pass

AISC-9: Case 9: simple beam, two equal loads symmetrically placed (a = 5 ft)

Source: AISC Steel Construction Manual, 16th Ed., Table 3-22, pp. p. 3-217 (PDF 441). Calculation: Continuous beam analysis.

AISC-9 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mmax = Pa	kip-ft	50.00	50.00	+0.00		Pass
R = P	kips	10.00	10.00	+0.00		Pass
Δmax = Pa(3l² − 4a²)/24EI	in.	0.137	0.137	+0.00		Pass

AISC-16: Case 16: beam fixed at both ends, concentrated load at center

Source: AISC Steel Construction Manual, 16th Ed., Table 3-22, pp. p. 3-220 (PDF 444). Calculation: Continuous beam analysis.

AISC-16 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mmax at center = Pl/8	kip-ft	25.00	25.00	+0.00		Pass
Mmax at ends = −Pl/8	kip-ft	-25.00	-25.00	+0.00		Pass
Δmax = Pl³/192EI	in.	0.025	0.025	+0.00		Pass

AISC-17: Case 17: beam fixed at both ends, concentrated load at any point (a = 5 ft, b = 15 ft)

Source: AISC Steel Construction Manual, 16th Ed., Table 3-22, pp. p. 3-220 (PDF 444). Calculation: Continuous beam analysis.

AISC-17 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
M1 = −Pab²/l²	kip-ft	-28.12	-28.12	+0.00		Pass
M2 = −Pa²b/l²	kip-ft	-9.375	-9.375	+0.00		Pass
Ma = 2Pa²b²/l³	kip-ft	14.06	14.06	+0.00		Pass
R1 = Pb²(3a + b)/l³	kips	8.438	8.438	+0.00		Pass

AISC-37: Case 37: three equal spans, one end span unloaded

Source: AISC Steel Construction Manual, 16th Ed., Table 3-22, pp. p. 3-229 (PDF 453). Calculation: Continuous beam analysis.

AISC-37 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
RA = 0.383wl	kips	7.660	7.667	+0.09		Pass
RB = 1.20wl	kips	24.00	24.00	+0.00		Pass
RC = 0.450wl	kips	9.000	9.000	+0.00		Pass
RD = −0.0330wl	kips	-0.660	-0.667	+1.01		Pass
MB = −0.117wl²	kip-ft	-46.80	-46.67	-0.28		Pass
MC = −0.0333wl²	kip-ft	-13.32	-13.33	+0.10		Pass
M+ = 0.0735wl²	kip-ft	29.40	29.39	-0.04		Pass
Δmax = 0.0059wl⁴/EI	in.	0.056	0.056	+0.00		Pass

AISC-39: Case 39: three equal spans, all spans loaded

Source: AISC Steel Construction Manual, 16th Ed., Table 3-22, pp. p. 3-229 (PDF 453). Calculation: Continuous beam analysis.

AISC-39 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
RA = 0.400wl	kips	8.000	8.000	+0.00		Pass
RB = 1.10wl	kips	22.00	22.00	+0.00		Pass
MB = −0.100wl²	kip-ft	-40.00	-40.00	+0.00		Pass
End span M+ = 0.0800wl²	kip-ft	32.00	32.00	+0.00		Pass
Center span M+ = 0.0250wl²	kip-ft	10.00	10.00	-0.00		Pass
Δmax = 0.0069wl⁴/EI	in.	0.066	0.066	-0.24		Pass

AISC-41: Case 41: four equal spans, first and third spans loaded

Source: AISC Steel Construction Manual, 16th Ed., Table 3-22, pp. p. 3-230 (PDF 454). Calculation: Continuous beam analysis.

AISC-41 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
RA = 0.446wl	kips	8.920	8.929	+0.10		Pass
RB = 0.572wl	kips	11.44	11.43	-0.10		Pass
RC = 0.464wl	kips	9.280	9.286	+0.06		Pass
RE = −0.0540wl	kips	-1.080	-1.071	-0.79		Pass
MB = −0.0536wl²	kip-ft	-21.44	-21.43	-0.05		Pass
MC = −0.0357wl²	kip-ft	-14.28	-14.29	+0.04		Pass
M+ = 0.0996wl²	kip-ft	39.84	39.86	+0.04		Pass
Δmax = 0.0097wl⁴/EI	in.	0.092	0.092	-0.04		Pass

AISC-42: Case 42: four equal spans, all spans loaded

Source: AISC Steel Construction Manual, 16th Ed., Table 3-22, pp. p. 3-230 (PDF 454). Calculation: Continuous beam analysis.

AISC-42 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
RA = 0.393wl	kips	7.860	7.857	-0.04		Pass
RB = 1.14wl	kips	22.80	22.86	+0.25		Pass
RC = 0.928wl	kips	18.56	18.57	+0.06		Pass
MB = −0.107wl²	kip-ft	-42.80	-42.86	+0.13		Pass
MC = −0.0714wl²	kip-ft	-28.56	-28.57	+0.04		Pass
End span M+ = 0.0772wl²	kip-ft	30.88	30.86	-0.07		Pass
Interior span M+ = 0.0364wl²	kip-ft	14.56	14.54	-0.14		Pass
Δmax = 0.0065wl⁴/EI	in.	0.062	0.062	-0.63		Pass

T3-21c U3: Three equal spans, uniform load

Source: AISC Steel Construction Manual, 16th Ed., Table 3-21c, pp. 3-214. Calculation: Continuous beam analysis.

T3-21c U3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Interior support moment −0.10 wL²	kip-ft	-40.00	-40.00	+0.00		Pass
End span moment +0.08 wL²	kip-ft	32.00	32.00	+0.00		Pass
End reaction 0.4 wL	kips	8.000	8.000	+0.00		Pass
Interior reaction (0.6 + 0.5) wL	kips	22.00	22.00	+0.00		Pass

T3-21c U4: Four equal spans, uniform load

Source: AISC Steel Construction Manual, 16th Ed., Table 3-21c, pp. 3-214. Calculation: Continuous beam analysis.

T3-21c U4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
First interior support moment −0.107 wL²	kip-ft	-42.80	-42.86	+0.13		Pass
End span moment +0.077 wL²	kip-ft	30.80	30.86	+0.19		Pass
Center support moment −0.071 wL²	kip-ft	-28.40	-28.57	+0.60		Pass
End reaction 11/28 wL	kips	7.857	7.857	+0.00		Pass
Center reaction (13/28 + 13/28) wL	kips	18.57	18.57	+0.00		Pass

T3-21c P2: Two equal spans, concentrated load at each center

Source: AISC Steel Construction Manual, 16th Ed., Table 3-21c, pp. 3-214. Calculation: Continuous beam analysis.

T3-21c P2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Interior support moment −0.188 PL	kip-ft	-37.60	-37.50	-0.27		Pass
Span moment +0.156 PL	kip-ft	31.20	31.25	+0.16		Pass
End reaction 0.31 P	kips	3.100	3.125	+0.81		Pass
Interior reaction 2 × 0.69 P	kips	13.80	13.75	-0.36		Pass

T3-21c P3: Three equal spans, concentrated load at each center

Source: AISC Steel Construction Manual, 16th Ed., Table 3-21c, pp. 3-214. Calculation: Continuous beam analysis.

T3-21c P3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Interior support moment −0.15 PL	kip-ft	-30.00	-30.00	+0.00		Pass
End span moment +0.175 PL	kip-ft	35.00	35.00	+0.00		Pass
End reaction 0.35 P	kips	3.500	3.500	+0.00		Pass
Interior reaction (0.65 + 0.50) P	kips	11.50	11.50	+0.00		Pass

T3-21c T2: Two equal spans, concentrated loads at the third points

Source: AISC Steel Construction Manual, 16th Ed., Table 3-21c, pp. 3-214. Calculation: Continuous beam analysis.

T3-21c T2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Interior support moment −0.333 PL	kip-ft	-66.60	-66.67	+0.10		Pass
Span moment +0.222 PL	kip-ft	44.40	44.44	+0.10		Pass
End reaction 0.67 P	kips	6.700	6.667	-0.50		Pass
Interior reaction 2 × 1.33 P	kips	26.60	26.67	+0.25		Pass

UDOEYO-11.2: Fixed and pinned two-span beam, I and 3I, triangular and point loads

Source: Udoeyo, Structural Analysis (2020), Example 11.2, pp. 328-331. Calculation: Beam with varying stiffness.

UDOEYO-11.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Moment at the fixed end A	kip-ft	-23.40	-23.45	+0.20		Pass
Moment at support B	kip-ft	-29.90	-29.91	+0.03		Pass
Moment under the point load	kip-ft	57.10	57.05	-0.09		Pass
Reaction at A	kips	15.46	15.46	+0.01		Pass
Reaction at B	kips	23.04	23.03	-0.04		Pass
Reaction at C	kips	9.500	9.508	+0.08		Pass

THREE-MOMENT: Two spans, I and 2I, load on the first span only

Source: Hand calculation (closed form), three-moment equation. Calculation: Beam with varying stiffness.

THREE-MOMENT · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Moment at the interior support	kip-ft	-33.33	-33.33	+0.00		Pass
Reaction at the loaded end	kips	8.333	8.333	+0.00		Pass
Reaction at the far end	kips	-1.667	-1.667	+0.00		Pass

SS-STEP: Simple span, stiffer middle, point load at midspan

Source: Hand calculation (closed form), unit load method. Calculation: Beam with varying stiffness.

SS-STEP · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Deflection at midspan	in.	1.117	1.117	+0.00		Pass
Moment at midspan	kip-ft	50.00	50.00	+0.00		Pass

CANT-STEP: Cantilever, stiffer half at the fixed end, tip load

Source: Hand calculation (closed form), unit load method. Calculation: Beam with varying stiffness.

CANT-STEP · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tip deflection	in.	0.559	0.559	+0.00		Pass

CANT-HAUNCH: Cantilever, linear haunch 200 to 100 in⁴, tip load

Source: Hand calculation (closed form), unit load method, closed-form integral. Calculation: Beam with varying stiffness.

CANT-HAUNCH · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tip deflection	in.	0.575	0.575	+0.01		Pass

DG2-1-T4.6-1: W24X55, unreinforced 10 × 20 in. opening, e = 2 in. down, centerline 3 ft from the support

Source: AISC Design Guide 2 (1990, rev. 2003), Examples 1 and 1A, Tables 4.6, 4.7, pp. 22-25. Calculation: Beam with web openings.

DG2-1-T4.6-1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vu/φVm at 3 ft		0.555	0.553	-0.40		Pass
Mu/φMm at 3 ft		0.317	0.317	-0.06		Pass

DG2-1-T4.6-1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R at 3 ft		0.630	0.628	-0.39		Pass

DG2-1-T4.6-2: W24X55, unreinforced 10 × 20 in. opening, e = 2 in. down, centerline 6 ft from the support

Source: AISC Design Guide 2 (1990, rev. 2003), Examples 1 and 1A, Tables 4.6, 4.7, pp. 22-25. Calculation: Beam with web openings.

DG2-1-T4.6-2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R at 6 ft		0.650	0.652	+0.36		Pass

DG2-1-T4.6-2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R at 6 ft		0.700	0.699	-0.11		Pass

DG2-1-T4.6-3: W24X55, unreinforced 10 × 20 in. opening, e = 2 in. down, centerline 9 ft from the support

Source: AISC Design Guide 2 (1990, rev. 2003), Examples 1 and 1A, Tables 4.6, 4.7, pp. 22-25. Calculation: Beam with web openings.

DG2-1-T4.6-3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R at 9 ft		0.800	0.797	-0.35		Pass
φMm	kip-in.	3,766	3,766	-0.01		Pass
φVm	kips	54.28	54.50	+0.40		Pass
Vmb	kips	16.27	16.36	+0.58		Pass
Vmt	kips	44.04	44.19	+0.34		Pass
αv bottom		0.415	0.415	+0.06		Pass
αv top		0.610	0.612	+0.27		Pass
Vcap = ⅔ V̄p	kips	129.0	129.2	+0.13		Pass
Centerline may reach (text: 14.6 ft)	ft	14.60	14.59	-0.08		Pass
Centerline from the support, d + ao/2 (text: 33.6 in.)	in.	33.60	33.60	+0.01		Pass

DG2-1-T4.6-3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R at 9 ft		0.860	0.855	-0.64		Pass
Mm	kip-in.	4,184	4,184	+0.00		Pass
Vm	kips	60.31	60.55	+0.40		Pass

DG2-1-T4.6-4: W24X55, unreinforced 10 × 20 in. opening, e = 2 in. down, centerline 12 ft from the support

Source: AISC Design Guide 2 (1990, rev. 2003), Examples 1 and 1A, Tables 4.6, 4.7, pp. 22-25. Calculation: Beam with web openings.

DG2-1-T4.6-4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R at 12 ft		0.930	0.926	-0.45		Pass

DG2-1-T4.6-4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R at 12 ft		1.000	0.992	-0.76		Pass

DG2-1-T4.6-5: W24X55, unreinforced 10 × 20 in. opening, e = 2 in. down, centerline 15 ft from the support

Source: AISC Design Guide 2 (1990, rev. 2003), Examples 1 and 1A, Tables 4.6, 4.7, pp. 22-25. Calculation: Beam with web openings.

DG2-1-T4.6-5 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R at 15 ft		1.010	1.008	-0.15		Pass

DG2-1-T4.6-5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R at 15 ft		1.080	1.081	+0.09		Pass

DG2-1-T4.6-6: W24X55, unreinforced 10 × 20 in. opening, e = 2 in. down, centerline 18 ft from the support

Source: AISC Design Guide 2 (1990, rev. 2003), Examples 1 and 1A, Tables 4.6, 4.7, pp. 22-25. Calculation: Beam with web openings.

DG2-1-T4.6-6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R at 18 ft		1.040	1.037	-0.31		Pass

DG2-1-T4.6-6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R at 18 ft		1.110	1.111	+0.12		Pass

DG2-2-A: W18X55, concentric 11 × 20 in. opening, Vu = 30 kips, Mu = 300 kip-ft, unreinforced: not adequate

Source: AISC Design Guide 2 (1990, rev. 2003), Example 2, pp. 25-26. Calculation: Beam with web openings.

DG2-2-A · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φMm	kip-in.	4,509	4,509	+0.00		Pass
Vmb + Vmt	kips	26.64	26.58	-0.22		Pass
φVm	kips	23.98	23.92	-0.24		Pass
αv		0.333	0.333	-0.14		Pass

DG2-2-B: The same with 3/8 × 1 3/4 in. bars on one side: R = 0.96 from the chart

Source: AISC Design Guide 2 (1990, rev. 2003), Example 2 (it tries Ar = 0.65 in.², then 0.656), pp. 26-27. Calculation: Beam with web openings.

DG2-2-B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φMm the guide's Ar = 0.65 in.², here the bar's 0.656	kip-in.	4,831	4,834	+0.06		Pass
Pr (of the bar, Ar = 0.656 in.²)	kips	32.80	32.81	+0.04		Pass
φVm	kips	38.70	38.75	+0.12		Pass
R		0.960	0.957	-0.28		Pass
Rwr within the opening	kips	59.00	59.06	+0.11		Pass
Rwr in each extension	kips	29.50	29.53	+0.11		Pass
Extension ao/4 (it uses 5 in.)	in.	5.000	5.000	+0.00		Pass

DG2-3: W21X44 composite, 11 × 22 in. opening at the quarter point, deck ribs across the beam, 9 studs to the support, 1 rib over the opening

Source: AISC Design Guide 2 (1990, rev. 2003), Example 3, pp. 27-30. Calculation: Beam with web openings.

DG2-3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pc	kips	189.0	189.0	+0.00		Pass
Pc,min	kips	56.60	57.02	+0.73		Pass
ā	in.	0.772	0.772	+0.01		Pass
φMm	kip-in.	3,469	3,478	+0.27		Pass
αv bottom		0.390	0.391	+0.20		Pass
Vmb	kips	13.70	13.79	+0.64		Pass
Ast	in.²	4.580	4.575	-0.11		Pass
Pch	kips	164.7	164.7	+0.00		Pass
Pcl the guide takes 21.3 kips per stud here and 21.0 above; 143.7 kips with 21.0	kips	143.4	143.7	+0.21		Pass
dh	in.	3.660	3.664	+0.10		Pass
dl	in.	2.290	2.294	+0.15		Pass
μ		1.620	1.600	-1.22		Deviation DG2-1986-SHAPES
DG2-1986-SHAPES: the guide uses d = 20.66 in. and the top tee 4.83 in.; the current shape table prints 20.7 in.						
αv top		0.648	0.646	-0.30		Pass
Vmt	kips	22.70	22.79	+0.42		Pass
φVm	kips	30.94	31.09	+0.50		Pass
R		0.930	0.926	-0.41		Pass

DG2-4-1A: W18X60 composite girder, 10 × 24 in. eccentric opening, middle third, with the 2 Ar = 3.93 in.² the guide solves for Mu = 614 kip-ft

Source: AISC Design Guide 2 (1990, rev. 2003), Example 4, part 1, pp. 31-32. Calculation: Beam with web openings.

DG2-4-1A · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φMpc	kip-in.	7,452	7,445	-0.10		Pass
φMm at the bars it solves for (it sets this to Mu)	kip-in.	7,368	7,345	-0.31		Pass

DG2-4-1B: The same with the 2 in.² per edge it adopts

Source: AISC Design Guide 2 (1990, rev. 2003), Example 4, part 1, pp. 32. Calculation: Beam with web openings.

DG2-4-1B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pr	kips	72.00	72.00	+0.00		Pass
Limit Fy tw ao/(2√3)	kips	103.5	103.5	+0.01		Pass

DG2-4-2A: W18X60 composite girder, concentric 10 × 24 in. opening 6 1/2 ft from the support, unreinforced: V = 46 kips, M = 300 kip-ft: not adequate

Source: AISC Design Guide 2 (1990, rev. 2003), Example 4, part 2, pp. 32-33. Calculation: Beam with web openings.

DG2-4-2A · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pc	kips	364.0	364.0	+0.00		Pass
Pc,min	kips	55.00	54.53	-0.85		Pass
φMm	kip-in.	5,318	5,309	-0.17		Pass
Vmb	kips	11.50	11.42	-0.70		Pass
Pch (Eq. 3-20)	kips	179.0	178.8	-0.13		Pass
Pcl	kips	127.0	126.8	-0.18		Pass
dh	in.	5.280	5.281	+0.02		Pass
dl	in.	0.420	0.414	-1.36		Deviation DG2-EX4-QN
DG2-EX4-QN: the guide's 26.1 kips per stud here, 26.0 kips on its page before, and its rounding of the force to 127 kips						
μ		6.090	6.149	+0.96		Pass
αv top		1.045	1.050	+0.52		Pass
Vmt	kips	37.10	37.15	+0.13		Pass
Vmt(sh)	kips	50.10	49.89	-0.43		Pass
Vm	kips	48.60	48.57	-0.07		Pass
φVm	kips	41.40	41.28	-0.28		Pass
R (chart)		1.210	1.192	-1.46		Pass

DG2-4-2B: The same with 3/8 × 2 in. bars on one side (Ar = 0.75 in.²)

Source: AISC Design Guide 2 (1990, rev. 2003), Example 4, part 2, pp. 33-35. Calculation: Beam with web openings.

DG2-4-2B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φMm	kip-in.	5,736	5,727	-0.16		Pass
μ bottom		1.480	1.457	-1.55		Deviation DG2-EX4-DR
DG2-EX4-DR: the guide computes with an assumed bar centroid of 3.995 in.; the bar it adopts gives 3.93 in., as it says						
αv bottom		0.515	0.510	-0.94		Pass
Vmb	kips	18.28	18.04	-1.30		Pass
Pch (Eq. 3-20)	kips	206.2	205.8	-0.21		Pass
Pcl	kips	154.0	153.8	-0.15		Pass
μ top (Eq. 3-14, as computed on p. 34)		8.350	8.372	+0.26		Pass
αv top		1.550	1.430	-7.73		Deviation DG2-EX4-MU
DG2-EX4-MU: p. 34 computes μ = 8.35, p. 35 uses 9.05 for 1.55; 8.35 gives 1.43. Vmt(sh) governs either way						
Vmt = Vmt(sh)	kips	50.10	49.89	-0.43		Pass
Vm	kips	68.38	67.93	-0.66		Pass
φVm	kips	58.10	57.74	-0.62		Pass
R		0.905	0.910	+0.58		Pass

GEC6-B1: Interior pier footing on silty sand (Vesić factors, GEC 6 Eq. 5-14)

Source: FHWA IF-02-054 (2002) GEC 6, Shallow Foundations, pp. Table 5-1 p. 54; Appendix B Example 1 Step 7, pp. B-7 to B-9. Calculation: Bearing capacity and settlement.

Bf = 6 m, the upper-bound width of the example; the load only sets the pressure.

GEC6-B1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nq (φ = 35°, Table 5-1)		33.30	33.30	-0.01		Pass
Nγ (φ = 35°, Table 5-1)		48.00	48.03	+0.06		Pass
sq = 1 + (B/L) tan φ		1.700	1.700	+0.01		Pass
sγ = 1 − 0.4 B/L		0.600	0.600	+0.00		Pass
q Nq Cwq sq term (2,553 kPa)	ksf	53.32	53.30	-0.04		Pass
0.5 γ Bf Nγ Cwγ sγ term, Bf = 6 m (254 × 6 kPa)	ksf	31.83	31.06	-2.40		Deviation BC-CWG-ROUND

BC-CWG-ROUND: the example rounds Cwγ to 0.9; Eq. 5-9 gives 0.878 for Bf = 6 m, which ILX keeps (1,487 kPa)

GEC6-T51: Bearing capacity factors at φ = 30° (GEC 6 Table 5-1)

Source: FHWA IF-02-054 (2002) GEC 6, Shallow Foundations, pp. p. 54. Calculation: Bearing capacity and settlement.

GEC6-T51 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nc at 30°		30.10	30.14	+0.13		Pass
Nq at 30°		18.40	18.40	+0.01		Pass
Nγ at 30°		22.40	22.40	+0.01		Pass

BC-UND: Undrained clay, φ = 0: Nc = 5.14, sc = 1 + B/(5L)

Source: FHWA IF-02-054 (2002) GEC 6, Shallow Foundations, pp. Table 5-1, Table 5-2. Calculation: Bearing capacity and settlement.

BC-UND · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nc at φ = 0		5.140	5.142	+0.03		Pass
sc of a square, φ = 0		1.200	1.200	+0.00		Pass
qult = 5.14 × 1.2 × c	ksf	9.255	9.255	+0.00		Pass

BC-TER: Terzaghi factors at φ = 30°

Source: Hand calculation (closed form), pp. Terzaghi (1943). Calculation: Bearing capacity and settlement.

BC-TER · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Terzaghi Nq		22.46	22.46	+0.00		Pass
Terzaghi Nc		37.16	37.16	+0.00		Pass

BC-MEY: Meyerhof Nγ = (Nq − 1) tan 1.4φ

Source: Hand calculation (closed form), pp. Meyerhof (1963). Calculation: Bearing capacity and settlement.

BC-MEY · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Meyerhof Nγ at 30°		15.67	15.67	+0.00		Pass

BC-HAN: Hansen Ny = 1.5 (Nq − 1) tan φ

Source: Hand calculation (closed form), pp. Hansen (1970). Calculation: Bearing capacity and settlement.

BC-HAN · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Hansen Ny at 30°		15.07	15.07	+0.00		Pass

BC-ECC: Eccentric strip footing: B' = B − 2e

Source: Hand calculation (closed form), pp. Meyerhof (1953), GEC 6 6.4.1. Calculation: Bearing capacity and settlement.

BC-ECC · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
B' = 6 − 2 × 0.5 ft	ft	5.000	5.000	+0.00		Pass
qult on B' (Vesić, strip)	ksf	11.14	11.14	+0.00		Pass
Pressure P / B'	ksf	2.000	2.000	+0.00		Pass

BC-CONS: Normally consolidated clay under a square footing (2:1 stress)

Source: Hand calculation (closed form), pp. Terzaghi one-dimensional consolidation. Calculation: Bearing capacity and settlement.

BC-CONS · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Consolidation settlement	in.	7.538	7.538	+0.00		Pass

II.A-24A: Eccentric bolt group, IC method, vertical load (Table 7-8)

Source: AISC Design Examples v16.0, Example II.A-24, Solution A, pp. IIA-256. Calculation: Eccentric bolt group.

II.A-24A · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available shear strength per bolt	kips	24.30	24.35	+0.22		Pass
C		3.550	3.554	+0.10		Pass
Manual table C		3.550	3.554	+0.10		Pass
Available strength	kips	86.30	86.54	+0.28		Pass

II.A-24A · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available shear strength per bolt	kips	16.20	16.24	+0.22		Pass
Available strength	kips	57.50	57.69	+0.34		Pass

II.A-24B: Eccentric bolt group, IC method, load at 15 degrees (Table 7-8)

Source: AISC Design Examples v16.0, Example II.A-24, Solution B, pp. IIA-257. Calculation: Eccentric bolt group.

II.A-24B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ex at the centroid level	in.	14.00	13.99	-0.07		Pass
C		4.050	4.048	-0.04		Pass
Manual table C		4.050	4.049	-0.04		Pass
Available strength	kips	98.40	98.59	+0.19		Pass

II.A-24B · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available strength	kips	65.60	65.73	+0.19		Pass

II.A-25: Eccentric bolt group, elastic method

Source: AISC Design Examples v16.0, Example II.A-25, pp. IIA-258 to IIA-259. Calculation: Eccentric bolt group.

II.A-25 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ix		315.0	315.0	+0.00		Pass
Iy		90.80	90.75	-0.06		Pass
Ip		406.0	405.8	-0.06		Pass
rmx / P		0.296	0.296	-0.08		Pass
rmy / P		0.108	0.108	+0.41		Pass
r / P		0.352	0.352	+0.14		Pass
Available strength	kips	69.00	69.09	+0.13		Pass

II.A-25 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available strength	kips	46.00	46.06	+0.13		Pass

II.A-22: Bracket plate: bolt shear, bearing and tearout of the plate, Table 7-8

Source: AISC Design Examples v16.0, Example II.A-22, pp. IIA-244 to IIA-245. Calculation: Eccentric bolt group.

II.A-22 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required strength	kips	36.00	36.00	+0.00		Pass
Bolt shear per bolt	kips	17.90	17.89	-0.04		Pass
Bearing and tearout per bolt	kips	32.90	32.91	+0.02		Pass
C		4.530	4.529	-0.03		Pass
C required		2.010	2.012	+0.10		Pass

II.A-22 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required strength	kips	24.00	24.00	+0.00		Pass
Bolt shear per bolt	kips	11.90	11.93	+0.24		Pass
Bearing and tearout per bolt	kips	21.90	21.94	+0.17		Pass
C required		2.020	2.012	-0.39		Pass

II.A-20: All-bolted shear splice: tearout governs, Table 7-6

Source: AISC Design Examples v16.0, Example II.A-20, pp. IIA-231 to IIA-232. Calculation: Eccentric bolt group.

The published C is interpolated in Table 7-6 between ex = 2 and 3 in.; so is the table value compared.

II.A-20 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required strength	kips	60.00	60.00	+0.00		Pass
Bolt shear per bolt	kips	24.30	24.35	+0.22		Pass
Bearing, nominal	kips	51.20	51.19	-0.02		Pass
Clear distance lc	in.	1.030	1.031	+0.12		Pass
Tearout, nominal	kips	30.10	30.16	+0.21		Pass
Tearout per bolt	kips	22.60	22.62	+0.10		Pass
C		3.070	3.067	-0.11		Pass
C required		2.650	2.652	+0.08		Pass

II.A-20 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bolt shear per bolt	kips	16.20	16.24	+0.22		Pass
Tearout per bolt	kips	15.10	15.08	-0.12		Pass
C required		2.650	2.652	+0.08		Pass

II.A-30: All-bolted tee: tearout at the bottom edge bolt of the stem, Table 7-6

Source: AISC Design Examples v16.0, Example II.A-30, pp. IIA-295 to IIA-296. Calculation: Eccentric bolt group.

The example uses a greater strength for the interior bolts; the module takes the edge bolt's value for every bolt (conservative, the simplification of Example II.A-22).

II.A-30 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		2.450	2.454	+0.18		Pass
Bolt shear per bolt	kips	17.90	17.89	-0.04		Pass
Tearout at the edge bolt	kips	17.30	17.28	-0.14		Pass

II.A-30 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bolt shear per bolt	kips	11.90	11.93	+0.24		Pass
Tearout at the edge bolt	kips	11.50	11.52	+0.15		Pass

II.A-17A: Single plate: C from Table 7-6, ex = 1.50 in.

Source: AISC Design Examples v16.0, Example II.A-17A, pp. IIA-178. Calculation: Eccentric bolt group.

II.A-17A · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.540	3.536	-0.13		Pass

II.A-17B: Single plate: C from Table 7-6 at 30 degrees, ex = 2-1/2 in.

Source: AISC Design Examples v16.0, Example II.A-17B, pp. IIA-181. Calculation: Eccentric bolt group.

II.A-17B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bolt shear per bolt	kips	24.30	24.35	+0.22		Pass
C		4.070	4.061	-0.21		Pass

II.A-17B · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bolt shear per bolt	kips	16.20	16.24	+0.22		Pass

II.A-19A: Extended single plate: C and C' from Table 7-7

Source: AISC Design Examples v16.0, Example II.A-19A, pp. IIA-206 to IIA-207. Calculation: Eccentric bolt group.

II.A-19A · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		2.330	2.329	-0.06		Pass
Pure moment C'		26.00	26.03	+0.12		Pass
Available strength	kips	41.70	41.47	-0.56		Pass

II.A-19A · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available strength	kips	27.70	27.64	-0.20		Pass

II.A-19B: Extended single plate: C and C' from Table 7-7 at 30 degrees

Source: AISC Design Examples v16.0, Example II.A-19B, pp. IIA-215. Calculation: Eccentric bolt group.

II.A-19B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pure moment C'		38.70	38.67	-0.08		Pass
Bolt shear per bolt	kips	31.80	31.81	+0.03		Pass
C		3.530	3.534	+0.10		Pass

II.A-19B · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bolt shear per bolt	kips	21.20	21.21	+0.03		Pass

J.4A: Slip-critical: 3/4 in. Group 120, double shear, short slots across the load

Source: AISC Design Examples v16.0, Example J.4A, pp. J-13 to J-14. Calculation: Eccentric bolt group.

J.4A · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required strength	kips	102.0	102.0	+0.00		Pass
Slip resistance, nominal	kips	19.00	18.98	-0.08		Pass
Slip resistance per bolt	kips	19.00	18.98	-0.08		Pass
Bolts required		5.370	5.373	+0.05		Pass

J.4A · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required strength	kips	68.00	68.00	+0.00		Pass
Slip resistance per bolt	kips	12.70	12.66	-0.35		Pass
Bolts required		5.350	5.373	+0.43		Pass

J.4B: Slip-critical: 3/4 in. Group 120, double shear, long slots

Source: AISC Design Examples v16.0, Example J.4B, pp. J-15 to J-16. Calculation: Eccentric bolt group.

J.4B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Slip resistance per bolt	kips	13.30	13.29	-0.08		Pass

J.4B · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Slip resistance per bolt	kips	8.880	8.871	-0.10		Pass

II.D-3: Slip-critical: 3/4 in. Group 120, double shear, oversized holes

Source: AISC Design Examples v16.0, Example II.D-3, pp. IID-22. Calculation: Eccentric bolt group.

II.D-3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Slip resistance per bolt	kips	16.10	16.14	+0.23		Pass

II.D-3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Slip resistance per bolt	kips	10.80	10.79	-0.13		Pass

T7-3-A: Table 7-3: 7/8 in. Group 120, standard holes, single shear

Source: AISC Steel Construction Manual, 16th Ed., Table 7-3, pp. 7-24. Calculation: Eccentric bolt group.

T7-3-A · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Slip resistance per bolt	kips	13.20	13.22	+0.16		Pass

T7-3-A · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Slip resistance per bolt	kips	8.810	8.814	+0.05		Pass

T7-3-B: Table 7-3: 7/8 in. Group 120, oversized holes, double shear

Source: AISC Steel Construction Manual, 16th Ed., Table 7-3, pp. 7-24. Calculation: Eccentric bolt group.

T7-3-B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Slip resistance per bolt	kips	22.50	22.48	-0.11		Pass

T7-3-B · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Slip resistance per bolt	kips	15.00	15.02	+0.16		Pass

T7-3-C: Table 7-3: 1-1/8 in. Group 120, long slots, single shear

Source: AISC Steel Construction Manual, 16th Ed., Table 7-3, pp. 7-24. Calculation: Eccentric bolt group.

T7-3-C · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Slip resistance per bolt	kips	15.20	15.19	-0.08		Pass

T7-3-C · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Slip resistance per bolt	kips	10.10	10.14	+0.38		Pass

T7-1-A: Table 7-1: 7/8 in. Group 120-X, single shear

Source: AISC Steel Construction Manual, 16th Ed., Table 7-1, pp. 7-21. Calculation: Eccentric bolt group.

T7-1-A · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bolt shear per bolt	kips	30.70	30.67	-0.11		Pass

T7-1-A · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bolt shear per bolt	kips	20.40	20.44	+0.22		Pass

T7-1-B: Table 7-1: 1 in. Group 150-N, double shear

Source: AISC Steel Construction Manual, 16th Ed., Table 7-1, pp. 7-21. Calculation: Eccentric bolt group.

T7-1-B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bolt shear per bolt	kips	80.10	80.11	+0.01		Pass

T7-1-B · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bolt shear per bolt	kips	53.40	53.41	+0.01		Pass

T7-1-C: Table 7-1: 1 in. Group 200-X, single shear

Source: AISC Steel Construction Manual, 16th Ed., Table 7-1, pp. 7-21. Calculation: Eccentric bolt group.

T7-1-C · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bolt shear per bolt	kips	66.60	66.56	-0.06		Pass

T7-1-C · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bolt shear per bolt	kips	44.40	44.37	-0.06		Pass

T7-1-D: Table 7-1: 7/8 in. A307, single shear

Source: AISC Steel Construction Manual, 16th Ed., Table 7-1, pp. 7-21. Calculation: Eccentric bolt group.

T7-1-D · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bolt shear per bolt	kips	12.20	12.18	-0.19		Pass

T7-1-D · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bolt shear per bolt	kips	8.110	8.118	+0.10		Pass

T7-9-A: Table 7-9: 0 degrees, s = 3 in., ex = 16 in., n = 6

Source: AISC Steel Construction Manual, 16th Ed., Table 7-9, pp. 7-49 (PDF page 877). Calculation: Eccentric bolt group.

T7-9-A · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.910	3.914	+0.11		Pass

T7-9-B: Table 7-9: 0 degrees, s = 6 in., ex = 8 in., n = 10

Source: AISC Steel Construction Manual, 16th Ed., Table 7-9, pp. 7-49 (PDF page 877). Calculation: Eccentric bolt group.

T7-9-B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		17.50	17.47	-0.17		Pass

T7-9-C: Table 7-9: 75 degrees, s = 3 in., ex = 12 in., n = 6

Source: AISC Steel Construction Manual, 16th Ed., Table 7-9, pp. 7-54 (PDF page 882). Calculation: Eccentric bolt group.

T7-9-C · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		9.300	9.303	+0.03		Pass

T7-9-D: Table 7-9: 75 degrees, s = 6 in., ex = 24 in., n = 8

Source: AISC Steel Construction Manual, 16th Ed., Table 7-9, pp. 7-54 (PDF page 882). Calculation: Eccentric bolt group.

T7-9-D · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		11.90	11.86	-0.31		Pass

T7-10-A: Table 7-10: 30 degrees, s = 3 in., ex = 14 in., n = 6

Source: AISC Steel Construction Manual, 16th Ed., Table 7-10, pp. 7-57 (PDF page 885). Calculation: Eccentric bolt group.

T7-10-A · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		6.400	6.397	-0.04		Pass

T7-10-B: Table 7-10: 30 degrees, s = 6 in., ex = 6 in., n = 4

Source: AISC Steel Construction Manual, 16th Ed., Table 7-10, pp. 7-57 (PDF page 885). Calculation: Eccentric bolt group.

T7-10-B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		8.480	8.482	+0.02		Pass

T7-10-C: Table 7-10: 30 degrees, s = 3 in., ex = 36 in., n = 12

Source: AISC Steel Construction Manual, 16th Ed., Table 7-10, pp. 7-57 (PDF page 885). Calculation: Eccentric bolt group.

T7-10-C · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		9.440	9.440	+0.00		Pass

T7-11-A: Table 7-11: 15 degrees, s = 3 in., ex = 12 in., n = 5

Source: AISC Steel Construction Manual, 16th Ed., Table 7-11, pp. 7-62 (PDF page 890). Calculation: Eccentric bolt group.

T7-11-A · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		6.160	6.160	-0.00		Pass

T7-11-B: Table 7-11: 15 degrees, s = 6 in., ex = 20 in., n = 8

Source: AISC Steel Construction Manual, 16th Ed., Table 7-11, pp. 7-62 (PDF page 890). Calculation: Eccentric bolt group.

T7-11-B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		12.40	12.41	+0.10		Pass

T7-11-C: Table 7-11: 15 degrees, s = 3 in., ex = 28 in., n = 3

Source: AISC Steel Construction Manual, 16th Ed., Table 7-11, pp. 7-62 (PDF page 890). Calculation: Eccentric bolt group.

T7-11-C · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		1.550	1.550	+0.02		Pass

T7-12-A: Table 7-12: 45 degrees, s = 3 in., ex = 8 in., n = 4

Source: AISC Steel Construction Manual, 16th Ed., Table 7-12, pp. 7-70 (PDF page 898). Calculation: Eccentric bolt group.

T7-12-A · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		8.550	8.548	-0.02		Pass

T7-12-B: Table 7-12: 45 degrees, s = 6 in., ex = 16 in., n = 7

Source: AISC Steel Construction Manual, 16th Ed., Table 7-12, pp. 7-70 (PDF page 898). Calculation: Eccentric bolt group.

T7-12-B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		16.90	16.91	+0.07		Pass

T7-12-C: Table 7-12: 45 degrees, s = 3 in., ex = 36 in., n = 9

Source: AISC Steel Construction Manual, 16th Ed., Table 7-12, pp. 7-70 (PDF page 898). Calculation: Eccentric bolt group.

T7-12-C · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		9.300	9.299	-0.02		Pass

T7-13-A: Table 7-13: 60 degrees, s = 3 in., ex = 10 in., n = 2

Source: AISC Steel Construction Manual, 16th Ed., Table 7-13, pp. 7-77 (PDF page 905). Calculation: Eccentric bolt group.

T7-13-A · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		4.690	4.691	+0.02		Pass

T7-13-B: Table 7-13: 60 degrees, s = 6 in., ex = 24 in., n = 10

Source: AISC Steel Construction Manual, 16th Ed., Table 7-13, pp. 7-77 (PDF page 905). Calculation: Eccentric bolt group.

T7-13-B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		26.40	26.38	-0.06		Pass

T7-13-C: Table 7-13: 60 degrees, s = 3 in., ex = 18 in., n = 5

Source: AISC Steel Construction Manual, 16th Ed., Table 7-13, pp. 7-77 (PDF page 905). Calculation: Eccentric bolt group.

T7-13-C · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		9.420	9.418	-0.03		Pass

T7-10-D: Table 7-10: 75 degrees, s = 6 in., ex = 2 in., n = 9

Source: AISC Steel Construction Manual, 16th Ed., Table 7-10, pp. 7-60 (PDF page 888). Calculation: Eccentric bolt group.

T7-10-D · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		26.40	25.85	-2.07		Deviation AISC-T7-75DEG
AISC-T7-75DEG: printed value above the IC method (75 degrees, s = 6 in., ex = 2 in., larger groups)						

BX-DM72-4.55: Narrow cut in soft clay

Source: UFS 3-220-20 (DM7.2, 2026), Figure 4-55, pp. p. 258. Calculation: Braced excavation.

BX-DM72-4.55 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
FBH = 1.35		1.350	1.347	-0.24		Pass
Ka = 1 − m·4su/γH = 0.64		0.640	0.641	+0.13		Pass
σh = 0.64 × 0.12 kcf × 20 ft = 1.54 ksf	psf	1,540	1,538	-0.13		Pass
Resultant PH1 = (15 + 20)(1.54)/2 = 27 kips/ft	kip/ft	27.00	26.92	-0.31		Pass
Resultant location R1 = 8.8 ft above the base	ft	8.800	8.810	+0.11		Pass
Force on the buried sheeting P'H = 1.6 kips/ft	kips	1.600	1.575	-1.55		Pass

BX-SAND-HAND: Braced cut in sand, tributary loads

Source: Hand calculation: UFS 3-220-20 (2026) Figure 4-51. Calculation: Braced excavation.

BX-SAND-HAND · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
σH = 0.65·Ka·γ·H = 624 psf	psf	624.0	624.0	+0.00		Pass
Level 1 load 624 psf × 8 ft	lb/ft	4,992	4,992	+0.00		Pass
Level 2 load 624 psf × 8 ft	lb/ft	4,992	4,992	+0.00		Pass

UDOEYO-6.6: Three point loads, sag given at a load

Source: Udoeyo, Structural Analysis (2020), Example 6.6, pp. 152-154. Calculation: Cable and catenary.

UDOEYO-6.6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Horizontal tension	kips	39.42	39.43	+0.02		Pass
Sag at the first load	ft	2.760	2.761	+0.03		Pass
Sag at the third load	ft	2.260	2.261	+0.04		Pass
Tension at the left support	kips	53.58	53.58	+0.01		Pass
Tension at the right support	kips	49.36	49.37	+0.02		Pass

UDOEYO-6.8: Uniform load along a level span (metric)

Source: Udoeyo, Structural Analysis (2020), Example 6.8, pp. 159. Calculation: Cable and catenary.

UDOEYO-6.8 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Horizontal tension (3,000 N)	kips	0.674	0.674	-0.00		Pass
Largest tension (3,841.87 N)	kips	0.864	0.864	+0.00		Pass
Cable length (21.93 m)	ft	71.95	72.06	+0.16		Pass

CATENARY: Catenary under its own weight, level supports

Source: Hand calculation (closed form), catenary (Irvine 1981, Ch. 1). Calculation: Cable and catenary.

CATENARY · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Horizontal tension	kips	3.750	3.750	+0.00		Pass
Largest tension	kips	4.054	4.054	+0.00		Pass
Cable length	ft	102.7	102.7	-0.00		Pass
Horizontal tension, parabolic approximation	kips	3.700	3.700	-0.00		Pass

STRETCH: Elastic stretch of a parabolic cable

Source: Hand calculation (closed form), parabola. Calculation: Cable and catenary.

STRETCH · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Horizontal tension	kips	25.00	25.00	+0.00		Pass
Elastic stretch	in.	2.111	2.111	-0.00		Pass

INCLINED: Uniform load, right support 20 ft higher

Source: Hand calculation (closed form), general cable theorem (Udoeyo 2020, 6.2.1), pp. 148-149. Calculation: Cable and catenary.

INCLINED · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Horizontal tension	kips	25.00	25.00	+0.00		Pass
Tension at the lower support	kips	25.00	25.00	+0.00		Pass
Tension at the higher support	kips	26.93	26.93	+0.00		Pass

THERMAL: Temperature rise of an inextensible parabolic cable

Source: Hand calculation (closed form), length series of Udoeyo (2020) Eq. 6.20, pp. 158. Calculation: Cable and catenary.

THERMAL · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Sag increase for the temperature rise	in.	2.955	2.954	-0.03		Pass

DG31-4.1-S: W12X14 to CB18X14, section properties

Source: AISC Design Guide 31 (2017), Example 4.1, pp. 26-28. Calculation: Castellated or cellular beam.

DG31-4.1-S · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
h	in.	5.900	5.900	+0.00		Pass
ho	in.	11.80	11.80	+0.00		Pass
dg	in.	17.80	17.80	+0.00		Pass
Cut angle		59.30	59.32	+0.04		Pass
S	in.	13.00	13.00	+0.00		Pass
Atee	in.²	1.450	1.448	-0.12		Pass
ytee from the stem tip	in.	2.320	2.313	-0.32		Pass
Ix of the tee	in.⁴	1.130	1.130	+0.01		Pass
Iy of the tee	in.⁴	1.180	1.175	-0.42		Pass
J of the tee	in.⁴	0.022	0.022	+1.07		Pass
rx of the tee	in.	0.883	0.883	+0.04		Pass
ry of the tee	in.	0.901	0.901	-0.03		Pass
Sx of the tee to the flange	in.³	1.640	1.644	+0.26		Pass
Sx of the tee to the stem	in.³	0.489	0.489	-0.07		Pass
Zx of the tee	in.³	0.863	0.863	+0.04		Pass
Anet	in.²	2.900	2.897	-0.12		Pass
deffec	in.	16.40	16.43	+0.15		Pass
Ix-net	in.⁴	197.0	197.6	+0.32		Pass
Sx-net	in.³	22.10	22.20	+0.47		Pass
Zx-net	in.³	23.80	23.79	-0.05		Pass
Agross	in.²	5.260	5.256	-0.07		Pass
Ix-gross	in.⁴	224.0	225.0	+0.45		Pass
Sx-gross	in.³	25.20	25.28	+0.32		Pass

DG31-4.1: CB18X14, 40 ft roof beam, 239 lb/ft service, fully braced

Source: AISC Design Guide 31 (2017), Example 4.1, pp. 28-39. Calculation: Castellated or cellular beam.

DG31-4.1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Global shear at opening 1	kips	6.320	6.318	-0.03		Pass
Global shear at the end	kips	6.540	6.536	-0.06		Pass
Global moment at midspan	kip-ft	65.40	65.36	-0.06		Pass
Moment at opening 16	kip-ft	63.80	63.81	+0.01		Pass
Axial force at midspan	kips	47.80	47.75	-0.10		Pass
Vierendeel moment at opening 1	kip-in.	4.740	4.739	-0.03		Pass
Flexural buckling Pn	kips	72.50	72.35	-0.20		Pass
Fey	ksi	25,800	25,803	+0.01		Pass
Fez	ksi	3,440	89.46	-97.40		Deviation DG31-FTB
DG31-FTB: the guide's Fez keeps a term as if Cw were 1 in.^6, and its yo is measured from the stem tip; AISC 360-22 E4 gives a lower strength						
H		0.880	0.828	-5.90		Deviation DG31-H41
DG31-H41: the example divides by ro^2 squared and prints H = 0.880						
Fe, flexural-torsional	ksi	3,880	89.41	-97.70		Deviation DG31-FTB
DG31-FTB: the guide's Fez keeps a term as if Cw were 1 in.^6, and its yo is measured from the stem tip; AISC 360-22 E4 gives a lower strength						
Pn, flexural-torsional	kips	72.10	57.30	-20.53		Deviation DG31-FTB
DG31-FTB: the guide's Fez keeps a term as if Cw were 1 in.^6, and its yo is measured from the stem tip; AISC 360-22 E4 gives a lower strength						
φPn of the tee	kips	64.90	51.57	-20.54		Deviation DG31-FTB
DG31-FTB: the guide's Fez keeps a term as if Cw were 1 in.^6, and its yo is measured from the stem tip; AISC 360-22 E4 gives a lower strength						
Yield moment of the tee	kip-in.	24.50	24.43	-0.27		Pass
φMn of the tee	kip-in.	22.10	21.99	-0.50		Pass
Largest interaction		0.741	0.936	+26.38		Deviation DG31-FTB
DG31-FTB: the printed interaction uses the printed tee compression strength, about 26 % high; the module's is higher						
Largest horizontal shear	kips	4.860	4.860	+0.01		Pass
Web post Mu	kip-in.	28.70	28.68	-0.08		Pass
Web post Mp	kip-in.	250.0	250.0	+0.00		Pass
Mocr/Mp on the e/tw = 10 curve		0.418	0.417	-0.13		Pass
φMn of the web post	kip-in.	94.10	93.93	-0.18		Pass
φVn, horizontal	kips	18.00	18.00	+0.00		Pass
φVn, net section, both tees	kips	36.00	36.00	+0.00		Pass
Net shear ratio		0.176	0.176	-0.28		Pass
φVn, gross	kips	70.30	70.26	-0.06		Pass
Gross shear ratio		0.093	0.093	+0.03		Pass

DG31-4.1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Global moment at midspan	kip-ft	47.80	47.80	+0.00		Pass
Global shear at the end	kips	4.780	4.780	+0.00		Pass
Axial force at midspan	kips	34.90	34.92	+0.06		Pass
Vierendeel moment at opening 1	kip-in.	3.470	3.466	-0.13		Pass
Pn/Ω of the tee	kips	43.20	34.31	-20.57		Deviation DG31-FTB
DG31-FTB: the guide's Fez keeps a term as if Cw were 1 in.^6, and its yo is measured from the stem tip; AISC 360-22 E4 gives a lower strength						
Mn/Ω of the tee	kip-in.	14.70	14.63	-0.47		Pass
Largest interaction		0.815	1.029	+26.30		Deviation DG31-FTB
DG31-FTB: the printed interaction uses the printed tee compression strength, about 26 % high; the module's is higher						

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Largest horizontal shear	kips	3.560	3.555	-0.15		Pass
Web post Ma	kip-in.	21.00	20.97	-0.13		Pass
Mn/Ω of the web post	kip-in.	62.60	62.50	-0.17		Pass
Vn/Ω, horizontal	kips	12.00	12.00	+0.00		Pass
Vn/Ω, net section, both tees	kips	24.00	24.00	+0.00		Pass
Vn/Ω, gross	kips	46.70	46.75	+0.10		Pass
Live load deflection	in.	1.120	1.117	-0.29		Pass
Dead load deflection	in.	1.560	1.552	-0.50		Pass
Total load deflection	in.	2.680	2.669	-0.41		Pass

DG31-4.2-S: W12X14 to LB18X14, section properties

Source: AISC Design Guide 31 (2017), Example 4.2, pp. 41-44. Calculation: Castellated or cellular beam.

DG31-4.2-S · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Waste, loss	in.	0.426	0.426	+0.09		Pass
dg	in.	17.60	17.62	+0.13		Pass
dt at the center	in.	2.650	2.662	+0.45		Pass
y of the critical section	in.	5.490	5.492	+0.04		Pass
dt at the critical section	in.	3.310	3.320	+0.29		Pass
Atee at the center	in.²	1.380	1.381	+0.04		Pass
Ix of the tee at the center	in.⁴	0.814	0.803	-1.29		Deviation DG31-42-IX
DG31-42-IX: the printed section values follow rounded dimensions; unrounded, Ix of the tee and Ix-net are about 1 % away, and so is the deflection						
Sx to the stem at the center	in.³	0.390	0.386	-0.93		Pass
Atee at the critical section	in.²	1.510	1.512	+0.14		Pass
Ix of the tee, critical	in.⁴	1.520	1.505	-0.99		Pass
rx, critical	in.	1.000	0.998	-0.24		Pass
ry, critical	in.	0.881	0.882	+0.07		Pass
Sx to the stem, critical	in.³	0.598	0.595	-0.44		Pass
Zx, critical	in.³	1.060	1.053	-0.62		Pass
deffec at the center	in.	16.50	16.46	-0.25		Pass
Ix-net	in.⁴	190.0	188.6	-0.73		Pass
deffec, critical	in.	16.00	16.04	+0.25		Pass
Ix, critical	in.⁴	196.0	197.5	+0.78		Pass
Ix-gross	in.⁴	220.0	219.6	-0.17		Pass
Sx-gross	in.³	25.00	24.92	-0.30		Pass

DG31-4.2: LB18X14, the same beam

Source: AISC Design Guide 31 (2017), Example 4.2, pp. 44-55. Calculation: Castellated or cellular beam.

DG31-4.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Global shear at opening 1	kips	6.250	6.247	-0.05		Pass
Axial force at midspan	kips	49.00	48.90	-0.21		Pass
Vierendeel moment at opening 1	kip-in.	9.570	9.604	+0.36		Pass
Flexural buckling Pn	kips	75.20	75.34	+0.19		Pass
Fey	ksi	5,870	5,881	+0.19		Pass
Fez	ksi	678.0	76.54	-88.71		Deviation DG31-FTB
DG31-FTB: the guide's Fez keeps a term as if Cw were 1 in.^6, and its yo is measured from the stem tip; AISC 360-22 E4 gives a lower strength						
H		0.233	0.793	+240.51		Deviation DG31-FTB
DG31-FTB: the guide's Fez keeps a term as if Cw were 1 in.^6, and its yo is measured from the stem tip; AISC 360-22 E4 gives a lower strength						
Fe	ksi	622.0	76.34	-87.73		Deviation DG31-FTB
DG31-FTB: the guide's Fez keeps a term as if Cw were 1 in.^6, and its yo is measured from the stem tip; AISC 360-22 E4 gives a lower strength						
φPn of the tee	kips	65.60	51.73	-21.14		Deviation DG31-FTB
DG31-FTB: the guide's Fez keeps a term as if Cw were 1 in.^6, and its yo is measured from the stem tip; AISC 360-22 E4 gives a lower strength						
Yield moment of the tee	kip-in.	29.90	29.77	-0.44		Pass
φMn of the tee	kip-in.	26.90	26.79	-0.40		Pass
Largest interaction		0.759	0.975	+28.40		Deviation DG31-FTB
DG31-FTB: the printed interaction uses the printed tee compression strength, about 26 % high; the module's is higher						
Largest horizontal shear	kips	6.260	6.303	+0.69		Pass
Web post Mu	kip-in.	34.60	34.89	+0.83		Pass
Me	kip-in.	218.0	218.0	+0.01		Pass
C2		2.700	2.701	+0.05		Pass
C3		4.810	4.806	-0.08		Pass
C1		7.540	7.519	-0.27		Pass
Mallow/Me		0.450	0.425	-5.63		Deviation DG31-ROUND
DG31-ROUND: Eq. 3-36 is very sensitive to rounding; the printed ratio follows rounded C1, C2, C3 and more, and the module carries them unrounded and comes out lower						
φMn of the web post	kip-in.	88.30	83.32	-5.64		Deviation DG31-ROUND
DG31-ROUND: Eq. 3-36 is very sensitive to rounding; the printed ratio follows rounded C1, C2, C3 and more, and the module carries them unrounded and comes out lower						
φVn, horizontal	kips	27.00	27.00	+0.00		Pass
φVn, net section, both tees	kips	31.80	31.94	+0.45		Pass
φVn, gross	kips	70.20	70.30	+0.15		Pass

DG31-4.2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Axial force at midspan	kips	35.80	35.76	-0.11		Pass
Pn/Ω of the tee	kips	43.70	34.42	-21.24		Deviation DG31-FTB
DG31-FTB: the guide's Fez keeps a term as if Cw were 1 in.^6, and its yo is measured from the stem tip; AISC 360-22 E4 gives a lower strength						
Mn/Ω of the tee	kip-in.	17.90	17.83	-0.41		Pass
Largest interaction		0.835	1.071	+28.29		Deviation DG31-FTB
DG31-FTB: the printed interaction uses the printed tee compression strength, about 26 % high; the module's is higher						
Largest horizontal shear	kips	4.610	4.610	-0.01		Pass
Web post Ma	kip-in.	25.50	25.51	+0.06		Pass
Mn/Ω of the web post	kip-in.	58.70	55.44	-5.56		Deviation DG31-ROUND
DG31-ROUND: Eq. 3-36 is very sensitive to rounding; the printed ratio follows rounded C1, C2, C3 and more, and the module carries them unrounded and comes out lower						

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vn/Ω, horizontal	kips	18.00	18.00	+0.00		Pass
Vn/Ω, gross	kips	46.70	46.78	+0.16		Pass
Live load deflection	in.	1.160	1.170	+0.87		Pass
Dead load deflection	in.	1.610	1.626	+1.02		Deviation DG31-42-IX
DG31-42-IX: the printed section values follow rounded dimensions; unrounded, Ix of the tee and Ix-net are about 1 % away, and so is the deflection						
Total load deflection	in.	2.770	2.796	+0.96		Pass

DG31-4.3-S: W21X44 + W21X57 to CB30X44/57, section properties

Source: AISC Design Guide 31 (2017), Example 4.3, pp. 57-60. Calculation: Castellated or cellular beam.

DG31-4.3-S · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ho	in.	19.80	19.80	+0.00		Pass
dg	in.	30.80	30.80	+0.00		Pass
Angle, top		60.40	60.45	+0.08		Pass
Angle, bottom		61.40	61.43	+0.05		Pass
S	in.	27.00	27.00	+0.00		Pass
Atop	in.²	4.700	4.692	-0.16		Pass
Abot	in.²	6.220	6.228	+0.13		Pass
ytee top, from the stem	in.	4.240	4.239	-0.02		Pass
ytee bottom, from the flange	in.	1.190	1.192	+0.19		Pass
Ix top tee	in.⁴	12.10	12.14	+0.31		Pass
Ix bottom tee	in.⁴	14.20	14.17	-0.21		Pass
J top	in.⁴	0.266	0.264	-0.67		Pass
J bottom	in.⁴	0.685	0.678	-1.08		Pass
Sx top tee, to the stem	in.³	2.860	2.863	+0.11		Pass
Sx bottom tee, to the stem	in.³	3.290	3.290	-0.01		Pass
yo of the bottom tee	in.	0.870	0.867	-0.31		Pass
ybs	in.	13.40	13.37	-0.20		Pass
deffec	in.	28.40	28.35	-0.19		Pass
Ix-net	in.⁴	2,180	2,177	-0.15		Pass
Sx-net top	in.³	125.0	124.9	-0.08		Pass
Sx-net bottom	in.³	163.0	162.8	-0.14		Pass
n		9.190	9.189	-0.01		Pass
Effective width	in.	96.00	96.00	+0.00		Pass
Actr	in.²	31.30	31.34	+0.13		Pass
Kc		0.741	0.742	+0.08		Pass
ycc	in.	5.870	5.881	+0.20		Pass
yc	in.	15.50	15.52	+0.13		Pass
Ix-comp	in.⁴	5,740	5,747	+0.13		Pass
Vnc	kips	9.850	9.859	+0.09		Pass
V'	kips	545.0	546.0	+0.19		Pass
Stud force per foot	kip/ft	22.20	22.24	+0.18		Pass

DG31-4.3: CB30X44/57, 50 ft composite floor beam, 54 studs

Source: AISC Design Guide 31 (2017), Example 4.3, pp. 61-77. Calculation: Castellated or cellular beam.

DG31-4.3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vc	kips	7.390	7.394	+0.06		Pass
Net shear at opening 1	kips	41.10	41.13	+0.06		Pass
Global moment at midspan	kip-ft	644.0	644.1	+0.02		Pass
T1 at opening 1	kips	25.30	25.36	+0.25		Pass
T1 at opening 7	kips	189.0	189.4	+0.23		Pass
T1 at midspan	kips	226.0	226.4	+0.16		Pass
Top tee Vierendeel moment, opening 1	kip-in.	70.70	71.29	+0.83		Pass
Bottom tee Vierendeel moment, opening 1	kip-in.	93.70	94.62	+0.98		Pass
Tensile strength, φPn	kips	280.0	280.3	+0.10		Pass
Mcr, top tee	kip-in.	596.0	589.1	-1.16		Deviation DG31-J
DG31-J: the printed J is about 1 % above the thin-rectangle value used here, and Mcr is very sensitive to J. Mcr does not govern						
Mcr, bottom tee	kip-in.	1,550	1,508	-2.71		Deviation DG31-J
DG31-J: the printed J is about 1 % above the thin-rectangle value used here, and Mcr is very sensitive to J. Mcr does not govern						
φMn top tee	kip-in.	129.0	128.8	-0.12		Pass
φMn bottom tee	kip-in.	149.0	148.0	-0.65		Pass
Largest interaction, top		0.549	0.553	+0.78		Pass
Largest interaction, bottom		0.858	0.858	+0.05		Pass
Largest horizontal shear	kips	36.30	36.49	+0.54		Pass
Web post, top Mu	kip-in.	352.0	354.0	+0.57		Pass
Web post, bottom Mu	kip-in.	367.0	368.6	+0.43		Pass
Mp top	kip-in.	1,580	1,579	-0.04		Pass
Mp bottom	kip-in.	1,830	1,828	-0.13		Pass
Mocr/Mp, top		0.476	0.476	-0.05		Pass
Mocr/Mp, bottom		0.471	0.472	+0.14		Pass
φMn top post	kip-in.	677.0	676.3	-0.11		Pass
φMn bottom post	kip-in.	776.0	775.8	-0.03		Pass
φVn, horizontal	kips	84.00	84.00	+0.00		Pass
Shear at the top tee	kips	20.90	21.00	+0.47		Pass
Shear at the bottom tee	kips	27.70	27.87	+0.62		Pass
φVn top tee	kips	57.80	57.75	-0.09		Pass
φVn bottom tee	kips	66.80	66.83	+0.04		Pass
φVn, gross	kips	218.0	217.3	-0.32		Pass
Gross shear ratio		0.236	0.237	+0.49		Pass

DG31-4.3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vc	kips	4.930	4.930	-0.01		Pass
Global moment at midspan	kip-ft	453.0	453.4	+0.10		Pass
T1 at midspan	kips	159.0	158.7	-0.18		Pass
Pn/Ω, bottom tee	kips	186.0	186.5	+0.26		Pass
Mn/Ω top tee	kip-in.	85.60	85.72	+0.15		Pass
Mn/Ω bottom tee	kip-in.	98.80	98.49	-0.32		Pass
Largest interaction, top		0.586	0.591	+0.84		Pass

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Largest interaction, bottom		0.911	0.912	+0.06		Pass
Largest horizontal shear	kips	25.50	25.65	+0.60		Pass
Mn/Ω top post	kip-in.	450.0	449.9	-0.01		Pass
Mn/Ω bottom post	kip-in.	516.0	516.2	+0.03		Pass
Vn/Ω, horizontal	kips	56.00	56.00	+0.00		Pass
Vn/Ω top tee	kips	38.50	38.50	-0.00		Pass
Vn/Ω bottom tee	kips	44.50	44.55	+0.11		Pass
Vn/Ω, gross	kips	145.0	144.6	-0.29		Pass

DG31-4.3-D: The same, the example's deflection loads (no steel weight)

Source: AISC Design Guide 31 (2017), Example 4.3, pp. 77-78. Calculation: Castellated or cellular beam.

DG31-4.3-D · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Dead load on the steel alone	in.	1.090	1.089	-0.08		Pass
Live load	in.	0.749	0.750	+0.13		Pass
Dead load after the concrete sets	in.	0.150	0.150	-0.00		Pass
Total after set	in.	0.899	0.900	+0.11		Pass

DG31-4.3-30: The same with 30 studs: partial composite action, Table 4-19

Source: AISC Design Guide 31 (2017), Example 4.3, pp. 65. Calculation: Castellated or cellular beam.

DG31-4.3-30 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
q	kip/ft	12.60	12.60	+0.00		Pass
To at opening 1	kips	8.430	8.493	+0.75		Pass
T1-new at opening 1	kips	26.80	26.89	+0.33		Pass
To at opening 4	kips	24.00	24.31	+1.30		Pass
T1-new at opening 4	kips	127.0	127.8	+0.60		Pass
To at opening 7	kips	0.885	1.143	+29.10		Pass
T1-new at opening 7	kips	189.0	189.6	+0.34		Pass

DG31-4.4-S: W21X44 + W21X57 to LB30X44/57, section properties

Source: AISC Design Guide 31 (2017), Example 4.4, pp. 79-85. Calculation: Castellated or cellular beam.

DG31-4.4-S · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Waste, loss	in.	0.802	0.800	-0.25		Pass
dt top	in.	4.750	4.750	+0.00		Pass
dt bottom	in.	4.950	4.950	+0.00		Pass
dg	in.	30.50	30.50	+0.00		Pass
y	in.	9.290	9.287	-0.03		Pass
dt top, critical	in.	5.860	5.863	+0.04		Pass
dt bottom, critical	in.	6.060	6.063	+0.04		Pass
Atop, center	in.²	4.440	4.430	-0.23		Pass
Abot, center	in.²	6.010	6.005	-0.07		Pass
Atop, critical	in.²	4.820	4.819	-0.01		Pass
Abot, critical	in.²	6.460	6.456	-0.06		Pass
Sx top, critical, to the stem	in.³	3.250	3.245	-0.17		Pass
Sx bottom, critical, to the stem	in.³	4.010	3.994	-0.40		Pass
Ix-net	in.⁴	1,710	2,078	+21.54		Deviation DG31-44-I
DG31-44-I: the example measures the top tee's centroid from the stem tip as if from the flange, so its Ix-net of 1,710 in.^4 is low (2,078 by the same equation as Example 4.3); its composite Ix mixes sections too						
Ix, critical	in.⁴	2,160	2,161	+0.05		Pass
deffec, critical	in.	27.80	27.77	-0.11		Pass
Ix-comp at the net section	in.⁴	5,100	5,518	+8.20		Deviation DG31-44-I
DG31-44-I: the example measures the top tee's centroid from the stem tip as if from the flange, so its Ix-net of 1,710 in.^4 is low (2,078 by the same equation as Example 4.3); its composite Ix mixes sections too						

DG31-4.4: LB30X44/57, the same floor beam

Source: AISC Design Guide 31 (2017), Example 4.4, pp. 86-98. Calculation: Castellated or cellular beam.

DG31-4.4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Net shear at opening 1	kips	41.00	40.98	-0.04		Pass
T1 at opening 1	kips	26.90	26.90	+0.01		Pass
T1 at midspan	kips	230.0	229.5	-0.21		Pass
Top Vierendeel moment, opening 1	kip-in.	92.40	91.09	-1.42		Deviation DG31-44-MV
DG31-44-MV: the example's own areas give about 91 kip-in.						
Bottom Vierendeel moment, opening 1	kip-in.	122.0	122.0	+0.02		Pass
Tensile strength, φPn	kips	291.0	290.5	-0.16		Pass
Mcr, top	kip-in.	534.0	562.7	+5.38		Deviation DG31-44-MCR
DG31-44-MCR: the example mixes the depth at the critical section with J at the center; here both are at the critical section. Mcr does not govern						
Mcr, bottom	kip-in.	1,350	1,391	+3.01		Deviation DG31-44-MCR
DG31-44-MCR: the example mixes the depth at the critical section with J at the center; here both are at the critical section. Mcr does not govern						
φMn top	kip-in.	147.0	146.0	-0.68		Pass
φMn bottom	kip-in.	181.0	179.7	-0.70		Pass
Largest interaction, top		0.631	0.624	-1.13		Pass
Largest interaction, bottom		0.861	0.861	+0.02		Pass
Largest horizontal shear	kips	38.90	38.93	+0.08		Pass
Web post Mu	kip-in.	363.0	364.4	+0.39		Pass
Me	kip-in.	1,130	1,136	+0.49		Pass
Mallow/Me		0.466	0.436	-6.38		Deviation DG31-ROUND
DG31-ROUND: Eq. 3-36 is very sensitive to rounding; the printed ratio follows rounded C1, C2, C3 and more, and the module carries them unrounded and comes out lower						
φMn of the web post	kip-in.	474.0	445.9	-5.94		Deviation DG31-ROUND
DG31-ROUND: Eq. 3-36 is very sensitive to rounding; the printed ratio follows rounded C1, C2, C3 and more, and the module carries them unrounded and comes out lower						
φVn, horizontal	kips	84.00	84.00	+0.00		Pass
φVn top tee	kips	49.90	49.88	-0.05		Pass
φVn bottom tee	kips	60.10	60.14	+0.07		Pass
φVn, gross	kips	218.0	217.4	-0.25		Pass
Gross shear ratio		0.202	0.237	+17.31		Deviation DG31-44-VG
DG31-44-VG: the summary prints 44.1 kips, the net shear; the example's own working gives 51.5 kips, which the module uses						

DG31-4.4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
T1 at midspan	kips	161.0	160.9	-0.06		Pass
Pn/Ω, bottom tee	kips	193.0	193.3	+0.15		Pass
Mn/Ω top	kip-in.	97.60	97.14	-0.47		Pass
Mn/Ω bottom	kip-in.	120.0	119.6	-0.35		Pass
Largest interaction, top		0.674	0.666	-1.13		Pass
Largest interaction, bottom		0.915	0.915	+0.01		Pass
Largest horizontal shear	kips	27.30	27.36	+0.23		Pass
Web post Ma	kip-in.	255.0	256.1	+0.43		Pass
Mn/Ω of the web post	kip-in.	315.0	296.7	-5.83		Deviation DG31-ROUND
DG31-ROUND: Eq. 3-36 is very sensitive to rounding; the printed ratio follows rounded C1, C2, C3 and more, and the module carries them unrounded and comes out lower						
Vn/Ω, horizontal	kips	50.30	56.00	+11.33		Deviation DG31-44-ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
DG31-44-ASD: the example prints 50.3 kips, which is 84.0 / 1.50 = 56.0 kips						
Vn/Ω top tee	kips	33.30	33.25	-0.15		Pass
Vn/Ω bottom tee	kips	40.10	40.09	-0.01		Pass
Vn/Ω, gross	kips	145.0	144.7	-0.22		Pass

DG31-4.4-D: The same, the example's deflection loads (no steel weight)

Source: AISC Design Guide 31 (2017), Example 4.4, pp. 99. Calculation: Castellated or cellular beam.

DG31-4.4-D · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Dead load on the steel alone	in.	1.390	1.141	-17.94		Deviation DG31-44-I
DG31-44-I: the example measures the top tee's centroid from the stem tip as if from the flange, so its Ix-net of 1,710 in.^4 is low (2,078 by the same equation as Example 4.3); its composite Ix mixes sections too						
Live load	in.	0.845	0.781	-7.56		Deviation DG31-44-I
DG31-44-I: the example measures the top tee's centroid from the stem tip as if from the flange, so its Ix-net of 1,710 in.^4 is low (2,078 by the same equation as Example 4.3); its composite Ix mixes sections too						
Dead load after the concrete sets	in.	0.169	0.156	-7.56		Deviation DG31-44-I
DG31-44-I: the example measures the top tee's centroid from the stem tip as if from the flange, so its Ix-net of 1,710 in.^4 is low (2,078 by the same equation as Example 4.3); its composite Ix mixes sections too						

SSMA-M-600S162-54: 600S162-54: shear center to web, m

Source: SSMA Product Technical Guide (2022), Structural Section Properties, pp. 10. Calculation: Cold-formed steel bridging.

SSMA-M-600S162-54 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
m	in.	0.663	0.663	+0.06		Pass

SSMA-M-800S200-54: 800S200-54: shear center to web, m

Source: SSMA Product Technical Guide (2022), Structural Section Properties, pp. 11. Calculation: Cold-formed steel bridging.

SSMA-M-800S200-54 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
m	in.	0.804	0.804	+0.04		Pass

SSMA-M-600S200-43: 600S200-43: shear center to web, m

Source: SSMA Product Technical Guide (2022), Structural Section Properties, pp. 11. Calculation: Cold-formed steel bridging.

SSMA-M-600S200-43 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
m	in.	0.894	0.894	+0.02		Pass

HC-BRIDGE-AXIAL: Axial only: 2 % of 2,000 lb, half to each strap, 10 studs

Source: Hand calculation (closed form). Calculation: Cold-formed steel bridging.

HC-BRIDGE-AXIAL · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Force per strap	lb	20.00	20.00	+0.00		Pass
Accumulated	lb	200.0	200.0	+0.00		Pass

HC-BRIDGE-WIND: Wind only: 20 psf × 16/12 × 4 ft = 106.7 lb nominal, 0.6W ASD, P = 1.5 (m/d) W

Source: Hand calculation (closed form). Calculation: Cold-formed steel bridging.

HC-BRIDGE-WIND · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Force at a stud	lb	10.61	10.61	+0.06		Pass

HC-BRIDGE-STRAP: Strap 2 in. × 54 mil, 33 ksi: yield Ag Fy

Source: Hand calculation (closed form). Calculation: Cold-formed steel bridging.

HC-BRIDGE-STRAP · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Design Tn	lb	3,362	3,362	+0.00		Pass

HAND-BU-DEFAULT: 2 × 800S162-54 back to back, 12 ft, braced at 48 in., connectors at 12 in.

Source: Hand calculation (closed form). Calculation: Built-up cold-formed steel member.

Hand calculation; the default design.

HAND-BU-DEFAULT · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pu = 1.2 × 1,500 + 1.6 × 3,000	lb	6,600	6,600	+0.00		Pass
Mu = (1.2 × 20 + 120) × 12² / 8	lb-in	31,104	31,104	+0.00		Pass
(KL/r)m (Eq. I1.2-1)		78.04	78.04	+0.00		Pass
End screws over 1.5 × 8 in. at 4 × 0.19 in. (I1.2(b))		16.00	16.00	+0.00		Pass
smax = L/6 (I1.1)	in.	24.00	24.00	+0.00		Pass

HAND-BU-BOX: 2 × 800S162-54 toe to toe (box), confirmed closed

Source: Hand calculation (closed form). Calculation: Built-up cold-formed steel member.

Hand calculation (parallel axes).

HAND-BU-BOX · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Iy of the box	in.⁴	2.571	2.571	+0.00		Pass
Ix of the box = 2 Ix	in.⁴	11.47	11.47	+0.00		Pass

HAND-BYP-2SPAN: 600S162-54 bypass studs at 16 in., two 12 ft spans on slide clips (the default)

Source: Hand calculation (closed form). Calculation: Cold-formed steel bypass and infill framing.

Hand calculation; no axial load in these values.

HAND-BYP-2SPAN · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Interior clip reaction 1.25 wL	lb	600.0	600.0	-0.00		Pass
Moment at the interior clip wL²/8	lb-in	8,640	8,640	+0.00		Pass
Largest shear 0.625 wL	lb	300.0	300.0	+0.00		Pass
φ Pn per screw, stud to clip (J4.3.1, J4.3.2)	lb	822.0	822.0	+0.00		Pass
Deflection at 0.42 W	in.	0.039	0.039	-0.10		Pass

HAND-BYP-2SPAN · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Interior clip reaction at 0.6W	lb	360.0	360.0	-0.00		Pass
Pn / Ω per screw	lb	548.0	548.0	+0.00		Pass

HAND-BYP-INFILL: 600S162-54 infill studs, 10 ft, 54 mil deflection track at the head

Source: Hand calculation (closed form). Calculation: Cold-formed steel bypass and infill framing.

HAND-BYP-INFILL · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Head reaction wL/2	lb	200.0	200.0	-0.00		Pass
φ Pndt (Eq. B3.2.5.2-1)	lb	369.3	369.3	-0.00		Pass
φ Pn, stud web crippling, N = 1 in. (G5)	lb	838.5	838.5	+0.00		Pass

HAND-BYP-INFILL · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pndt / Ω	lb	239.8	239.8	-0.00		Pass

HC-CEIL-HAT: Hat 7/8 × 1-1/4 in., 1/2 in. flanges, 0.0296 in.: gross A and Ix (square-corner centerline)

Source: Hand calculation (closed form). Calculation: Cold-formed steel ceiling framing.

HC-CEIL-HAT · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Gross area	in.²	0.115	0.115	+0.00		Pass
Gross Ix	in.⁴	0.014	0.014	+0.00		Pass

HC-CEIL-SIMPLE: Simple span 10 ft, 10 psf at 16 in., 1.4D

Source: Hand calculation (closed form). Calculation: Cold-formed steel ceiling framing.

HC-CEIL-SIMPLE · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Moment 1.4 w L²/8	lb-in	2,800	2,800	-0.00		Pass
Hanger force 1.4 w L/2	lb	93.33	93.33	-0.00		Pass
Hanger design strength 0.75 × 0.75 Fu Ab	lb	295.0	295.0	+0.00		Pass

HC-CEIL-TWO: Two equal spans of 10 ft: interior reaction 1.25 w L, support moment w L²/8

Source: Hand calculation (closed form). Calculation: Cold-formed steel ceiling framing.

HC-CEIL-TWO · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Interior hanger 1.4 × 1.25 w L	lb	233.3	233.3	-0.00		Pass
Support moment 1.4 w L²/8	lb-in	2,800	2,800	-0.00		Pass

HC-CEIL-EV: Vertical seismic, SDS = 1.5: 1.2D + 1.0Ev = 1.5D

Source: Hand calculation (closed form). Calculation: Cold-formed steel ceiling framing.

HC-CEIL-EV · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Moment (1.2 + 0.2 × 1.5) w L²/8	lb-in	3,000	3,000	-0.00		Pass

HC-CHORD-STACK: Two stacked walls, 10 ft long, wind: overturning accumulated down the stack

Source: Hand calculation (closed form). Calculation: Cold-formed steel shear wall chord studs.

HC-CHORD-STACK · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Hold-down tension, top story, 0.9D + 1.0W	kips	3.311	3.311	+0.00		Pass
Hold-down tension, bottom story, 0.9D + 1.0W	kips	10.80	10.80	+0.00		Pass
Chord compression, bottom story, M/d	kips	13.05	13.05	+0.00		Pass

HC-CHORD-STACK · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Hold-down tension, bottom story, 0.6D + 0.6W	kips	6.332	6.332	+0.00		Pass

HC-CHORD-SEISMIC: One story, seismic amplified × 2.5, Ev with SDS = 0.5

Source: Hand calculation (closed form). Calculation: Cold-formed steel shear wall chord studs.

HC-CHORD-SEISMIC · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Hold-down tension, (0.9 − 0.2SDS)D + 2.5E	kips	6.027	6.027	+0.00		Pass

HC-CLIP-A-SHEET: Leg A screws No. 10, 54 mil member over a 97 mil clip: sheet shear per screw

Source: Hand calculation (closed form). Calculation: Cold-formed steel clip angle.

HC-CLIP-A-SHEET · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Design sheet shear per screw	lb	943.7	943.7	+0.00		Pass

HC-CLIP-A-SHEET · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable sheet shear per screw	lb	629.1	629.1	+0.00		Pass

HC-CLIP-B-PULL: Leg B, No. 12 screws into 1/8 in. steel: pull-out and pull-over

Source: Hand calculation (closed form). Calculation: Cold-formed steel clip angle.

HC-CLIP-B-PULL · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Design pull-out per screw	lb	665.5	665.5	+0.00		Pass
Design pull-over per screw	lb	1,686	1,686	+0.00		Pass
Tension per screw	lb	75.00	75.00	+0.00		Pass

HC-CLIP-LEG-BEND: Leg B bending, 97 mil, 4 in. long, elastic section, A1.2(c) connection factors

Source: Hand calculation (closed form). Calculation: Cold-formed steel clip angle.

HC-CLIP-LEG-BEND · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Design leg moment	lb-in	189.6	189.6	+0.00		Pass
Leg moment N (e − t)	lb-in	97.25	97.25	+0.00		Pass

HC-CLIP-LEG-BEND · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable leg moment	lb-in	114.9	114.9	+0.00		Pass

HC-CLIP-LEG-PLASTIC: Leg B bending with the plastic section and member factors

Source: Hand calculation (closed form). Calculation: Cold-formed steel clip angle.

HC-CLIP-LEG-PLASTIC · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Design leg moment, plastic	lb-in	413.7	413.7	+0.00		Pass

HC-CLIP-TENSION: Leg A tension yielding: Ag Fy, Ag = L t

Source: Hand calculation (closed form). Calculation: Cold-formed steel clip angle.

HC-CLIP-TENSION · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Design tension	lb	18,306	18,306	+0.00		Pass

HC-CLIP-RUPTURE: Leg A shear rupture toward the free edge: 0.6 Fu × 2 n t enet

Source: Hand calculation (closed form). Calculation: Cold-formed steel clip angle.

HC-CLIP-RUPTURE · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Design rupture strength	lb	7,794	7,794	+0.00		Pass

SSMA-S-18-33-no8: no8 screw, two 18 mil sheets, Fy 33, Fu 33 ksi, allowable capacities

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-S-18-33-no8 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable shear	lb	48.00	48.23	+0.48		Pass
Allowable pull-out	lb	29.00	28.83	-0.59		Pass
Allowable pull-over	lb	84.00	84.37	+0.45		Pass

SSMA-S-33-33-no8: no8 screw, two 33 mil sheets, Fy 33, Fu 45 ksi, allowable capacities

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-S-33-33-no8 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable shear	lb	164.0	164.2	+0.12		Pass
Allowable pull-out	lb	72.00	72.35	+0.48		Pass
Allowable pull-over	lb	195.0	195.3	+0.17		Pass

SSMA-S-43-33-no8: no8 screw, two 43 mil sheets, Fy 33, Fu 45 ksi, allowable capacities

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-S-43-33-no8 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable shear	lb	244.0	244.4	+0.15		Pass
Allowable pull-out	lb	94.00	94.30	+0.32		Pass
Allowable pull-over	lb	195.0	195.3	+0.17		Pass

SSMA-S-54-33-no8: no8 screw, two 54 mil sheets, Fy 33, Fu 45 ksi, allowable capacities

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-S-54-33-no8 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable shear	lb	344.0	343.5	-0.13		Pass
Allowable pull-out	lb	118.0	118.4	+0.30		Pass
Allowable pull-over	lb	195.0	195.3	+0.17		Pass

SSMA-S-97-33-no8: no8 screw, two 97 mil sheets, Fy 33, Fu 45 ksi, allowable capacities

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-S-97-33-no8 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable shear	lb	426.0	426.0	+0.00		Pass
Allowable pull-out	lb	195.0	195.3	+0.17		Pass
Allowable pull-over	lb	195.0	195.3	+0.17		Pass

SSMA-S-33-33-no10: no10 screw, two 33 mil sheets, Fy 33, Fu 45 ksi, allowable capacities

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-S-33-33-no10 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable shear	lb	177.0	176.7	-0.15		Pass
Allowable pull-out	lb	84.00	83.82	-0.22		Pass
Allowable pull-over	lb	265.0	264.7	-0.12		Pass

SSMA-S-43-33-no10: no10 screw, two 43 mil sheets, Fy 33, Fu 45 ksi, allowable capacities

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-S-43-33-no10 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable shear	lb	263.0	263.0	+0.01		Pass
Allowable pull-out	lb	109.0	109.3	+0.23		Pass
Allowable pull-over	lb	345.0	345.0	+0.00		Pass

SSMA-S-54-33-no10: no10 screw, two 54 mil sheets, Fy 33, Fu 45 ksi, allowable capacities

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-S-54-33-no10 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable shear	lb	370.0	369.8	-0.06		Pass
Allowable pull-out	lb	137.0	137.1	+0.08		Pass
Allowable pull-over	lb	386.0	386.0	+0.00		Pass

SSMA-S-68-33-no10: no10 screw, two 68 mil sheets, Fy 33, Fu 45 ksi, allowable capacities

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-S-68-33-no10 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable shear	lb	523.0	522.8	-0.03		Pass
Allowable pull-out	lb	173.0	172.7	-0.16		Pass
Allowable pull-over	lb	386.0	386.0	+0.00		Pass

SSMA-S-54-50-no10: no10 screw, two 54 mil sheets, Fy 50, Fu 65 ksi, allowable capacities

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-S-54-50-no10 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable shear	lb	534.0	534.1	+0.02		Pass
Allowable pull-out	lb	198.0	198.1	+0.03		Pass
Allowable pull-over	lb	386.0	386.0	+0.00		Pass

SSMA-S-68-50-no10: no10 screw, two 68 mil sheets, Fy 50, Fu 65 ksi, allowable capacities

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-S-68-50-no10 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable shear	lb	548.0	548.0	+0.00		Pass
Allowable pull-out	lb	249.0	249.5	+0.20		Pass
Allowable pull-over	lb	386.0	386.0	+0.00		Pass

SSMA-S-33-33-no12: no12 screw, two 33 mil sheets, Fy 33, Fu 45 ksi, allowable capacities

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-S-33-33-no12 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable shear	lb	188.0	188.4	+0.24		Pass
Allowable pull-out	lb	95.00	95.29	+0.30		Pass
Allowable pull-over	lb	265.0	264.7	-0.12		Pass

SSMA-S-43-33-no12: no12 screw, two 43 mil sheets, Fy 33, Fu 45 ksi, allowable capacities

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-S-43-33-no12 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable shear	lb	280.0	280.4	+0.16		Pass
Allowable pull-out	lb	124.0	124.2	+0.17		Pass
Allowable pull-over	lb	345.0	345.0	+0.00		Pass

SSMA-S-54-50-no12: no12 screw, two 54 mil sheets, Fy 50, Fu 65 ksi, allowable capacities

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-S-54-50-no12 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable shear	lb	569.0	569.5	+0.09		Pass
Allowable pull-out	lb	225.0	225.2	+0.07		Pass
Allowable pull-over	lb	625.0	625.4	+0.07		Pass

SSMA-S-97-50-no12: no12 screw, two 97 mil sheets, Fy 50, Fu 65 ksi, allowable capacities

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-S-97-50-no12 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable shear	lb	777.0	776.7	-0.04		Pass
Allowable pull-out	lb	405.0	404.6	-0.11		Pass
Allowable pull-over	lb	775.0	775.0	+0.00		Pass

SSMA-S-118-50-quarter: quarter screw, two 118 mil sheets, Fy 50, Fu 65 ksi, allowable capacities

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-S-118-50-quarter · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable shear	lb	1,016	1,016	+0.00		Pass
Allowable pull-out	lb	572.0	571.8	-0.03		Pass
Allowable pull-over	lb	1,067	1,067	+0.00		Pass

SSMA-S-30-33-no6: no6 screw, two 30 mil sheets, Fy 33, Fu 33 ksi, allowable capacities

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-S-30-33-no6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable shear	lb	95.00	94.58	-0.44		Pass
Allowable pull-out	lb	40.00	40.26	+0.64		Pass
Allowable pull-over	lb	140.0	139.7	-0.24		Pass

SSMA-S-43-33-no6: no6 screw, two 43 mil sheets, Fy 33, Fu 45 ksi, allowable capacities

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-S-43-33-no6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable shear	lb	214.0	214.3	+0.16		Pass
Allowable pull-out	lb	79.00	79.35	+0.45		Pass
Allowable pull-over	lb	140.0	139.7	-0.24		Pass

SSMA-W-fillet-43-33-longitudinal: fillet weld, 43 mil, Fy 33 ksi, longitudinal, allowable lb per in.

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-W-fillet-43-33-longitudinal · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable per inch	lb	499.0	499.1	+0.01		Pass

SSMA-W-fillet-43-33-transverse: fillet weld, 43 mil, Fy 33 ksi, transverse, allowable lb per in.

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-W-fillet-43-33-transverse · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable per inch	lb	864.0	863.6	-0.04		Pass

SSMA-W-fillet-68-50-longitudinal: fillet weld, 68 mil, Fy 50 ksi, longitudinal, allowable lb per in.

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-W-fillet-68-50-longitudinal · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable per inch	lb	1,140	1,140	-0.03		Pass

SSMA-W-fillet-68-50-transverse: fillet weld, 68 mil, Fy 50 ksi, transverse, allowable lb per in.

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-W-fillet-68-50-transverse · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable per inch	lb	1,972	1,972	+0.01		Pass

SSMA-W-fillet-97-50-longitudinal: fillet weld, 97 mil, Fy 50 ksi, longitudinal, allowable lb per in.

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-W-fillet-97-50-longitudinal · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable per inch	lb	1,269	1,269	-0.01		Pass

SSMA-W-fillet-97-33-transverse: fillet weld, 97 mil, Fy 33 ksi, transverse, allowable lb per in.

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-W-fillet-97-33-transverse · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable per inch	lb	1,269	1,269	-0.01		Pass

SSMA-W-flare-43-33-longitudinal: flare weld, 43 mil, Fy 33 ksi, longitudinal, allowable lb per in.

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-W-flare-43-33-longitudinal · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable per inch	lb	544.0	543.6	-0.07		Pass

SSMA-W-flare-43-33-transverse: flare weld, 43 mil, Fy 33 ksi, transverse, allowable lb per in.

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-W-flare-43-33-transverse · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable per inch	lb	663.0	663.0	-0.00		Pass

SSMA-W-flare-54-50-longitudinal: flare weld, 54 mil, Fy 50 ksi, longitudinal, allowable lb per in.

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-W-flare-54-50-longitudinal · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable per inch	lb	985.0	985.4	+0.05		Pass

SSMA-W-flare-68-50-transverse: flare weld, 68 mil, Fy 50 ksi, transverse, allowable lb per in.

Source: SSMA Product Technical Guide (2022), Screw and Weld Capacities, pp. 70. Calculation: Cold-formed steel fastener connection.

SSMA-W-flare-68-50-transverse · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable per inch	lb	1,514	1,514	-0.00		Pass

HC-BOLT-1: 1/2 in. A307 bolt, two 68 mil sheets, washers both sides

Source: Hand calculation (closed form). Calculation: Cold-formed steel fastener connection.

HC-BOLT-1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Design bearing, 0.60 × 3.0 × 1.00 × d t Fu	lb	4,171	4,171	+0.00		Pass
Design bolt shear, 0.75 × Ab × 27 ksi	lb	3,976	3,976	-0.00		Pass
Design shear rupture, 0.65 × 0.6 Fu × 2 t enet	lb	6,213	6,213	-0.00		Pass

HC-SCREW-1: No. 10, 33 mil at the head on 97 mil at the tip: t2/t1 = 2.94, bearing governs

Source: Hand calculation (closed form). Calculation: Cold-formed steel fastener connection.

HC-SCREW-1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Design sheet shear, 0.50 × 2.7 t1 d Fu1	lb	399.4	399.4	+0.00		Pass

SSMA-CW-SEC-362S162-54: 362S162-54 (50 ksi): the two section values the double span table's interior check rests on, both at the punchout

Source: SSMA Product Technical Guide (2022), Structural Section Properties, pp. 9. Calculation: Cold-formed steel curtain wall.

SSMA-CW-SEC-362S162-54 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable moment Mal	lb-in	13,280	13,318	+0.29		Pass
Allowable shear at a punchout Vanet	lb	1,016	1,016	+0.02		Pass

SSMA-CW-single-400S162-54-16-15-240: 400S162-54 (50 ksi) at 16 in., 15 psf, L/240, single span

Source: SSMA Product Technical Guide (2022), Curtain Wall Limiting Heights, pp. 26. Calculation: Cold-formed steel curtain wall.

SSMA-CW-single-400S162-54-16-15-240 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Limiting height	ft	17.25	17.26	+0.05		Pass

SSMA-CW-single-400S162-54-16-15-360: 400S162-54 (50 ksi) at 16 in., 15 psf, L/360, single span

Source: SSMA Product Technical Guide (2022), Curtain Wall Limiting Heights, pp. 26. Calculation: Cold-formed steel curtain wall.

SSMA-CW-single-400S162-54-16-15-360 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Limiting height	ft	15.08	15.08	-0.05		Pass

SSMA-CW-single-400S162-54-16-15-600: 400S162-54 (50 ksi) at 16 in., 15 psf, L/600, single span

Source: SSMA Product Technical Guide (2022), Curtain Wall Limiting Heights, pp. 26. Calculation: Cold-formed steel curtain wall.

SSMA-CW-single-400S162-54-16-15-600 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Limiting height	ft	12.75	12.72	-0.27		Pass

SSMA-CW-single-400S162-54-16-20-240: 400S162-54 (50 ksi) at 16 in., 20 psf, L/240, single span

Source: SSMA Product Technical Guide (2022), Curtain Wall Limiting Heights, pp. 26. Calculation: Cold-formed steel curtain wall.

SSMA-CW-single-400S162-54-16-20-240 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Limiting height	ft	15.67	15.68	+0.09		Pass

SSMA-CW-single-400S162-54-16-20-360: 400S162-54 (50 ksi) at 16 in., 20 psf, L/360, single span

Source: SSMA Product Technical Guide (2022), Curtain Wall Limiting Heights, pp. 26. Calculation: Cold-formed steel curtain wall.

SSMA-CW-single-400S162-54-16-20-360 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Limiting height	ft	13.67	13.70	+0.23		Pass

SSMA-CW-single-400S162-54-16-20-600: 400S162-54 (50 ksi) at 16 in., 20 psf, L/600, single span

Source: SSMA Product Technical Guide (2022), Curtain Wall Limiting Heights, pp. 26. Calculation: Cold-formed steel curtain wall.

SSMA-CW-single-400S162-54-16-20-600 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Limiting height	ft	11.58	11.55	-0.26		Pass

SSMA-CW-single-400S162-54-16-5-240: 400S162-54 (50 ksi) at 16 in., 5 psf, L/240, single span

Source: SSMA Product Technical Guide (2022), Curtain Wall Limiting Heights, pp. 26. Calculation: Cold-formed steel curtain wall.

SSMA-CW-single-400S162-54-16-5-240 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Limiting height	ft	22.08	22.10	+0.08		Pass

SSMA-CW-single-400S162-54-16-5-360: 400S162-54 (50 ksi) at 16 in., 5 psf, L/360, single span

Source: SSMA Product Technical Guide (2022), Curtain Wall Limiting Heights, pp. 26. Calculation: Cold-formed steel curtain wall.

SSMA-CW-single-400S162-54-16-5-360 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Limiting height	ft	19.33	19.31	-0.14		Pass

SSMA-CW-single-600S162-43-16-15-240: 600S162-43 (33 ksi) at 16 in., 15 psf, L/240, single span

Source: SSMA Product Technical Guide (2022), Curtain Wall Limiting Heights, pp. 26. Calculation: Cold-formed steel curtain wall.

SSMA-CW-single-600S162-43-16-15-240 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Limiting height	ft	21.92	22.13	+0.99		Pass

SSMA-CW-single-600S162-43-16-15-360: 600S162-43 (33 ksi) at 16 in., 15 psf, L/360, single span

Source: SSMA Product Technical Guide (2022), Curtain Wall Limiting Heights, pp. 26. Calculation: Cold-formed steel curtain wall.

SSMA-CW-single-600S162-43-16-15-360 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Limiting height	ft	19.33	19.34	+0.01		Pass

SSMA-CW-single-600S162-43-16-15-600: 600S162-43 (33 ksi) at 16 in., 15 psf, L/600, single span

Source: SSMA Product Technical Guide (2022), Curtain Wall Limiting Heights, pp. 26. Calculation: Cold-formed steel curtain wall.

SSMA-CW-single-600S162-43-16-15-600 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Limiting height	ft	16.33	16.31	-0.15		Pass

SSMA-CW-single-600S162-43-16-20-360: 600S162-43 (33 ksi) at 16 in., 20 psf, L/360, single span

Source: SSMA Product Technical Guide (2022), Curtain Wall Limiting Heights, pp. 26. Calculation: Cold-formed steel curtain wall.

SSMA-CW-single-600S162-43-16-20-360 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Limiting height	ft	17.58	17.57	-0.09		Pass

SSMA-CW-single-800S162-54-16-15-240: 800S162-54 (50 ksi) at 16 in., 15 psf, L/240, single span

Source: SSMA Product Technical Guide (2022), Curtain Wall Limiting Heights, pp. 27. Calculation: Cold-formed steel curtain wall.

SSMA-CW-single-800S162-54-16-15-240 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Limiting height	ft	29.92	29.95	+0.10		Pass

SSMA-CW-single-800S162-54-16-15-360: 800S162-54 (50 ksi) at 16 in., 15 psf, L/360, single span

Source: SSMA Product Technical Guide (2022), Curtain Wall Limiting Heights, pp. 27. Calculation: Cold-formed steel curtain wall.

SSMA-CW-single-800S162-54-16-15-360 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Limiting height	ft	26.17	26.16	-0.02		Pass

SSMA-CW-single-800S162-54-16-15-600: 800S162-54 (50 ksi) at 16 in., 15 psf, L/600, single span

Source: SSMA Product Technical Guide (2022), Curtain Wall Limiting Heights, pp. 27. Calculation: Cold-formed steel curtain wall.

SSMA-CW-single-800S162-54-16-15-600 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Limiting height	ft	22.08	22.07	-0.08		Pass

SSMA-CW-single-800S162-54-16-20-600: 800S162-54 (50 ksi) at 16 in., 20 psf, L/600, single span

Source: SSMA Product Technical Guide (2022), Curtain Wall Limiting Heights, pp. 27. Calculation: Cold-formed steel curtain wall.

SSMA-CW-single-800S162-54-16-20-600 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Limiting height	ft	20.08	20.05	-0.18		Pass

SSMA-CW-double-362S162-54-16-15-240: 362S162-54 (50 ksi) at 16 in., 15 psf, L/240, double span

Source: SSMA Product Technical Guide (2022), Curtain Wall Limiting Heights, pp. 28. Calculation: Cold-formed steel curtain wall.

SSMA-CW-double-362S162-54-16-15-240 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Limiting span	ft	20.67	20.72	+0.25		Pass

SSMA-CW-double-362S162-54-16-15-360: 362S162-54 (50 ksi) at 16 in., 15 psf, L/360, double span

Source: SSMA Product Technical Guide (2022), Curtain Wall Limiting Heights, pp. 28. Calculation: Cold-formed steel curtain wall.

SSMA-CW-double-362S162-54-16-15-360 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Limiting span	ft	18.75	18.72	-0.17		Pass

SSMA-CW-double-362S162-54-16-15-600: 362S162-54 (50 ksi) at 16 in., 15 psf, L/600, double span

Source: SSMA Product Technical Guide (2022), Curtain Wall Limiting Heights, pp. 28. Calculation: Cold-formed steel curtain wall.

SSMA-CW-double-362S162-54-16-15-600 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Limiting span	ft	15.75	15.79	+0.23		Pass

SSMA-CW-double-362S162-54-16-20-600: 362S162-54 (50 ksi) at 16 in., 20 psf, L/600, double span

Source: SSMA Product Technical Guide (2022), Curtain Wall Limiting Heights, pp. 28. Calculation: Cold-formed steel curtain wall.

SSMA-CW-double-362S162-54-16-20-600 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Limiting span	ft	14.33	14.34	+0.07		Pass

HC-CW-1: 600S162-43, single interior stud to a 43 mil track, 1-1/4 in. flange: Eq. B3.2.5.1-1

Source: Hand calculation (closed form). Calculation: Cold-formed steel curtain wall.

HC-CW-1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Design Pnst	lb	654.1	654.1	+0.00		Pass

HC-CW-2: Deflection track 54 mil, gap 3/4 in., studs at 16 in.: Eqs. B3.2.5.2-1, -2

Source: Hand calculation (closed form). Calculation: Cold-formed steel curtain wall.

HC-CW-2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Design Pndt	lb	369.3	369.3	-0.00		Pass

S240-T-SI-1532-B6: Structural I 15/32 in., blocked, 6 in. edges

Source: AISI S240-20, Table B5.4.2.2-1, pp. 91 (PDF). Calculation: Cold-formed steel diaphragm.

S240-T-SI-1532-B6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nominal unit shear	plf	925.0	925.0	+0.00		Pass
Design unit shear	plf	601.2	601.2	+0.00		Pass

S240-T-SI-1532-B6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable unit shear	plf	462.5	462.5	+0.00		Pass

S240-T-SI-716-B4: Structural I 7/16 in., blocked, 4 in. edges

Source: AISI S240-20, Table B5.4.2.2-1, pp. 91 (PDF). Calculation: Cold-formed steel diaphragm.

S240-T-SI-716-B4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nominal unit shear	plf	1,127	1,127	+0.00		Pass
Design unit shear	plf	732.6	732.5	+0.00		Pass

S240-T-SI-716-B4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable unit shear	plf	563.5	563.5	+0.00		Pass

S240-T-OT-38-B2: Other graded 3/8 in., blocked, 2 in. edges

Source: AISI S240-20, Table B5.4.2.2-1, pp. 91 (PDF). Calculation: Cold-formed steel diaphragm.

S240-T-OT-38-B2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nominal unit shear	plf	1,840	1,840	+0.00		Pass
Design unit shear	plf	1,196	1,196	+0.00		Pass

S240-T-OT-38-B2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable unit shear	plf	920.0	920.0	+0.00		Pass

S240-T-SI-1532-UP: Structural I 15/32 in., unblocked, load perpendicular to unblocked edges

Source: AISI S240-20, Table B5.4.2.2-1, pp. 91 (PDF). Calculation: Cold-formed steel diaphragm.

S240-T-SI-1532-UP · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nominal unit shear	plf	825.0	825.0	+0.00		Pass
Design unit shear	plf	536.2	536.2	+0.00		Pass

S240-T-SI-1532-UP · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable unit shear	plf	412.5	412.5	+0.00		Pass

S240-T-OT-716-UO: Other graded 7/16 in., unblocked, other configurations

Source: AISI S240-20, Table B5.4.2.2-1, pp. 91 (PDF). Calculation: Cold-formed steel diaphragm.

S240-T-OT-716-UO · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nominal unit shear	plf	505.0	505.0	+0.00		Pass
Design unit shear	plf	328.2	328.2	+0.00		Pass

S240-T-OT-716-UO · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable unit shear	plf	252.5	252.5	+0.00		Pass

S400-T-SI-1532-B25: Structural I 15/32 in., blocked, 2.5 in. edges (seismic)

Source: AISI S400-20, Table F2.4-1, pp. 80 (PDF). Calculation: Cold-formed steel diaphragm.

S400-T-SI-1532-B25 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nominal unit shear	plf	1,970	1,970	+0.00		Pass
Design unit shear	plf	1,182	1,182	+0.00		Pass

S400-T-SI-1532-B25 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable unit shear	plf	788.0	788.0	+0.00		Pass

HC-DIAPH-STATICS: 300 plf over 40 ft, 20 ft deep: unit shear and chord force

Source: Hand calculation (closed form). Calculation: Cold-formed steel diaphragm.

HC-DIAPH-STATICS · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Unit shear	plf	300.0	300.0	+0.00		Pass
Chord force	lb	3,000	3,000	+0.00		Pass

HC-DIAPH-STATICS · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Unit shear, 0.6W	plf	180.0	180.0	+0.00		Pass

HC-DIAPH-DEFL: Blocked diaphragm deflection, Eq. B5.4.2.4-1 term by term

Source: Hand calculation (closed form). Calculation: Cold-formed steel diaphragm.

HC-DIAPH-DEFL · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Deflection, blocked	in.	0.152	0.152	+0.00		Pass

HC-DIAPH-DEFL-UB: Unblocked: 2.5 times Eq. B5.4.2.4-1 (Eq. B5.4.2.4-5)

Source: Hand calculation (closed form). Calculation: Cold-formed steel diaphragm.

HC-DIAPH-DEFL-UB · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Deflection, unblocked	in.	0.380	0.380	+0.00		Pass

HAND-CFV-SLAB: 1200S200-68 joists at 24 in., 24 ft, concrete on deck (the default)

Source: Hand calculation (closed form), SSMA Guide (2022) section properties. Calculation: Cold-formed steel floor vibration.

Hand calculation; the joist panel mode only.

HAND-CFV-SLAB · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Natural frequency fn (DG11 Eq. 3-3)	Hz	6.843	6.843	+0.01		Pass
Effective weight W (DG11 Eq. 4-2)	lb	50,323	50,321	-0.00		Pass
ap/g (DG11 Eq. 4-1)	%g	0.393	0.393	-0.01		Pass

HAND-CFV-SHEATH: 800S162-54 joists at 16 in., 11.5 ft, sheathed floor (high frequency)

Source: Hand calculation (closed form), SSMA Guide (2022) section properties. Calculation: Cold-formed steel floor vibration.

Hand calculation; Eq. 2-10 rebuilt from Eqs. 1-6, 2-7 to 2-9.

HAND-CFV-SHEATH · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Natural frequency fn	Hz	12.06	12.06	+0.00		Pass
Effective weight W	lb	3,167	3,167	-0.00		Pass
aESPA/g (DG11 Eq. 2-10, h = 6)	%g	7.872	7.873	+0.00		Pass
Limit ao fn / 8 (Figure 2-1 above 8 Hz)	%g	0.754	0.754	+0.00		Pass

HAND-GIRT-DEFAULT: 8ZS2.75x085 (55 ksi), 20 ft simple span, 5 ft spacing, +20 / −22 psf

Source: Hand calculation (closed form). Calculation: Cold-formed steel girt.

Hand calculation, Se from the MBMA Guide through calcs/cfs_z.py.

HAND-GIRT-DEFAULT · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Suction moment w L²/8	lb-in	66,000	66,000	-0.00		Pass
Pressure moment w L²/8	lb-in	60,000	60,000	-0.00		Pass
φ R Mno, R = 0.65 (6.5 < d ≤ 8.5 in.) Se published (MBMA Guide p. 83); R from Table I6.2.1-1	lb-in	91,377	91,932	+0.61		Pass
φ Mno, panel flange braced	lb-in	140,580	141,434	+0.61		Pass

HAND-GIRT-DEFAULT · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Suction moment 0.6 w L²/8	lb-in	39,600	39,600	-0.00		Pass
R Mno / Ω	lb-in	60,796	61,166	+0.61		Pass

HAND-GIRT-ASCE: Wall zone 4 pressures, V = 115 mph, Exposure C, h = 20 ft, enclosed

Source: Hand calculation (closed form). Calculation: Cold-formed steel girt.

Hand calculation: Kh by Table 26.10-1 note 1, GCp of Fig. 30.3-1 linear in log A between 10 and 500 ft².

HAND-GIRT-ASCE · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
qh = 0.00256 Kh V²	psf	30.56	30.56	+0.00		Pass
Suction qh (|GCp| + 0.18)	psf	33.05	33.05	-0.00		Pass
Pressure qh (GCp + 0.18)	psf	29.99	29.99	-0.00		Pass

HAND-GIRT-ROD: Sag rod: 1/2 in. A36, three girts

Source: Hand calculation (closed form). Calculation: Cold-formed steel girt.

Hand calculation, AISC 360-22 J3.7.

HAND-GIRT-ROD · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φ Rn = 0.75 × 0.75 Fu Ab	lb	6,406	6,406	+0.00		Pass

HAND-GIRT-CONT: Two continuous spans, laps confirmed: R = 0.70 for a Z

Source: Hand calculation (closed form). Calculation: Cold-formed steel girt.

Hand calculation: two equal spans, the largest positive moment 9wL²/128.

HAND-GIRT-CONT · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φ R Mno, continuous Z	lb-in	98,406	99,004	+0.61		Pass
Suction moment at mid-span 9 w L²/128	lb-in	37,125	37,107	-0.05		Pass

SSMA-HDR-800S162-54-3: 2 × 800S162-54 (50 ksi), 3 ft span, allowable uniform load

Source: SSMA Product Technical Guide (2022), Header Allowable Uniform Loads, pp. 56. Calculation: Cold-formed steel header.

Back-to-back or boxed: the table is the same for both.

SSMA-HDR-800S162-54-3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable uniform load	plf	2,788	2,788	-0.02		Pass

SSMA-HDR-800S162-54-6: 2 × 800S162-54 (50 ksi), 6 ft span, allowable uniform load

Source: SSMA Product Technical Guide (2022), Header Allowable Uniform Loads, pp. 56. Calculation: Cold-formed steel header.

Back-to-back or boxed: the table is the same for both.

SSMA-HDR-800S162-54-6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable uniform load	plf	1,215	1,215	+0.00		Pass

SSMA-HDR-800S162-54-8: 2 × 800S162-54 (50 ksi), 8 ft span, allowable uniform load

Source: SSMA Product Technical Guide (2022), Header Allowable Uniform Loads, pp. 56. Calculation: Cold-formed steel header.

Back-to-back or boxed: the table is the same for both.

SSMA-HDR-800S162-54-8 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable uniform load	plf	683.6	683.6	-0.00		Pass

SSMA-HDR-800S162-54-10: 2 × 800S162-54 (50 ksi), 10 ft span, allowable uniform load

Source: SSMA Product Technical Guide (2022), Header Allowable Uniform Loads, pp. 56. Calculation: Cold-formed steel header.

Back-to-back or boxed: the table is the same for both.

SSMA-HDR-800S162-54-10 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable uniform load	plf	437.5	437.5	-0.00		Pass

SSMA-HDR-800S162-54-12: 2 × 800S162-54 (50 ksi), 12 ft span, allowable uniform load

Source: SSMA Product Technical Guide (2022), Header Allowable Uniform Loads, pp. 56. Calculation: Cold-formed steel header.

Back-to-back or boxed: the table is the same for both.

SSMA-HDR-800S162-54-12 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable uniform load	plf	283.3	286.2	+1.03		Deviation CFS-SSMA-IXE

CFS-SSMA-IXE: the table takes the effective inertia at the allowable moment; the module takes it at the service moment, a little stiffer

SSMA-HDR-800S162-43-6: 2 × 800S162-43 (33 ksi), 6 ft span, allowable uniform load

Source: SSMA Product Technical Guide (2022), Header Allowable Uniform Loads, pp. 56. Calculation: Cold-formed steel header.

Back-to-back or boxed: the table is the same for both.

SSMA-HDR-800S162-43-6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable uniform load	plf	678.8	678.8	+0.00		Pass

SSMA-HDR-800S162-43-8: 2 × 800S162-43 (33 ksi), 8 ft span, allowable uniform load

Source: SSMA Product Technical Guide (2022), Header Allowable Uniform Loads, pp. 56. Calculation: Cold-formed steel header.

Back-to-back or boxed: the table is the same for both.

SSMA-HDR-800S162-43-8 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable uniform load	plf	381.8	381.8	+0.01		Pass

SSMA-HDR-800S162-43-12: 2 × 800S162-43 (33 ksi), 12 ft span, allowable uniform load

Source: SSMA Product Technical Guide (2022), Header Allowable Uniform Loads, pp. 56. Calculation: Cold-formed steel header.

Back-to-back or boxed: the table is the same for both.

SSMA-HDR-800S162-43-12 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable uniform load	plf	169.7	169.7	+0.00		Pass

SSMA-HDR-600S162-33-4: 2 × 600S162-33 (33 ksi), 4 ft span, allowable uniform load

Source: SSMA Product Technical Guide (2022), Header Allowable Uniform Loads, pp. 56. Calculation: Cold-formed steel header.

Back-to-back or boxed: the table is the same for both.

SSMA-HDR-600S162-33-4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable uniform load	plf	638.1	637.9	-0.03		Pass

SSMA-HDR-600S162-33-6: 2 × 600S162-33 (33 ksi), 6 ft span, allowable uniform load

Source: SSMA Product Technical Guide (2022), Header Allowable Uniform Loads, pp. 56. Calculation: Cold-formed steel header.

Back-to-back or boxed: the table is the same for both.

SSMA-HDR-600S162-33-6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable uniform load	plf	350.6	350.6	+0.00		Pass

SSMA-HDR-600S162-33-12: 2 × 600S162-33 (33 ksi), 12 ft span, allowable uniform load

Source: SSMA Product Technical Guide (2022), Header Allowable Uniform Loads, pp. 56. Calculation: Cold-formed steel header.

Back-to-back or boxed: the table is the same for both.

SSMA-HDR-600S162-33-12 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable uniform load	plf	87.60	87.65	+0.06		Pass

SSMA-HDR-800S200-54-8: 2 × 800S200-54 (50 ksi), 8 ft span, allowable uniform load

Source: SSMA Product Technical Guide (2022), Header Allowable Uniform Loads, pp. 56. Calculation: Cold-formed steel header.

Back-to-back or boxed: the table is the same for both.

SSMA-HDR-800S200-54-8 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable uniform load	plf	778.6	778.6	-0.01		Pass

SSMA-HDR-800S200-54-12: 2 × 800S200-54 (50 ksi), 12 ft span, allowable uniform load

Source: SSMA Product Technical Guide (2022), Header Allowable Uniform Loads, pp. 56. Calculation: Cold-formed steel header.

Back-to-back or boxed: the table is the same for both.

SSMA-HDR-800S200-54-12 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable uniform load	plf	332.5	332.5	-0.01		Pass

SSMA-HDR-800S162-68-8: 2 × 800S162-68 (50 ksi), 8 ft span, allowable uniform load

Source: SSMA Product Technical Guide (2022), Header Allowable Uniform Loads, pp. 56. Calculation: Cold-formed steel header.

Back-to-back or boxed: the table is the same for both.

SSMA-HDR-800S162-68-8 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable uniform load	plf	939.8	939.8	-0.00		Pass

SSMA-HDR-800S162-68-12: 2 × 800S162-68 (50 ksi), 12 ft span, allowable uniform load

Source: SSMA Product Technical Guide (2022), Header Allowable Uniform Loads, pp. 56. Calculation: Cold-formed steel header.

Back-to-back or boxed: the table is the same for both.

SSMA-HDR-800S162-68-12 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable uniform load	plf	357.6	358.6	+0.28		Pass

SSMA-WCB-600S162-54-N1: 2 × 600S162-54 (50 ksi) back to back, web crippling, fastened, N = 1 in.

Source: SSMA Product Technical Guide (2022), Allowable Web Crippling Loads, Back-to-Back Members, pp. 60. Calculation: Cold-formed steel header.

SSMA-WCB-600S162-54-N1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Condition 1, end one-flange	lb	2,860	2,860	+0.00		Pass
Condition 2, interior one-flange	lb	4,302	4,302	-0.01		Pass

SSMA-WCB-600S162-54-N3.5: 2 × 600S162-54 (50 ksi) back to back, web crippling, fastened, N = 3.5 in.

Source: SSMA Product Technical Guide (2022), Allowable Web Crippling Loads, Back-to-Back Members, pp. 60. Calculation: Cold-formed steel header.

SSMA-WCB-600S162-54-N3.5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Condition 1, end one-flange	lb	4,207	4,207	-0.01		Pass
Condition 2, interior one-flange	lb	5,486	5,486	-0.00		Pass

SSMA-WCB-800S162-54-N1: 2 × 800S162-54 (50 ksi) back to back, web crippling, fastened, N = 1 in.

Source: SSMA Product Technical Guide (2022), Allowable Web Crippling Loads, Back-to-Back Members, pp. 60. Calculation: Cold-formed steel header.

SSMA-WCB-800S162-54-N1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Condition 1, end one-flange	lb	2,855	2,855	+0.01		Pass
Condition 2, interior one-flange	lb	4,295	4,295	-0.01		Pass

SSMA-WCB-800S162-54-N3.5: 2 × 800S162-54 (50 ksi) back to back, web crippling, fastened, N = 3.5 in.

Source: SSMA Product Technical Guide (2022), Allowable Web Crippling Loads, Back-to-Back Members, pp. 60. Calculation: Cold-formed steel header.

SSMA-WCB-800S162-54-N3.5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Condition 1, end one-flange	lb	4,200	4,200	-0.01		Pass
Condition 2, interior one-flange	lb	5,477	5,477	-0.00		Pass

SSMA-WCB-800S162-54-N6: 2 × 800S162-54 (50 ksi) back to back, web crippling, fastened, N = 6 in.

Source: SSMA Product Technical Guide (2022), Allowable Web Crippling Loads, Back-to-Back Members, pp. 60. Calculation: Cold-formed steel header.

SSMA-WCB-800S162-54-N6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Condition 1, end one-flange	lb	5,093	5,093	-0.00		Pass
Condition 2, interior one-flange	lb	6,263	6,263	-0.01		Pass

SSMA-WCB-800S162-68-N1: 2 × 800S162-68 (50 ksi) back to back, web crippling, fastened, N = 1 in.

Source: SSMA Product Technical Guide (2022), Allowable Web Crippling Loads, Back-to-Back Members, pp. 60. Calculation: Cold-formed steel header.

SSMA-WCB-800S162-68-N1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Condition 1, end one-flange	lb	4,270	4,270	-0.00		Pass
Condition 2, interior one-flange	lb	6,589	6,589	+0.00		Pass

SSMA-WCB-800S162-68-N3.5: 2 × 800S162-68 (50 ksi) back to back, web crippling, fastened, N = 3.5 in.

Source: SSMA Product Technical Guide (2022), Allowable Web Crippling Loads, Back-to-Back Members, pp. 60. Calculation: Cold-formed steel header.

SSMA-WCB-800S162-68-N3.5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Condition 1, end one-flange	lb	6,173	6,173	+0.00		Pass
Condition 2, interior one-flange	lb	8,263	8,263	+0.00		Pass

SSMA-WCB-800S162-68-N6: 2 × 800S162-68 (50 ksi) back to back, web crippling, fastened, N = 6 in.

Source: SSMA Product Technical Guide (2022), Allowable Web Crippling Loads, Back-to-Back Members, pp. 60. Calculation: Cold-formed steel header.

SSMA-WCB-800S162-68-N6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Condition 1, end one-flange	lb	7,438	7,438	-0.00		Pass
Condition 2, interior one-flange	lb	9,375	9,376	+0.01		Pass

DG8-T3-600L150-43-16: 2 × 600L150-43 (33 ksi), 24 ft building, ground snow 16 psf

Source: CFSEI Design Guide 8 (2000), L-Header Field Guide, Table 3, pp. 7. Calculation: Cold-formed steel header.

DG8-T3-600L150-43-16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span A cross-check on assumed tributary width and snow factor; see the module's Verification section.	ft	4.833	4.797	-0.75		Pass

DG8-T3-600L150-54-16: 2 × 600L150-54 (33 ksi), 24 ft building, ground snow 16 psf

Source: CFSEI Design Guide 8 (2000), L-Header Field Guide, Table 3, pp. 7. Calculation: Cold-formed steel header.

DG8-T3-600L150-54-16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span A cross-check on assumed tributary width and snow factor; see the module's Verification section.	ft	5.500	5.547	+0.86		Pass

DG8-T3-600L150-68-16: 2 × 600L150-68 (33 ksi), 24 ft building, ground snow 16 psf

Source: CFSEI Design Guide 8 (2000), L-Header Field Guide, Table 3, pp. 7. Calculation: Cold-formed steel header.

DG8-T3-600L150-68-16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span A cross-check on assumed tributary width and snow factor; see the module's Verification section.	ft	6.250	6.433	+2.93		Deviation CFS-DG8-BASIS
CFS-DG8-BASIS: the guide prints spans without its method, tributary width or snow factor; the comparison assumes them, and the guide predates the S240 factors						

DG8-T3-800L150-43-16: 2 × 800L150-43 (33 ksi), 24 ft building, ground snow 16 psf

Source: CFSEI Design Guide 8 (2000), L-Header Field Guide, Table 3, pp. 7. Calculation: Cold-formed steel header.

DG8-T3-800L150-43-16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span A cross-check on assumed tributary width and snow factor; see the module's Verification section.	ft	6.333	6.126	-3.27		Deviation CFS-DG8-BASIS
CFS-DG8-BASIS: the guide prints spans without its method, tributary width or snow factor; the comparison assumes them, and the guide predates the S240 factors						

DG8-T3-800L150-54-16: 2 × 800L150-54 (33 ksi), 24 ft building, ground snow 16 psf

Source: CFSEI Design Guide 8 (2000), L-Header Field Guide, Table 3, pp. 7. Calculation: Cold-formed steel header.

DG8-T3-800L150-54-16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span A cross-check on assumed tributary width and snow factor; see the module's Verification section.	ft	7.250	7.046	-2.82		Deviation CFS-DG8-BASIS
CFS-DG8-BASIS: the guide prints spans without its method, tributary width or snow factor; the comparison assumes them, and the guide predates the S240 factors						

DG8-T3-800L150-68-16: 2 × 800L150-68 (33 ksi), 24 ft building, ground snow 16 psf

Source: CFSEI Design Guide 8 (2000), L-Header Field Guide, Table 3, pp. 7. Calculation: Cold-formed steel header.

DG8-T3-800L150-68-16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span A cross-check on assumed tributary width and snow factor; see the module's Verification section.	ft	8.167	8.129	-0.47		Pass

DG8-T3-1000L150-43-16: 2 × 1000L150-43 (33 ksi), 24 ft building, ground snow 16 psf

Source: CFSEI Design Guide 8 (2000), L-Header Field Guide, Table 3, pp. 7. Calculation: Cold-formed steel header.

DG8-T3-1000L150-43-16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span A cross-check on assumed tributary width and snow factor; see the module's Verification section.	ft	7.000	5.941	-15.13		Deviation CFS-DG8-BASIS
CFS-DG8-BASIS: the guide prints spans without its method, tributary width or snow factor; the comparison assumes them, and the guide predates the S240 factors						

DG8-T3-1000L150-54-16: 2 × 1000L150-54 (33 ksi), 24 ft building, ground snow 16 psf

Source: CFSEI Design Guide 8 (2000), L-Header Field Guide, Table 3, pp. 7. Calculation: Cold-formed steel header.

DG8-T3-1000L150-54-16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span A cross-check on assumed tributary width and snow factor; see the module's Verification section.	ft	8.917	7.350	-17.57		Deviation CFS-DG8-BASIS
CFS-DG8-BASIS: the guide prints spans without its method, tributary width or snow factor; the comparison assumes them, and the guide predates the S240 factors						

DG8-T3-1000L150-68-16: 2 × 1000L150-68 (33 ksi), 24 ft building, ground snow 16 psf

Source: CFSEI Design Guide 8 (2000), L-Header Field Guide, Table 3, pp. 7. Calculation: Cold-formed steel header.

DG8-T3-1000L150-68-16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span A cross-check on assumed tributary width and snow factor; see the module's Verification section.	ft	10.08	8.448	-16.22		Deviation CFS-DG8-BASIS
CFS-DG8-BASIS: the guide prints spans without its method, tributary width or snow factor; the comparison assumes them, and the guide predates the S240 factors						

DG8-T3-600L150-43-70: 2 × 600L150-43 (33 ksi), 24 ft building, ground snow 70 psf

Source: CFSEI Design Guide 8 (2000), L-Header Field Guide, Table 3, pp. 7. Calculation: Cold-formed steel header.

DG8-T3-600L150-43-70 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span A cross-check on assumed tributary width and snow factor; see the module's Verification section.	ft	3.167	3.280	+3.59		Deviation CFS-DG8-BASIS
CFS-DG8-BASIS: the guide prints spans without its method, tributary width or snow factor; the comparison assumes them, and the guide predates the S240 factors						

DG8-T3-800L150-43-70: 2 × 800L150-43 (33 ksi), 24 ft building, ground snow 70 psf

Source: CFSEI Design Guide 8 (2000), L-Header Field Guide, Table 3, pp. 7. Calculation: Cold-formed steel header.

DG8-T3-800L150-43-70 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span A cross-check on assumed tributary width and snow factor; see the module's Verification section.	ft	4.167	4.189	+0.54		Pass

DG8-T3-800L150-54-70: 2 × 800L150-54 (33 ksi), 24 ft building, ground snow 70 psf

Source: CFSEI Design Guide 8 (2000), L-Header Field Guide, Table 3, pp. 7. Calculation: Cold-formed steel header.

DG8-T3-800L150-54-70 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span A cross-check on assumed tributary width and snow factor; see the module's Verification section.	ft	4.750	4.818	+1.43		Deviation CFS-DG8-BASIS

CFS-DG8-BASIS: the guide prints spans without its method, tributary width or snow factor; the comparison assumes them, and the guide predates the S240 factors

HC-L-1: 800L150-54 at 33 ksi: the section modulus at the compression fiber

Source: Hand calculation (closed form). Calculation: Cold-formed steel header.

Manual linear method, S240 Commentary Eq. C-B3.3.3-1, vertical leg fully effective.

HC-L-1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mng / Ω = 2 Sxc Fy / 1.67	lb-in	34,609	34,610	+0.00		Pass

HC-L-1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φ Mng = 0.90 × 2 Sxc Fy	lb-in	52,018	52,019	+0.00		Pass

HC-L-2: 800L150-54 uplift: R = 0.25, Ω = 2.0, φ = 0.80

Source: Hand calculation (closed form). Calculation: Cold-formed steel header.

HC-L-2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mnu / Ω	lb-in	7,225	7,225	+0.00		Pass

HC-L-2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φ Mnu	lb-in	11,560	11,560	+0.00		Pass

HC-L-3: 800L150-54 inverted double: Mng and Mnu each with its own factor

Source: Hand calculation (closed form). Calculation: Cold-formed steel header.

S240 B3.3.5.2 sums the nominal strengths and names no factor for the sum: the module's reading.

HC-L-3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mng / 1.67 + Mnu / 2.0	lb-in	41,834	41,835	+0.00		Pass

HAND-JAMB-DEFAULT: 2 × 600S162-54 back to back, 10 ft, 6 ft opening, 30 psf

Source: Hand calculation (closed form). Calculation: Cold-formed steel jamb studs.

Hand calculation; the default design.

HAND-JAMB-DEFAULT · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tributary width	ft	3.667	3.667	+0.00		Pass
Reaction at the base (1.0W)	lb	550.0	550.0	+0.00		Pass
Moment (1.0W)	lb-in	16,500	16,500	+0.00		Pass
φ Pnst, back-to-back studs at an opening (Eq. B3.2.5.1-1, C = 7.40)	lb	2,800	2,800	+0.00		Pass
φ Pnst, track (Eq. B3.2.5.1-3)	lb	2,374	2,374	+0.00		Pass

HAND-JAMB-DEFAULT · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Reaction at the base (0.6W)	lb	330.0	330.0	-0.00		Pass
Pnst / Ω (Eq. B3.2.5.1-3)	lb	1,507	1,507	+0.00		Pass

HAND-JAMB-TRIB: Entered tributary width 5 ft, 40 psf, 12 ft

Source: Hand calculation (closed form). Calculation: Cold-formed steel jamb studs.

Hand calculation.

HAND-JAMB-TRIB · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Moment w L² / 8	lb-in	43,200	43,200	+0.00		Pass
Reaction w L / 2	lb	1,200	1,200	+0.00		Pass

SSMA-600S162-33-33: 600S162-33 (33 ksi) allowable moments and shear, no holes

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 10. Calculation: Cold-formed steel joist.

SSMA-600S162-33-33 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mal, local buckling (F3)	lb-in	11,410	11,419	+0.08		Pass
Mad, distortional, kφ = 0 (F4)	lb-in	9,470	9,466	-0.04		Pass
Vag, away from the punchout (G2)	lb	638.0	637.9	-0.01		Pass

SSMA-600S200-54-50: 600S200-54 (50 ksi) allowable moments and shear, no holes

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 11. Calculation: Cold-formed steel joist.

SSMA-600S200-54-50 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mal, local buckling (F3)	lb-in	30,400	30,484	+0.28		Pass
Mad, distortional, kφ = 0 (F4)	lb-in	27,380	27,383	+0.01		Pass
Vag, away from the punchout (G2)	lb	2,823	2,822	-0.03		Pass

SSMA-800S162-43-33: 800S162-43 (33 ksi) allowable moments and shear, no holes

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 11. Calculation: Cold-formed steel joist.

SSMA-800S162-43-33 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mal, local buckling (F3)	lb-in	20,140	20,141	+0.00		Pass
Mad, distortional, kφ = 0 (F4)	lb-in	18,330	18,328	-0.01		Pass
Vag, away from the punchout (G2)	lb	1,051	1,051	-0.01		Pass

SSMA-800S162-54-50: 800S162-54 (50 ksi) allowable moments and shear, no holes

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 11. Calculation: Cold-formed steel joist.

SSMA-800S162-54-50 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mal, local buckling (F3)	lb-in	36,790	36,833	+0.12		Pass
Mad, distortional, kφ = 0 (F4)	lb-in	32,810	32,812	+0.01		Pass
Vag, away from the punchout (G2)	lb	2,091	2,091	-0.01		Pass

SSMA-800S162-68-50: 800S162-68 (50 ksi) allowable moments and shear, no holes

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 11. Calculation: Cold-formed steel joist.

SSMA-800S162-68-50 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mal, local buckling (F3)	lb-in	49,800	49,804	+0.01		Pass
Mad, distortional, kφ = 0 (F4)	lb-in	45,110	45,110	-0.00		Pass
Vag, away from the punchout (G2)	lb	4,221	4,220	-0.03		Pass

SSMA-800S200-54-50: 800S200-54 (50 ksi) allowable moments and shear, no holes

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 11. Calculation: Cold-formed steel joist.

SSMA-800S200-54-50 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mal, local buckling (F3)	lb-in	44,870	44,991	+0.27		Pass
Mad, distortional, kφ = 0 (F4)	lb-in	37,370	37,371	+0.00		Pass
Vag, away from the punchout (G2)	lb	2,091	2,091	-0.01		Pass

SSMA-1000S162-54-50: 1000S162-54 (50 ksi) allowable moments and shear, no holes

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 12. Calculation: Cold-formed steel joist.

SSMA-1000S162-54-50 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mal, local buckling (F3)	lb-in	47,070	47,108	+0.08		Pass
Mad, distortional, kφ = 0 (F4)	lb-in	40,370	40,370	-0.00		Pass
Vag, away from the punchout (G2)	lb	1,661	1,660	-0.03		Pass

SSMA-1000S162-68-50: 1000S162-68 (50 ksi) allowable moments and shear, no holes

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 12. Calculation: Cold-formed steel joist.

SSMA-1000S162-68-50 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mal, local buckling (F3)	lb-in	64,510	64,507	-0.01		Pass
Mad, distortional, kφ = 0 (F4)	lb-in	56,350	56,355	+0.01		Pass
Vag, away from the punchout (G2)	lb	3,345	3,345	-0.01		Pass

SSMA-1000S200-54-50: 1000S200-54 (50 ksi) allowable moments and shear, no holes

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 12. Calculation: Cold-formed steel joist.

SSMA-1000S200-54-50 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mal, local buckling (F3)	lb-in	51,050	51,144	+0.18		Pass
Mad, distortional, kφ = 0 (F4)	lb-in	46,620	46,617	-0.01		Pass
Vag, away from the punchout (G2)	lb	1,661	1,660	-0.03		Pass

SSMA-1200S162-68-50: 1200S162-68 (50 ksi) allowable moments and shear, no holes

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 13. Calculation: Cold-formed steel joist.

SSMA-1200S162-68-50 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mal, local buckling (F3)	lb-in	79,190	79,195	+0.01		Pass
Mad, distortional, kφ = 0 (F4)	lb-in	66,140	66,139	-0.00		Pass
Vag, away from the punchout (G2)	lb	2,771	2,770	-0.03		Pass

SSMA-800S162-54-PROPS: 800S162-54 (50 ksi) gross properties and Lu

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 11. Calculation: Cold-formed steel joist.

SSMA-800S162-54-PROPS · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Area	in.²	0.670	0.670	-0.07		Pass
Ix	in.⁴	5.736	5.736	-0.00		Pass
Sx	in.³	1.434	1.434	-0.00		Pass
Weight	plf	2.280	2.278	-0.08		Pass
Lu, unbraced length limit (F2.1)	in.	32.10	32.14	+0.12		Pass

SSMA-COLD-600S162-54: 600S162-54 (50 ksi) at the catalog yield stress

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 10. Calculation: Cold-formed steel joist.

SSMA-COLD-600S162-54 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mal (footnote 2)	lb-in	30,330	27,798	-8.35		Deviation CFS-COLD-WORK
CFS-COLD-WORK: the guide's value includes cold work of forming (its footnote 2); the module uses the Fy entered						
Mad (same row)	lb-in	25,900	24,229	-6.45		Deviation CFS-COLD-WORK
CFS-COLD-WORK: the guide's value includes cold work of forming (its footnote 2); the module uses the Fy entered						
Vag	lb	2,823	2,822	-0.03		Pass

SSMA-COLD-600S162-54-FYA: 600S162-54 at Fya = 30.33 × 1.67 / 0.916 = 55.3 ksi from the same row

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 10. Calculation: Cold-formed steel joist.

Fya is recovered from the row's own Mal and Sxe; it is not a published number.

SSMA-COLD-600S162-54-FYA · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mal (footnote 2)	lb-in	30,330	30,347	+0.06		Pass
Mad (same row)	lb-in	25,900	25,894	-0.02		Pass

SSMA-COLD-600S162-68-FYA: 600S162-68 at Fya = 39.47 × 1.67 / 1.175 = 56.1 ksi from the same row

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 10. Calculation: Cold-formed steel joist.

Fya is recovered from the row's own Mal and Sxe; it is not a published number.

SSMA-COLD-600S162-68-FYA · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mad (same row)	lb-in	35,690	35,470	-0.62		Pass

SSMA-VANET-600S162-33-33: 600S162-33 (33 ksi) shear at the 1-1/2 × 4-1/2 in. punchout

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 10. Calculation: Cold-formed steel joist.

SSMA-VANET-600S162-33-33 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vanet (G3, qs)	lb	638.0	637.9	-0.01		Pass

SSMA-VANET-600S162-43-33: 600S162-43 (33 ksi) shear at the 1-1/2 × 4-1/2 in. punchout

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 10. Calculation: Cold-formed steel joist.

SSMA-VANET-600S162-43-33 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vanet (G3, qs)	lb	1,240	1,240	+0.00		Pass

SSMA-VANET-600S162-54-50: 600S162-54 (50 ksi) shear at the 1-1/2 × 4-1/2 in. punchout

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 10. Calculation: Cold-formed steel joist.

SSMA-VANET-600S162-54-50 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vanet (G3, qs)	lb	1,947	1,947	-0.00		Pass

SSMA-VANET-600S162-68-50: 600S162-68 (50 ksi) shear at the 1-1/2 × 4-1/2 in. punchout

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 10. Calculation: Cold-formed steel joist.

SSMA-VANET-600S162-68-50 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vanet (G3, qs)	lb	2,879	2,880	+0.03		Pass

SSMA-VANET-800S162-54-50: 800S162-54 (50 ksi) shear at the 1-1/2 × 4-1/2 in. punchout

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 11. Calculation: Cold-formed steel joist.

SSMA-VANET-800S162-54-50 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vanet (G3, qs)	lb	2,091	2,091	-0.01		Pass

SSMA-VANET-800S162-68-50: 800S162-68 (50 ksi) shear at the 1-1/2 × 4-1/2 in. punchout

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 11. Calculation: Cold-formed steel joist.

SSMA-VANET-800S162-68-50 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vanet (G3, qs)	lb	3,367	3,367	-0.01		Pass

SSMA-WC-600S162-54-50-N1: 600S162-54 (50 ksi) web crippling, fastened, N = 1 in.

Source: SSMA Product Technical Guide (2022), Allowable Web Crippling Loads, Single Members, pp. 59. Calculation: Cold-formed steel joist.

SSMA-WC-600S162-54-50-N1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Condition 1, end one-flange	lb	599.0	598.9	-0.01		Pass
Condition 2, interior one-flange	lb	1,295	1,295	+0.02		Pass

SSMA-WC-600S162-54-50-N3.5: 600S162-54 (50 ksi) web crippling, fastened, N = 3.5 in.

Source: SSMA Product Technical Guide (2022), Allowable Web Crippling Loads, Single Members, pp. 59. Calculation: Cold-formed steel joist.

SSMA-WC-600S162-54-50-N3.5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Condition 1, end one-flange	lb	909.0	909.4	+0.05		Pass
Condition 2, interior one-flange	lb	1,713	1,713	+0.01		Pass

SSMA-WC-600S162-54-50-N6: 600S162-54 (50 ksi) web crippling, fastened, N = 6 in.

Source: SSMA Product Technical Guide (2022), Allowable Web Crippling Loads, Single Members, pp. 59. Calculation: Cold-formed steel joist.

SSMA-WC-600S162-54-50-N6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Condition 1, end one-flange	lb	1,116	1,116	-0.02		Pass
Condition 2, interior one-flange	lb	1,991	1,991	-0.01		Pass

SSMA-WC-800S162-54-50-N1: 800S162-54 (50 ksi) web crippling, fastened, N = 1 in.

Source: SSMA Product Technical Guide (2022), Allowable Web Crippling Loads, Single Members, pp. 59. Calculation: Cold-formed steel joist.

SSMA-WC-800S162-54-50-N1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Condition 1, end one-flange	lb	575.0	574.6	-0.08		Pass
Condition 2, interior one-flange	lb	1,272	1,272	-0.01		Pass

SSMA-WC-800S162-54-50-N3.5: 800S162-54 (50 ksi) web crippling, fastened, N = 3.5 in.

Source: SSMA Product Technical Guide (2022), Allowable Web Crippling Loads, Single Members, pp. 59. Calculation: Cold-formed steel joist.

SSMA-WC-800S162-54-50-N3.5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Condition 1, end one-flange	lb	872.0	872.4	+0.05		Pass
Condition 2, interior one-flange	lb	1,682	1,682	+0.01		Pass

SSMA-WC-800S162-54-50-N6: 800S162-54 (50 ksi) web crippling, fastened, N = 6 in.

Source: SSMA Product Technical Guide (2022), Allowable Web Crippling Loads, Single Members, pp. 59. Calculation: Cold-formed steel joist.

SSMA-WC-800S162-54-50-N6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Condition 1, end one-flange	lb	1,070	1,070	+0.03		Pass
Condition 2, interior one-flange	lb	1,955	1,955	-0.01		Pass

SSMA-WC-600S162-43-33-N3.5: 600S162-43 (33 ksi) web crippling, fastened, N = 3.5 in.

Source: SSMA Product Technical Guide (2022), Allowable Web Crippling Loads, Single Members, pp. 59. Calculation: Cold-formed steel joist.

SSMA-WC-600S162-43-33-N3.5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Condition 1, end one-flange	lb	400.0	399.5	-0.12		Pass
Condition 2, interior one-flange	lb	745.0	744.8	-0.03		Pass

SSMA-WC-800S162-68-50-N3.5: 800S162-68 (50 ksi) web crippling, fastened, N = 3.5 in.

Source: SSMA Product Technical Guide (2022), Allowable Web Crippling Loads, Single Members, pp. 59. Calculation: Cold-formed steel joist.

SSMA-WC-800S162-68-50-N3.5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Condition 1, end one-flange	lb	1,318	1,318	-0.02		Pass
Condition 2, interior one-flange	lb	2,555	2,555	-0.01		Pass

SSMA-SPAN-600S162-54-12-L360: 600S162-54 (50 ksi), single span at 12 in., L/360 live load, 10 psf dead + 20 psf live

Source: SSMA Product Technical Guide (2022), Floor Joist Spans, pp. 43. Calculation: Cold-formed steel joist.

SSMA-SPAN-600S162-54-12-L360 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span at the deflection limit The table prints spans to the inch.	ft	18.42	18.42	+0.02		Pass

SSMA-SPAN-600S162-54-16-L360: 600S162-54 (50 ksi), single span at 16 in., L/360 live load, 10 psf dead + 20 psf live

Source: SSMA Product Technical Guide (2022), Floor Joist Spans, pp. 43. Calculation: Cold-formed steel joist.

SSMA-SPAN-600S162-54-16-L360 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span at the deflection limit The table prints spans to the inch.	ft	16.75	16.74	-0.08		Pass

SSMA-SPAN-600S162-54-12-L480: 600S162-54 (50 ksi), single span at 12 in., L/480 live load, 10 psf dead + 20 psf live

Source: SSMA Product Technical Guide (2022), Floor Joist Spans, pp. 43. Calculation: Cold-formed steel joist.

SSMA-SPAN-600S162-54-12-L480 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span at the deflection limit The table prints spans to the inch.	ft	16.75	16.74	-0.08		Pass

SSMA-SPAN-600S162-54-16-L480: 600S162-54 (50 ksi), single span at 16 in., L/480 live load, 10 psf dead + 20 psf live

Source: SSMA Product Technical Guide (2022), Floor Joist Spans, pp. 43. Calculation: Cold-formed steel joist.

SSMA-SPAN-600S162-54-16-L480 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span at the deflection limit The table prints spans to the inch.	ft	15.17	15.21	+0.27		Pass

SSMA-SPAN-800S162-54-12-L360: 800S162-54 (50 ksi), single span at 12 in., L/360 live load, 10 psf dead + 20 psf live

Source: SSMA Product Technical Guide (2022), Floor Joist Spans, pp. 43. Calculation: Cold-formed steel joist.

SSMA-SPAN-800S162-54-12-L360 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span at the deflection limit The table prints spans to the inch.	ft	23.25	23.23	-0.09		Pass

SSMA-SPAN-800S162-54-16-L360: 800S162-54 (50 ksi), single span at 16 in., L/360 live load, 10 psf dead + 20 psf live

Source: SSMA Product Technical Guide (2022), Floor Joist Spans, pp. 43. Calculation: Cold-formed steel joist.

SSMA-SPAN-800S162-54-16-L360 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span at the deflection limit The table prints spans to the inch.	ft	21.08	21.11	+0.11		Pass

SSMA-SPAN-800S162-54-12-L480: 800S162-54 (50 ksi), single span at 12 in., L/480 live load, 10 psf dead + 20 psf live

Source: SSMA Product Technical Guide (2022), Floor Joist Spans, pp. 43. Calculation: Cold-formed steel joist.

SSMA-SPAN-800S162-54-12-L480 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span at the deflection limit The table prints spans to the inch.	ft	21.08	21.11	+0.11		Pass

SSMA-SPAN-800S162-54-16-L480: 800S162-54 (50 ksi), single span at 16 in., L/480 live load, 10 psf dead + 20 psf live

Source: SSMA Product Technical Guide (2022), Floor Joist Spans, pp. 43. Calculation: Cold-formed steel joist.

SSMA-SPAN-800S162-54-16-L480 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span at the deflection limit The table prints spans to the inch.	ft	19.17	19.18	+0.06		Pass

HC-MANSARD-SPLIT: Dead 15 psf on the slope and snow 20 psf on plan, studs at 16 in., θ = 60°

Source: Hand calculation (closed form). Calculation: Cold-formed steel sloped and mansard wall.

HC-MANSARD-SPLIT · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Dead load normal to the stud	plf	10.00	10.00	+0.00		Pass
Dead load along the stud	plf	17.32	17.32	+0.00		Pass
Snow normal to the stud	plf	6.667	6.667	+0.00		Pass
Snow along the stud	plf	11.55	11.55	+0.00		Pass
Axial force at the floor, 1.2D + 1.0S	lb	388.0	388.0	-0.00		Pass

HC-MANSARD-WIND: Wind 30 psf toward and 35 psf away, simple span of 12 ft

Source: Hand calculation (closed form). Calculation: Cold-formed steel sloped and mansard wall.

HC-MANSARD-WIND · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Moment w L²/8, wind away	lb-in	10,080	10,080	+0.00		Pass

HC-MANSARD-WIND · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Moment 0.6 w L²/8, wind away	lb-in	6,048	6,048	+0.00		Pass

HC-MANSARD-KICKER: Kicker at midlength of 14 ft, two spans: Rn = 1.25 w a, H = Rn / sin θ

Source: Hand calculation (closed form). Calculation: Cold-formed steel sloped and mansard wall.

HC-MANSARD-KICKER · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Kicker compression, wind toward	lb	404.1	404.1	-0.00		Pass
Kicker tension, wind away	lb	471.5	471.5	-0.00		Pass

HC-SBMF-EXPECTED: S400-20 E4.3.3 expected strength, 8 bolts a = 3, b = 6, c = 4-1/4, h = 12 ft, two channels

Source: Hand calculation (closed form). Calculation: Cold-formed steel special bolted moment frame.

HC-SBMF-EXPECTED · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Slip component VS	kips	1.837	1.837	+0.00		Pass
Slip drift ΔS	in.	2.708	2.708	+0.00		Pass
Least d t Rt Fu R0	kips	10.40	10.39	+0.00		Pass
Bearing deformation factor CDB		1.284	1.284	+0.00		Pass
Maximum bearing column shear VB,max	kips	10.19	10.19	+0.00		Pass
Drift at maximum bearing ΔB,max	in.	9.631	9.631	+0.00		Pass
Bearing component VB	kips	7.457	7.457	-0.00		Pass
Expected column shear Ve	kips	9.294	9.294	-0.00		Pass
Expected moment Me	kip-in.	1,338	1,338	-0.00		Pass

HC-SBMF-CAP: S400-20 E4.3.1: design shear capped at Ω0 Eh per column

Source: Hand calculation (closed form). Calculation: Cold-formed steel special bolted moment frame.

HC-SBMF-CAP · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Design column shear Vd = Ω0 Eh / n	kips	3.000	3.000	+0.00		Pass
Column shear demand	kips	3.000	3.000	+0.00		Pass

HC-PARAPET-WIND: ASCE 7-22 30.6, V = 115 mph, Exposure C, top at 30 ft, interior zones, 12 ft² effective area

Source: Hand calculation (closed form). Calculation: Cold-formed steel parapet.

HC-PARAPET-WIND · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Velocity pressure qp	psf	33.20	33.20	+0.00		Pass
Net pressure, case A	psf	88.75	88.75	+0.00		Pass
Net pressure, case B	psf	52.62	52.62	+0.00		Pass

HC-PARAPET-STATICS: Entered 60 psf toward the roof: cantilever moment and kicker force (45°)

Source: Hand calculation (closed form). Calculation: Cold-formed steel parapet.

HC-PARAPET-STATICS · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cantilever moment w a²/2	lb-in	3,000	3,000	-0.00		Pass
Kicker compression w H²/(2 hk) / cos θ	lb	581.8	581.8	-0.00		Pass

HC-PARAPET-STATICS · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Kicker tension, 0.6W case B	lb	232.7	232.7	-0.00		Pass

MBMA-3311-SEC: Section properties, 8ZS2.75x059 and 8ZS2.75x085, computed against the Design Manual values the Guide prints

Source: MBMA Roof Framing Design Guide (2024), Example 3.3.1.1; Example 3.3.1.2 for A, rx, ry; Example 5.4.3 for Ixy, pp. 65, 66, 81, 83, 199. Calculation: Cold-formed steel purlin.

MBMA-3311-SEC · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Area, x085	in.²	1.270	1.270	+0.03		Pass
Area, x059	in.²	0.881	0.881	+0.02		Pass
Ix, x085	in.⁴	12.40	12.44	+0.30		Pass
Ix, x059	in.⁴	8.690	8.691	+0.01		Pass
Sf, x085	in.³	3.110	3.109	-0.02		Pass
Sf, x059	in.³	2.170	2.173	+0.13		Pass
Iy, x085	in.⁴	2.510	2.516	+0.25		Pass
Iy, x059	in.⁴	1.720	1.720	-0.01		Pass
Ixy, x085	in.⁴	4.110	4.120	+0.24		Pass
Ixy, x059	in.⁴	2.850	2.846	-0.14		Pass
rx, x085	in.	3.130	3.129	-0.03		Pass
ry, x085	in.	1.410	1.407	-0.18		Pass
rx, x059	in.	3.140	3.141	+0.02		Pass
ry, x059	in.	1.400	1.397	-0.21		Pass
Se at 55 ksi, x085	in.³	2.840	2.857	+0.61		Pass
Se at 55 ksi, x059	in.³	1.820	1.824	+0.21		Pass
Flat flange width to thickness, x085		27.60	27.65	+0.19		Pass

MBMA-3311-MOM: Moments, shears and reactions of the non-prismatic analysis under D + Lr

Source: MBMA Roof Framing Design Guide (2024), Example 3.3.1.1, Figure 3.3-1, pp. 64, 66, 73, 75. Calculation: Cold-formed steel purlin.

MBMA-3311-MOM · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
End span largest positive moment	kip-ft	5.210	5.196	-0.26		Pass
Negative moment at end of end span's lap	kip-ft	5.260	5.273	+0.26		Pass
Moment over support 2	kip-ft	8.580	8.607	+0.32		Pass
Interior span, end of left lap	kip-ft	3.770	3.780	+0.25		Pass
Interior span largest positive moment	kip-ft	2.280	2.254	-1.13		Pass
Interior span, end of right lap	kip-ft	3.780	3.794	+0.38		Pass
Moment over the center support	kip-ft	5.030	5.031	+0.02		Pass
Inflection point from support 1	ft	19.04	19.01	-0.14		Pass
Inflection point from support 2, interior span	ft	7.430	7.483	+0.71		Pass
Inflection point from support 3, interior span	ft	4.980	4.995	+0.30		Pass
Shear, end span outside the lap	kips	1.550	1.552	+0.11		Pass
Shear, support 2 lap	kips	1.780	1.782	+0.10		Pass
Shear, interior span outside the laps	kips	1.180	1.179	-0.05		Pass
Shear, center support lap	kips	1.300	1.294	-0.43		Pass
Reaction, support 1	kips	1.090	1.093	+0.30		Pass
Reaction, support 2	kips	3.360	3.362	+0.07		Pass
Reaction, center support	kips	2.590	2.589	-0.04		Pass

MBMA-3311-FLEX: Through-fastened, gravity: bending by region

Source: MBMA Roof Framing Design Guide (2024), Example 3.3.1.1, pp. 66 to 72. Calculation: Cold-formed steel purlin.

MBMA-3311-FLEX · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
End span, positive, F3	kip-ft	7.790	7.842	+0.66		Pass
kφfe, x085		0.795	0.790	-0.65		Pass
k̄φfg, x085		0.027	0.027	-0.39		Pass
kφwe, x085		0.712	0.708	-0.52		Pass
k̄φwg, x085		0.003	0.002	-3.88		Deviation CFSZ-KWG
CFSZ-KWG: the web's geometric stiffness at that half-wavelength; Fcrd still lands on the printed value						
kφfe, x059		0.250	0.249	-0.35		Pass
k̄φfg, x059		0.013	0.013	-0.06		Pass
kφwe, x059		0.230	0.229	-0.36		Pass
k̄φwg, x059		0.001	0.001	-2.55		Deviation CFSZ-KWG
CFSZ-KWG: the web's geometric stiffness at that half-wavelength; Fcrd still lands on the printed value						
Fcrd with kφ = 0.300, x085	ksi	61.30	61.40	+0.17		Pass
End span, positive, F4	kip-ft	6.920	6.921	+0.01		Pass
Unbraced length, end span	in.	47.50	47.85	+0.74		Pass
Fcre, end span, Eq. F2.1.3-2	ksi	347.9	343.0	-1.40		Deviation CFSZ-LY
CFSZ-LY: the inflection point of this analysis against the printed diagram; the strength is unaffected						
End span, negative, F2 and F3	kip-ft	7.790	7.842	+0.66		Pass
Fcrd / β with kφ = 0, x085	ksi	51.10	51.16	+0.12		Pass
Lcrd, x085	in.	21.70	22.13	+1.97		Deviation CFSZ-LCR
CFSZ-LCR: the half-wavelength comes from the Table 2.3.1.3-1 mid-line equations; the Design Manual prints a shorter value						
β, end span		1.230	1.233	+0.25		Pass
Fcrd, end span, negative	ksi	62.90	63.09	+0.30		Pass
End span, negative, F4	kip-ft	7.000	6.986	-0.20		Pass
Support 2, in the lap	kip-ft	12.79	12.85	+0.45		Pass
Unbraced length, interior span left	in.	47.20	47.79	+1.25		Deviation CFSZ-LY
CFSZ-LY: the inflection point of this analysis against the printed diagram; the strength is unaffected						
Fcre, interior span	ksi	346.0	336.4	-2.78		Deviation CFSZ-LY
CFSZ-LY: the inflection point of this analysis against the printed diagram; the strength is unaffected						
Interior span, negative, F2 and F3	kip-ft	5.000	5.005	+0.11		Pass
Fcrd / β with kφ = 0, x059	ksi	32.50	32.58	+0.26		Pass
Lcrd, x059	in.	25.40	25.80	+1.57		Deviation CFSZ-LCR
CFSZ-LCR: the half-wavelength comes from the Table 2.3.1.3-1 mid-line equations; the Design Manual prints a shorter value						
β, interior span		1.260	1.260	-0.02		Pass
Fcrd, interior span, negative	ksi	41.00	41.05	+0.12		Pass
Interior span, negative, F4	kip-ft	4.150	4.173	+0.55		Pass
Interior span, positive, F3	kip-ft	5.000	5.005	+0.11		Pass
Fcrd with kφ = 0.300, x059	ksi	53.00	53.02	+0.04		Pass
Interior span, positive, F4	kip-ft	4.580	4.590	+0.23		Pass
Center support, in the lap	kip-ft	9.990	10.01	+0.21		Pass

MBMA-3311-VWC: Through-fastened, gravity: shear, bending and shear, web crippling, bending and web crippling

Source: MBMA Roof Framing Design Guide (2024), Example 3.3.1.1, pp. 73 to 78. Calculation: Cold-formed steel purlin.

MBMA-3311-VWC · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Shear, end span	kips	7.330	7.330	+0.01		Pass
Shear, support 2 lap	kips	9.760	9.765	+0.05		Pass
Shear, interior span	kips	2.430	2.435	+0.19		Pass
Shear, center lap	kips	4.860	4.869	+0.19		Pass
H2, end span		0.710	0.705	-0.70		Pass
H2, support 2 lap		0.700	0.694	-0.81		Pass
H2, interior span		0.900	0.900	-0.04		Pass
H2, center lap		0.570	0.569	-0.25		Pass
Web crippling, end	kips	2.150	2.154	+0.19		Pass
Web crippling, support 2	kips	5.680	5.682	+0.03		Pass
Web crippling, center	kips	3.610	3.614	+0.12		Pass
H3 value, support 2, twice the thinner section		1.000	1.000	-0.03		Pass
H3 limit, 1.65 / 1.70		0.970	0.971	+0.06		Pass
H3 value, center support		0.680	0.674	-0.84		Pass

MBMA-3311-UP: Through-fastened, uplift: I6.2.1 with R = 0.70

Source: MBMA Roof Framing Design Guide (2024), Example 3.3.1.1, pp. 78, 79. Calculation: Cold-formed steel purlin.

MBMA-3311-UP · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
End span, uplift moment	kip-ft	2.720	2.711	-0.33		Pass
End span, R Mno / Ω	kip-ft	5.460	5.489	+0.54		Pass
Interior span, uplift moment	kip-ft	1.180	1.176	-0.33		Pass
Interior span, R Mno / Ω	kip-ft	3.500	3.504	+0.11		Pass

MBMA-3321: Four span Z, standing seam, R from S908 tests

Source: MBMA Roof Framing Design Guide (2024), Example 3.3.2.1, pp. 93 to 104. Calculation: Cold-formed steel purlin.

MBMA-3321 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
End span, positive, R = 0.85	kip-ft	6.630	6.665	+0.54		Pass
Interior span, positive, R = 0.90	kip-ft	4.490	4.505	+0.33		Pass
End span, negative, F2 and F3	kip-ft	7.790	7.842	+0.66		Pass
End span, negative, F4	kip-ft	7.000	6.986	-0.20		Pass
Interior span, negative, F4	kip-ft	4.150	4.173	+0.55		Pass
Support 2, in the lap	kip-ft	12.79	12.85	+0.45		Pass
End span uplift, R = 0.70	kip-ft	5.460	5.489	+0.54		Pass
Interior span uplift, R = 0.70	kip-ft	3.500	3.504	+0.11		Pass

MBMA-3322: Four span C, standing seam, LRFD

Source: MBMA Roof Framing Design Guide (2024), Example 3.3.2.2, pp. 106 to 118. Calculation: Cold-formed steel purlin.

MBMA-3322 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Area, x070	in.²	1.050	1.046	-0.41		Pass
Ix, x070	in.⁴	12.20	12.18	-0.12		Pass
Sf, x070	in.³	2.710	2.708	-0.08		Pass
Se, x070	in.³	2.470	2.478	+0.34		Pass
Iy, x070	in.⁴	0.828	0.828	-0.04		Pass
Area, x059	in.²	0.881	0.881	+0.04		Pass
Ix, x059	in.⁴	10.30	10.30	+0.02		Pass
Sf, x059	in.³	2.290	2.289	-0.02		Pass
Se, x059	in.³	1.890	1.892	+0.09		Pass
Iy, x059	in.⁴	0.698	0.698	-0.00		Pass
End span largest positive moment	kip-ft	7.340	7.277	-0.86		Pass
End span, end of lap	kip-ft	7.400	7.534	+1.81		Pass
Support 2	kip-ft	12.10	12.24	+1.15		Pass
Interior span, end of left lap	kip-ft	5.310	5.413	+1.93		Pass
Center support	kip-ft	7.080	7.018	-0.88		Pass
End span, positive, R = 0.90	kip-ft	9.170	9.201	+0.34		Pass
Interior span, positive, R = 0.95	kip-ft	7.410	7.413	+0.04		Pass
End span, negative, F2 and F3	kip-ft	10.19	10.22	+0.33		Pass
Fcre, end span	ksi	542.0	262.1	-51.64		Deviation CFSZ-FCRE-C
CFSZ-FCRE-C: the example leaves the square off the polar radius in the torsional stress						
Fcrd / β, x070	ksi	51.30	51.30	+0.01		Pass
Lcrd, x070	in.	24.10	24.12	+0.10		Pass
End span, negative, F4	kip-ft	9.230	9.184	-0.50		Pass
Support 2, in the lap	kip-ft	18.00	18.03	+0.15		Pass
Interior span, negative, F2 and F3	kip-ft	7.800	7.803	+0.04		Pass
Fcrd / β, x059	ksi	41.20	41.16	-0.10		Pass
Lcrd, x059	in.	25.80	25.83	+0.10		Pass
Interior span, negative, F4	kip-ft	7.220	7.206	-0.20		Pass
Center support, in the lap	kip-ft	15.59	15.61	+0.11		Pass
Shear, end span	kips	5.470	5.468	-0.04		Pass
Shear, support 2 lap	kips	8.740	8.733	-0.08		Pass
Shear, interior span	kips	3.270	3.265	-0.14		Pass
Shear, center lap	kips	6.540	6.531	-0.14		Pass
H2, end span		0.830	0.839	+1.06		Pass
H2, support 2 lap		0.730	0.737	+1.02		Pass
H2, interior span		0.850	0.861	+1.32		Pass
H2, center lap		0.530	0.529	-0.24		Pass
Web crippling, end	kips	2.180	2.180	+0.01		Pass
Web crippling, support 2	kips	6.480	6.482	+0.03		Pass
Web crippling, center	kips	5.330	5.323	-0.13		Pass
H3 value, support 2, Eq. H3-2		1.180	1.191	+0.95		Pass
H3 limit, 1.46 φ		1.310	1.314	+0.31		Pass

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
H3 value, center support		0.950	0.945	-0.51		Pass
End span uplift moment	kip-ft	4.830	2.762	-42.81		Deviation CFSZ-W16
CFSZ-W16: the example takes 1.6W; ASCE 7-22 takes 1.0W						
End span uplift, R = 0.75	kip-ft	7.640	7.668	+0.36		Pass
Interior span uplift moment	kip-ft	2.100	1.201	-42.83		Deviation CFSZ-W16
CFSZ-W16: the example takes 1.6W; ASCE 7-22 takes 1.0W						
Interior span uplift, R = 0.75	kip-ft	5.850	5.852	+0.04		Pass

MBMA-3322-W16: The same C-section line, wind entered as 1.6 times the printed 75 plf, to land on the example's 1.6W

Source: MBMA Roof Framing Design Guide (2024), Example 3.3.2.2, pp. 117, 118. Calculation: Cold-formed steel purlin.

MBMA-3322-W16 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
End span uplift moment	kip-ft	4.830	4.784	-0.96		Pass
Interior span uplift moment	kip-ft	2.100	2.079	-1.00		Pass

RP20-5-8ZS225: Gross properties of 8ZS2.25x070 and 8ZS2.25x059, printed from the Design Manual

Source: AISI RP20-5 (2020), Section 8.6, pp. p. 5 of the notebook. Calculation: Cold-formed steel purlin.

RP20-5-8ZS225 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ix, x070	in.⁴	9.180	9.180	+0.00		Pass
Iy, x070	in.⁴	1.280	1.285	+0.39		Pass
Ixy, x070	in.⁴	2.470	2.475	+0.19		Pass
Cw, x070	in.⁶	15.10	15.09	-0.07		Pass
Ix, x059	in.⁴	7.760	7.761	+0.01		Pass
Iy, x059	in.⁴	1.080	1.076	-0.36		Pass
Ixy, x059	in.⁴	2.080	2.082	+0.09		Pass
Cw, x059	in.⁶	12.70	12.65	-0.39		Pass
J, x070, times 1000		1.590	1.593	+0.22		Pass
J, x059, times 1000		0.954	0.954	-0.00		Pass

MBMA-541: Single bay Z, third point anchorage at the low eave purlin, through-fastened

Source: MBMA Roof Framing Design Guide (2024), Example 5.4.1, pp. 193 to 196. Calculation: Cold-formed steel purlin.

MBMA-541 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ix	in.⁴	28.40	28.43	+0.11		Pass
Ixy	in.⁴	8.410	8.411	+0.01		Pass
P1	kips	0.078	0.078	-0.19		Pass
P2	kips	0.156	0.156	-0.19		Pass
Ksys		1.220	1.218	-0.19		Pass
Kreq		1.250	1.246	-0.35		Pass
Ktotal at the far purlin		15.32	15.32	+0.01		Pass
PL	kips	0.432	0.431	-0.22		Pass

MBMA-542: The same, devices at the low and ridge purlins

Source: MBMA Roof Framing Design Guide (2024), Example 5.4.2, pp. 197, 198. Calculation: Cold-formed steel purlin.

MBMA-542 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
PL, low	kips	0.225	0.224	-0.36		Pass
PL, ridge	kips	0.225	0.224	-0.36		Pass
Smallest Ktotal		30.30	30.30	-0.01		Pass

MBMA-543: Four span Z, standing seam, support restraints at purlins 1, 5, 9

Source: MBMA Roof Framing Design Guide (2024), Example 5.4.3, pp. 199 to 204. Calculation: Cold-formed steel purlin.

MBMA-543 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Frame line 1, P1	kips	0.134	0.134	-0.04		Pass
Frame line 1, P2	kips	0.226	0.225	-0.09		Pass
Frame line 1, Ksys		28.77	28.77	+0.01		Pass
Frame line 1, PL at A	kips	0.514	0.513	-0.11		Pass
Frame line 1, PL at B	kips	0.603	0.603	-0.02		Pass
Frame line 1, PL at C	kips	0.607	0.607	-0.05		Pass
Frame line 1, Kreq		11.20	11.17	-0.31		Pass
Frame line 2, Ksys		13.76	13.76	+0.03		Pass
Frame line 2, P1, average	kips	0.153	0.153	-0.01		Pass
Frame line 2, P2, average	kips	0.121	0.121	-0.04		Pass
Frame line 2, PL at A	kips	0.255	0.254	-0.21		Pass
Frame line 2, PL at B	kips	0.349	0.349	+0.08		Pass
Frame line 2, PL at C	kips	0.361	0.360	-0.19		Pass
Frame line 2, Kreq		5.600	5.612	+0.21		Pass
Frame line 3, Ksys		8.090	8.087	-0.04		Pass
Frame line 3, P2	kips	0.167	0.167	-0.16		Pass
Frame line 3, PL at A	kips	0.407	0.406	-0.15		Pass
Frame line 3, PL at B	kips	0.518	0.518	-0.08		Pass
Frame line 3, PL at C	kips	0.529	0.528	-0.10		Pass
Frame line 3, Kreq		7.900	7.916	+0.21		Pass
In-plane force, w diaphragm	plf	328.0	327.9	-0.02		Pass
In-plane deflection	in.	0.388	0.388	-0.04		Pass

SSMA-RAFT-800S200-54-50: 800S200-54 (50 ksi): section strengths with the top flange sheathed

Source: SSMA Product Technical Guide (2022), Structural Section Properties, pp. 11. Calculation: Cold-formed steel rafter.

SSMA-RAFT-800S200-54-50 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable moment Mal	lb-in	44,870	44,991	+0.27		Pass
Allowable distortional moment Mad	lb-in	37,370	37,371	+0.00		Pass
Allowable shear Vag	lb	2,091	2,091	-0.01		Pass

SSMA-RAFT-800S162-54-50: 800S162-54 (50 ksi): section strengths with the top flange sheathed

Source: SSMA Product Technical Guide (2022), Structural Section Properties, pp. 11. Calculation: Cold-formed steel rafter.

SSMA-RAFT-800S162-54-50 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable moment Mal	lb-in	36,790	36,833	+0.12		Pass
Allowable distortional moment Mad	lb-in	32,810	32,812	+0.01		Pass
Allowable shear Vag	lb	2,091	2,091	-0.01		Pass

SSMA-RAFT-600S200-43-33: 600S200-43 (33 ksi): section strengths with the top flange sheathed

Source: SSMA Product Technical Guide (2022), Structural Section Properties, pp. 11. Calculation: Cold-formed steel rafter.

SSMA-RAFT-600S200-43-33 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable moment Mal	lb-in	17,240	17,266	+0.15		Pass
Allowable distortional moment Mad	lb-in	15,390	15,389	-0.01		Pass
Allowable shear Vag	lb	1,416	1,415	-0.04		Pass

HC-RAFT-1: 45 degree rafter, 12 ft span, 100 plf on plan, ridge board: H = w L²/(2 h), M = w L²/8 on the horizontal span

Source: Hand calculation (closed form). Calculation: Cold-formed steel rafter.

HC-RAFT-1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Thrust H	lb	600.0	600.0	-0.00		Pass
Largest moment	lb-ft	1,800	1,800	-0.00		Pass
Axial at the plate, R sin + H cos	lb	1,273	1,273	-0.00		Pass

HC-RAFT-2: Same rafter on a ridge beam: no thrust, tension at the ridge

Source: Hand calculation (closed form). Calculation: Cold-formed steel rafter.

HC-RAFT-2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Thrust H	lb	0.000	0.000	+0.00		Pass
Axial at the plate, R sin	lb	424.3	424.3	+0.00		Pass
Tension at the ridge, R sin	lb	424.3	424.3	-0.00		Pass

HC-RAFT-3: Normal load on a ridge board frame: H = w Ls²/(2 h), no axial from the load itself

Source: Hand calculation (closed form). Calculation: Cold-formed steel rafter.

HC-RAFT-3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Thrust H	lb	1,200	1,200	-0.00		Pass
Moment	lb-ft	3,600	3,600	-0.00		Pass

SW-1 · Cold-formed steel shear wall: 8 ft × 9 ft wall, 7/16 in. OSB one side, wind

Source: Hand calculation (closed form). Calculation: Cold-formed steel shear wall.

SW-1 · Cold-formed steel shear wall · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Unit shear v = V/w	plf	500.0	500.0	+0.00		Pass
φ vn = 0.65 × 910	plf	591.5	591.5	+0.00		Pass
Hold-down tension (0.9D + 1.0W)	kips	3.616	3.616	+0.00		Pass
Chord compression (1.2D + 1.0W + L)	kips	5.202	5.202	+0.00		Pass
Chord φc Pn, 2 studs	kips	20.35	20.35	+0.01		Pass
Chord φt Tn = 0.90 × 2 Ag Fy	kips	50.07	50.07	+0.00		Pass

SW-1 · Cold-formed steel shear wall · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Unit shear v = 0.6V/w	plf	300.0	300.0	+0.00		Pass
vn/Ω = 910/2.00	plf	455.0	455.0	+0.00		Pass
Hold-down tension (0.6D + 0.6W)	kips	2.097	2.097	+0.00		Pass
Chord compression	kips	3.017	3.017	+0.00		Pass
Chord Pn/Ωc, 2 studs	kips	13.30	13.30	+0.01		Pass

SW-2 · Cold-formed steel shear wall: 4 ft × 10 ft wall, Structural 1 both sides, seismic, h/w = 2.5

Source: Hand calculation (closed form). Calculation: Cold-formed steel shear wall.

SW-2 · Cold-formed steel shear wall · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Unit shear v = E/w	plf	750.0	750.0	+0.00		Pass
φ vn = 0.60 × 990 × 2 × 2w/h	plf	950.4	950.4	+0.00		Pass
Hold-down tension (0.9D + Ω0E)	kips	24.19	24.19	+0.00		Pass

SW-2 · Cold-formed steel shear wall · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Unit shear v = 0.7E/w	plf	525.0	525.0	-0.00		Pass
vn/Ω = 990 × 2 × 0.8 / 2.50	plf	633.6	633.6	+0.00		Pass
Hold-down tension (0.6D + 0.7Ω0E)	kips	16.94	16.94	+0.00		Pass

S400-T1: 7/16 in. OSB, 43 mil framing, 6 in. edges, seismic

Source: AISI S400-15 w/S1-16 Table E1.3-1, pp. 19 (PDF p. 40). Calculation: Cold-formed steel shear wall.

S400-T1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φv vn = 0.60 × 825	plf	495.0	495.0	+0.00		Pass

S400-T1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
vn/Ωv = 825/2.50	plf	330.0	330.0	+0.00		Pass

S400-T2: 7/16 in. OSB, 54 mil framing, 4 in. edges, seismic (2:1 row)

Source: AISI S400-15 w/S1-16 Table E1.3-1, pp. 19 (PDF p. 40). Calculation: Cold-formed steel shear wall.

Two rows apply to 54 mil framing (825 / 1235 / 1545 / 2060 up to 4:1, and 940 / 1410 / 1760 / 2350 up to 2:1); at h/w ≤ 2 the larger value governs.

S400-T2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φv vn = 0.60 × 1410	plf	846.0	846.0	+0.00		Pass

S400-T3: 15/32 in. Structural 1, 68 mil framing, 2 in. edges, seismic

Source: AISI S400-15 w/S1-16 Table E1.3-1, pp. 19 (PDF p. 40). Calculation: Cold-formed steel shear wall.

Table row 68 mil requires No. 10 screws.

S400-T3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φv vn = 0.60 × 2190	plf	1,314	1,314	+0.00		Pass

S400-T4: 0.018 in. steel sheet, 43 mil framing (33 min.), 6 in. edges, seismic

Source: AISI S400-15 w/S1-16 Table E2.3-1, pp. 30 (PDF p. 51). Calculation: Cold-formed steel shear wall.

S400-T4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φv vn = 0.60 × 390	plf	234.0	234.0	+0.00		Pass

S400-T5: 15/32 in. Structural 1, 33 mil framing, 4 in. edges, h/w = 3 (Eq. E1.3.1.1-2)

Source: AISI S400-15 w/S1-16 Table E1.3-1 and Eq. E1.3.1.1-2, Section E1.3.2, pp. 17, 19, 21 (PDF pp. 38, 40, 42). Calculation: Cold-formed steel shear wall.

The 33 / 43 mil Structural 1 row carries footnote 3 (2:1, up to 4:1 with the 2w/h reduction).

S400-T5 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Aspect ratio h/w		3.000	3.000	+0.00		Pass
φv vn (2w/h) = 0.60 × 990 × 8/12	plf	396.0	396.0	+0.00		Pass

S400-T5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
vn (2w/h)/Ωv = 990 × 8/12 / 2.50	plf	264.0	264.0	+0.00		Pass

S400-T6: 7/16 in. OSB both sides, 33 mil framing, 6 in. edges (E1.3.1.1.2)

Source: AISI S400-15 w/S1-16 Table E1.3-1 and Section E1.3.1.1.2, pp. 18, 19, 21 (PDF pp. 39, 40, 42). Calculation: Cold-formed steel shear wall.

Same material and spacing on both faces: the two faces add (E1.3.1.1.2).

S400-T6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φv × 2 × 700	plf	840.0	840.0	+0.00		Pass

S400-T6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
2 × 700 / 2.50	plf	560.0	560.0	+0.00		Pass

S240-T-B3.2-1: 600S162-54 at 16 in., 10 ft, 5/8 in. gypsum with No. 8 screws on both faces (the default)

Source: AISI S240-20 Table B3.2-1 (printed) and hand calculations, pp. S240-20 PDF p. 31. Calculation: Sheathing-braced cold-formed steel stud.

The table value is published; the bracing demand is a hand calculation.

S240-T-B3.2-1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Table B3.2-1 limit, 5/8 in. gypsum, No. 8 screws	lb	7,800	7,800	+0.00		Pass
Nominal stud load, D + L	lb	3,000	3,000	+0.00		Pass
Prb = 0.01 Pra (Eq. C2.3-1)	lb	42.00	42.00	+0.00		Pass
βrb (Eq. C2.3-2, φ = 0.75), kip/in.		3.526	3.526	+0.00		Pass
M per 1.0W = p S h² / 8	lb-in	4,000	4,000	-0.00		Pass

S240-T-B3.2-1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Prb = 0.01 Pra, D + L	lb	30.00	30.00	+0.00		Pass
βrb (Eq. C2.3-2, Ω = 2.00), kip/in.		3.778	3.778	-0.00		Pass

S240-T-B3.2-1b: Same stud, 1/2 in. gypsum with No. 6 screws

Source: AISI S240-20 Table B3.2-1 (printed) and hand calculations, pp. S240-20 PDF p. 31. Calculation: Sheathing-braced cold-formed steel stud.

S240-T-B3.2-1b · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Table B3.2-1 limit, 1/2 in. gypsum, No. 6 screws	lb	5,800	5,800	+0.00		Pass

HAND-SOF-1: 600S162-54 soffit joists at 16 in., 6 ft, hangers and a kicker (the default)

Source: Hand calculation (closed form). Calculation: Cold-formed steel soffit framing.

Hand calculation; the joist's self-weight from the SSMA area.

HAND-SOF-1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
M, net down, 1.2D + 1.0W	lb-in	3,147	3,147	+0.00		Pass
M, net up, 0.9D − 1.0W	lb-in	2,140	2,140	-0.00		Pass
V = w L / 2	lb	174.8	174.8	+0.00		Pass
Hanger tension (reaction + kicker H tan α)	lb	281.5	281.5	+0.00		Pass
Hanger compression	lb	225.6	225.6	-0.00		Pass
Kicker force H / cos α	lb	150.8	150.8	+0.00		Pass
φ Pn per screw, hanger to joist (J4.3.1)	lb	751.9	751.9	+0.00		Pass
Deflection, D + 0.42W (gross section)	in.	0.011	0.011	-0.01		Pass

HAND-SOF-1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Hanger tension, D + 0.6W	lb	181.7	181.7	+0.00		Pass
Pn / Ω per screw, hanger to joist	lb	501.3	501.3	+0.00		Pass

HC-RACK-DEFAULT: 3 levels at 5 ft, 2 bays of 8 ft, 3 kips per level and bay, SDS = 0.3

Source: Hand calculation (closed form). Calculation: Cold-formed steel storage rack.

HC-RACK-DEFAULT · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Beam end moment on springs Me	kip-in.	4.431	4.431	+0.00		Pass
Beam midspan moment w L²/8 − Me	kip-in.	24.64	24.64	+0.00		Pass
Down-aisle base shear V = Cs W	kips	0.633	0.633	+0.00		Pass
Cross-aisle bracing force V Ld / d	kips	0.625	0.625	+0.00		Pass
Upright effective area by the Q factor	in.²	0.461	0.461	+0.00		Pass
Upright gravity load	kips	6.480	6.480	+0.00		Pass
Base bearing 0.65 × 0.85 f'c A1	kips	44.20	44.20	+0.00		Pass

S400-A32-33: Sheet and strip, Fy below 37 ksi

Source: AISI S400-20, Table A3.2-1, pp. 9. Calculation: Cold-formed steel strap braced wall.

S400-A32-33 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ry		1.500	1.500	+0.00		Pass
Rt		1.200	1.200	+0.00		Pass

S400-A32-38: Sheet and strip, Fy from 37 to below 40 ksi

Source: AISI S400-20, Table A3.2-1, pp. 9. Calculation: Cold-formed steel strap braced wall.

S400-A32-38 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ry		1.400	1.400	+0.00		Pass
Rt		1.100	1.100	+0.00		Pass

S400-A32-45: Sheet and strip, Fy from 40 to below 50 ksi

Source: AISI S400-20, Table A3.2-1, pp. 9. Calculation: Cold-formed steel strap braced wall.

S400-A32-45 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ry		1.300	1.300	+0.00		Pass
Rt		1.100	1.100	+0.00		Pass

S400-A32-50: Sheet and strip, Fy of 50 ksi and above

Source: AISI S400-20, Table A3.2-1, pp. 9. Calculation: Cold-formed steel strap braced wall.

S400-A32-50 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ry		1.100	1.100	+0.00		Pass
Rt		1.100	1.100	+0.00		Pass

HC-STRAP-VN: 8 × 10 ft wall, 4 in. × 54 mil straps both sides, 50 ksi: Vn = 2 Ag Fy w / √(h² + w²)

Source: Hand calculation (closed form). Calculation: Cold-formed steel strap braced wall.

HC-STRAP-VN · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available wall shear	kips	12.73	12.73	+0.00		Pass

HC-STRAP-VN · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available wall shear	kips	8.469	8.469	+0.00		Pass

HC-STRAP-OE: ΩE with vfinish at its floor of 0.2 Vn / w, Ry = 1.1

Source: Hand calculation (closed form). Calculation: Cold-formed steel strap braced wall.

HC-STRAP-OE · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Expected strength factor		1.300	1.300	+0.00		Pass

HC-STRAP-CP: Capacity protected force: Ω0 E governs at 2 × 4 kips, against ΩE Vn; per strap along the diagonal

Source: Hand calculation (closed form). Calculation: Cold-formed steel strap braced wall.

HC-STRAP-CP · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Force per strap end	kips	6.403	6.403	+0.00		Pass

HC-STRAP-CP2: Capacity protected force: ΩE Vn governs with Ω0 = 5

Source: Hand calculation (closed form). Calculation: Cold-formed steel strap braced wall.

HC-STRAP-CP2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Force per strap end, expected strength	kips	14.72	14.72	+0.00		Pass

HC-STRAP-C: Chord force V h / L, wind at strength level, no gravity

Source: Hand calculation (closed form). Calculation: Cold-formed steel strap braced wall.

HC-STRAP-C · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Chord compression	kips	6.250	6.250	+0.00		Pass
Chord tension	kips	6.250	6.250	+0.00		Pass

HC-STRAP-C · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Chord compression	kips	3.750	3.750	+0.00		Pass

HC-STRAP-T: Chord tension: 0.9D resists, the story above adds

Source: Hand calculation (closed form). Calculation: Cold-formed steel strap braced wall.

HC-STRAP-T · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Chord tension with the story above	kips	7.450	7.450	+0.00		Pass

SSMA-STRAP-CHORD: Chord tension strength, two 600S162-54 studs at 50 ksi, from the gross area the SSMA table prints (0.556 in.²)

Source: SSMA Product Technical Guide (2022), Structural Section Properties, pp. 10. Calculation: Cold-formed steel strap braced wall.

SSMA-STRAP-CHORD · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Chord tension strength	kips	50.04	50.07	+0.06		Pass

SSMA-STRAP-CHORD · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Chord tension strength	kips	33.29	33.31	+0.06		Pass

CS-1: 600S162-54 gross section properties (linear method)

Source: Hand calculation (closed form). Calculation: Cold-formed steel stud.

A, Ix, Iy by the Manual's linear-method formulas with rounded corners (u = 1.57r, 0.637r, 0.149r³); m and Cw by the Manual's square-corner closed forms. The engine integrates the corners numerically and computes xo, Cw by the sectorial algorithm.

CS-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A	in.²	0.556	0.556	+0.00		Pass
Ix	in.⁴	2.861	2.860	-0.02		Pass
Sf	in.³	0.954	0.953	-0.02		Pass
Iy	in.⁴	0.180	0.180	+0.01		Pass
x̄ (centroid from the web centerline)	in.	0.385	0.385	+0.00		Pass
J		0.001	0.001	+0.00		Pass
m (shear center from the web, square corners)	in.	0.663	0.663	+0.00		Pass
Cw (square corners)		1.337	1.337	+0.00		Pass

CS-2: 600S162-54 axial compression, Kx Lx = 12 ft, Ky Ly = Kt Lt = 48 in.

Source: Hand calculation (closed form). Calculation: Cold-formed steel stud.

CS-2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fe (governing global buckling)	ksi	39.86	39.86	+0.00		Pass
Fn (Eq. E2-2)	ksi	29.58	29.58	+0.00		Pass
Ae at Fn	in.²	0.400	0.400	+0.01		Pass
φc Pn	lb	10,055	10,055	+0.01		Pass

CS-2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pn/Ωc	lb	6,572	6,572	+0.01		Pass

CS-3: 600S162-54 flexure, bridging at 48 in., Cb = 1.0

Source: Hand calculation (closed form). Calculation: Cold-formed steel stud.

CS-3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required moment (1.0W)	lb-in	8,640	8,640	+0.00		Pass
φb Mn (F2 / F3)	lb-in	37,530	37,534	+0.01		Pass
φv Vn (G2.1)	lb	4,290	4,290	+0.00		Pass
Required shear	lb	240.0	240.0	+0.00		Pass
Wind deflection (0.42W)	in.	0.093	0.093	+0.02		Pass

CS-3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mn/Ωb	lb-in	24,970	24,973	+0.01		Pass
Vn/Ωv	lb	2,822	2,822	+0.00		Pass

CS-4: 600S162-54 flexure, compression flange braced (Fn = Fy)

Source: Hand calculation (closed form). Calculation: Cold-formed steel stud.

CS-4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Se at Fy	in.³	0.928	0.928	+0.01		Pass
φb Mn	lb-in	41,778	41,781	+0.01		Pass

CS-5: 600S162-54 web crippling, one-flange end, fastened, N = 1.5 in.

Source: Hand calculation (closed form). Calculation: Cold-formed steel stud.

CS-5 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φw Pn (Eq. G5-1, Table G5-2)	lb	1,010	1,010	+0.00		Pass

CS-5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pn/Ωw	lb	679.1	679.1	+0.00		Pass

CS-6: 600S162-54 combined axial and wind (H1.2)

Source: Hand calculation (closed form). Calculation: Cold-formed steel stud.

Moment amplified by B1 = 1/(1 − α P/Pe1) (Eq. C1.2.1.1-3), Cm = 1.0, α = 1.0 (LRFD) / 1.6 (ASD).

CS-6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
P/Pa + M/Max (1.2D + 1.0W)		0.357	0.357	-0.01		Pass

CS-6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
P/Pa + M/Max (D + 0.6W)		0.368	0.368	-0.01		Pass

C-2.2.2-2a: 9CS2.5x059 yield load Py and yield moment My (published)

Source: AISI S100-16 Commentary, Appendix 2, Figure C-2.2.2-2(a) (9CS2.5x059 of the AISI Cold-Formed Steel Design Manual (2002), Example I-8), pp. 2-5 (PDF p. 438). Calculation: Cold-formed steel stud.

The figure gives Py = 48.42 kips and My = 126.55 kip-in. for the section of Manual Example I-8 (D = 9 in., B = 2.5 in., lip 0.773 in., t = 0.059 in., R = 0.1875 in., Fy = 55 ksi; the dimensions are the Manual's, not printed in the figure). The finite strip model of the figure is a centerline model; ILX uses the linear method with rounded corners (A within 0.2 %, Sf within 0.6 %).

C-2.2.2-2a · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Py = A Fy = 48.42 kips: A = Py/Fy	$in.^2$	0.880	0.881	+0.11		Pass
My = Sf Fy = 126.55 kip-in.: Sf = My/Fy	$in.^3$	2.301	2.289	-0.50		Pass

SSMA-600S162-54: 600S162-54 (50 ksi): gross, torsional and effective properties

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 10 (PDF p. 10). Calculation: Cold-formed steel stud.

SSMA-600S162-54 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A	in.²	0.556	0.556	+0.06		Pass
Ix	in.⁴	2.860	2.860	+0.01		Pass
Sx	in.³	0.953	0.953	+0.05		Pass
Rx	in.	2.267	2.267	+0.02		Pass
Iy	in.⁴	0.180	0.180	+0.28		Pass
Ry	in.	0.570	0.570	-0.07		Pass
J (0.594 × 10⁻³)		0.001	0.001	+0.01		Pass
Cw		1.337	1.337	+0.01		Pass
Xo	in.	-1.049	-1.049	-0.03		Pass
m	in.	0.663	0.663	+0.06		Pass
Ro	in.	2.562	2.562	+0.01		Pass
β = 1 − (xo/ro)²		0.832	0.832	+0.06		Pass
Vag (allowable shear, no punchout)	lb	2,823	2,822	-0.03		Pass
Sxe	in.³	0.916	0.928	+1.36		Deviation SSMA-SXE
SSMA-SXE: the SSMA effective section modulus of this section is 1.4 % below the S100 Appendix 1 effective section (0.928 in.³, reproduced by the hand calculation CS-4); the SSMA program details are not published						
Mal = 30.33 kip-in.	lb-in	30,330	27,798	-8.35		Deviation SSMA-COLD-WORK
SSMA-COLD-WORK: the SSMA Mal of this section includes the strength increase from the cold work of forming (table footnote 2, S100 A7.2); ILX does not use the cold-work increase						

SSMA-600S162-33: 600S162-33 (33 ksi): properties, local buckling moment, shear

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 10 (PDF p. 10). Calculation: Cold-formed steel stud.

Effective section below the gross one at Fy (Sxe/Sx = 0.96): the effective widths are exercised.

SSMA-600S162-33 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A	in.²	0.344	0.344	+0.09		Pass
Ix	in.⁴	1.793	1.793	-0.01		Pass
Sx	in.³	0.598	0.598	-0.06		Pass
Iy	in.⁴	0.116	0.116	+0.19		Pass
J (0.137 × 10⁻³)		0.000	0.000	+0.29		Pass
Cw		0.861	0.861	+0.05		Pass
Xo	in.	-1.072	-1.072	+0.03		Pass
m	in.	0.677	0.677	-0.04		Pass
Ro	in.	2.587	2.587	+0.02		Pass
β		0.828	0.828	+0.03		Pass
Sxe	in.³	0.577	0.578	+0.15		Pass
Mal = 11.41 kip-in.	lb-in	11,410	11,419	+0.08		Pass
Vag	lb	638.0	637.9	-0.01		Pass

SSMA-800S162-54: 800S162-54 (50 ksi): Sxe, Mal, Vag and Ixe at Mal

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 11 (PDF p. 11). Calculation: Cold-formed steel stud.

Ixe: the wind service moment is set to Mal (wind factor 1.0), where SSMA evaluates the effective moment of inertia for deflection (table note 5, p. 5).

SSMA-800S162-54 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A	in.²	0.670	0.670	-0.07		Pass
Ix	in.⁴	5.736	5.736	-0.00		Pass
Sx	in.³	1.434	1.434	-0.00		Pass
Sxe	in.³	1.229	1.230	+0.10		Pass
Mal = 36.79 kip-in.	lb-in	36,790	36,833	+0.12		Pass
Vag (elastic shear buckling)	lb	2,091	2,091	-0.01		Pass
Ixe (at the allowable moment)	in.⁴	5.600	5.600	-0.00		Pass

SSMA-1000S162-54: 1000S162-54 (50 ksi): Sxe, Mal, Vag and Ixe at Mal

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 12 (PDF p. 12). Calculation: Cold-formed steel stud.

SSMA-1000S162-54 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ix	$in.^4$	9.950	9.950	+0.00		Pass
Sxe	$in.^3$	1.572	1.573	+0.09		Pass
Mal = 47.07 kip-in.	lb-in	47,070	47,108	+0.08		Pass
Vag	lb	1,661	1,660	-0.03		Pass
Ixe (at the allowable moment)	$in.^4$	9.391	9.391	-0.00		Pass

SSMA-800S162-43: 800S162-43 (33 ksi): Sxe, Mal, Vag

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 11 (PDF p. 11). Calculation: Cold-formed steel stud.

SSMA-800S162-43 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Sxe	in.³	1.019	1.019	+0.02		Pass
Mal = 20.14 kip-in.	lb-in	20,140	20,141	+0.00		Pass
Vag	lb	1,051	1,051	-0.01		Pass

SSMA-600S200-33: 600S200-33 (33 ksi): Ixe at the allowable moment

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 11 (PDF p. 11). Calculation: Cold-formed steel stud.

SSMA-600S200-33 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mal = 12.28 kip-in.	lb-in	12,280	12,289	+0.07		Pass
Ixe (at the allowable moment)	in.⁴	2.058	2.059	+0.04		Pass

SSMA-WC-600-54-N1: 600S162-54 (50 ksi) web crippling, end one-flange, fastened, N = 1 in.

Source: SSMA Product Technical Guide (2022), Allowable Web Crippling Loads, Single Members (S-Sections), pp. 59 (PDF p. 59). Calculation: Cold-formed steel stud.

SSMA tabulates by web depth and thickness (6 in., 54 / 33 mil); Table G5-2 coefficients C = 4, CR = 0.14, CN = 0.35, Ch = 0.02, Ω = 1.75 (unchanged from S100-12).

SSMA-WC-600-54-N1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable web crippling load (Condition 1)	lb	599.0	598.9	-0.01		Pass

SSMA-WC-600-54-N3.5: 600S162-54 (50 ksi) web crippling, end one-flange, fastened, N = 3.5 in.

Source: SSMA Product Technical Guide (2022), Allowable Web Crippling Loads, Single Members (S-Sections), pp. 59 (PDF p. 59). Calculation: Cold-formed steel stud.

SSMA tabulates by web depth and thickness (6 in., 54 / 33 mil); Table G5-2 coefficients C = 4, CR = 0.14, CN = 0.35, Ch = 0.02, Ω = 1.75 (unchanged from S100-12).

SSMA-WC-600-54-N3.5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable web crippling load (Condition 1)	lb	909.0	909.4	+0.05		Pass

SSMA-WC-600-54-N6: 600S162-54 (50 ksi) web crippling, end one-flange, fastened, N = 6 in.

Source: SSMA Product Technical Guide (2022), Allowable Web Crippling Loads, Single Members (S-Sections), pp. 59 (PDF p. 59). Calculation: Cold-formed steel stud.

SSMA tabulates by web depth and thickness (6 in., 54 / 33 mil); Table G5-2 coefficients C = 4, CR = 0.14, CN = 0.35, Ch = 0.02, Ω = 1.75 (unchanged from S100-12).

SSMA-WC-600-54-N6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable web crippling load (Condition 1)	lb	1,116	1,116	-0.02		Pass

SSMA-WC-600-33-N3.5: 600S162-33 (33 ksi) web crippling, end one-flange, fastened, N = 3.5 in.

Source: SSMA Product Technical Guide (2022), Allowable Web Crippling Loads, Single Members (S-Sections), pp. 59 (PDF p. 59). Calculation: Cold-formed steel stud.

SSMA tabulates by web depth and thickness (6 in., 54 / 33 mil); Table G5-2 coefficients C = 4, CR = 0.14, CN = 0.35, Ch = 0.02, Ω = 1.75 (unchanged from S100-12).

SSMA-WC-600-33-N3.5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable web crippling load (Condition 1)	lb	240.0	239.7	-0.12		Pass

SSMA-WC-600-33-N6: 600S162-33 (33 ksi) web crippling, end one-flange, fastened, N = 6 in.

Source: SSMA Product Technical Guide (2022), Allowable Web Crippling Loads, Single Members (S-Sections), pp. 59 (PDF p. 59). Calculation: Cold-formed steel stud.

SSMA tabulates by web depth and thickness (6 in., 54 / 33 mil); Table G5-2 coefficients C = 4, CR = 0.14, CN = 0.35, Ch = 0.02, Ω = 1.75 (unchanged from S100-12).

SSMA-WC-600-33-N6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable web crippling load (Condition 1)	lb	297.0	297.5	+0.15		Pass

SSMA-AX-800S162-54-8-12: 800S162-54 (50 ksi), 8 ft wall at 12 in., 5 psf: allowable axial load, punched

Source: SSMA Product Technical Guide (2022), Combined Axial and Lateral Loads, pp. 32. Calculation: Cold-formed steel stud.

SSMA-AX-800S162-54-8-12 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable axial load	lb	5,430	5,433	+0.06		Pass

SSMA-AX-800S162-54-8-16: 800S162-54 (50 ksi), 8 ft wall at 16 in., 5 psf: allowable axial load, punched

Source: SSMA Product Technical Guide (2022), Combined Axial and Lateral Loads, pp. 32. Calculation: Cold-formed steel stud.

SSMA-AX-800S162-54-8-16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable axial load	lb	5,400	5,405	+0.09		Pass

SSMA-AX-800S162-54-8-24: 800S162-54 (50 ksi), 8 ft wall at 24 in., 5 psf: allowable axial load, punched

Source: SSMA Product Technical Guide (2022), Combined Axial and Lateral Loads, pp. 32. Calculation: Cold-formed steel stud.

SSMA-AX-800S162-54-8-24 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable axial load	lb	5,350	5,348	-0.04		Pass

SSMA-AX-800S162-54-12-16: 800S162-54 (50 ksi), 12 ft wall at 16 in., 5 psf: allowable axial load, punched

Source: SSMA Product Technical Guide (2022), Combined Axial and Lateral Loads, pp. 32. Calculation: Cold-formed steel stud.

SSMA-AX-800S162-54-12-16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable axial load	lb	5,240	5,247	+0.13		Pass

SSMA-AX-800S162-54-16-16: 800S162-54 (50 ksi), 16 ft wall at 16 in., 5 psf: allowable axial load, punched

Source: SSMA Product Technical Guide (2022), Combined Axial and Lateral Loads, pp. 32. Calculation: Cold-formed steel stud.

SSMA-AX-800S162-54-16-16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable axial load	lb	4,980	4,993	+0.26		Pass

SSMA-AX-800S162-43-8-16: 800S162-43 (33 ksi), 8 ft wall at 16 in., 5 psf: allowable axial load, punched

Source: SSMA Product Technical Guide (2022), Combined Axial and Lateral Loads, pp. 32. Calculation: Cold-formed steel stud.

SSMA-AX-800S162-43-8-16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable axial load	lb	3,320	3,321	+0.04		Pass

SSMA-AX-800S162-43-12-16: 800S162-43 (33 ksi), 12 ft wall at 16 in., 5 psf: allowable axial load, punched

Source: SSMA Product Technical Guide (2022), Combined Axial and Lateral Loads, pp. 32. Calculation: Cold-formed steel stud.

SSMA-AX-800S162-43-12-16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable axial load	lb	3,150	3,152	+0.05		Pass

SSMA-AX-800S162-43-16-24: 800S162-43 (33 ksi), 16 ft wall at 24 in., 5 psf: allowable axial load, punched

Source: SSMA Product Technical Guide (2022), Combined Axial and Lateral Loads, pp. 32. Calculation: Cold-formed steel stud.

SSMA-AX-800S162-43-16-24 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable axial load	lb	2,620	2,627	+0.26		Pass

SSMA-AX-800S162-68-8-16: 800S162-68 (50 ksi), 8 ft wall at 16 in., 5 psf: allowable axial load, punched

Source: SSMA Product Technical Guide (2022), Combined Axial and Lateral Loads, pp. 32. Calculation: Cold-formed steel stud.

SSMA-AX-800S162-68-8-16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable axial load	lb	7,220	7,220	-0.00		Pass

SSMA-AX-800S162-68-16-16: 800S162-68 (50 ksi), 16 ft wall at 16 in., 5 psf: allowable axial load, punched

Source: SSMA Product Technical Guide (2022), Combined Axial and Lateral Loads, pp. 32. Calculation: Cold-formed steel stud.

SSMA-AX-800S162-68-16-16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable axial load	lb	6,800	6,811	+0.16		Pass

SSMA-AX-800S162-97-8-16: 800S162-97 (50 ksi), 8 ft wall at 16 in., 5 psf: allowable axial load, punched

Source: SSMA Product Technical Guide (2022), Combined Axial and Lateral Loads, pp. 32. Calculation: Cold-formed steel stud.

SSMA-AX-800S162-97-8-16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable axial load	lb	11,230	11,237	+0.07		Pass

SSMA-AX-800S162-97-16-16: 800S162-97 (50 ksi), 16 ft wall at 16 in., 5 psf: allowable axial load, punched

Source: SSMA Product Technical Guide (2022), Combined Axial and Lateral Loads, pp. 32. Calculation: Cold-formed steel stud.

SSMA-AX-800S162-97-16-16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable axial load	lb	10,800	10,822	+0.20		Pass

SSMA-MAD-800S162-54: 800S162-54 (50 ksi) allowable distortional moment

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 11. Calculation: Cold-formed steel stud.

SSMA-MAD-800S162-54 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mad	lb-in	32,810	32,812	+0.01		Pass

SSMA-MAD-800S162-43: 800S162-43 (33 ksi) allowable distortional moment

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 11. Calculation: Cold-formed steel stud.

SSMA-MAD-800S162-43 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mad	lb-in	18,330	18,328	-0.01		Pass

SSMA-MAD-600S162-33: 600S162-33 (33 ksi) allowable distortional moment

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 10. Calculation: Cold-formed steel stud.

SSMA-MAD-600S162-33 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mad	lb-in	9,470	9,466	-0.04		Pass

HAND-TRK-DT: 600S162-43 studs at 16 in., 54 mil deflection track, e = 3/4 in.

Source: Hand calculation (closed form). Calculation: Cold-formed steel track.

Hand calculation; the default design.

HAND-TRK-DT · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
wdt (Eq. B3.2.5.2-2)	in.	12.57	12.57	+0.00		Pass
φ Pndt (Eq. B3.2.5.2-1)	lb	369.3	369.3	+0.00		Pass
φ Pn, stud web crippling, N = 1 in. (G5)	lb	362.7	362.7	+0.00		Pass

HAND-TRK-DT · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pndt / Ω	lb	239.8	239.8	+0.00		Pass
Screws into the support, Pn / Ω (J4.3.1)	lb	715.2	715.2	+0.00		Pass

HAND-TRK-STD: 362S162-54 stud in a 54 mil standard track, both flanges screwed

Source: Hand calculation (closed form). Calculation: Cold-formed steel track.

Hand calculation; N = 1.25 in., the track flange.

HAND-TRK-STD · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φ Pnst, single interior stud (Eq. B3.2.5.1-1, C = 3.70)	lb	1,565	1,565	+0.00		Pass

HAND-TRK-STD · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pnst / Ω, single interior stud	lb	1,023	1,023	+0.00		Pass

HAND-TRK-OPEN: 362S162-54 stud with its web facing an opening, standard track

Source: Hand calculation (closed form). Calculation: Cold-formed steel track.

Hand calculation; N = 1.25 in. for configurations other than a single interior stud.

HAND-TRK-OPEN · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φ Pnst, web facing the opening (C = 1.85)	lb	739.0	739.0	+0.00		Pass

HAND-TRK-JAMB: Two 362S162-54 jamb studs back to back, 54 mil track

Source: Hand calculation (closed form). Calculation: Cold-formed steel track.

Hand calculation; Fut = 65 ksi.

HAND-TRK-JAMB · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φ Pnst, track at back-to-back jamb studs (Eq. B3.2.5.1-3)	lb	2,374	2,374	+0.00		Pass
φ Pnst, stud webs (C = 7.40)	lb	2,956	2,956	+0.00		Pass

S100-J7.2.2: PAFs at 16 in. into concrete, 54 mil track (the default)

Source: AISI S100-16 J7.2.2 (printed constants) and hand calculations, pp. Specification pp. 117-124. Calculation: Cold-formed steel track anchorage.

The J7.2.2 values are printed in the Specification; the rest is hand calculation.

S100-J7.2.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φ Pnos, PAF pull-out in shear (J7.2.2: 0.50 × 1,450 lb)	lb	725.0	725.0	+0.00		Pass
φ Pntp (Eq. J5.2.1-1, Fuh = 260 ksi)	lb	2,576	2,576	+0.00		Pass
φ Pnov, pull-over of the track (Eq. J5.2.3-1)	lb	1,656	1,656	+0.00		Pass
φ Pnb, track bearing (Eq. J5.3.2-1 form)	lb	1,366	1,366	+0.00		Pass
Uplift per PAF, 0.9D + 1.0W	lb	80.00	80.00	+0.00		Pass
T/Ta + V/Va (Commentary Eq. C-J5.4-1, n = 1)		0.606	0.606	+0.00		Pass

S100-J7.2.2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pnos / Ω (J7.2.2: 1,450 lb / 3.25)	lb	446.2	446.2	+0.00		Pass
Pnov / Ω	lb	1,104	1,104	+0.00		Pass

HAND-TA-PAF-STEEL: PAFs (ds 0.157 in.) into a 1/4 in. steel support

Source: Hand calculation (closed form). Calculation: Cold-formed steel track anchorage.

HAND-TA-PAF-STEEL · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φ Pnb, bearing and tilting (Eq. J5.3.2-1)	lb	1,479	1,479	+0.00		Pass
φ Pnos, pull-out in shear (Eq. J5.3.3-1)	lb	1,903	1,903	+0.00		Pass

HAND-TA-PAF-STEEL · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pnos / Ω (Eq. J5.3.3-1)	lb	1,244	1,244	+0.00		Pass

HAND-TA-SCREW: No. 12 screws into a 1/4 in. steel support

Source: Hand calculation (closed form). Calculation: Cold-formed steel track anchorage.

HAND-TA-SCREW · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φ Pnot, screw pull-out (Eq. J4.4.1-1)	lb	1,492	1,492	+0.00		Pass
φ Pnov, pull-over (Eq. J4.4.2-1, head 0.340 in.)	lb	938.1	938.1	+0.00		Pass

HAND-TA-SCREW · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pnov / Ω, screws	lb	625.4	625.4	+0.00		Pass

HAND-TA-ANCHOR: 1/2 in. anchors into concrete through a 54 mil track

Source: Hand calculation (closed form). Calculation: Cold-formed steel track anchorage.

HAND-TA-ANCHOR · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φ Pnb, track bearing (Eq. J3.3.1-1)	lb	2,483	2,483	+0.00		Pass

HAND-TA-ANCHOR · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pnb / Ω, track bearing	lb	1,656	1,656	+0.00		Pass

SSMA-T-800S162-54: 800S162-54 (50 ksi) as a sheathed top chord: Mal, Vag

Source: SSMA Product Technical Guide (2022), pp. 11 (PDF p. 11). Calculation: Cold-formed steel truss.

SSMA-T-800S162-54 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mal = 36.79 kip-in.	lb-in	36,790	36,833	+0.12		Pass
Vag	lb	2,091	2,091	-0.01		Pass

SSMA-T-1000S162-54: 1000S162-54 (50 ksi) as a sheathed top chord: Mal, Vag

Source: SSMA Product Technical Guide (2022), pp. 12 (PDF p. 12). Calculation: Cold-formed steel truss.

SSMA-T-1000S162-54 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mal = 47.07 kip-in.	lb-in	47,070	47,108	+0.08		Pass
Vag	lb	1,661	1,660	-0.03		Pass

SSMA-T-600S162-33: 600S162-33 (33 ksi) as a sheathed top chord: Mal, Vag

Source: SSMA Product Technical Guide (2022), pp. 10 (PDF p. 10). Calculation: Cold-formed steel truss.

SSMA-T-600S162-33 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mal = 11.41 kip-in.	lb-in	11,410	11,419	+0.08		Pass
Vag	lb	638.0	637.9	-0.01		Pass

CT-D1: 600S162-54 top chord: S100 E4 against the library's Pnd, and web crippling, all from their equations

Source: Hand calculation from the cited sections, pp. AISI S100-16 E4, G5; AISI S240-20 E4.4.2.3. Calculation: Cold-formed steel truss.

CT-D1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φ Pnd	kips	13.12	13.12	+0.00		Pass
φ Pn at a reaction	kips	1.432	1.353	-5.56		Pass

CT-D1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pn at a reaction / Ω	kips	0.909	0.909	+0.00		Pass

CT-H1: 600S162-54 top chord compression, all lengths 48 in.

Source: Hand calculation from the cited sections, pp. AISI S100-16 E2, E3. Calculation: Cold-formed steel truss.

CT-H1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φc Pn	kips	10.18	10.18	+0.01		Pass

CT-H1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pn/Ωc	kips	6.651	6.651	+0.01		Pass

CT-H2: 600S162-54 bottom chord tension yielding and rupture

Source: Hand calculation from the cited sections, pp. AISI S100-16 D2, D3. Calculation: Cold-formed steel truss.

CT-H2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φt Tn yielding	kips	25.03	25.04	+0.00		Pass
φt Tn rupture	kips	27.12	27.12	+0.00		Pass

CT-H2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tn/Ωt yielding	kips	16.66	16.66	+0.00		Pass

CT-H3: 600S162-54 top chord, local buckling in flexure, 48 in. unbraced

Source: Hand calculation from the cited sections, pp. AISI S100-16 F2, F3. Calculation: Cold-formed steel truss.

CT-H3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mne	kip-ft	41.90	41.89	-0.01		Pass
Mnℓ	kip-ft	41.70	41.70	+0.01		Pass

CT-H4: 600S162-54 shear

Source: Hand calculation from the cited sections, pp. AISI S100-16 G2. Calculation: Cold-formed steel truss.

CT-H4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φv Vn	kips	4.290	4.290	+0.00		Pass

CT-H4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vn/Ωv	kips	2.822	2.822	+0.00		Pass

HC-TRUSSBR-C23: Web restrained at midheight, 10 trusses at 24 in. per diagonal

Source: Hand calculation (closed form). Calculation: Cold-formed steel truss bracing.

HC-TRUSSBR-C23 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Brace force Prb = 0.01 Pr	kips	0.029	0.029	+0.00		Pass
Required stiffness βrb (LRFD)		0.427	0.427	+0.00		Pass
Accumulated force m Prb	kips	0.288	0.288	+0.00		Pass
Diagonal force m Prb Ld / run	kips	0.519	0.519	+0.00		Pass
Stiffness provided		1.987	1.987	+0.00		Pass

HC-TRUSSBR-C23 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required stiffness βrb (ASD)		0.444	0.444	+0.00		Pass

HC-TRUSSBR-ROWS: Two restraint rows: n = 2, Lb = L/3

Source: Hand calculation (closed form). Calculation: Cold-formed steel truss bracing.

HC-TRUSSBR-ROWS · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required stiffness βrb with n = 2		0.960	0.960	+0.00		Pass

SSMA-WH-600S162-33-33: 600S162-33 (33 ksi) unpunched: allowable moments and shear

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 10. Calculation: Web holes in cold-formed members.

SSMA-WH-600S162-33-33 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mal, local buckling (F3)	lb-in	11,410	11,419	+0.08		Pass
Mad, distortional, kφ = 0 (F4)	lb-in	9,470	9,466	-0.04		Pass
Vag, unpunched (G2)	lb	638.0	637.9	-0.01		Pass

SSMA-WH-600S200-54-50: 600S200-54 (50 ksi) unpunched: allowable moments and shear

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 11. Calculation: Web holes in cold-formed members.

SSMA-WH-600S200-54-50 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mal, local buckling (F3)	lb-in	30,400	30,484	+0.28		Pass
Mad, distortional, kφ = 0 (F4)	lb-in	27,380	27,383	+0.01		Pass
Vag, unpunched (G2)	lb	2,823	2,822	-0.03		Pass

SSMA-WH-800S162-54-50: 800S162-54 (50 ksi) unpunched: allowable moments and shear

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 11. Calculation: Web holes in cold-formed members.

SSMA-WH-800S162-54-50 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mal, local buckling (F3)	lb-in	36,790	36,833	+0.12		Pass
Mad, distortional, kφ = 0 (F4)	lb-in	32,810	32,812	+0.01		Pass
Vag, unpunched (G2)	lb	2,091	2,091	-0.01		Pass

SSMA-WH-800S162-68-50: 800S162-68 (50 ksi) unpunched: allowable moments and shear

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 11. Calculation: Web holes in cold-formed members.

SSMA-WH-800S162-68-50 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mal, local buckling (F3)	lb-in	49,800	49,804	+0.01		Pass
Mad, distortional, kφ = 0 (F4)	lb-in	45,110	45,110	-0.00		Pass
Vag, unpunched (G2)	lb	4,221	4,220	-0.03		Pass

SSMA-WH-1000S162-68-50: 1000S162-68 (50 ksi) unpunched: allowable moments and shear

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 12. Calculation: Web holes in cold-formed members.

SSMA-WH-1000S162-68-50 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mal, local buckling (F3)	lb-in	64,510	64,507	-0.01		Pass
Mad, distortional, kφ = 0 (F4)	lb-in	56,350	56,355	+0.01		Pass
Vag, unpunched (G2)	lb	3,345	3,345	-0.01		Pass

SSMA-WH-VANET-600S162-33-33: 600S162-33 (33 ksi) shear at the 1-1/2 × 4-1/2 in. punchout

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 10. Calculation: Web holes in cold-formed members.

SSMA-WH-VANET-600S162-33-33 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vanet (G3, qs)	lb	638.0	637.9	-0.01		Pass

SSMA-WH-VANET-600S162-43-33: 600S162-43 (33 ksi) shear at the 1-1/2 × 4-1/2 in. punchout

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 10. Calculation: Web holes in cold-formed members.

SSMA-WH-VANET-600S162-43-33 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vanet (G3, qs)	lb	1,240	1,240	+0.00		Pass

SSMA-WH-VANET-600S162-54-50: 600S162-54 (50 ksi) shear at the 1-1/2 × 4-1/2 in. punchout

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 10. Calculation: Web holes in cold-formed members.

SSMA-WH-VANET-600S162-54-50 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vanet (G3, qs)	lb	1,947	1,947	-0.00		Pass

SSMA-WH-VANET-600S162-68-50: 600S162-68 (50 ksi) shear at the 1-1/2 × 4-1/2 in. punchout

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 10. Calculation: Web holes in cold-formed members.

SSMA-WH-VANET-600S162-68-50 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vanet (G3, qs)	lb	2,879	2,880	+0.03		Pass

SSMA-WH-VANET-800S162-54-50: 800S162-54 (50 ksi) shear at the 1-1/2 × 4-1/2 in. punchout

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 11. Calculation: Web holes in cold-formed members.

SSMA-WH-VANET-800S162-54-50 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vanet (G3, qs)	lb	2,091	2,091	-0.01		Pass

SSMA-WH-VANET-800S162-68-50: 800S162-68 (50 ksi) shear at the 1-1/2 × 4-1/2 in. punchout

Source: SSMA Product Technical Guide (2022), Structural (S) Section Properties, pp. 11. Calculation: Web holes in cold-formed members.

SSMA-WH-VANET-800S162-68-50 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vanet (G3, qs)	lb	3,367	3,367	-0.01		Pass

SSMA-WH-WC-600S162-54-end-N1: 600S162-54 (50 ksi) web crippling, fastened, end, N = 1 in.

Source: SSMA Product Technical Guide (2022), Allowable Web Crippling Loads, Single Members, pp. 59. Calculation: Web holes in cold-formed members.

SSMA-WH-WC-600S162-54-end-N1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable web crippling, end one-flange	lb	599.0	598.9	-0.01		Pass

SSMA-WH-WC-600S162-54-interior-N3.5: 600S162-54 (50 ksi) web crippling, fastened, interior, N = 3.5 in.

Source: SSMA Product Technical Guide (2022), Allowable Web Crippling Loads, Single Members, pp. 59. Calculation: Web holes in cold-formed members.

SSMA-WH-WC-600S162-54-interior-N3.5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable web crippling, interior one-flange	lb	1,713	1,713	+0.01		Pass

HAND-WH-CIRC: 600S162-54, 2-1/2 in. circular hole: G3 shear

Source: Hand calculation (closed form). Calculation: Web holes in cold-formed members.

Hand calculation: h = 5.717 in., c/t below 54, Vn from G2 times qs.

HAND-WH-CIRC · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
c = h/2 − dh/2.83	in.	1.975	1.975	+0.00		Pass
qs (Eq. G3-1)		0.646	0.646	+0.00		Pass
φVn at the hole	lb	2,772	2,772	-0.00		Pass

HAND-WH-G6: 600S162-54, slotted hole 2 in. from an end bearing: G6

Source: Hand calculation (closed form). Calculation: Web holes in cold-formed members.

Hand calculation: Pn by Eq. G5-1 with Table G5-2 (fastened end: C 4, CR 0.14, CN 0.35, Ch 0.02), Rc = 1.01 − 0.325 dh/h + 0.083 x/h.

HAND-WH-G6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φ Pn Rc, end one-flange (Eq. G6-1)	lb	963.4	963.4	+0.00		Pass

WW-V3-5: 5-ply V3 floor panel, 15 ft span, 75 psf D + 50 psf L

Source: WoodWorks, Breneman, Structural Analysis and Design of CLT (slides, 2023-12), pp. slides 30, 33, 38-42. Calculation: CLT panel.

The built-in V3 bending value was corrected with this example (Fb of the major laminations 1,100 → 750 psi: Annex A then gives 3,977 lb-ft/ft against the published 4,000).

WW-V3-5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ma = wL²/8	lb-ft/ft	3,516	3,516	-0.01		Pass
(FbS)eff' = CD (FbS)eff,f,0 (PRG 320 Table A2)	lb-ft/ft	4,000	3,977	-0.56		Pass
Va = wL/2	lb/ft	938.0	937.5	-0.05		Pass
Vs,0 (no CD on rolling shear)	lb/ft	3,025	3,025	+0.00		Pass
(EI)eff,f,0	10^6 lb-in²/ft	363.0	360.3	-0.74		Pass
(GA)eff,f,0	10^6 lb/ft	0.980	0.981	+0.14		Pass

WW-V3-5d: 5-ply V3 floor panel: deflections with the PRG 320 table values

Source: WoodWorks, Breneman, Structural Analysis and Design of CLT (slides, 2023-12), pp. slide 43. Calculation: CLT panel.

WW-V3-5d · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ΔST from 50 psf live	in.	0.177	0.178	+0.30		Pass
ΔT = Kcr ΔLT + ΔST = 2.0 (0.266) + 0.177	in.	0.709	0.710	+0.15		Pass

WW-V1-5: 5-ply V1 floor panel, 16 ft span, 40 psf D + 40 psf L

Source: WoodWorks, Gesa, Mass Timber Structural Design (slides, 2025-03), pp. slides 30-32, 37, 40. Calculation: CLT panel.

WW-V1-5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mb = wL²/8	lb-ft/ft	2,560	2,560	+0.00		Pass
(FbS)eff' = CD (FbS)eff,f,0 (PRG 320 Table A2)	lb-ft/ft	4,800	4,773	-0.56		Pass
Va = wL/2	lb/ft	640.0	640.0	+0.00		Pass
Vs,0	lb/ft	3,300	3,300	+0.00		Pass
(EI)eff,f,0	10^6 lb-in²/ft	415.0	411.8	-0.78		Pass
(GA)eff,f,0 (quoted as 1.1)	10^6 lb/ft	1.100	1.062	-3.45		Pass

WW-V1-5d: 5-ply V1 floor panel: deflections with the PRG 320 table values

Source: WoodWorks, Gesa, Mass Timber Structural Design (slides, 2025-03), pp. slide 42. Calculation: CLT panel.

WW-V1-5d · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ΔST from 40 psf live	in.	0.159	0.159	-0.09		Pass
ΔT = Kcr ΔLT + ΔST = 2.0 (0.159) + 0.159	in.	0.477	0.477	-0.09		Pass

WW-V1-3: 3-ply V1 (residual section of the fire example): (FbS)eff

Source: WoodWorks, Mass Timber / CLT design webinar (slides, 2021-11), pp. slides 53, 55. Calculation: CLT panel.

WW-V1-3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
(FbS)eff,f,0 (PRG 320 Table A2)	lb-ft/ft	2,090	2,089	-0.04		Pass

HAND-1 · CLT panel: E1 5-ply floor panel, 15 ft simple span

Source: Hand calculation (closed form). Calculation: CLT panel.

HAND-1 · CLT panel · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
(EI)eff	10^6 lb-in²/ft	437.5	437.5	+0.00		Pass
(GA)eff	10^6 lb/ft	0.925	0.925	+0.00		Pass
(FbS)eff'	lb-ft/ft	10,341	10,341	+0.00		Pass
M	lb-ft/ft	1,828	1,828	+0.00		Pass
Vs'	lb/ft	2,475	2,475	+0.00		Pass
Live load deflection (with shear)	in.	0.152	0.152	+0.00		Pass
Total deflection with creep	in.	0.243	0.243	-0.00		Pass

HAND-1 · CLT panel · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
(FbS)eff' = (FbS)eff KF φ λ	lb-ft/ft	17,861	17,861	+0.00		Pass
Vs' = Vs KF φ	lb/ft	3,712	3,712	+0.00		Pass

PRG-E1-3: E1 3-ply effective properties

Source: ANSI/APA PRG 320-19 Table A2 (recalled; PRG 320 not on disk). Calculation: CLT panel.

PRG-E1-3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
(FbS)eff,f,0 [verify against the published example]	lb-ft/ft	4,525	4,526	+0.03		Pass
(EI)eff,f,0 [verify against the published example]	10^6 lb-in²/ft	115.0	114.9	-0.08		Pass
(GA)eff,f,0 [verify against the published example]	10^6 lb/ft	0.460	0.462	+0.51		Pass
Vs,0 [verify against the published example]	lb/ft	1,490	1,485	-0.34		Pass

PRG-V1-3: V1 3-ply effective properties

Source: ANSI/APA PRG 320-19 Table A2 (recalled; PRG 320 not on disk). Calculation: CLT panel.

PRG-V1-3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
(FbS)eff,f,0 [verify against the published example]	lb-ft/ft	2,090	2,089	-0.04		Pass
(EI)eff,f,0 [verify against the published example]	10^6 lb-in²/ft	108.0	108.1	+0.13		Pass
(GA)eff,f,0 [verify against the published example]	10^6 lb/ft	0.530	0.531	+0.20		Pass
Vs,0 [verify against the published example]	lb/ft	1,980	1,980	+0.00		Pass

FEMA-65: Unit shear and connector capacity, Tables 6-4, 6-5

Source: FEMA P-2192-V1 (2020), Ch. 6, Three-Story CLT Shear Wall, pp. pp. 229, 233. Calculation: CLT shear wall.

FEMA-65 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Unit shear, Story 3	plf	477.0	477.0	-0.00		Pass
Unit shear, Story 2	plf	1,009	1,009	+0.00		Pass
Unit shear, Story 1	plf	1,273	1,273	+0.01		Pass
Nominal unit shear capacity, Story 3	plf	1,096	1,097	+0.08		Pass
Nominal unit shear capacity, Story 2	plf	2,193	2,194	+0.03		Pass
Nominal unit shear capacity, Story 1	plf	2,742	2,742	+0.00		Pass
Design unit shear capacity, Story 3	plf	548.0	548.4	+0.08		Pass
Design unit shear capacity, Story 2	plf	1,097	1,097	-0.01		Pass
Design unit shear capacity, Story 1	plf	1,371	1,371	+0.00		Pass
Connectors at the adjoining edge, Story 3		4.000	4.000	+0.00		Pass
Connectors at the adjoining edge, Story 2		8.000	8.000	+0.00		Pass
Connectors at the adjoining edge, Story 1		10.00	10.00	+0.00		Pass

FEMA-PANEL: Panel shear and tension

Source: FEMA P-2192-V1 (2020), Ch. 6, Three-Story CLT Shear Wall, pp. pp. 233-234, 238. Calculation: CLT shear wall.

FEMA-PANEL · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fr, printed 20,849 plf: 0.75 x 2.88 x 9,700 is 20,952	plf	20,849	20,952	+0.49		Pass
Nominal panel shear, printed 27,799 plf	plf	27,799	27,936	+0.49		Pass
Panel tension over 1 ft	lb	98,010	98,010	+0.00		Pass

FEMA-66: Hold-down strength, Tables 6-6, 6-7

Source: FEMA P-2192-V1 (2020), Ch. 6, Three-Story CLT Shear Wall, pp. pp. 237-238. Calculation: CLT shear wall.

FEMA-66 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
T at 2 times the connector capacity, Story 3	lb	11,293	11,293	-0.00		Pass
T at 2 times the connector capacity, Story 2	lb	34,540	34,516	-0.07		Pass
T at 2 times the connector capacity, Story 1	lb	63,968	63,913	-0.09		Pass
T under strength forces, Story 3	lb	4,714	4,712	-0.05		Pass
T under strength forces, Story 2	lb	14,604	14,598	-0.04		Pass
T under strength forces, Story 1	lb	27,472	27,456	-0.06		Pass
Hold-down deformation, story 1	in.	0.098	0.098	+0.19		Pass
Hold-down deformation, story 3	in.	0.034	0.034	-0.89		Pass

FEMA-68: Compression zone, Table 6-8

Source: FEMA P-2192-V1 (2020), Ch. 6, Three-Story CLT Shear Wall, pp. pp. 242-243. Calculation: CLT shear wall.

FEMA-68 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Compression zone x, Story 3	in.	2.000	1.994	-0.28		Pass
Compression zone x, Story 2	in.	7.640	7.641	+0.01		Pass
Compression zone x, Story 1	in.	4.560	4.554	-0.12		Pass
Compression force C, Story 3	lb	5,257	5,255	-0.04		Pass
Compression force C, Story 2	lb	20,144	20,132	-0.06		Pass
Compression force C, Story 1	lb	36,545	36,522	-0.06		Pass
F' on the floor panel	psi	638.0	638.8	+0.12		Pass
F' in end grain	psi	2,916	2,916	+0.00		Pass

FEMA-69: Deflection, Eq. B-1 and Table 6-9

Source: FEMA P-2192-V1 (2020), Ch. 6, Three-Story CLT Shear Wall, pp. pp. 244-246. Calculation: CLT shear wall.

FEMA-69 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bending term, Story 3	in.	0.020	0.019	-7.16		Pass
Bending term, Story 2	in.	0.040	0.039	-1.80		Pass
Bending term, Story 1	in.	0.050	0.050	-0.88		Pass
Shear term, Story 3	in.	0.040	0.038	-4.24		Pass
Shear term, Story 2	in.	0.090	0.081	-9.97		Deviation FEMA-69-H
FEMA-69-H: Table 6-9's shear and total columns at stories 2 and 1 follow panel height plus the floor panel above, while Eq. B-1 defines h as the panel height: ILX uses the panel height, about 0.01 in. less						
Shear term, Story 1	in.	0.110	0.102	-7.06		Deviation FEMA-69-H
FEMA-69-H: Table 6-9's shear and total columns at stories 2 and 1 follow panel height plus the floor panel above, while Eq. B-1 defines h as the panel height: ILX uses the panel height, about 0.01 in. less						
Nail slip terms, Story 3	in.	0.150	0.148	-1.37		Pass
Nail slip terms, Story 2	in.	0.160	0.156	-2.20		Pass
Nail slip terms, Story 1	in.	0.160	0.158	-1.28		Pass
Anchorage term, Story 3	in.	0.040	0.037	-8.71		Pass
Anchorage term, Story 2	in.	0.040	0.042	+4.50		Pass
Anchorage term, Story 1	in.	0.030	0.028	-6.49		Pass
Deflection, Story 3	in.	0.240	0.241	+0.56		Pass
Deflection, Story 2	in.	0.330	0.319	-3.46		Deviation FEMA-69-H
FEMA-69-H: Table 6-9's shear and total columns at stories 2 and 1 follow panel height plus the floor panel above, while Eq. B-1 defines h as the panel height: ILX uses the panel height, about 0.01 in. less						
Deflection, Story 1	in.	0.350	0.338	-3.49		Deviation FEMA-69-H
FEMA-69-H: Table 6-9's shear and total columns at stories 2 and 1 follow panel height plus the floor panel above, while Eq. B-1 defines h as the panel height: ILX uses the panel height, about 0.01 in. less						
Load per nail, story 3	lb	142.0	141.6	-0.28		Pass
Bearing deformation on the floor panel, story 3	in.	0.094	0.094	+0.11		Pass
Total anchorage movement, story 3	in.	0.130	0.128	-1.69		Pass
Allowable deflection	in.	0.950	0.950	+0.00		Pass

WW-CG: Connector factor CG

Source: WoodWorks Carrigg 2023, CLT Shear Walls and Diaphragms, slide on the panel to platform connection. Calculation: CLT shear wall.

WW-CG · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
CG at G = 0.35		0.860	0.860	+0.00		Pass

HC-ASD · CLT shear wall: Allowable stress and wind, by hand

Source: Hand calculation (closed form). Calculation: CLT shear wall.

HC-ASD · CLT shear wall · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
v = 0.6 x 10,000 / 9.5	plf	631.6	631.6	-0.00		Pass
vd = 2 x 2,605 / 4.75 / 2.0	plf	548.4	548.4	+0.00		Pass
T = (2 x 548.4 x 4.75 x 9.5 − 0.6 x 200 x 4.75² / 2) / 4.25	lb	11,328	11,327	-0.01		Pass
Fr = 1.6 x 9,700	plf	15,520	15,520	+0.00		Pass

SP-CF: Combined footing at a property line, h = 36 in (Wight Ex. 15-5)

Source: StructurePoint, Reinforced Concrete Column Combined Footing Analysis and Design (ACI 318-14), after Wight, Reinforced Concrete Mechanics and Design, 7th Ed., Example 15-5, pp. pp. 4-11. Calculation: Combined footing.

SP-CF · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Punching vu, interior column (four-sided, d = 32.5 in)	psi	80.20	80.16	-0.06		Pass
Punching vu, exterior column (three-sided, with γv Munb) Vu = 405.1 kips, Munb = 6950 kip-in about the section centroid, γv = 0.335	psi	192.0	191.7	-0.14		Pass
φvc = 0.75 × 4√f'c	psi	164.3	164.3	+0.01		Pass
Negative moment between the columns read from the published moment diagram (rounded)	kip-ft	2,100	2,112	+0.57		Pass

SP-CF-40: Combined footing at a property line, h = 40 in (Wight Ex. 15-5)

Source: StructurePoint, Reinforced Concrete Column Combined Footing Analysis and Design (ACI 318-14), after Wight, Reinforced Concrete Mechanics and Design, 7th Ed., Example 15-5, pp. pp. 8-11. Calculation: Combined footing.

SP-CF-40 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
As,min = 0.0018 b h (slab provisions)	in.²	6.910	6.912	+0.03		Pass
Punching vu, exterior column (d = 36.5 in)	psi	157.0	242.6	+54.49		Deviation CF-OPEN-SIDE

CF-OPEN-SIDE: the column's side faces are 36 in from the long edges, less than d = 36.5 in, so the program also checks the section open to those edges, which governs; the publication checks only the three-sided section

CF-1: Two-column rectangular footing (the default design)

Source: Hand calculation (closed form). Calculation: Combined footing.

CF-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Service soil pressure (D + L) R/(BL)(1 + 6|e|/L), e from the resultant of the columns and the weights	ksf	3.296	3.296	+0.00		Pass
Largest negative moment (top steel) M(x) = w0 x²/2 + k x³/6 − P1 (x − x1) at V = 0	kip-ft	692.5	692.5	-0.00		Pass
φMn of 11 #8 top bars	kip-ft	1,274	1,274	+0.00		Pass
One-way shear Vu at d from column 2	kips	136.9	136.9	+0.00		Pass
φVc (Table 22.5.5.1(c), λs = 1)	kips	149.8	149.8	+0.00		Pass
Transverse moment under column 2	kip-ft	195.0	195.0	+0.00		Pass

I.1: Composite beam on perpendicular deck, partial composite

Source: AISC Design Examples v16.0, Example I.1, pp. I-4 to I-16. Calculation: Composite beam.

Self-weight 50 plf = the Example's 5 psf over 10 ft. φMn: the Example reads Manual Table 3-18 at PNA location 5 (ΣQn = 386 kips, Y2 = 7.00 in.); ILX computes the plastic stress distribution with the provided ΣQn = 390 kips (a = 0.956 in.). ILB: the Example reads Manual Table 3-19 (ΣQn = 386 kips, Y2 = 7.00 in.); ILX uses Eq. C-I3-1 with ΣQn = 390 kips and d1 = 7.02 in.

I.1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Effective width b (I3.1a)	in.	120.0	120.0	+0.00		Pass
Qn, one anchor per rib (Eq. I8-1)	kips	17.20	17.23	+0.17		Pass
Qn, two anchors per rib (Eq. I8-1)	kips	14.60	14.65	+0.31		Pass
ΣQn provided	kips	390.0	391.1	+0.29		Pass
Composite action ΣQn / min(0.85 f'c Ac, Fy As)		0.531	0.532	+0.21		Pass
Construction stage required strength	kip-ft	344.0	344.2	+0.07		Pass
Composite required flexural strength	kip-ft	678.0	678.4	+0.06		Pass
Composite available flexural strength Manual Table 3-18, PNA 5, ΣQn = 386 kips	kip-ft	769.0	772.5	+0.45		Pass
Pre-composite deflection (before camber)	in.	2.590	2.587	-0.13		Pass
Lower-bound moment of inertia ILB Manual Table 3-19	in.⁴	2,520	2,533	+0.53		Pass
Live load deflection	in.	1.260	1.256	-0.33		Pass
Required shear strength	kips	60.30	60.30	-0.00		Pass
Available shear strength	kips	237.0	237.1	+0.05		Pass

I.1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Effective width b (I3.1a)	in.	120.0	120.0	+0.00		Pass
Qn, one anchor per rib (Eq. I8-1)	kips	17.20	17.23	+0.17		Pass
Qn, two anchors per rib (Eq. I8-1)	kips	14.60	14.65	+0.31		Pass
ΣQn provided	kips	390.0	391.1	+0.29		Pass
Composite action ΣQn / min(0.85 f'c Ac, Fy As)		0.531	0.532	+0.21		Pass
Construction stage required strength	kip-ft	266.0	265.8	-0.08		Pass
Composite required flexural strength	kip-ft	481.0	480.9	-0.01		Pass
Composite available flexural strength Manual Table 3-18, PNA 5, ΣQn = 386 kips	kip-ft	512.0	513.9	+0.38		Pass
Pre-composite deflection (before camber)	in.	2.590	2.587	-0.13		Pass
Lower-bound moment of inertia ILB Manual Table 3-19	in.⁴	2,520	2,533	+0.53		Pass
Live load deflection	in.	1.260	1.256	-0.33		Pass
Required shear strength	kips	42.80	42.75	-0.12		Pass
Available shear strength	kips	158.0	158.1	+0.05		Pass

I.2: Composite girder on parallel deck, third-point loads

Source: AISC Design Examples v16.0, Example I.2, pp. I-17 to I-35. Calculation: Composite beam.

Self-weight 76 plf (the Example uses an 80 plf trial weight for the construction moment and 76 plf after the selection). Mn: the Example takes d/2 = 12.0 in. and rounds 16,955 kip-in. to 17,000 kip-in. (1,420 kip-ft); ILX uses d/2 = 11.95 in. (1,408 kip-ft, 0.8 % lower).

I.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Effective width b (I3.1a)	in.	90.00	90.00	+0.00		Pass
Qn (Eq. I8-1, Rg = 1.0, Rp = 0.75)	kips	21.50	21.54	+0.17		Pass
Slab force C = ΣQn	kips	560.0	560.0	-0.01		Pass
Compression block depth a	in.	1.830	1.830	-0.00		Pass
d1 = Ycon − a/2	in.	6.590	6.585	-0.08		Pass
PNA depth in the top flange x	in.	0.623	0.623	-0.01		Pass
Construction stage required strength Example: 80 plf trial self-weight	kip-ft	624.0	623.1	-0.15		Pass
Construction stage available strength (Lb = 10 ft, Cb = 1.0)	kip-ft	677.0	677.3	+0.04		Pass
Composite required flexural strength	kip-ft	1,220	1,216	-0.31		Pass
Composite available flexural strength	kip-ft	1,280	1,267	-0.99		Pass
Pre-composite deflection (before camber)	in.	1.000	1.002	+0.17		Pass
Required shear strength	kips	122.0	122.0	-0.03		Pass
Available shear strength	kips	315.0	315.5	+0.15		Pass

I.2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Effective width b (I3.1a)	in.	90.00	90.00	+0.00		Pass
Qn (Eq. I8-1, Rg = 1.0, Rp = 0.75)	kips	21.50	21.54	+0.17		Pass
Slab force C = ΣQn	kips	560.0	560.0	-0.01		Pass
Compression block depth a	in.	1.830	1.830	-0.00		Pass
d1 = Ycon − a/2	in.	6.590	6.585	-0.08		Pass
PNA depth in the top flange x	in.	0.623	0.623	-0.01		Pass
Construction stage required strength Example: 80 plf trial self-weight	kip-ft	482.0	481.6	-0.09		Pass
Construction stage available strength (Lb = 10 ft, Cb = 1.0)	kip-ft	450.0	450.6	+0.14		Pass
Composite required flexural strength	kip-ft	864.0	863.5	-0.05		Pass
Composite available flexural strength	kip-ft	850.0	843.2	-0.80		Pass
Pre-composite deflection (before camber)	in.	1.000	1.002	+0.17		Pass
Required shear strength	kips	86.60	86.64	+0.05		Pass
Available shear strength	kips	210.0	210.3	+0.15		Pass

I.2-D: Composite girder: lower-bound moment of inertia and live load deflection

Source: AISC Design Examples v16.0, Example I.2, pp. I-30 to I-34. Calculation: Composite beam.

Method 1 (ILB) of the Example; 27 anchors between midspan and each support.

I.2-D · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ΣQn to midspan	kips	581.0	581.5	+0.09		Pass
YENA (Eq. C-I3-2)	in.	18.30	18.27	-0.15		Pass
ILB (Eq. C-I3-1)	$in.^4$	4,730	4,720	-0.21		Pass
Live load deflection $23PL^3/(648\ E\ ILB)$	in.	0.543	0.544	+0.26		Pass

T3-18 W21X50 TFL: W21X50, PNA TFL, ΣQn = 735 kips, Y2 = 5.0 in.

Source: AISC Steel Construction Manual, 16th Ed., Tables 3-18 and 3-19, pp. 3-178, 3-179, 3-203. Calculation: Composite beam.

Solid slab tc = Y2 + a/2 = 5.901 in. (a = ΣQn / (0.85 f'c b) = 1.801 in.); full composite: As Fy governs ΣQn

T3-18 W21X50 TFL · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Slab force C = ΣQn (Eq. I3-1)	kips	735.0	735.0	+0.00		Pass
Composite available flexural strength (Table 3-18)	kip-ft	849.0	848.9	-0.01		Pass
ILB (Table 3-19)	in.⁴	2,730	2,727	-0.11		Pass

T3-18 W21X50 TFL · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Slab force C = ΣQn (Eq. I3-1)	kips	735.0	735.0	+0.00		Pass
Composite available flexural strength (Table 3-18)	kip-ft	565.0	564.8	-0.03		Pass

T3-18 W21X50 PNA7: W21X50, PNA 7, ΣQn = 184 kips, Y2 = 5.0 in.

Source: AISC Steel Construction Manual, 16th Ed., Tables 3-18 and 3-19, pp. 3-178, 3-179, 3-203. Calculation: Composite beam.

Solid slab tc = Y2 + a/2 = 5.225 in. (a = ΣQn / (0.85 f'c b) = 0.451 in.); 8 anchors with Fu = 69.42 ksi give Qn = 23.00 kips each

T3-18 W21X50 PNA7 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Slab force C = ΣQn (Eq. I3-1)	kips	184.0	184.0	+0.00		Pass
Composite available flexural strength (Table 3-18)	kip-ft	591.0	588.2	-0.47		Pass
ILB (Table 3-19)	in.⁴	1,680	1,682	+0.12		Pass

T3-18 W21X50 PNA7 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Slab force C = ΣQn (Eq. I3-1)	kips	184.0	184.0	+0.00		Pass
Composite available flexural strength (Table 3-18)	kip-ft	393.0	391.3	-0.42		Pass

T3-18 W21X44 BFL: W21X44, PNA BFL, ΣQn = 358 kips, Y2 = 6.0 in.

Source: AISC Steel Construction Manual, 16th Ed., Tables 3-18 and 3-19, pp. 3-178, 3-179, 3-203. Calculation: Composite beam.

Solid slab tc = Y2 + a/2 = 6.439 in. (a = ΣQn / (0.85 f'c b) = 0.877 in.); 16 anchors with Fu = 67.53 ksi give Qn = 22.38 kips each

T3-18 W21X44 BFL · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Slab force C = ΣQn (Eq. I3-1)	kips	358.0	358.0	+0.00		Pass
Composite available flexural strength (Table 3-18)	kip-ft	661.0	660.7	-0.04		Pass
ILB (Table 3-19)	in.⁴	2,080	2,077	-0.13		Pass

T3-18 W21X44 BFL · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Slab force C = ΣQn (Eq. I3-1)	kips	358.0	358.0	+0.00		Pass
Composite available flexural strength (Table 3-18)	kip-ft	440.0	439.6	-0.09		Pass

T3-18 W18X60 TFL: W18X60, PNA TFL, ΣQn = 880 kips, Y2 = 4.0 in.

Source: AISC Steel Construction Manual, 16th Ed., Tables 3-18 and 3-19, pp. 3-178, 3-179, 3-203. Calculation: Composite beam.

Solid slab tc = Y2 + a/2 = 5.078 in. (a = ΣQn / (0.85 f'c b) = 2.157 in.); full composite: As Fy governs ΣQn

T3-18 W18X60 TFL · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Slab force C = ΣQn (Eq. I3-1)	kips	880.0	880.0	+0.00		Pass
Composite available flexural strength (Table 3-18)	kip-ft	865.0	864.6	-0.05		Pass
ILB (Table 3-19)	in.⁴	2,490	2,494	+0.17		Pass

T3-18 W18X60 TFL · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Slab force C = ΣQn (Eq. I3-1)	kips	880.0	880.0	+0.00		Pass
Composite available flexural strength (Table 3-18)	kip-ft	575.0	575.2	+0.04		Pass

I.9: W10X45 encased in 24 × 24 in., axial compression

Source: AISC Design Examples v16.0, Example I.9, pp. I-97 to I-103. Calculation: Encased composite column.

I.9 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pno (Eq. I2-7)	kips	3,410	3,409	-0.03		Pass
C1 (Eq. I2-6)		0.352	0.352	+0.05		Pass
EIeff about y (×10⁶ kip-in.²)		51.30	51.32	+0.04		Pass
Pe (Eq. I2-4)	kips	17,900	17,946	+0.26		Pass
Pn (Eq. I2-2)	kips	3,150	3,148	-0.05		Pass
φc Pn	kips	2,360	2,361	+0.05		Pass

I.9 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pn/Ωc	kips	1,580	1,574	-0.37		Pass

I.10: The same member in axial tension

Source: AISC Design Examples v16.0, Example I.10, pp. I-104 to I-106. Calculation: Encased composite column.

I.10 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φt Pn (Eq. I2-8)	kips	936.0	939.8	+0.40		Pass
Pu = 0.9D + 1.0W	kips	746.0	746.0	+0.00		Pass

I.10 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pn/Ωt	kips	623.0	625.3	+0.36		Pass
Pa = 0.6D + 0.6W	kips	432.0	432.0	+0.00		Pass

I.11-L: Combined compression and flexure, LRFD (Pu = 1,170 kips, Mu = 670 kip-ft)

Source: AISC Design Examples v16.0, Example I.11, pp. I-107 to I-113. Calculation: Encased composite column.

I.11-L · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
MB (Manual Table 6-2a)	kip-ft	748.0	746.3	-0.23		Pass
MD	kip-ft	1,050	1,048	-0.17		Pass
hn of point B	in.	4.980	4.980	-0.00		Pass
λ = Pn/Pno		0.924	0.924	-0.05		Pass
φc λ PC	kips	1,640	1,638	-0.13		Pass
φb MC	kip-ft	673.0	671.6	-0.20		Pass
Method 2 Simplified: Mr/MC		0.996	0.998	+0.20		Pass

I.11-L1: The same, Method 1 (Chapter H)

Source: AISC Design Examples v16.0, Example I.11, pp. I-108, I-109. Calculation: Encased composite column.

I.11-L1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pr/Pc + 8/9 Mr/Mc		1.381	1.382	+0.09		Pass

I.11-A: Combined compression and flexure, ASD (Pa = 879 kips, Ma = 302 kip-ft)

Source: AISC Design Examples v16.0, Example I.11, pp. I-107 to I-113. Calculation: Encased composite column.

I.11-A · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
λ PC/Ωc	kips	1,090	1,092	+0.18		Pass
MC/Ωb	kip-ft	448.0	446.9	-0.25		Pass
Method 2 Simplified: Mr/MC		0.674	0.676	+0.25		Pass

I.8: Load transfer, the force applied to the concrete

Source: AISC Design Examples v16.0, Example I.8, pp. I-85 to I-96. Calculation: Encased composite column.

I.8 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
V'r = Pr Fy As/Pno (Eq. I6-2a)	kips	304.0	304.3	+0.11		Pass
φ Qnv per 3/4 in. stud	kips	18.70	18.67	-0.18		Pass

I.8 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
V'r	kips	203.0	202.9	-0.06		Pass
Qnv/Ω per stud	kips	12.40	12.43	+0.25		Pass

I.8-S: Load transfer, the force applied to the steel

Source: AISC Design Examples v16.0, Example I.8, pp. I-87. Calculation: Encased composite column.

I.8-S · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
V'r = Pr (1 − Fy As/Pno) (Eq. I6-1)	kips	1,260	1,256	-0.34		Pass

I.8-S · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
V'r	kips	837.0	837.1	+0.01		Pass

DG1 4.7-3 · Anchors in concrete: Four ⅞ in. headed rods in uplift, no edges

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-3, pp. 70 to 76. Calculation: Anchors in concrete.

DG1 4.7-3 · Anchors in concrete · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tension per rod Nua,i	kips	17.50	17.50	+0.00		Pass
φNsa = 0.75 Ase futa	kips	20.10	20.09	-0.07		Pass
φNpn = 0.70 × 8 Abrg f'c (heavy hex)	kips	26.70	26.62	-0.31		Pass
ANc	in.²	2,400	2,401	+0.04		Pass
ANco = 9 hef²	in.²	2,030	2,025	-0.25		Pass
Nb = 16 λa √f'c hef^5/3	kips	92.30	92.32	+0.02		Pass
φNcbg (φ = 0.70)	kips	76.30	76.62	+0.43		Pass

DG1 4.7-3 hook: Same rods with a 3½ in. hook (eh = 3 da)

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-3, pp. 70 to 76. Calculation: Anchors in concrete.

DG1 4.7-3 hook · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φNpn = 0.70 × 0.9 f'c eh da	kips	5.800	5.788	-0.20		Pass

DG1 4.7-4: Shear toward an edge, ca1 = 12 in., s < ca1 (Case 3)

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-4, pp. 76 to 78. Calculation: Anchors in concrete.

The example applies the whole shear to the two front rods (Case 3 of Fig. R17.7.2.1b), as ILX does.

DG1 4.7-4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
AVc	in.²	720.0	720.0	+0.00		Pass
AVco = 4.5 ca1²	in.²	648.0	648.0	+0.00		Pass
Vb = 9 λa √f'c ca1^1.5	kips	23.70	23.66	-0.16		Pass
φVcbg (φ = 0.70)	kips	18.40	18.40	+0.02		Pass

DG1 4.7-9 · Anchors in concrete: Two 1 in. rods in tension, s = 6 in., hef = 12 in.

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-9, pp. 109 to 115. Calculation: Anchors in concrete.

DG1 4.7-9 · Anchors in concrete · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φNsa (Ase = 0.606 in.²)	kips	26.30	26.35	+0.19		Pass
ANc	in.²	1,510	1,512	+0.13		Pass
ANco	in.²	1,300	1,296	-0.31		Pass
Nb = 16 √f'c hef^5/3	kips	63.60	63.65	+0.08		Pass
φNcbg	kips	51.70	51.98	+0.54		Pass
φNpn (Abrg = 1.50 in.²)	kips	33.60	33.63	+0.10		Pass

DG1 4.7-15: Four ⅞ in. rods in a 20 in. column: hef' near four edges

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-15, pp. 134 to 139. Calculation: Anchors in concrete.

DG1 4.7-15 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
hef' = max(ca,max/1.5, s/3)	in.	5.330	5.333	+0.06		Pass
ANc	in.²	400.0	400.0	+0.00		Pass
ANco = 9 hef'²	in.²	256.0	256.0	+0.00		Pass
Nb = 24 λa √f'c hef'^1.5	kips	18.70	18.70	-0.02		Pass
Ncbg	kips	29.20	29.21	+0.04		Pass
φNcbg (φ = 0.70)	kips	20.40	20.45	+0.24		Pass

DG1 4.7-7: Eight 1½ in. rods under brace tension and shear, hef = 24 in., grout pad

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-7, pp. 96 to 102. Calculation: Anchors in concrete.

DG1 4.7-7 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tension per rod Nua,i	kips	17.30	17.25	-0.29		Pass
φNsa = 0.75 Ase futa (Ase = 1.41 in.²)	kips	61.40	61.13	-0.44		Pass
ANc	in.²	7,850	7,850	+0.00		Pass
ANco = 9 hef²	in.²	5,180	5,184	+0.08		Pass
Nb = 16 λa √f'c hef^5/3	kips	226.0	225.9	-0.03		Pass
φNcbg (φ = 0.70)	kips	239.0	239.5	+0.20		Pass
φNpn = 0.70 × 8 Abrg f'c (Abrg = 3.12 in.²)	kips	87.50	87.30	-0.23		Pass
Shear per rod Vua,i	kips	14.50	14.50	+0.00		Pass
φVsa = 0.65 × 0.8 × 0.6 Ase futa (grout pad)	kips	25.50	25.43	-0.28		Pass
φVcpg = 0.70 × 2.0 Ncbg	kips	479.0	478.9	-0.01		Pass
Nua/φNn (breakout governs)		0.577	0.576	-0.20		Pass
Vua/φVn (steel with grout pad governs)		0.569	0.570	+0.28		Pass
Nua/φNn + Vua/φVn (Eq. 17.8.3, ≤ 1.2)		1.150	1.146	-0.31		Pass

MNL-17 Anch-2: Single 3/4 in. headed bolt in a slab, SDC D, tension, ductile option (a)

Source: ACI MNL-17(21), Anchorage Example 2, pp. Vol. 2 pp. 270 to 276. Calculation: Anchors in concrete.

Self-weight of the pipe and the miscellaneous dead load, (260 + 5) lb/ft × 28 ft = 7.42 kips, as D; no edges. The 1.2 Nsa / Npn ratio is the example's 23,246 lb over the governing 26,160 lb.

MNL-17 Anch-2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nua = 1.2D + 1.0E	kips	13.10	13.10	+0.00		Pass
φNsa = 0.75 Ase futa (Ase = 0.334 in.²)	kips	14.53	14.55	+0.14		Pass
Nb = 24 λa √f'c hef^1.5	kips	31.43	31.43	-0.00		Pass
Ncb	kips	31.43	31.43	-0.00		Pass
0.75 φNcb (17.10.5.4, φ = 0.70)	kips	16.50	16.50	+0.00		Pass
Np = 8 Abrg f'c (Abrg = 0.654 in.²)	kips	26.16	26.16	+0.00		Pass
0.75 φNpn	kips	13.73	13.73	+0.00		Pass
1.2 Nsa / Npn (option (a): concrete over steel)		0.889	0.890	+0.14		Pass

MNL-17 Anch-6: Single 1/2 in. headed bolt 3 in. from the edge of a grade beam, wind shear

Source: ACI MNL-17(21), Anchorage Example 6, pp. Vol. 2 pp. 298 to 303. Calculation: Anchors in concrete.

The grade beam is 16 in. wide: the far edge is 13 in. away and does not enter the values.

MNL-17 Anch-6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vua = 1.0W	kips	1.200	1.200	+0.00		Pass
φVsa = 0.65 × 0.6 Ase futa	kips	3.212	3.210	-0.07		Pass
Vb, le = 8 da	kips	2.136	2.135	-0.04		Pass
φVcb (φ = 0.70)	kips	1.495	1.495	-0.02		Pass
ANc of pryout	in.²	186.0	185.6	-0.20		Pass
ANco	in.²	272.0	272.2	+0.09		Pass
ψed,N		0.810	0.809	-0.11		Pass
Nb	kips	16.96	16.96	-0.00		Pass
Ncb of pryout	kips	9.339	9.354	+0.16		Pass
Vcp = 2.0 Ncb	kips	18.68	18.71	+0.16		Pass
φVcp (φ = 0.70)	kips	13.07	13.10	+0.15		Pass

MNL-17 Anch-10: 5/8 in. hex-headed bolt at a beam end, tension and shear

Source: ACI MNL-17(21), Anchorage Example 10, pp. Vol. 2 pp. 326 to 335. Calculation: Anchors in concrete.

The cast-in counterpart of the post-installed Examples 12 to 14 (the 2014 Examples 10 and 11). Abrg is the hex head of the example's Table 1b.

MNL-17 Anch-10 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nua = 0.9D + 1.0W	kips	1.935	1.935	+0.00		Pass
Vua = 1.0W	kips	1.440	1.440	+0.00		Pass
φNsa (Ase = 0.226 in.²)	kips	9.831	9.831	+0.00		Pass
hef' near three edges	in.	5.330	5.333	+0.06		Pass
ANc	in.²	168.0	168.0	+0.00		Pass
ANco	in.²	256.0	256.0	+0.00		Pass
ψed,N		0.850	0.850	+0.00		Pass
Nb (kc = 24)	kips	16.21	16.19	-0.12		Pass
Ncb	kips	9.090	9.031	-0.64		Pass
φNcb (φ = 0.70)	kips	6.363	6.322	-0.64		Pass
Np = 8 Abrg f'c (Abrg = 0.454 in.²)	kips	10.90	10.90	+0.00		Pass
φNpn	kips	7.627	7.627	+0.00		Pass
φVsa = 0.65 × 0.8 × 0.6 Ase futa (grout pad)	kips	4.090	4.090	-0.01		Pass
Vb, le = 8 da	kips	3.675	3.675	+0.01		Pass
φVcb	kips	2.573	2.573	-0.01		Pass
Vcp = 2.0 Ncb	kips	18.18	18.06	-0.64		Pass
φVcp	kips	12.73	12.64	-0.68		Pass
Nua/φNn + Vua/φVn		0.890	0.866	-2.72		Deviation MNL17-A10-INTERACTIO
MNL17-A10-INTERACTION: the example adds ratios of capacities rounded down to 6,300 and 2,500 lb and prints 0.89 for 0.88						

MNL-17 Anch-11: 5/8 in. hooked bolt at a beam end, tension and shear

Source: ACI MNL-17(21), Anchorage Example 11, pp. Vol. 2 pp. 336 to 345. Calculation: Anchors in concrete.

MNL-17 Anch-11 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φNsa	kips	9.831	9.831	+0.00		Pass
Ncb	kips	9.090	9.031	-0.64		Pass
φNcb	kips	6.363	6.322	-0.64		Pass
Np = 0.9 f'c eh da (eh = 2.8 in.)	kips	4.725	4.725	+0.00		Pass
φNpn (φ = 0.70)	kips	3.308	3.308	-0.02		Pass
φVsa (grout pad)	kips	4.090	4.090	-0.01		Pass
φVcb	kips	2.573	2.573	-0.01		Pass
φVcp	kips	12.73	12.64	-0.68		Pass
Nua/φNn + Vua/φVn		1.020	1.145	+12.23		Deviation MNL17-A11-INTERACTION

MNL17-A11-INTERACTION: the example divides Nua by 4,400 lb, not by the governing pullout strength of 3,300 lb

MNL-17 Anch-21a: Four 1-1/4 in. base plate rods in a 28 in. pedestal, tension

Source: ACI MNL-17(21), Anchorage Example 21, pp. Vol. 2 pp. 438 to 447. Calculation: Anchors in concrete.

The example designs anchor reinforcement for the breakout shortfall; ILX checks the concrete only. Nua,g = 0.9 × 60 − 170 = −116 kips (uplift).

MNL-17 Anch-21a · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nua,i = (0.9D + 1.0W)/4	kips	29.00	29.00	+0.00		Pass
φNsa = 0.75 Ase futa (Ase = 0.969 in.²)	kips	54.51	54.51	+0.01		Pass
hef' = s/3	in.	5.330	5.333	+0.06		Pass
ANc (the pedestal)	in.²	784.0	784.0	+0.00		Pass
ANco	in.²	256.0	256.0	+0.00		Pass
ψed,N		0.925	0.925	-0.00		Pass
Nb	kips	19.81	19.83	+0.08		Pass
Ncbg	kips	56.13	56.17	+0.08		Pass
φNcbg (supplementary reinforcement, φ = 0.75)	kips	42.10	42.13	+0.08		Pass
Np = 8 Abrg f'c (Abrg = 2.237 in.²)	kips	80.53	80.53	+0.00		Pass
φNpn (φ = 0.70)	kips	56.37	56.37	+0.00		Pass
Nsb = 160 ca1 √Abrg λa √f'c	kips	96.32	96.32	-0.00		Pass
Nsbg = (1 + s/(6 ca1)) Nsb, Nsb without the corner factor (17.6.4.2)	kips	139.1	139.1	+0.02		Pass

MNL-17 Anch-21b: The same rods in a 32 in. pedestal, tension and shear (Cases 1 and 2)

Source: ACI MNL-17(21), Anchorage Example 21, pp. Vol. 2 pp. 449 to 463. Calculation: Anchors in concrete.

Vua,g = 1.2D + 1.6Lr + 0.5W = 30 kips. Case 1 is computed through the library (the module reports the governing Case 2). Pryout: the example also takes φ = 0.75; ACI 318-19 Table 17.5.3(c) has 0.70.

MNL-17 Anch-21b · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ANc (the pedestal)	in.²	1,024	1,024	+0.00		Pass
ψed,N		1.000	1.000	+0.00		Pass
Ncbg	kips	79.26	79.32	+0.08		Pass
φNcbg (φ = 0.75)	kips	59.44	59.49	+0.08		Pass
φVsa = 0.65 × 0.8 × 0.6 Ase futa (grout pad)	kips	22.68	22.68	+0.01		Pass
Vua per rod, Case 2: 30 kips on the far row	kips	15.00	15.00	+0.00		Pass
Vcbg, Case 1 (front row, ca1 = 8 in.)	kips	19.60	19.67	+0.38		Pass
AVc, Case 2 (ca1 = 24 in.)	in.²	1,152	1,152	+0.00		Pass
AVco, Case 2	in.²	2,592	2,592	+0.00		Pass
Vb = 9 λa √f'c ca1^1.5, Case 2	kips	70.90	70.98	+0.12		Pass
Vcbg, Case 2	kips	28.87	29.02	+0.53		Pass
φVcbg, Case 2 (φ = 0.75)	kips	21.70	21.77	+0.32		Pass
Ncpg of pryout	kips	39.63	79.32	+100.16		Deviation MNL17-A21-PRYOUT
MNL17-A21-PRYOUT: the example takes the breakout area of one row of two rods; ACI 17.7.3 and ILX use the group						
Vcpg = 2.0 Ncpg	kips	79.26	158.6	+100.16		Deviation MNL17-A21-PRYOUT
MNL17-A21-PRYOUT: the example takes the breakout area of one row of two rods; ACI 17.7.3 and ILX use the group						

SP-SSB: Simply supported rectangular beam: flexure, shear, deflection

Source: StructurePoint, Simply Supported Reinforced Concrete Beam Analysis and Design (ACI 318-14), pp. pp. 2–14, 33 (Tables 2–6). Calculation: Concrete beam.

Ec = wc^1.5 × 33√f'c (wc = 150 pcf) as in the example; self-weight neglected; supports taken as points (Vu at d from the support centerline as in the example).

SP-SSB · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mu = wu ℓ²/8	kip-ft	201.9	201.9	-0.00		Pass
As required	in.²	2.872	2.872	+0.01		Pass
As,min (9.6.1.2)	in.²	0.702	0.702	+0.06		Pass
Vu at d from the support	kips	28.52	28.52	-0.01		Pass
Vc = 2√f'c bw d (φVc = 20.85 kips)	kips	27.80	27.80	-0.01		Pass
φVn with #3 @ 8.3 in.	kips	41.79	41.79	+0.01		Pass
Av,min/s (per ft)	in.²	0.120	0.120	+0.00		Pass
Maximum stirrup spacing d/2	in.	8.780	8.780	+0.01		Pass
Maximum bar spacing for crack control	in.	10.31	10.31	+0.02		Pass
Mcr	kip-ft	32.98	32.98	-0.01		Pass
Icr	in.⁴	3,759	3,759	-0.00		Pass
Ie under D + L	in.⁴	3,812	3,807	-0.13		Pass
Ie under D	in.⁴	4,337	4,009	-7.56		Deviation ACI318-14-IE
ACI318-14-IE: the example uses the ACI 318-14 (Branson) effective moment of inertia; ILX Calcs uses the ACI 318-19 Table 24.2.3.5 expression						
Immediate live load deflection ΔLL	in.	0.634	0.601	-5.17		Deviation ACI318-14-IE
ACI318-14-IE: the example uses the ACI 318-14 (Branson) effective moment of inertia; ILX Calcs uses the ACI 318-19 Table 24.2.3.5 expression						
Long-term Δcs + ΔLL (λΔ = 2)	in.	1.465	1.500	+2.42		Deviation ACI318-14-IE
ACI318-14-IE: the example uses the ACI 318-14 (Branson) effective moment of inertia; ILX Calcs uses the ACI 318-19 Table 24.2.3.5 expression						

SP-CB: Cantilever beam with a tip point load

Source: StructurePoint, Reinforced Concrete Cantilever Beam Analysis and Design (ACI 318-14), pp. pp. 2–14, 35 (Tables 2–5). Calculation: Concrete beam.

Two #4 bottom bars are entered (the program needs bottom bars; the example has none); they act as compression steel and raise Icr by 0.8 %. Ec = wc^1.5 × 33√f'c.

SP-CB · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mu at the fixed end	kip-ft	280.0	280.0	+0.00		Pass
As required	in.²	3.160	3.146	-0.43		Pass
As,min (9.6.1.2)	in.²	1.143	1.143	+0.02		Pass
Vu	kips	33.60	33.60	+0.00		Pass
φVn with #4 @ 10.444 in.	kips	69.48	69.48	+0.00		Pass
Av,min/s (per ft)	in.²	0.160	0.160	+0.25		Pass
Maximum bar spacing for crack control	in.	10.00	10.00	+0.00		Pass
Icr at the support	in.⁴	8,120	8,186	+0.82		Pass
Ie under D + L	in.⁴	8,409	8,377	-0.38		Pass
Ie under D	in.⁴	10,428	9,006	-13.63		Deviation ACI318-14-IE
ACI318-14-IE: the example uses the ACI 318-14 (Branson) effective moment of inertia; ILX Calcs uses the ACI 318-19 Table 24.2.3.5 expression						
Immediate live load deflection at the free end	in.	0.148	0.133	-9.97		Deviation ACI318-14-IE
ACI318-14-IE: the example uses the ACI 318-14 (Branson) effective moment of inertia; ILX Calcs uses the ACI 318-19 Table 24.2.3.5 expression						

SP-TOR: Equilibrium torsion in a cantilever beam (Wight, Example 7-2)

Source: StructurePoint, Reinforced Concrete Beam Equilibrium Torsion Design (ACI 318-14), pp. pp. 7–14, 34 (Table 1). Calculation: Concrete beam.

Factored envelope entered (Mu = 228.25 kip-ft, Vu = 57.14 kips at d, Tu = 28 kip-ft) as derived in the example.

SP-TOR · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
As required for Mu = 228.25 kip-ft	in.²	2.550	2.541	-0.34		Pass
As,min (9.6.1.2)	in.²	1.003	1.003	+0.03		Pass
φTth (φ × 7.83 kip-ft)	kip-ft	5.870	5.872	+0.03		Pass
Aoh	in.²	215.2	215.2	+0.00		Pass
Section limit, left side of Eq. 22.7.7.1a	psi	325.6	325.6	+0.00		Pass
Section limit, right side	psi	474.3	474.3	+0.00		Pass
Vc = 2√f'c bw d (φVc = 28.56 kips)	kips	38.08	38.07	-0.02		Pass
At/s per leg (per ft)	in.²	0.245	0.245	+0.02		Pass
Av/s for shear (per ft)	in.²	0.354	0.355	+0.15		Pass
(Av + 2At)/s (per ft)	in.²	0.845	0.844	-0.06		Pass
(Av + 2At)min/s (per ft)	in.²	0.140	0.140	-0.28		Pass
Al = (At/s) ph	in.²	1.265	1.265	+0.01		Pass
Al,min (9.6.4.3)	in.²	0.506	0.506	-0.05		Pass
Maximum torsion stirrup spacing ph/8	in.	7.750	7.750	+0.00		Pass

SP-CNB+: Continuous T-beam, positive moment and shear (end span)

Source: StructurePoint, Reinforced Concrete Continuous Beam Analysis and Design (ACI 318-14), pp. pp. 7–15, 35 (Tables 2, 5, 6). Calculation: Concrete beam.

Moments by moment distribution in the example are entered as the factored envelope; the clear cover is entered as 1.0 in. so that d = 22 in. as in the example (it measures d without the stirrup).

SP-CNB+ · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
As required for Mu+ = 272.52 kip-ft (bf = 130.5 in.)	in.²	2.780	2.776	-0.13		Pass
As,min (9.6.1.2)	in.²	1.170	1.173	+0.28		Pass
φVn with #4 @ 10.5 in.	kips	71.11	71.11	-0.00		Pass

SP-CNB-neg: Continuous T-beam, interior support negative moment

Source: StructurePoint, Reinforced Concrete Continuous Beam Analysis and Design (ACI 318-14), pp. pp. 8–9, 35 (Table 5). Calculation: Concrete beam.

Two #3 bottom bars entered as stirrup hangers (compression steel, −0.9 % on As required).

SP-CNB-neg · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
As required for Mu− = 471.13 kip-ft	in.²	5.520	5.469	-0.93		Pass
As,min (9.6.1.2)	in.²	1.170	1.173	+0.28		Pass

B-1 · Concrete beam: Rectangular beam, simple span: flexure, shear, deflection

Source: Hand calculation (closed form). Calculation: Concrete beam.

d = 24 − 1.5 − 0.375 − 0.5 in.; Ec = 57,000√f'c; Ie by Table 24.2.3.5; Δ = 5wℓ⁴/(384EcIe).

B-1 · Concrete beam · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mu (wu ℓ²/8)	kip-ft	224.6	224.6	+0.00		Pass
Mn	kip-ft	310.2	310.2	-0.00		Pass
φMn (tension-controlled, φ = 0.90)	kip-ft	279.2	279.2	-0.00		Pass
Neutral axis depth c	in.	4.686	4.686	-0.00		Pass
Vu at d from the support face	kips	30.26	30.26	+0.00		Pass
Vc, Table 22.5.5.1(a)	kips	38.30	38.30	+0.00		Pass
Vs = Av fyt d/s	kips	28.54	28.55	+0.00		Pass
φVn	kips	50.13	50.13	+0.00		Pass
Mcr = fr Ig/yt	kip-ft	53.13	53.13	+0.00		Pass
Icr	in.⁴	7,031	7,031	+0.00		Pass
Ie under D + L	in.⁴	7,235	7,235	-0.00		Pass
Immediate live load deflection	in.	0.375	0.375	+0.00		Pass
Long-term deflection λΔ ΔD + ΔL	in.	0.884	0.884	+0.00		Pass

B-2 · Concrete beam: T-beam with the stress block below the flange

Source: Hand calculation (closed form). Calculation: Concrete beam.

B-2 · Concrete beam · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mn (flange + web couple)	kip-ft	497.1	497.1	+0.00		Pass
Net tensile strain εt		0.010	0.010	-0.00		Pass
φMn	kip-ft	447.4	447.4	+0.00		Pass

B-3 · Concrete beam: Torsion with closed stirrups (22.7)

Source: Hand calculation (closed form). Calculation: Concrete beam.

Overhanging flanges neglected; Ao = 0.85Aoh; fyt = fy = 60 ksi.

B-3 · Concrete beam · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tth = λ√f'c Acp²/pcp	kip-ft	7.829	7.829	+0.00		Pass
Section limit, left side of Eq. 22.7.7.1a	psi	173.2	173.2	+0.00		Pass
Section limit, right side	psi	474.3	474.3	+0.00		Pass
At/s per ft (θ = 45°)	in.²	0.131	0.131	-0.00		Pass
Al = (At/s) ph	in.²	0.678	0.678	+0.00		Pass

SP-WMSJ: Spandrel beam with slab on one side: compatibility torsion

Source: StructurePoint, Wide-Module Joist System (Skip Joist) Design: exterior spandrel beam (ACI 318-14), pp. pp. 64–65. Calculation: Concrete beam.

Only the torsion threshold and the compatibility reduction are compared: the example's stirrup layout (2.125 in. clear at the top, bundled #3 stirrups) differs from one cover all round.

SP-WMSJ · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Acp²/pcp with the overhanging flange (584²/122)	in.³	2,796	2,796	-0.02		Pass
Acp²/pcp of the rectangle (504²/90)	in.³	2,822	2,822	+0.01		Pass
Acp²/pcp used (the rectangle, 9.2.4.4(b))	in.³	2,822	2,822	+0.01		Pass
φTth	kip-ft	12.48	12.47	-0.05		Pass
Tu reduced to φTcr	kip-ft	49.90	49.89	-0.01		Pass

B-4 · Concrete beam: Torsion with θ from analysis (35°)

Source: Hand calculation (closed form), pp. ACI 318-19 Eq. 22.7.6.1a, 22.7.6.1b. Calculation: Concrete beam.

B-4 · Concrete beam · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
At/s per ft (θ = 35°)	in.²	0.092	0.092	+0.00		Pass
Al = (At/s) ph cot²θ	in.²	0.968	0.968	+0.00		Pass

B-5 · Concrete beam: T-beam torsion threshold with the slab overhangs (9.2.4.4)

Source: Hand calculation (closed form), pp. ACI 318-19 9.2.4.4, Table 22.7.4.1(a). Calculation: Concrete beam.

B-5 · Concrete beam · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A_{cp}^2/p_{cp} used (overhangs 19 in. each side)	$in.^3$	1,820	1,820	+0.00		Pass
$T_{th} = \lambda\sqrt{f'_c}\, A_{cp}^2/p_{cp}$	kip-ft	9.593	9.593	+0.00		Pass

B-6 · Concrete beam: Four-leg stirrups: outer closed leg for torsion

Source: Hand calculation (closed form), pp. ACI 318-19 22.7.6.1a. Calculation: Concrete beam.

B-6 · Concrete beam · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
At/s + (Av/s)/4 per ft	in.²	0.136	0.136	-0.00		Pass

MNL17-B1+: Continuous interior T-beam, exterior span positive moment and shear

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 7, Beam Example 1, pp. pp. 152, 155–159, 161, 166. Calculation: Concrete beam.

Factored envelope from the approximate coefficients entered (Mu+ = 306 ft-kip, Vu = 63.5 kips at d); cover entered as 1.6875 in. so that d = 27.5 in. as the example uses; no top bars in the positive section (the example neglects compression steel).

MNL17-B1+ · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
bf = 51 + 18 + 51 in. (p. 152)	in.	120.0	120.0	+0.00		Pass
As required for Mu+ = 306 ft-kip (Table 1.1, p. 156)	in.²	2.490	2.486	-0.16		Pass
a with five No. 7 (Table 1.2, p. 156)	in.	0.350	0.353	+0.84		Pass
εt with five No. 7 (Table 1.2, p. 156)		0.166	0.184	+10.84		Deviation MNL17-B1-EPS
MNL17-B1-EPS: the handbook's tabulated positive-moment strains do not follow from its own a and β1 (306 ft-kip: a = 0.35 in., c = 0.44 in., εt = 0.003(27.5 − 0.44)/0.44 = 0.184, printed 0.166)						
As,min = 3√f'c bw d/fy (p. 157)	in.²	1.750	1.750	+0.01		Pass
Vc = 2√f'c bw d (p. 158)	kips	70.00	70.00	+0.01		Pass
φ(Vc + 8√f'c bw d) (p. 158)	kips	263.0	262.5	-0.19		Pass
Av,min/s per ft (0.016 in.²/in., p. 159)	in.²	0.192	0.191	-0.56		Pass
Maximum stirrup spacing d/2 (p. 159)	in.	13.80	13.75	-0.36		Pass
φVn with No. 3 at 12 in. (p. 166)	kips	75.20	75.19	-0.01		Pass

MNL17-B1-I+: Continuous interior T-beam, interior span positive moment

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 7, Beam Example 1, pp. p. 156 (Tables 1.1, 1.2). Calculation: Concrete beam.

As MNL17-B1+ with four No. 7 bottom bars.

MNL17-B1-I+ · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
As required for Mu+ = 267 ft-kip	in.²	2.170	2.168	-0.11		Pass
a with four No. 7	in.	0.280	0.282	+0.84		Pass
εt with four No. 7		0.208	0.231	+10.94		Deviation MNL17-B1-EPS

MNL17-B1-EPS: the handbook's tabulated positive-moment strains do not follow from its own a and β1 (306 ft-kip: a = 0.35 in., c = 0.44 in., εt = 0.003(27.5 − 0.44)/0.44 = 0.184, printed 0.166)

MNL17-B1-E2: Continuous interior T-beam, first interior support negative moment

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 7, Beam Example 1, pp. pp. 156–157 (Table 1.1). Calculation: Concrete beam.

Seven No. 7 top bars; two No. 3 bottom bars entered (the program needs bottom bars; they act as compression steel, about −0.1 % on As required).

MNL17-B1-E2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
As required for Mu− = 428 ft-kip	in.²	3.650	3.646	-0.11		Pass
As,min = 3√f'c bw d/fy	in.²	1.750	1.750	+0.01		Pass

MNL17-B1-I-: Continuous interior T-beam, interior support negative moment

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 7, Beam Example 1, pp. p. 156 (Table 1.1). Calculation: Concrete beam.

Six No. 7 top bars; two No. 3 bottom bars entered.

MNL17-B1-I- · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
As required for Mu− = 389 ft-kip	in.²	3.300	3.298	-0.07		Pass

MNL17-B1-E1: Continuous interior T-beam, exterior support negative moment

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 7, Beam Example 1, pp. p. 156 (Table 1.1). Calculation: Concrete beam.

Four No. 7 top bars; two No. 3 bottom bars entered.

MNL17-B1-E1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
As required for Mu− = 267 ft-kip	in.²	2.230	2.228	-0.08		Pass

MNL17-B1-cc: Continuous interior T-beam, crack-control bar spacing

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 7, Beam Example 1, pp. p. 161. Calculation: Concrete beam.

Cover 1.5 in. as stated (cc to the No. 7 bar = 1.875 in.).

MNL17-B1-cc · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Maximum bar spacing, Table 24.3.2 (fs = 40 ksi)	in.	10.00	10.31	+3.12		Deviation MNL17-B1-CC
MNL17-B1-CC: the handbook rounds cc = 1.5 + 0.375 = 1.875 in. up to 2 in.; 15(40/40) − 2.5(1.875) = 10.3 in.						

MNL17-B2: Single interior L-beam: flexure and torsion threshold

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 7, Beam Example 2, pp. pp. 171, 174, 176–177, 179. Calculation: Concrete beam.

Mu+ = wuℓ²/8 = 256 ft-kip entered; d = 25.75 in. (printed 25.7); shear is not compared (Vu entered as 0); Tu = 9.6 ft-kip < φTth, torsion neglected as in the example.

MNL17-B2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
bf = 28.5 + 18 in. (p. 171)	in.	46.50	46.50	+0.00		Pass
As required for Mu+ = 256 ft-kip (p. 176)	in.²	2.240	2.239	-0.05		Pass
a with six No. 6 (p. 176)	in.	0.800	0.802	+0.19		Pass
c = a/0.8 (p. 176)	in.	1.000	1.002	+0.19		Pass
εt (p. 176)		0.074	0.074	+0.14		Pass
As,min = 3√f'c bw d/fy (p. 177)	in.²	1.630	1.639	+0.53		Pass
Tth with the 21 in. overhang, Acp = 651 in.², pcp = 134 in. (p. 179)	kip-ft	18.60	18.64	+0.20		Pass
φTth (p. 179)	kip-ft	14.00	13.98	-0.16		Pass

MNL17-B3-defl: Girder fixed at both ends: deflection section properties

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 7, Beam Example 3, pp. pp. 199–200, 202.
Calculation: Concrete beam.

Only the section values and λΔ are compared: the example's service moments come from coefficient tables (Ma = 189 ft-kip at midspan) and it averages Ie over three sections, while the program analyses the loads and uses Ie at midspan (24.2.3.7).

MNL17-B3-defl · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ig = bh³/12 (p. 199)	in.⁴	40,500	40,500	+0.00		Pass
Mcr = fr Ig/yt (p. 199)	kip-ft	120.0	119.3	-0.56		Pass
Icr at midspan, As = 2.64, As' = 0.88 in.² (p. 200)	in.⁴	10,314	10,324	+0.09		Pass
λΔ = 2.0/(1 + 50ρ') (p. 202)		1.840	1.838	-0.10		Pass

MNL17-B4: Continuous edge L-beam: positive moment, shear and torsion

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 7, Beam Example 4, pp. pp. 205, 209–214. Calculation: Concrete beam.

Envelope entered: Mu+ = 223 ft-kip (exterior span), Vu = 46 kips and Tu = 17.3 ft-kip at d as used in Eq. 22.7.7.1a; compatibility torsion, Tu below φTcr so not reduced; overhang min(h − hf, 4hf) = 23 in.

MNL17-B4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
bf = ℓn/12 + bw (p. 205)	in.	52.00	52.00	+0.00		Pass
As required for Mu+ = 223 ft-kip (Table 4.1, p. 209)	in.²	1.810	1.810	-0.00		Pass
a with five No. 6 (Table 4.2, p. 209)	in.	0.600	0.597	-0.45		Pass
εt with five No. 6 (Table 4.2, p. 209)		0.108	0.108	+0.00		Pass
As,min = 3√f'c bw d/fy (p. 210)	in.²	1.760	1.758	-0.11		Pass
Vc = 2√f'c bw d (p. 211)	kips	70.30	70.32	+0.03		Pass
Av,min threshold φλ√f'c bw d (p. 211)	kips	26.40	26.37	-0.11		Pass
φ(Vc + 8√f'c bw d) (p. 211)	kips	211.0	263.7	+24.98		Deviation MNL17-B4-VSEC
MNL17-B4-VSEC: the handbook drops Vc from φ(Vc + 8√f'c bw d); 0.75(70.3 + 281.1) = 263.6 kips						
Tth, Acp = 701 in.², pcp = 142 in. (p. 212)	kip-ft	20.40	20.39	-0.04		Pass
φTth (p. 212)	kip-ft	15.30	15.29	-0.04		Pass
Aoh = 14.5 × 26.5 in. (p. 213)	in.²	384.2	384.2	+0.00		Pass
Section limit, left side of Eq. 22.7.7.1a (p. 213)	psi	115.0	114.7	-0.26		Pass
Section limit, right side (p. 213)	psi	530.0	530.3	+0.06		Pass
At/s per ft (0.007 in.²/in., p. 213)	in.²	0.084	0.085	+0.89		Pass
Al = (At/s) ph (p. 213)	in.²	0.580	0.579	-0.15		Pass
(Av + 2At)/s per ft with Av = 0 (0.014 in.²/in., p. 214)	in.²	0.168	0.169	+0.89		Pass
(Av + 2At)min/s per ft (0.016 in.²/in., p. 214)	in.²	0.192	0.191	-0.56		Pass
Provided (Av + 2At)/s per ft, two No. 4 legs at 10 in. (p. 214)	in.²	0.480	0.480	+0.00		Pass
Al,min (9.6.4.3, p. 214)	in.²	2.490	3.516	+41.19		Deviation MNL17-B4-ALMIN
MNL17-B4-ALMIN: the handbook puts the provided At/s = 0.02 in.²/in. in 9.6.4.3(a); the program uses the required At/s = 0.0071 in.²/in., so (b) governs at 3.52 in.²						

MNL17-B4-I+: Continuous edge L-beam, interior span positive moment

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 7, Beam Example 4, pp. p. 209 (Tables 4.1, 4.2). Calculation: Concrete beam.

As MNL17-B4 with four No. 6 bottom bars and no torsion.

MNL17-B4-I+ · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
As required for Mu+ = 195 ft-kip	in.²	1.570	1.581	+0.69		Pass
a with four No. 6	in.	0.480	0.478	-0.45		Pass
εt with four No. 6		0.136	0.136	-0.18		Pass

MNL17-B4-E2: Continuous edge L-beam, first interior support negative moment

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 7, Beam Example 4, pp. p. 209 (Table 4.1). Calculation: Concrete beam.

Six No. 6 top bars; two No. 3 bottom bars entered (the program needs bottom bars).

MNL17-B4-E2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
As required for Mu− = 312 ft-kip	in.²	2.600	2.606	+0.25		Pass

MNL17-B4-I-: Continuous edge L-beam, interior support negative moment

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 7, Beam Example 4, pp. p. 209 (Table 4.1). Calculation: Concrete beam.

Six No. 6 top bars; two No. 3 bottom bars entered.

MNL17-B4-I- · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
As required for Mu− = 284 ft-kip	in.²	2.360	2.364	+0.17		Pass

MNL17-B7: Precast simply supported beam: flexure and shear

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 7, Beam Example 7, pp. pp. 276, 278–281. Calculation: Concrete beam.

Factored loads are given in the example: Mu = 254 ft-kip and Vu = 48.7 kips at d entered; cover entered as 1.125 in. so that d = 20 in. as the example uses; the two No. 5 top bars are not entered (the example's flexure neglects them).

MNL17-B7 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
As required for Mu = 254 ft-kip (p. 279)	in.²	3.100	3.131	+1.01		Pass
a with four No. 8 (p. 279)	in.	3.980	3.983	+0.08		Pass
c = a/0.85 (p. 279)	in.	4.680	4.686	+0.13		Pass
As,min = 200 bw d/fy (p. 279)	in.²	0.930	0.933	+0.36		Pass
Vc = 2√f'c bw d (p. 280)	kips	35.40	35.42	+0.05		Pass
φ(Vc + 8√f'c bw d) (p. 280)	kips	132.8	132.8	+0.01		Pass
Maximum stirrup spacing d/2 (p. 281)	in.	10.00	10.00	+0.00		Pass
φVn with No. 3 at 10 in. (p. 281)	kips	46.40	46.36	-0.08		Pass

MNL17-B8: Equilibrium torsion and shear, closed ties

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 7, Beam Example 8, pp. pp. 284–286.
Calculation: Concrete beam.

Two No. 8 bottom bars entered so that d = 21.5 in. as given (pw only enters Vc through Table 22.5.5.1(b), which does not govern); Mu not entered (the example designs no flexural steel).

MNL17-B8 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φTth = 0.25φTcr (p. 284)	kip-ft	8.200	8.146	-0.66		Pass
Aoh = (bw − 3.5)(h − 3.5) (p. 284)	in.²	256.0	256.2	+0.10		Pass
√(fv² + fvt²) (p. 284)	psi	416.0	415.7	-0.06		Pass
φ(2√f'c + 8√f'c) (p. 284)	psi	530.0	530.3	+0.06		Pass
Av/s per ft (0.0253 in.²/in., p. 285)	in.²	0.304	0.304	+0.15		Pass
At/s per ft (0.0324 in.²/in., p. 285)	in.²	0.389	0.389	+0.14		Pass
(Av + 2At)/s per ft (0.09 in.²/in., p. 285)	in.²	1.080	1.083	+0.25		Pass
Provided (Av + 2At)/s per ft, No. 4 ties at 4 in. (p. 285)	in.²	1.200	1.200	+0.00		Pass
0.75√f'c bw/fyt per ft (0.0141, p. 285)	in.²	0.169	0.170	+0.30		Pass
Al = (At/s) ph (p. 286)	in.²	2.140	2.141	+0.06		Pass
Al,min, lesser of 9.6.4.3(a) and (b) (p. 286)	in.²	0.120	0.121	+1.21		Pass
Tie spacing ph/8 (p. 286)	in.	8.250	8.250	+0.00		Pass

MNL17-B9: Compatibility torsion reduced to φTcr, closed ties

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 7, Beam Example 9, pp. pp. 288–290.
Calculation: Concrete beam.

As MNL17-B8 with No. 4 ties at 6 in. and compatibility torsion.

MNL17-B9 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φTth (p. 288)	kip-ft	8.150	8.146	-0.05		Pass
Tu reduced to φTcr (p. 288)	kip-ft	32.60	32.58	-0.05		Pass
Left side of Eq. 22.7.7.1a (p. 289)	psi	292.0	291.4	-0.22		Pass
Right side (p. 289)	psi	530.0	530.3	+0.06		Pass
At/s per ft (0.0199 in.²/in., p. 289)	in.²	0.239	0.239	+0.23		Pass
Av/s per ft (0.0253 in.²/in., p. 289)	in.²	0.304	0.304	+0.15		Pass
(Av + 2At)/s per ft (0.065 in.²/in., p. 289)	in.²	0.780	0.783	+0.35		Pass
Al = (At/s) ph (p. 289)	in.²	1.320	1.316	-0.27		Pass
Al,min (p. 290)	in.²	0.120	0.946	+688.59		Deviation MNL17-B9-ALMIN
MNL17-B9-ALMIN: the handbook reuses Example 8's At/s = 0.0324 in.²/in. in 9.6.4.3(a); with this example's 0.0199 in.²/in. (a) = 2.26 − 1.32 = 0.95 in.²						
Tie spacing ph/8 (p. 290)	in.	8.250	8.250	+0.00		Pass

MNL17-D2: Lintel, simple span: Ie and immediate deflections

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 2, Chapter 13, Deflection Example 1 and 2, pp. Vol. 2 pp. 156–157. Calculation: Concrete beam.

Uniform loads 0.6 and 0.285 kip/ft on 40 ft give MD = 120 and MD+L = 177 ft-kip; Ec = wc^1.5 × 33√f'c with wc = 145 pcf (n = 7.96, printed 8); no stirrups, cover 1.895 in. so that d = 21.4 in.

MNL17-D2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ig = bh³/12 (p. 156)	in.⁴	16,100	16,128	+0.17		Pass
Mcr (p. 156)	kip-ft	53.10	53.13	+0.05		Pass
Icr (p. 156)	in.⁴	11,000	11,024	+0.22		Pass
Ie at Ma = 177 ft-kip (Ex. 1, p. 156)	in.⁴	11,100	11,165	+0.59		Pass
Ie at MD = 120 ft-kip (Ex. 2, p. 157)	in.⁴	11,400	11,336	-0.56		Pass
Immediate dead load deflection (p. 157)	in.	0.840	0.837	-0.41		Pass
Immediate live load deflection (p. 157)	in.	0.400	0.416	+4.07		Deviation MNL17-D2-IE

MNL17-D2-IE: Example 2 divides by the dead-load Ie = 11,400 in.⁴ for D + L instead of 11,100 in.⁴ from Example 1; with 11,100 its own numbers give 1.28 − 0.84 = 0.43 in.

MNL17-D3: Cracked moment of inertia of a T-section

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 2, Chapter 13, Deflection Example 3, pp. Vol. 2 p. 158. Calculation: Concrete beam.

f'c entered as (29,000/9/57)² psi so that n = 9; h = 38 in. and cover 2.195 in. give d = 35.1 in.; loads only to trigger the deflection check.

MNL17-D3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Icr = Ki2 bw d³	in.⁴	147,000	147,633	+0.43		Pass

MNL17-D6: Effective moment of inertia, lightly reinforced rectangle

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 2, Chapter 13, Deflection Example 6, pp. Vol. 2 p. 163. Calculation: Concrete beam.

0.3 + 0.3 kip/ft on a 10 ft simple span gives Ma = 7.5 ft-kip; Ec = 57,000√f'c (n = 7.2); cover 0.75 in. and no stirrups so that d = 7.0 in.

MNL17-D6 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ig	in.⁴	512.0	512.0	+0.00		Pass
Mcr	kip-ft	5.650	5.657	+0.12		Pass
Icr	in.⁴	100.4	100.3	-0.09		Pass
Ie by Table 24.2.3.5 at Ma = 7.5 ft-kip	in.⁴	125.9	125.9	+0.00		Pass

MNL17-D7+: Cracking moment of a T-section, positive moment

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 2, Chapter 13, Deflection Example 7, pp. Vol. 2 p. 165. Calculation: Concrete beam.

Simple span; the program computes fr Ig/yt of the gross T-section directly.

MNL17-D7+ · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mcr, positive moment	kip-ft	229.0	229.5	+0.21		Pass

MNL17-D7-: Cracking moment of a T-section, negative moment

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 2, Chapter 13, Deflection Example 7, pp. Vol. 2 p. 165. Calculation: Concrete beam.

Cantilever, so the program reports the negative-moment Mcr (flange in tension).

MNL17-D7- · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mcr, negative moment	kip-ft	387.0	402.3	+3.94		Deviation MNL17-D7-KCRT

MNL17-D7-KCRT: the handbook reads Kcrt = 2.3 from Design Aid 13.3.1; fr Ig/yt of the section gives Kcrt = 2.39 and Mcr = 402 ft-kip

J.6 · Bearing on concrete: W12×96 base plate 22 × 22 in. on a 24 × 24 in. pedestal, f'c = 3 ksi

Source: AISC Design Examples v16.0, Example J.6, pp. J-20 to J-22. Calculation: Bearing on concrete.

J.6 · Bearing on concrete · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pu = 1.2 × 115 + 1.6 × 345	kips	690.0	690.0	+0.00		Pass
A2 = 24 × 24 (pedestal)	in.²	576.0	576.0	+0.00		Pass
φPp = 0.65 × 0.85 × 3 × 484 × √(576/484)	kips	875.0	875.2	+0.02		Pass

SP-SF-5.1: 18 in. column on an 11 ft-2 in. square footing (factor 2 governs)

Source: StructurePoint, Reinforced Concrete Spread Footing (Isolated Footing) Analysis and Design (ACI 318-14), pp. pp. 9 to 10. Calculation: Bearing on concrete.

The footing depth is not used: √(A2/A1) is far above 2 for any depth over 4.5 in.

SP-SF-5.1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φBn top of footing = 0.65 × 2 × 0.85 × 3 × 324	kips	1,070	1,074	+0.38		Pass

SP-SF-5.2: Base of the 18 in. column, f'c = 5 ksi, no increase

Source: StructurePoint, Reinforced Concrete Spread Footing (Isolated Footing) Analysis and Design (ACI 318-14), pp. p. 10. Calculation: Bearing on concrete.

The example shows the column base needs dowels (Bu > φBn): the module reports NG.

SP-SF-5.2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φBn column = 0.65 × 0.85 × 5 × 324	kips	895.0	895.0	+0.01		Pass

BRG-OFFSET: Eccentric plate: the 2 in. edge distance sets the frustum

Source: Hand calculation (closed form, ACI 318-19 22.8.3.2). Calculation: Bearing on concrete.

BRG-OFFSET · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A2 = (10 + 2 × 2)²	in.²	196.0	196.0	+0.00		Pass
Bn = 0.85 × 4 × 100 × 1.4	kips	476.0	476.0	-0.00		Pass

BRG-DEPTH: Thin slab: twice the depth sets the frustum

Source: Hand calculation (closed form, ACI 318-19 22.8.3.2). Calculation: Bearing on concrete.

BRG-DEPTH · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A2 = (10 + 2 × 4)²	in.²	324.0	324.0	+0.00		Pass
Bn = 0.85 × 4 × 100 × 1.8	kips	612.0	612.0	+0.00		Pass

BRG-CAP: Wide support: √(A2/A1) capped at 2

Source: Hand calculation (closed form, ACI 318-19 22.8.3.2). Calculation: Bearing on concrete.

BRG-CAP · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bn = 2 × 0.85 × 4 × 100	kips	680.0	680.0	+0.00		Pass

BRG-ENTERED: Stepped support, A2 entered

Source: Hand calculation (closed form, ACI 318-19 22.8.3.2). Calculation: Bearing on concrete.

BRG-ENTERED · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bn = 0.85 × 4 × 100 × 1.5	kips	510.0	510.0	+0.00		Pass

SP-IDT: Tied 16 × 16 in. column, 8 #9 on two faces: axial limits

Source: StructurePoint, Interaction Diagram - Tied Reinforced Concrete Column Design Strength (ACI 318-19), pp. pp. 1–4, 26 (Table 1). Calculation: Concrete column.

Wight & MacGregor, Example 11-1; d' = 2.5 in. to the bar centers.

SP-IDT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φPo = 0.65 Po (max compression)	kips	997.1	997.1	+0.00		Pass
φPn,max = 0.65 × 0.80 Po	kips	797.7	797.7	-0.00		Pass

SP-IDT fs = 0: Tied column interaction diagram: fs = 0

Source: StructurePoint, Interaction Diagram - Tied Reinforced Concrete Column Design Strength (ACI 318-19), pp. pp. 5–26 (Table 1). Calculation: Concrete column.

Strain compatibility, εcu = 0.003, φ by Table 21.2.2 (εty + 0.003 limit of ACI 318-19).

SP-IDT fs = 0 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φMn at fs = 0	kip-ft	169.9	169.8	-0.05		Pass
φPn at fs = 0	kips	622.3	622.0	-0.05		Pass

SP-IDT fs = 0.5fy: Tied column interaction diagram: fs = 0.5fy

Source: StructurePoint, Interaction Diagram - Tied Reinforced Concrete Column Design Strength (ACI 318-19), pp. pp. 5–26 (Table 1). Calculation: Concrete column.

Strain compatibility, εcu = 0.003, φ by Table 21.2.2 (εty + 0.003 limit of ACI 318-19).

SP-IDT fs = 0.5fy · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φMn at fs = 0.5fy	kip-ft	220.1	220.0	-0.00		Pass
φPn at fs = 0.5fy	kips	421.9	421.9	-0.00		Pass

SP-IDT balanced point: Tied column interaction diagram: balanced point

Source: StructurePoint, Interaction Diagram - Tied Reinforced Concrete Column Design Strength (ACI 318-19), pp. pp. 5–26 (Table 1). Calculation: Concrete column.

Strain compatibility, εcu = 0.003, φ by Table 21.2.2 (εty + 0.003 limit of ACI 318-19).

SP-IDT balanced point · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φMn at balanced point	kip-ft	250.8	250.8	+0.00		Pass
φPn at balanced point	kips	270.9	270.9	+0.00		Pass

SP-IDT tension control (εt = εty + 0.003): Tied column interaction diagram: tension control (εt = εty + 0.003)

Source: StructurePoint, Interaction Diagram - Tied Reinforced Concrete Column Design Strength (ACI 318-19), pp. pp. 5–26 (Table 1). Calculation: Concrete column.

Strain compatibility, εcu = 0.003, φ by Table 21.2.2 (εty + 0.003 limit of ACI 318-19).

SP-IDT tension control (εt = εty + 0.003) · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φMn at tension control (εt = εty + 0.003)	kip-ft	286.8	286.7	-0.01		Pass
φPn at tension control (εt = εty + 0.003)	kips	171.6	171.6	-0.01		Pass

SP-IDT pure bending: Tied column interaction diagram: pure bending

Source: StructurePoint, Interaction Diagram - Tied Reinforced Concrete Column Design Strength (ACI 318-19), pp. pp. 5–26 (Table 1).
Calculation: Concrete column.

Strain compatibility, εcu = 0.003, φ by Table 21.2.2 (εty + 0.003 limit of ACI 318-19).

SP-IDT pure bending · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φMn at pure bending	kip-ft	214.0	213.9	-0.03		Pass

SP-IDS: Spiral column D = 20 in., 8 #10: axial limits

Source: StructurePoint, Interaction Diagram - Circular Spiral Reinforced Concrete Column (ACI 318-19), pp. pp. 1–4, 31 (Table 8). Calculation: Concrete column.

Pincheira et al., Example 10.18.1; #4 spiral, 1.5 in. clear cover (bar circle radius 7.365 in.).

SP-IDS · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φPo = 0.75 Po (max compression)	kips	1,426	1,426	-0.00		Pass
φPn,max = 0.75 × 0.85 Po	kips	1,212	1,212	-0.00		Pass

SP-IDS fs = 0: Spiral column interaction diagram: fs = 0

Source: StructurePoint, Interaction Diagram - Circular Spiral Reinforced Concrete Column (ACI 318-19), pp. pp. 5–31 (Table 8). Calculation: Concrete column.

Strain compatibility on the circular section, φ = 0.75 to 0.90 for spirals (Table 21.2.2).

SP-IDS fs = 0 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φMn at fs = 0	kip-ft	208.2	208.1	-0.04		Pass
φPn at fs = 0	kips	984.5	984.1	-0.04		Pass

SP-IDS fs = 0.5fy: Spiral column interaction diagram: fs = 0.5fy

Source: StructurePoint, Interaction Diagram - Circular Spiral Reinforced Concrete Column (ACI 318-19), pp. pp. 5–31 (Table 8). Calculation: Concrete column.

Strain compatibility on the circular section, φ = 0.75 to 0.90 for spirals (Table 21.2.2).

SP-IDS fs = 0.5fy · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φMn at fs = 0.5fy	kip-ft	281.4	281.2	-0.07		Pass
φPn at fs = 0.5fy	kips	642.2	641.8	-0.07		Pass

SP-IDS balanced point: Spiral column interaction diagram: balanced point

Source: StructurePoint, Interaction Diagram - Circular Spiral Reinforced Concrete Column (ACI 318-19), pp. pp. 5–31 (Table 8). Calculation: Concrete column.

Strain compatibility on the circular section, φ = 0.75 to 0.90 for spirals (Table 21.2.2).

SP-IDS balanced point · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φMn at balanced point	kip-ft	305.8	305.8	-0.00		Pass
φPn at balanced point	kips	389.2	389.2	-0.00		Pass

SP-IDS tension control (εt = εty + 0.003): Spiral column interaction diagram: tension control (εt = εty + 0.003)

Source: StructurePoint, Interaction Diagram - Circular Spiral Reinforced Concrete Column (ACI 318-19), pp. pp. 5–31 (Table 8). Calculation: Concrete column.

Strain compatibility on the circular section, φ = 0.75 to 0.90 for spirals (Table 21.2.2).

SP-IDS tension control (εt = εty + 0.003) · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φMn at tension control (εt = εty + 0.003)	kip-ft	295.3	295.3	+0.00		Pass
φPn at tension control (εt = εty + 0.003)	kips	26.60	26.60	+0.00		Pass

SP-IDS pure bending: Spiral column interaction diagram: pure bending

Source: StructurePoint, Interaction Diagram - Circular Spiral Reinforced Concrete Column (ACI 318-19), pp. pp. 5–31 (Table 8). Calculation: Concrete column.

Strain compatibility on the circular section, φ = 0.75 to 0.90 for spirals (Table 21.2.2).

SP-IDS pure bending · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φMn at pure bending	kip-ft	288.1	288.7	+0.21		Pass

SP-SNS: Column in a nonsway frame: slenderness limit (6.2.5.1)

Source: StructurePoint, Slenderness Effects for Concrete Columns in Non-Sway Frame - Moment Magnification Method (ACI 318-19), pp. pp. 1–3. Calculation: Concrete column.

Wang et al., Example 13.17.3: k = 0.959, ℓu = 12 ft − 24 in. beam = 10 ft; slenderness may be neglected either way.

SP-SNS · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Limit 34 − 12 M1/M2 (M1 = 0)		34.00	34.00	+0.00		Pass
k ℓu/r		23.45	22.56	-3.78		Deviation ACI318-19-R

ACI318-19-R: the example takes r = √(Ig/Ag) = 4.91 in. (6.2.5.2(a)); ILX Calcs uses r = 0.3h = 5.10 in. (6.2.5.2(b)); both are permitted

C-1: Tied column in concentric compression (Po, Pn,max)

Source: Hand calculation (closed form). Calculation: Concrete column.

Po = 0.85f'c(Ag − Ast) + fy Ast (Eq. 22.4.2.2).

C-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φPn,max = 0.65 × 0.80 Po	kips	638.6	638.6	+0.00		Pass

C-2: Balanced point by strain compatibility

Source: Hand calculation (closed form). Calculation: Concrete column.

C-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Load at half the balanced design point: ratio Balanced point Pb = 365.9 kips, Mb = 271.6 kip-ft (εt = εty, φ = 0.65)		0.500	0.500	+0.00		Pass

C-3 · Concrete column: Slender braced column, moment magnification (6.6.4.5)

Source: Hand calculation (closed form). Calculation: Concrete column.

(EI)eff = 0.4EcIg/(1 + βdns), Ec = 57,000√f'c.

C-3 · Concrete column · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
k ℓu/r		50.00	50.00	+0.00		Pass
Pc = π²(EI)eff/(kℓu)²	kips	843.4	843.4	+0.00		Pass
δ		1.902	1.902	+0.00		Pass
Mc = δ M2	kip-ft	95.11	95.11	+0.00		Pass

C-4 · Concrete column: Spiral volumetric ratio (Eq. 25.7.3.3)

Source: Hand calculation (closed form). Calculation: Concrete column.

C-4 · Concrete column · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ρs provided = 4Asp/(Dch s)		0.015	0.015	+0.00		Pass
ρs,min = 0.45(Ag/Ach − 1)f'c/fyt		0.013	0.013	+0.00		Pass

MNL17-C1: Moment magnification along the column, Load Combination (iii)

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 9, Columns Example 1, pp. pp. 398, 401–402. Calculation: Concrete column.

Second-order moments along the length (6.6.4.5) with the sway-magnified end moments M1 = 1,962 and M2 = 2,634 kip-in. (double curvature), Pu = 789 kips, βdns = 0.80 and k = 2.2 as the example takes them; entered as a braced column with those values.

MNL17-C1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
k ℓu/r with k = 2.2 (p. 398, 59 with r = 6.9 in.)		59.00	56.83	-3.67		Deviation ACI318-19-R
ACI318-19-R: the example takes r = √(Ig/Ag) = 6.9 in. (6.2.5.2(a)) and notes that 0.3h = 7.2 in. is also permitted; ILX Calcs uses r = 0.3h, k ℓu/r = 56.8						
Limit 34 + 12 M1/M2 ≤ 40 (p. 398)		40.00	40.00	+0.00		Pass
M2,min = Pu(0.6 + 0.03h) (1,041 kip-in., p. 401)	kip-ft	86.75	86.79	+0.05		Pass
Cm = 0.6 − 0.4 M1/M2 (p. 401)		0.300	0.302	+0.68		Pass
(EI)eff = 0.4EcIg/(1 + βdns) (24.8 × 10⁶ kip-in.², p. 401)		172.2	172.0	-0.15		Pass
Pc (p. 401)	kips	1,460	1,460	-0.03		Pass
δ (p. 402)		1.070	1.082	+1.08		Deviation MNL17-C1-CM
MNL17-C1-CM: the handbook rounds Cm = 0.6 − 0.4(1962/2634) = 0.302 to 0.30 before dividing; with 0.302, δ = 0.302/(1 − 789/(0.75 × 1460)) = 1.08 and Mc = 2,849 kip-in.						
Mc = δ M2 (2,820 kip-in., p. 402)	kip-ft	235.0	237.4	+1.03		Deviation MNL17-C1-CM
MNL17-C1-CM: the handbook rounds Cm = 0.6 − 0.4(1962/2634) = 0.302 to 0.30 before dividing; with 0.302, δ = 0.302/(1 − 789/(0.75 × 1460)) = 1.08 and Mc = 2,849 kip-in.						

MNL17-C2: Ordinary moment frame column, 8 No. 8: a point of the interaction diagram

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 9, Columns Example 2, pp. pp. 403–406, 407. Calculation: Concrete column.

Bars at 2.5, 12 and 21.5 in. from the compression face; bars inside the stress block displace concrete, as in the example's spreadsheet.

MNL17-C2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
c for εt = 0.0007 in compression (p. 405) −0.003 × 21.5/(0.0007 − 0.003) = 28.04 in.; the example prints 28.09	in.	28.09	28.04	-0.17		Pass
Pn at that strain (2,292 + 38.2 + 72.1 + 132 kips, p. 405)	kips	2,530	2,530	+0.02		Pass
Mn at that strain (p. 406)	kip-ft	222.0	223.7	+0.78		Pass
As,min = 0.01Ag (p. 404)	in.²	5.760	5.760	+0.00		Pass
Minimum clear bar spacing (p. 404)	in.	1.500	1.500	+0.00		Pass
Maximum tie spacing 16db (p. 407)	in.	16.00	16.00	+0.00		Pass

MNL17-C3: Intermediate moment frame column, 8 No. 8: nominal Mn at Pu

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 9, Columns Example 3, pp. p. 414. Calculation: Concrete column.

Nominal strength (φ = 1.0) at the factored axial forces, from the example's interaction diagram spreadsheet.

MNL17-C3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mn at P = 848 kips (9,373 kip-in.)	kip-ft	781.1	779.3	-0.23		Pass
Mn at P = 456 kips (7,994 kip-in.)	kip-ft	666.2	647.1	-2.87		Deviation MNL17-C34-MN

MNL17-C34-MN: strain compatibility at Pn = Pu (checked by hand) gives 7,765 kip-in. (Example 3, 456 kips) and 7,842 kip-in. (Example 4, 432 kips); the example's spreadsheet values at the lower axial load are 2.9 and 6.9 percent higher and are not reproduced with the stated bars, while its values at the higher load (848 and 872 kips) agree within 1 percent

MNL17-C4: Special moment frame column, 12 No. 7: nominal Mn at Pu

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 9, Columns Example 4, pp. p. 420. Calculation: Concrete column.

MNL17-C4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mn at P = 872 kips (9,720 kip-in.)	kip-ft	810.0	806.3	-0.46		Pass
Mn at P = 432 kips (8,380 kip-in.)	kip-ft	698.3	653.5	-6.42		Deviation MNL17-C34-MN

MNL17-C34-MN: strain compatibility at Pn = Pu (checked by hand) gives 7,765 kip-in. (Example 3, 456 kips) and 7,842 kip-in. (Example 4, 432 kips); the example's spreadsheet values at the lower axial load are 2.9 and 6.9 percent higher and are not reproduced with the stated bars, while its values at the higher load (848 and 872 kips) agree within 1 percent

MNL17-C5: Column not in the seismic system, 12 No. 7: Po

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 9, Columns Example 5, pp. p. 430. Calculation: Concrete column.

MNL17-C5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Po = 0.85f'c(Ag − Ast) + fy Ast	kips	2,849	2,849	+0.01		Pass
0.35Po (18.14.3.2(c))	kips	997.1	997.3	+0.02		Pass

SP-CNB-1: Grid 3 T-beam, 16 × 24 in. with an 8 in. slab, 40 ft spans

Source: StructurePoint, Reinforced Concrete Continuous Beam Analysis and Design (ACI 318-14), pp. pp. 3 to 4 (printed 3 and 4). Calculation: Continuous concrete beam.

Clear span 40 ft − 20/2 − 24/2 in. = 458 in. (support width taken as 22 in.); sw = 16 ft − 16 in.

SP-CNB-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Effective flange width (Table 6.3.2.1)	in.	130.5	130.5	+0.00		Pass
Ib of the T-section	in.⁴	40,634	40,634	-0.00		Pass
hmin end span ℓ / 18.5	in.	25.94	25.95	+0.02		Pass

CB-2SPAN: Two equal 20 ft spans, wD = wL = 1 kip/ft, patterns (6.4.2)

Source: Hand calculation (closed form, ACI 318-19 6.4.2, 6.5, 9.7.3). Calculation: Continuous concrete beam.

The negative envelope crosses zero 8.333 ft from the interior support with 1.2D on both spans and 1.6L on the far span only; the ℓd of the #8 top bars (37.0 in.) does not govern.

CB-2SPAN · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mu+ = (1.15 L)² / (4 × 1.4) (1.2D both, 1.6L on the span)	kip-ft	94.46	94.44	-0.02		Pass
Mu− = 2.8 × 20² / 8 at the interior support	kip-ft	140.0	140.0	+0.00		Pass
Vu at d = 0.625 × 2.8 × 20 − 2.8 × d	kips	29.98	29.98	+0.00		Pass
Top bars beyond the inflection point: 8.333 ft + max(d, 12db, ℓn/16)	ft	10.12	10.12	-0.00		Pass

CB-COEF: Three 20 ft spans, 12 in. supports, coefficients of 6.5

Source: Hand calculation (closed form, ACI 318-19 6.4.2, 6.5, 9.7.3). Calculation: Continuous concrete beam.

CB-COEF · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
End span Mu+ = wu ℓn² / 14	kip-ft	72.20	72.20	+0.00		Pass
Interior span Mu+ = wu ℓn² / 16	kip-ft	63.17	63.17	+0.00		Pass
First interior support Mu− = wu ℓn² / 10	kip-ft	101.1	101.1	+0.00		Pass
Exterior support (column) Mu− = wu ℓn² / 16	kip-ft	63.17	63.17	+0.00		Pass
End span Vu = 1.15 wu ℓn / 2	kips	30.59	30.59	+0.00		Pass

SP-CNB-NEG-RECT: Negative region as a rectangle: 16 × 24 in., 7 #8 top

Source: StructurePoint DE-CNB-ACI14, Continuous Reinforced Concrete Beam, pp. Section 6.1, Table 3 (printed pp. 14 to 15). Calculation: Concrete deflection.

SP-CNB-NEG-RECT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ig, negative (rectangle)	in.⁴	18,432	18,432	+0.00		Pass
Mcr, negative (rectangle)	kip-ft	60.72	60.72	-0.01		Pass
kd, 7 #8 at d = 22 in.	in.	8.420	8.425	+0.06		Pass
Icr, 7 #8 at d = 22 in.	in.⁴	10,897	10,897	+0.00		Pass

SP-CNB-T: T section 120 × 8 in. flange, positive and negative Mcr

Source: StructurePoint DE-CNB-ACI14, Continuous Reinforced Concrete Beam, pp. Table 4 (printed p. 16) and the spBeam output. Calculation: Concrete deflection.

SP-CNB-T · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ig, T section	in.⁴	39,684	39,684	+0.00		Pass
Mcr, positive (T)	kip-ft	89.77	89.77	+0.00		Pass
Mcr, negative (T)	kip-ft	240.4	240.4	+0.00		Pass

CD-UNCRACKED: Simple span, uncracked: 5wL⁴/(384 Ec Ig)

Source: Hand calculation (closed form, ACI 318-19 Table 24.2.3.5, Eq. 24.2.4.1.1). Calculation: Concrete deflection.

CD-UNCRACKED · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Δ(D + L) with Ig	in.	0.043	0.043	+0.00		Pass
ΔL with Ig	in.	0.014	0.014	+0.00		Pass

CD-CRACKED: Simple span, cracked: Ie by Table 24.2.3.5, λΔ = 2.0

Source: Hand calculation (closed form, ACI 318-19 Table 24.2.3.5, Eq. 24.2.4.1.1). Calculation: Concrete deflection.

CD-CRACKED · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Icr, 4 #8 at 21.5 in.	in.⁴	6,667	6,667	-0.00		Pass
Ie under D + L	in.⁴	6,736	6,736	-0.00		Pass
Δ(D + L)	in.	0.922	0.922	+0.00		Pass
ΔL = Δ(D + L) − Δ(D)	in.	0.315	0.315	+0.00		Pass
After attachment 2.0 Δ(D + 0.2L) + ΔL	in.	1.656	1.656	-0.00		Pass

SP17-E1-EW: Eight-story diaphragm, east-west

Source: ACI SP-17(14), Chapter 8, Example 1, pp. pp. 298, 305, 306. Calculation: Concrete diaphragm.

SP17-E1-EW · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
w	kip/ft	1.940	1.944	+0.23		Pass
V	kips	70.00	70.00	+0.00		Pass
M	kip-ft	1,260	1,260	+0.00		Pass
Vn	kips	2,590	2,590	-0.01		Pass
φVn	kips	1,940	1,942	+0.12		Pass
Chord area required	in.²	0.100	0.107	+7.03		Pass

SP17-E1-NS: North-south, φ = 0.6, with the torsion share in the reaction

Source: ACI SP-17(14), Chapter 8, Example 1, pp. pp. 298 to 304. Calculation: Concrete diaphragm.

SP17-E1-NS · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
V	kips	52.20	52.20	+0.00		Pass
Vn	kips	855.0	855.3	+0.04		Pass
φVn	kips	513.0	513.2	+0.04		Pass
M, trapezoidal in the example	kip-ft	2,595	2,589	-0.24		Pass
Chord T	kips	37.60	37.52	-0.22		Pass
Chord area required	in.²	0.700	0.695	-0.75		Pass
v Printed to 0.01	kip/ft	0.720	0.725	+0.69		Pass
Collector T	kips	15.80	15.95	+0.95		Pass

P1051-WWR: Noncomposite topping, wire across the joints, μ = 1.0, λ = 0.85

Source: FEMA P-1051 (2015), 11.1.2, pp. p. 539. Calculation: Concrete diaphragm.

P1051-WWR · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φ Vn at the joint	kips	264.0	264.4	+0.15		Pass

HC-DEF · Concrete diaphragm: The default

Source: Hand calculation (closed form), pp. Eq. 12.5.3.3, 12.5.3.4. Calculation: Concrete diaphragm.

HC-DEF · Concrete diaphragm · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vn	kips	1,358	1,358	-0.00		Pass
φ 8√f'c Acv (kips)	kips	1,913	1,913	-0.00		Pass
T	kips	22.11	22.11	+0.00		Pass
V along the wall line, per ft (kip/ft)	kip/ft	1.167	1.167	+0.00		Pass

HC-OPEN: An opening off the middle, strips by depth

Source: Hand calculation (closed form), pp. 12.2.2, net section and local moments. Calculation: Concrete diaphragm.

HC-OPEN · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
V at the opening	kips	35.00	35.00	+0.00		Pass
M at the opening	kip-ft	945.0	945.0	+0.00		Pass
Share by depth		0.500	0.500	+0.00		Pass
T with the local moment	kips	19.69	19.69	+0.00		Pass

MNL-D1-EW: Eight-story diaphragm, east-west

Source: ACI MNL-17(21), Rigid Diaphragm Example 1, pp. pp. 330, 337-338. Calculation: Concrete diaphragm.

MNL-D1-EW · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
w	kip/ft	1.940	1.944	+0.23		Pass
V	kips	70.00	70.00	+0.00		Pass
M	kip-ft	1,260	1,260	+0.00		Pass
Vn	kips	2,590	2,590	-0.01		Pass
φVn	kips	1,940	1,942	+0.12		Pass
Chord area required	in.²	0.100	0.107	+7.03		Pass

MNL-D1-NS: North-south, φ = 0.6, with the torsion share in the reaction

Source: ACI MNL-17(21), Rigid Diaphragm Example 1, pp. pp. 329-335. Calculation: Concrete diaphragm.

MNL-D1-NS · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
V	kips	52.20	52.20	+0.00		Pass
Vn	kips	855.0	855.3	+0.04		Pass
φVn	kips	513.0	513.2	+0.04		Pass
M, trapezoidal in the example	kip-ft	2,595	2,589	-0.24		Pass
Chord T	kips	37.60	37.52	-0.22		Pass
Chord area required	in.²	0.700	0.695	-0.75		Pass
v Printed to 0.01	kip/ft	0.720	0.725	+0.69		Pass
Collector T	kips	15.80	15.95	+0.95		Pass

T722.2.1.1-CARB: Carbonate wall, 6.6 in.: 4 hours

Source: IBC 2021 Table 722.2.1.1, pp. p. 7-65. Calculation: Concrete fire resistance.

T722.2.1.1-CARB · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Wall rating, carbonate, 6.6 in.		4.000	4.000	+0.00		Pass

T722.2.1.1-LW: Lightweight wall, 3.6 in.: 2 hours

Source: IBC 2021 Table 722.2.1.1, pp. p. 7-65. Calculation: Concrete fire resistance.

T722.2.1.1-LW · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Wall rating, lightweight, 3.6 in.		2.000	2.000	+0.00		Pass

T722.2.2.1-SIL: Siliceous slab, 5 in.: 2 hours

Source: IBC 2021 Table 722.2.2.1, pp. p. 7-68. Calculation: Concrete fire resistance.

T722.2.2.1-SIL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Slab rating, siliceous, 5 in.		2.000	2.000	+0.00		Pass
Cover, reinforced, unrestrained, 2 h	in.	1.000	1.000	+0.00		Pass

T722.2.3-2: Prestressed slab, siliceous, unrestrained, 3 hours

Source: IBC 2021 Tables 722.2.3(1) to (4), pp. p. 7-71. Calculation: Concrete fire resistance.

T722.2.3-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cover, prestressed slab, 3 h	in.	2.375	2.375	+0.00		Pass

T722.2.3-3: Reinforced beam 7 in. wide, unrestrained, 4 hours

Source: IBC 2021 Tables 722.2.3(1) to (4), pp. p. 7-71. Calculation: Concrete fire resistance.

T722.2.3-3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cover, 7 in. beam, 4 h	in.	3.000	3.000	+0.00		Pass

T722.2.3-4: Prestressed beam 12 in. wide, carbonate, unrestrained, 3 hours

Source: IBC 2021 Tables 722.2.3(1) to (4), pp. p. 7-72. Calculation: Concrete fire resistance.

T722.2.3-4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cover, 12 in. prestressed beam, 3 h	in.	2.500	2.500	+0.00		Pass

T722.2.4-SIL: Siliceous column, 4 hours

Source: IBC 2021 Table 722.2.4, 722.2.4.2, pp. p. 7-71. Calculation: Concrete fire resistance.

T722.2.4-SIL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Least dimension, siliceous, 4 h	in.	14.00	14.00	+0.00		Pass
Column cover, 4 h	in.	2.000	2.000	+0.00		Pass

T722.2.4-NOTE-A: Carbonate column 12 x 36 in., 3 hours (note a)

Source: IBC 2021 Table 722.2.4, 722.2.4.2, pp. p. 7-71. Calculation: Concrete fire resistance.

T722.2.4-NOTE-A · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Least dimension with note a	in.	8.000	8.000	+0.00		Pass

HC-WIDTH: Reinforced beam 8.5 in. wide, unrestrained, 4 hours

Source: Hand calculation from IBC 2021 722.2, pp. 3.0 + (1.75 − 3.0) × 1.5/3 (Table 722.2.3(3) note b). Calculation: Concrete fire resistance.

HC-WIDTH · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cover interpolated by width	in.	2.375	2.375	+0.00		Pass

HC-PS-WIDTH: Prestressed beam 10 in. wide, carbonate, unrestrained, 2 hours

Source: Hand calculation from IBC 2021 722.2, pp. 2.5 + (1.875 − 2.5) × 2/4 (Table 722.2.3(4) note b). Calculation: Concrete fire resistance.

HC-PS-WIDTH · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Prestressed cover interpolated by width	in.	2.188	2.188	+0.00		Pass

HC-FINISH · Concrete fire resistance: 4 in. carbonate bearing wall, 5/8 in. gypsum wallboard on side 2

Source: Hand calculation from IBC 2021 722.2, pp. fire on side 1: 4.0 + 3.00 × 0.625 = 5.875 in. → 3 h, capped at 1.5 + 0.75 = 2.25 h (722.2.1.4.4); fire on side 2: 1.5 h + 20 min. Calculation: Concrete fire resistance.

HC-FINISH · Concrete fire resistance · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fire on side 1		2.250	2.250	+0.00		Pass
Fire on side 2		1.833	1.833	+0.00		Pass
Wall rating, the lower side		1.833	1.833	+0.00		Pass

SMF-BEAM: Beam Mn, Mpr (singly reinforced) and Ve

Source: Hand calculation (closed form, ACI 318-19 18.6, 18.7). Calculation: Special moment frame members.

SMF-BEAM · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mn− = 5.0 × 60 (27.5 − a/2)	kip-ft	641.5	641.5	+0.00		Pass
Mn+ = 4.0 × 60 (27.5 − a/2)	kip-ft	520.6	520.6	+0.00		Pass
Mpr− = 5.0 × 75 (27.5 − a/2)	kip-ft	787.6	787.6	+0.00		Pass
Mpr+ = 4.0 × 75 (27.5 − a/2)	kip-ft	641.5	641.5	+0.00		Pass
wu = (1.2 + 0.2) × 1.5 + 0.8	kip/ft	2.900	2.900	-0.00		Pass
Ve = ΣMpr / ℓn + wu ℓn / 2	kips	92.67	92.67	+0.00		Pass

SMF-LO: ℓo, hx and so with three legs each way

Source: Hand calculation (closed form, ACI 318-19 18.6, 18.7). Calculation: Special moment frame members.

SMF-LO · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ℓo = max(28, 132/6, 18)	in.	28.00	28.00	+0.00		Pass
hx = (28 − 2 × 2.635) / 2	in.	11.37	11.37	+0.00		Pass
so = 4 + (14 − hx)/3	in.	4.878	4.878	+0.00		Pass

SMF-ASH: Table 18.7.5.4 (a), (b), kn

Source: Hand calculation (closed form, ACI 318-19 18.6, 18.7). Calculation: Special moment frame members.

SMF-ASH · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
(a) 0.3 (784/625 − 1) × 4/60		0.005	0.005	+0.00		Pass
(b) 0.09 × 4/60		0.006	0.006	+0.00		Pass
kn = 12 / 10		1.200	1.200	+0.00		Pass
kf = 1.0 at 4,000 psi		1.000	1.000	+0.00		Pass

ST-1: Flight only, pinned ends: self-weight on plan, flexure, shear, deflection

Source: Hand calculation (closed form), pp. ACI 318-19 7.5, 22.2, 22.5, 24.2. Calculation: Concrete stair.

ST-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Flight self-weight on plan 150(t √(R² + T²)/T + R/2)	psf	162.3	162.3	+0.00		Pass
Mu = wu ℓ²/8	kip-ft	3.171	3.171	-0.00		Pass
φMn (#5 @ 6 in.)	kip-ft	18.08	18.08	+0.00		Pass
Vu at d from the face, normal to the flight	kips	1.011	1.011	-0.00		Pass
φVc (Table 22.5.5.1(c))	kips	6.169	6.169	+0.00		Pass
ΔL = 5wL ℓ⁴/(384 Ec Ig cos θ)	in.	0.007	0.007	-0.00		Pass

ST-2: Flight with two landings, pinned at the landing ends

Source: Hand calculation (closed form), pp. ACI 318-19 7.5, 22.2. Calculation: Concrete stair.

ST-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mu at midspan (landing and flight loads)	kip-ft	9.125	9.122	-0.03		Pass
φMn of the flight	kip-ft	18.08	18.08	+0.00		Pass

ST-3: Flight fixed at both ends: top bars at the supports

Source: Hand calculation (closed form), pp. ACI 318-19 7.5, 22.2. Calculation: Concrete stair.

ST-3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mu− = wu ℓ²/12	kip-ft	2.114	2.114	+0.00		Pass
φMn of the top bars (#4 @ 12 in.)	kip-ft	6.168	6.168	+0.00		Pass
Mu+ = wu ℓ²/24	kip-ft	1.057	1.057	-0.00		Pass

TW-CANT: Rectangular wall, cantilever: Ms = yH³/6, Sd

Source: Hand calculation (closed form: beam formulas, Timoshenko §117, the ACI 350 expressions as built). Calculation: Liquid-containing tank wall.

TW-CANT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ms = 0.0624 × 12³ / 6	kip-ft	17.97	17.97	+0.00		Pass
fs = 320 / (1.35 √(s² + 4(2 + db/2)²))	ksi	25.30	25.30	+0.00		Pass
Sd = 0.9 × 60 / (1.4 fs)		1.524	1.524	+0.00		Pass

TW-PROPPED: Fixed base, pinned top: Mbase = w0 L²/15

Source: Hand calculation (closed form: beam formulas, Timoshenko §117, the ACI 350 expressions as built). Calculation: Liquid-containing tank wall.

TW-PROPPED · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ms = 0.7488 × 144 / 15	kip-ft	7.188	7.188	+0.00		Pass

TW-PINNED: Pinned both ends: Mmax = w0 L²/(9√3)

Source: Hand calculation (closed form: beam formulas, Timoshenko §117, the ACI 350 expressions as built). Calculation: Liquid-containing tank wall.

TW-PINNED · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ms = w0 L² / (9√3)	kip-ft	6.917	6.917	+0.00		Pass

TW-FREE: Circular, free base: T = γ H a

Source: Hand calculation (closed form: beam formulas, Timoshenko §117, the ACI 350 expressions as built). Calculation: Liquid-containing tank wall.

TW-FREE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
T = 0.0624 × 12 × 30.58	kip/ft	22.90	22.90	+0.00		Pass

TW-FIXED: Circular, fixed base: M0 of the long shell

Source: Hand calculation (closed form: beam formulas, Timoshenko §117, the ACI 350 expressions as built). Calculation: Liquid-containing tank wall.

The base moment governs the vertical bending of this wall (the positive moment is smaller).

TW-FIXED · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
M0 = (1 − 1/(βd)) γ a d t / √(12(1 − ν²))	kip-ft	4.864	4.864	+0.00		Pass

SP-BW: Precast bearing wall, alternative slender wall method (11.8)

Source: StructurePoint, Reinforced Concrete Bearing Wall Design (ACI 318-19), pp. pp. 4–11 (Tables 1, 2). Calculation: Concrete shear wall.

Per foot of wall; the concentrated double-tee reactions are spread over 5 ft as in the example. Wall self-weight above midheight 1.0 kip/ft (150 pcf).

SP-BW · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pu at midheight, 1.2D + 0.5Lr + 1.6W	kips	4.050	4.055	+0.12		Pass
Mua (32.61 in.-kips)	kip-ft	2.717	2.718	+0.00		Pass
Icr (Eq. 11.8.3.1c)	in.⁴	32.30	32.25	-0.14		Pass
Mu with P-Δ (45.22 in.-kips)	kip-ft	3.768	3.769	+0.02		Pass
φMn at Pu (67.76 in.-kips)	kip-ft	5.647	5.647	+0.00		Pass
Mcr = fr Ig / yt (60.72 in.-kips)	kip-ft	5.060	5.060	-0.01		Pass
Largest Pu (1.2D + 1.6Lr + 0.8W)	kips	5.040	5.045	+0.10		Pass
0.06 f'c Ag	kips	23.04	23.04	+0.00		Pass
Δcr	in.	0.197	0.197	+0.19		Pass
Ma = Msa + Ps Δs (22.15 in.-kips)	kip-ft	1.846	1.847	+0.04		Pass
Service deflection Δs	in.	0.072	0.072	+0.04		Pass
ℓc/150	in.	1.600	1.600	+0.00		Pass

SP-TU · Concrete shear wall: Tilt-up wall panel, slender wall method: strength (1.2D + 1.6Lr + 0.5W)

Source: StructurePoint, Reinforced Concrete Tilt-Up Wall Panel Analysis and Design (ACI 318-19), pp. pp. 5–7, 36 (Table 1). Calculation: Concrete shear wall.

Values per foot of the 15 ft panel; the example's single combination is entered as dead load / 1.4.

SP-TU · Concrete shear wall · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pum at midheight (43.49 kips per panel)	kips	2.899	2.899	-0.00		Pass
Mua (24.77 kip-ft per panel)	kip-ft	1.651	1.651	+0.01		Pass
Icr (353.56 in.⁴ per panel)	in.⁴	23.57	23.57	-0.00		Pass
Mu with P-Δ (61.00 kip-ft per panel)	kip-ft	4.067	4.066	-0.01		Pass

SP-TU-svc: Tilt-up wall panel: service deflection (Table 11.8.4.1)

Source: StructurePoint, Reinforced Concrete Tilt-Up Wall Panel Analysis and Design (ACI 318-19), pp. pp. 8–9, 36 (Table 1). Calculation: Concrete shear wall.

Parapet weight (1.5 ft) entered as a concentric dead load; Lr excluded from the service load as in the example.

SP-TU-svc · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mcr (46.32 kip-ft per panel)	kip-ft	3.088	3.088	+0.01		Pass
Δcr	in.	0.550	0.550	-0.07		Pass
Ma (20.84 kip-ft per panel)	kip-ft	1.389	1.391	+0.09		Pass
Service deflection Δs	in.	0.247	0.247	+0.20		Pass
ℓc/150	in.	2.360	2.360	+0.00		Pass

SP-SW: Shear wall: in-plane shear, flexure and minimum reinforcement

Source: StructurePoint, Reinforced Concrete Shear Wall Analysis and Design (ACI 318-19), pp. pp. 4–7, 34 (Table 1). Calculation: Concrete shear wall.

Factored loads 0.9D + 1.0W entered as D = 230 kips and W (V = 121 kips, M = 4,665 kip-ft).

SP-SW · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
αc (hw/ℓw = 3.0)		2.000	2.000	+0.00		Pass
Acv	in.²	2,160	2,160	+0.00		Pass
φVn = φ(αcλ√f'c + ρt fy)Acv	kips	447.9	447.9	-0.00		Pass
φMn at Nu = 207 kips (hand, 4,808 kip-ft) The example uses the approximate uniform-steel method (Cardenas); ILX Calcs uses strain compatibility of the bars (+0.9 %)	kip-ft	4,808	4,853	+0.95		Pass
ρℓ,min × 12h (0.0025, 11.6.2)	in.²	0.300	0.300	+0.00		Pass
ρt,min × 12h (0.0025, 11.6.2)	in.²	0.300	0.300	+0.00		Pass
Maximum vertical spacing	in.	18.00	18.00	+0.00		Pass

W-1: In-plane shear, squat wall (αc = 3)

Source: Hand calculation (closed form), pp. ACI 318-19 Eq. 11.5.4.3. Calculation: Concrete shear wall.

W-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φVn	kips	899.5	899.5	+0.00		Pass
Vu (1.0E)	kips	150.0	150.0	+0.00		Pass

W-2: In-plane shear, αc interpolated

Source: Hand calculation (closed form), pp. ACI 318-19 11.5.4.3. Calculation: Concrete shear wall.

W-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φVn	kips	842.6	842.6	+0.00		Pass

W-3: In-plane shear with net axial tension

Source: Hand calculation (closed form), pp. ACI 318-19 Eq. 11.5.4.4. Calculation: Concrete shear wall.

W-3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φVn under net tension	kips	747.7	747.7	+0.00		Pass

W-4: Maximum axial strength of the wall section

Source: Hand calculation (closed form), pp. ACI 318-19 Eq. 22.4.2.2. Calculation: Concrete shear wall.

W-4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Po	kips	8,862	8,862	+0.00		Pass
φPn,max	kips	4,608	4,608	-0.00		Pass

W-5: Simplified design method, axial strength per foot

Source: Hand calculation (closed form), pp. ACI 318-19 Eq. 11.5.3.1. Calculation: Concrete shear wall.

W-5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φPn (kips per ft)		149.4	149.4	+0.00		Pass

W-6: Alternative slender wall method (11.8)

Source: Hand calculation (closed form), pp. ACI 318-19 11.8.3.1, 11.8.4. Calculation: Concrete shear wall.

W-6 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mu with P-Δ (kip-ft per ft)		1.412	1.412	-0.00		Pass
φMn (kip-ft per ft)		5.453	5.453	+0.00		Pass
Icr (in.⁴ per ft)		31.40	31.40	-0.00		Pass
Service deflection Δs (in.)		0.032	0.032	+0.01		Pass
φVc (kips per ft)		3.392	3.392	-0.00		Pass
0.06 f'c Ag (kips per ft)		23.04	23.04	+0.00		Pass

W-7: Special wall: extreme-fiber stress for the boundary element need

Source: Hand calculation (closed form), pp. ACI 318-19 18.10.6.3. Calculation: Concrete shear wall.

W-7 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
σ (ksi)	ksi	0.407	0.407	-0.01		Pass

W-8: Special wall: amplified design shear Ve

Source: Hand calculation (closed form), pp. ACI 318-19 Eq. 18.10.3.1. Calculation: Concrete shear wall.

W-8 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ve	kips	315.9	315.9	+0.00		Pass

W-9: Minimum vertical reinforcement, Table 11.6.1

Source: Hand calculation (closed form), pp. ACI 318-19 Table 11.6.1. Calculation: Concrete shear wall.

W-9 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
As,min vertical (in.² per ft)		0.144	0.144	+0.00		Pass

W-10: Minimum vertical reinforcement, Eq. 11.6.2

Source: Hand calculation (closed form), pp. ACI 318-19 11.6.2. Calculation: Concrete shear wall.

W-10 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
As,min vertical (in.² per ft) The cap 'need not exceed ρt required by 11.5.4.3' is not taken below the 0.0025 minimum of ρt (11.6.2(b), R11.6.2), as in the StructurePoint shear wall example		0.300	0.300	+0.00		Pass

MNL17-W1: Ordinary wall (SDC B, wind): shear, P-M, minimum steel, simplified method

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 10, Shear Wall Example 1, pp. pp. 446–449. Calculation: Concrete shear wall.

φMn from the example's interaction diagram spreadsheet at Pu; the example's spreadsheet places the first bar pair 3 in. and the second 12 in. from each end (29 positions); ILX Calcs spaces the distributed bars at s from s/2 at each end (28 positions).

MNL17-W1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φMn at Pu = 1,015 kips (24,600 kip-ft, p. 446)	kip-ft	24,600	24,133	-1.90		Deviation MNL17-W-LAYOUT
MNL17-W-LAYOUT: the example's spreadsheet places the first bar pair 3 in. and the second 12 in. from each end (29 positions); ILX Calcs spaces the distributed bars at s from s/2 at each end (28 positions): φMn = 24,130 kip-ft						
αc (hw/ℓw = 3.3, p. 447)		2.000	2.000	+0.00		Pass
Acv (p. 447)	in.²	4,032	4,032	+0.00		Pass
Vu (p. 447)	kips	235.0	235.0	+0.00		Pass
ρt,min × 12h = 0.0025 × 144 (11.6.2, p. 448)	in.²	0.360	0.360	+0.00		Pass
ρℓ,min × 12h (p. 448: 0, ρt required for strength being zero)	in.²	0.000	0.360	+0.00		Deviation MNL17-W1-RHOL
MNL17-W1-RHOL: the example lets ρℓ fall to the ρt required for strength (zero); ILX Calcs does not take ρℓ below 0.0025 (ρt is at least 0.0025 by 11.6.2(b)): 0.36 in.²/ft						
φPn per foot, simplified method (5,920 kips / 28 ft, p. 448)		211.4	211.8	+0.18		Pass
Maximum vertical spacing 18 in. (p. 449)	in.	18.00	18.00	+0.00		Pass
Maximum horizontal spacing 18 in. (p. 449)	in.	18.00	18.00	+0.00		Pass

MNL17-W2: Special structural wall (SDC D): design shear and boundary element need

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 10, Shear Wall Example 2, pp. pp. 456–459. Calculation: Concrete shear wall.

Factored loads at the base: Pu = 1,015 kips (1.2D + 1.0E), Vu = 470 kips; the special boundary elements of 18.10.6.4 are not designed by the module.

MNL17-W2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ve = Ωv ωv Vu (1,107 kips, p. 457)	kips	1,107	1,104	-0.23		Pass
Vn = (αc√f'c + ρt fy)Acv (p. 457)	kips	2,045	2,049	+0.18		Pass
φVn with φ = 0.60 (1,227 kips, p. 457)	kips	1,227	1,536	+25.22		Deviation MNL17-W2-PHI
MNL17-W2-PHI: the example applies φ = 0.60 of 21.2.4.1; 18.10.4.6 exempts walls designed by 18.10.6.2, as this one is, so ILX Calcs keeps φ = 0.75 (1,537 kips)						
δu/hwcs = 12/1,104 (p. 458)		0.011	0.011	-0.28		Pass
c (p. 458, from the example's software)	in.	67.90	65.29	-3.84		Deviation MNL17-W2-C
MNL17-W2-C: the example takes c = 67.9 in. from its software, with its own bar layout (bars 3 in. from each end); ILX Calcs computes c = 65.3 in. at Pu = 1,015 kips with No. 8 at 12 in. from s/2, and so b required = 23.4 in.; special boundary elements are required either way						
b required = √(0.025 c ℓw) (p. 459)	in.	23.90	23.42	-2.01		Deviation MNL17-W2-C
MNL17-W2-C: the example takes c = 67.9 in. from its software, with its own bar layout (bars 3 in. from each end); ILX Calcs computes c = 65.3 in. at Pu = 1,015 kips with No. 8 at 12 in. from s/2, and so b required = 23.4 in.; special boundary elements are required either way						
δc/hwcs by Eq. 18.10.6.2b with b = 12 in. (p. 459)		0.004	0.015	+328.57		Deviation MNL17-W2-DC
MNL17-W2-DC: ILX Calcs reports δc/hwcs at the 0.015 that Eq. 18.10.6.2b need not be taken below; the example prints the raw value 0.0035. Both are below 1.5δu/hwcs = 0.0163, so the boundary still fails at b = 12 in.						
φPn per foot, simplified method (5,900 kips / 28 ft, p. 455) The example prints Pn = 9,090 kips here and 9,120 kips in Example 1 for the same inputs; 0.55 × 5 × 12 × 336 × (1 − (0.8 × 202/384)²) = 9,124 kips		210.7	211.8	+0.52		Pass

MNL17-W2-PM: Special structural wall (SDC D): φMn at Pu, No. 8 at 12 in. each face

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 10, Shear Wall Example 2, pp. p. 454.
Calculation: Concrete shear wall.

Before the boundary element bars are added; the example's spreadsheet places the first bar pair 3 in. and the second 12 in. from each end (29 positions); ILX Calcs spaces the distributed bars at s from s/2 at each end (28 positions).

MNL17-W2-PM · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φMn at Pu = 1,015 kips (40,200 kip-ft)	kip-ft	40,200	39,049	-2.86		Deviation MNL17-W-LAYOUT
MNL17-W-LAYOUT: the example's spreadsheet places the first bar pair 3 in. and the second 12 in. from each end (29 positions); ILX Calcs spaces the distributed bars at s from s/2 at each end (28 positions): φMn = 39,050 kip-ft						

VC-CORBEL: Corbel: shear friction, axial tension, flexure (ACI 318-11 = 318-19 16.5)

Source: VCmaster US catalog, Corbel design (ACI 318-11), pp. pp. 4–6. Calculation: Corbel.

Factored Vu = 88.8 kips and Nuc = 32 kips entered as live load (1.6L); d = 11.0 in. (cover to the bar centroid 1.0 in.).

VC-CORBEL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φVn,max = 0.75 × (480 + 0.08f'c) b d	kips	101.6	101.6	+0.01		Pass
Avf = Vu / (φ μ fy)	in.²	1.410	1.410	-0.03		Pass
An = Nuc / (φ fy)	in.²	0.710	0.711	+0.16		Pass
Mu = Vu av + Nuc (h − d) (298.4 kip-in.)	kip-ft	24.87	24.87	+0.00		Pass
Af (0.9d lever arm)	in.²	0.670	0.620	-7.39		Deviation CORBEL-AF-LEVER
CORBEL-AF-LEVER: the worksheet takes the lever arm as 0.9d; ILX solves the stress block (0.62 in.²); Asc is governed by 2/3 Avf + An either way						
Asc,min = 0.04 (f'c/fy) b d	in.²	0.510	0.513	+0.65		Pass
Asc required	in.²	1.650	1.651	+0.05		Pass
Ah = 0.5 (Asc − An), Asc provided 2.00 in.²	in.²	0.650	0.644	-0.85		Pass

MP-CORBEL: Corbel 15 × 22 in.: shear friction, Asc, Ah

Source: Maplesoft, Maple Flow Corbel Design (labelled ACI 318-19), pp. pp. 1–4. Calculation: Corbel.

Factored Vu = 80 kips and Nuc = 40 kips entered as live load (1.6L); d = 20 in.

MP-CORBEL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
An = max(Nuc, 0.2Vu) / (φ fy)	in.²	0.889	0.889	-0.01		Pass
Avf	in.²	1.270	1.270	-0.01		Pass
Mu (33.33 kip-ft)	kip-ft	33.33	33.33	+0.01		Pass
Af	in.²	0.373	0.449	+20.43		Deviation CORBEL-AF-PHI
CORBEL-AF-PHI: the worksheet uses φ = 0.90 for flexure; ACI 318-19 Table 21.2.1(f) gives 0.75 for every action of a corbel (ILX 0.450 in.²)						
Asc,min = 0.04 (f'c/fy) b d	in.²	1.000	1.000	+0.00		Pass
Asc required = 2/3 Avf + An	in.²	1.735	1.735	+0.03		Pass
φVn,max (worksheet: 0.8 φ b d = 180 kips)	kips	180.0	198.0	+10.00		Deviation CORBEL-VN-800
CORBEL-VN-800: the worksheet limits Vn to 800 b d (ACI 318-08 and earlier); ACI 318-19 16.5.2.4 gives the least of 0.2f'c, 480 + 0.08f'c and 1,600 psi (198 kips here)						
φVn,max (ACI 318-19 16.5.2.4)	kips	198.0	198.0	+0.00		Pass
Ah = 0.5 (Asc − An), from Asc required	in.²	0.423	0.456	+7.70		Deviation CORBEL-AH-ASC
CORBEL-AH-ASC: the worksheet takes Asc as the required area; ILX uses the primary reinforcement provided (1.80 in.², Ah = 0.456 in.²), as 16.5.5.2 reads						

CB-1: Corbel on bearing pads: restraint force, reinforcement, bearing, hook

Source: Hand calculation (closed form), pp. ACI 318-19 16.2.2.3(b), 16.5, 22.8, 25.4.3. Calculation: Corbel.

CB-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nuc = 1.6 × 0.2 × 30 kips	kips	9.600	9.600	+0.00		Pass
Avf	in.²	1.079	1.079	+0.00		Pass
Af (stress block, φ = 0.75)	in.²	0.599	0.599	+0.00		Pass
Asc required	in.²	0.933	0.933	+0.00		Pass
Ah = 0.5 (Asc − An)	in.²	0.553	0.553	+0.00		Pass
φBn = 0.65 × 0.85 f'c A1	kips	106.1	106.1	+0.00		Pass
ℓdh (ψr = 1.6, ψo = 1.25)	in.	19.42	19.42	+0.00		Pass

CB-2: Lightweight corbel: Vn limit of 16.5.2.5, μ = 1.4λ

Source: Hand calculation (closed form), pp. ACI 318-19 16.5.2.5. Calculation: Corbel.

CB-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φVn,max (lightweight)	kips	134.6	134.6	+0.00		Pass
Avf with μ = 1.4 × 0.85	in.²	1.270	1.270	+0.00		Pass

CB-3: Corbel cast against hardened concrete, not roughened

Source: Hand calculation (closed form), pp. ACI 318-19 Table 22.9.4.2(c), Table 22.9.4.4(d), (e). Calculation: Corbel.

CB-3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φVn,max = 0.75 min(0.2f'c, 800) b d	kips	154.2	154.2	+0.00		Pass
Avf with μ = 0.6	in.²	2.519	2.519	+0.00		Pass

FEMA-4.5.3: Coupling beam as a special moment frame beam (18.10.7.3, 18.6.3 to 18.6.5)

Source: FEMA P-2192-V1 (2020), NEHRP Provisions Design Examples, 4.5.3, pp. PDF pp. 166 to 170. Calculation: Coupling beam.

d = 28 − 1.5 − 0.5 − 0.5 = 25.5 in.; gravity shear neglected as in the example.

FEMA-4.5.3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
As,min = 3√f'c/fy bw d (2.97 in.²)	in.²	2.970	2.965	-0.17		Pass
As,max = 0.025 bw d (16.58 in.²)	in.²	16.58	16.57	-0.03		Pass
φMn with 6 #8 (spColumn, 526 kip-ft)	kip-ft	526.0	526.9	+0.17		Pass
Mpr (1.25 fy, 724 kip-ft)	kip-ft	724.0	723.7	-0.04		Pass
Ve = 2 Mpr / ℓn (229 kips)	kips	229.0	228.5	-0.20		Pass
Vs with six #4 legs at 6 in. (305 kips)	kips	305.0	306.0	+0.33		Pass
8√f'c bw d (474 kips)	kips	474.0	474.4	+0.09		Pass
Hoop spacing limit min(d/4, 6 in., 6db)	in.	6.000	6.000	+0.00		Pass

CB-DIAG: Diagonally reinforced coupling beam: Vn = 2 Avd fy sin α, φ = 0.85

Source: Hand calculation (closed form), pp. ACI 318-19 Eq. 18.10.7.4, 21.2.4.4. Calculation: Coupling beam.

CB-DIAG · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
α (tan α = 24/72)		18.43	18.43	+0.00		Pass
Vn = 2 Avd fy sin α	kips	289.2	289.2	+0.00		Pass
φVn = 0.85 Vn	kips	245.8	245.8	+0.00		Pass
Ash across bw, 18.10.7.4(d)(ii)	in.²	0.356	0.356	+0.00		Pass

CB-CAP: Diagonal bars capped at 10√f'c Acw

Source: Hand calculation (closed form), pp. ACI 318-19 Eq. 18.10.7.4. Calculation: Coupling beam.

CB-CAP · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φ 10√f'c Acw governs	kips	309.7	309.7	+0.00		Pass

CPT-LCPC-SAND: LCPC, steel pile in uniform sand

Source: Hand calculation: UFS 3-220-20 (2026) 6-5.4.4; FHWA GEC 12 (2016) 7.2.1.3.6, pp. Eqs. 6-32, 6-33. Calculation: Pile capacity from CPT.

CPT-LCPC-SAND · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rs = (200/200) ksf × π × 1 ft × 20 ft	kips	62.83	62.83	+0.00		Pass
Rb = 0.5 × 200 ksf × 0.7854 ft²	kips	78.54	78.54	-0.00		Pass

CPT-EF-SAND: Eslami-Fellenius, steel pile in uniform sand

Source: Hand calculation: UFS 3-220-20 (2026) 6-5.4.4; FHWA GEC 12 (2016) 7.2.1.3.6, pp. Eqs. 7-24 to 7-27. Calculation: Pile capacity from CPT.

CPT-EF-SAND · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rs = 0.4 % × 200 ksf × π × 1 ft × 20 ft	kips	50.27	50.27	-0.01		Pass
Rb = 200 ksf × 0.7854 ft²	kips	157.1	157.1	-0.01		Pass

CPT-LCPC-CLAY: LCPC, drilled shaft in uniform clay

Source: Hand calculation: UFS 3-220-20 (2026) 6-5.4.4; FHWA GEC 12 (2016) 7.2.1.3.6, pp. Tables 6-21 to 6-23. Calculation: Pile capacity from CPT.

CPT-LCPC-CLAY · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rs with fp = 0.35 pa	kips	139.6	139.6	+0.01		Pass
Rb = 0.35 × 40 ksf × π ft²	kips	43.98	43.98	+0.01		Pass

CPT-LCPC-CLAY-CAREFUL: LCPC, careful construction

Source: Hand calculation: UFS 3-220-20 (2026) 6-5.4.4; FHWA GEC 12 (2016) 7.2.1.3.6, pp. Table 6-22. Calculation: Pile capacity from CPT.

CPT-LCPC-CLAY-CAREFUL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rs with fs = qc/ks = 1.0 ksf	kips	188.5	188.5	-0.00		Pass

CPT-EF-CLAY: Eslami-Fellenius, 24 in. shaft in clay with pore pressure

Source: Hand calculation: UFS 3-220-20 (2026) 6-5.4.4; FHWA GEC 12 (2016) 7.2.1.3.6, pp. Eqs. 7-24 to 7-28. Calculation: Pile capacity from CPT.

CPT-EF-CLAY · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rs = 5 % × 32 ksf × 2π ft × 30 ft	kips	301.6	301.6	-0.00		Pass
Rb = (12/24) × 32 ksf × π ft²	kips	50.27	50.27	-0.01		Pass

DG7-14.1.1 · Crane runway beam: W24X131, 30 ft, 20 ton crane, class B, cab-operated (25 % impact), wheels 12 ft apart

Source: AISC Design Guide 7, 3rd Ed. (2019), Example 14.1.1, pp. 63-68. Calculation: Crane runway beam.

DG7-14.1.1 · Crane runway beam · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Moment per kip of wheel, 9.60 P	ft	9.600	9.600	+0.00		Pass
Lateral force per wheel	kips	2.530	2.530	+0.00		Pass
Mrx with impact	kip-ft	478.0	477.6	-0.09		Pass
Mrx without impact	kip-ft	386.0	386.1	+0.03		Pass
Mry	kip-ft	24.30	24.29	-0.05		Pass
Mnx/Ω at Lb = 30 ft	kip-ft	605.0	605.0	+0.00		Pass
Mny/Ω	kip-ft	203.0	203.3	+0.17		Pass
Tension flange ratio		0.790	0.789	-0.09		Pass
Compression flange ratio		0.758	0.758	-0.05		Pass
Required Ix for span/600	in.⁴	3,370	3,371	+0.03		Pass
Required It for span/400	in.⁴	149.0	149.2	+0.16		Pass
Web sidesway Rn	kips	185.0	182.7	-1.27		Deviation DG7-ROUND
DG7-ROUND: the guide rounds the slenderness ratio to 1.28 before cubing it (exactly 1.276), and 3,470 / 1.67 to 2,100 (2,078)						
Available, Rn/Ω	kips	105.0	103.8	-1.16		Deviation DG7-ROUND
DG7-ROUND: the guide rounds the slenderness ratio to 1.28 before cubing it (exactly 1.276), and 3,470 / 1.67 to 2,100 (2,078)						
Wheel with impact	kips	47.60	47.62	+0.05		Pass

DG7-14.1.2: The same, LRFD

Source: AISC Design Guide 7, 3rd Ed. (2019), Example 14.1.2, pp. 68-70. Calculation: Crane runway beam.

DG7-14.1.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Factored crane dead per wheel	kips	23.50	23.52	+0.09		Pass
Factored lifted load per wheel	kips	32.00	32.00	+0.00		Pass
Pu per wheel	kips	55.50	55.52	+0.04		Pass
Hu per wheel	kips	4.050	4.048	-0.05		Pass
Mrx with impact	kip-ft	690.0	690.7	+0.10		Pass
Mrx without impact	kip-ft	557.0	557.4	+0.08		Pass
Mry	kip-ft	38.90	38.86	-0.10		Pass
φMnx	kip-ft	909.0	909.4	+0.04		Pass
φMny	kip-ft	306.0	305.6	-0.12		Pass
Tension flange ratio		0.759	0.760	+0.07		Pass
Compression flange ratio		0.740	0.740	+0.02		Pass

DG7-14.1.3: W30X99 with C15X33.9 cap channel, the same crane and dead loads

Source: AISC Design Guide 7, 3rd Ed. (2019), Example 14.1.3, pp. 70-75. Calculation: Crane runway beam.

DG7-14.1.3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
y1	in.	18.50	18.56	+0.31		Pass
Ix	in.⁴	5,550	5,553	+0.06		Pass
S1	in.³	300.0	299.2	-0.25		Pass
S2	in.³	481.0	481.1	+0.03		Pass
Zx	in.³	408.0	405.3	-0.65		Pass
It	in.⁴	380.0	379.6	-0.10		Pass
Syt	in.³	50.60	50.62	+0.04		Pass
Zyt	in.³	69.30	69.27	-0.05		Pass
rt	in.	4.500	4.501	+0.03		Pass
Lp	in.	119.0	119.2	+0.20		Pass
FL	ksi	31.20	31.10	-0.33		Pass
Lr of Table A-2 (AISC 360-22 Eq. F4-8)	in.	457.0	459.5	+0.55		Pass
Rpg		1.000	1.000	+0.00		Pass
Compression flange yielding	kip-in.	24,100	24,057	-0.18		Pass
Available, compression flange yielding	kip-in.	14,400	14,406	+0.04		Pass
Fcr	ksi	39.30	37.45	-4.70		Deviation DG7-LR
DG7-LR: AISC 360-22 F5-5 gives Lr = 407 in.; the guide's Table A-2 prints 457 in., which is F4-8, and uses it in F5-3						
Lateral-torsional buckling Mn	kip-in.	18,900	18,020	-4.66		Deviation DG7-LR
DG7-LR: AISC 360-22 F5-5 gives Lr = 407 in.; the guide's Table A-2 prints 457 in., which is F4-8, and uses it in F5-3						
Available, lateral-torsional buckling	kip-in.	11,300	10,790	-4.51		Deviation DG7-LR
DG7-LR: AISC 360-22 F5-5 gives Lr = 407 in.; the guide's Table A-2 prints 457 in., which is F4-8, and uses it in F5-3						
Mp of the top flange and channel	kip-in.	3,470	3,463	-0.19		Pass
Available, top flange and channel	kip-in.	2,100	2,074	-1.24		Deviation DG7-ROUND
DG7-ROUND: the guide rounds the slenderness ratio to 1.28 before cubing it (exactly 1.276), and 3,470 / 1.67 to 2,100 (2,078)						
Biaxial ratio		0.550	0.570	+3.63		Deviation DG7-LR
DG7-LR: AISC 360-22 F5-5 gives Lr = 407 in.; the guide's Table A-2 prints 457 in., which is F4-8, and uses it in F5-3						
Mn = Fy S1	kip-in.	15,000	14,962	-0.25		Pass
Available, tension flange	kip-in.	8,980	8,959	-0.23		Pass
Web sidesway Rn	kips	86.50	86.14	-0.42		Pass
Available, web sidesway	kips	49.10	48.94	-0.32		Pass
Q	in.³	108.0	107.5	-0.43		Pass
y	in.	10.80	10.75	-0.43		Pass
q per side the guide adds 75.0 + 2.74 where it found 76.2 kips	kip/in.	0.756	0.764	+1.07		Pass

DG7-14.1.4: The same, LRFD

Source: AISC Design Guide 7, 3rd Ed. (2019), Example 14.1.4, pp. 75-76. Calculation: Crane runway beam.

DG7-14.1.4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mrx with impact	kip-ft	690.0	690.7	+0.10		Pass
Mrx without impact	kip-ft	557.0	557.4	+0.08		Pass
Mry	kip-in.	467.0	466.3	-0.14		Pass
φ Fy S1	kip-in.	13,500	13,466	-0.25		Pass
Biaxial ratio		0.540	0.562	+4.09		Deviation DG7-LR
DG7-LR: AISC 360-22 F5-5 gives Lr = 407 in.; the guide's Table A-2 prints 457 in., which is F4-8, and uses it in F5-3						
φRn, web sidesway	kips	73.50	73.22	-0.38		Pass
Wheel with impact	kips	69.40	69.40	-0.00		Pass

HC-WT-1: One wheel at midspan: M = P L / 4; hand calculation

Source: Hand calculation. Calculation: Crane runway beam.

HC-WT-1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Moment per kip	ft	7.500	7.500	+0.00		Pass
Wheel load from the weights: 10/2 + 2 + 10	kips	17.00	17.00	+0.00		Pass

HC-CURVED: Curved 5-1/8 × 24 in. 24F-1.8E, R = 100 ft, 30 ft span

Source: Hand calculation (NDS 2024 equations, closed form). Calculation: Curved and tapered glulam.

HC-CURVED · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cc = 1 − 2000 (t/R)²		0.999	0.999	-0.00		Pass
CV		0.900	0.900	+0.00		Pass
Fb' = Fb CD CV Cc	psi	2,483	2,483	-0.00		Pass
fb = 6M / (b d²)	psi	1,592	1,591	-0.00		Pass
fr = 3M / (2 Rm b d)	psi	7.878	7.879	+0.00		Pass
Frt' = 15 psi × CD	psi	17.25	17.25	+0.00		Pass
Vr' = (2/3) F'v Cvr b d	lb	17,992	17,992	+0.00		Pass
Live load deflection	in.	0.686	0.686	-0.00		Pass
Total deflection, Kcr = 1.5	in.	1.458	1.458	-0.00		Pass

HC-PITCHED: Double-tapered curved 5-1/8 in., de = 15, dc = 30 in., 3:12 roof

Source: Hand calculation (NDS 2024 equations, closed form). Calculation: Curved and tapered glulam.

HC-PITCHED · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Kφ = 1 + 2.7 tan φT		1.675	1.675	-0.00		Pass
Krs		0.068	0.068	+0.00		Pass
Crs		0.664	0.664	+0.00		Pass
fb = Kφ 6M / (b dc²)	psi	1,706	1,706	+0.00		Pass
fr = Krs Crs 6M / (b dc²)	psi	45.87	45.87	+0.00		Pass
dequiv	in.	25.58	25.58	+0.00		Pass
Δc (Eq. 5.4-4), 1.5 D + S	in.	1.204	1.204	+0.00		Pass
ΔH = 2 h Δc / ℓ	in.	0.251	0.251	+0.00		Pass

F.1-1A · Custom calculation: W18X50 flexure typed as a sheet

Source: AISC Design Examples v16.0, Example F.1-1A, pp. F-3 to F-5. Calculation: Custom calculation.

F.1-1A · Custom calculation · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Factored load wu	kip/ft	1.740	1.740	+0.00		Pass
Required strength Mu	kip-ft	266.0	266.4	+0.16		Pass
Design strength phiMn	kip-ft	379.0	378.8	-0.07		Pass
Live load deflection, 5wL4/384EI Hand value of the formula, AISC Manual Table 3-23 case 1	in.	1.092	1.092	-0.04		Pass

ACI-22.5.5.1: One-way shear Vc = 2 lambda sqrt(f'c) bw d

Source: ACI 318-19 Table 22.5.5.1(a), by hand. Calculation: Custom calculation.

ACI-22.5.5.1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vc	kips	32.64	32.63	-0.02		Pass

SP811-sheet: Unit factors through the sheet

Source: NIST SP 811 (2008) Appendix B.8, pp. 63, 65. Calculation: Custom calculation.

SP811-sheet · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 ksi in MPa		6.895	6.895	+0.00		Pass
1 kip-ft in kN-m		1.356	1.356	-0.00		Pass
1 lbf/ft in N/m		14.59	14.59	+0.00		Pass

DAP-1: Dapped end, default beam: the five failure modes

Source: Hand calculation (closed form), pp. PCI Design Handbook 8th Ed. 5.6 (from knowledge); ACI 318-19 22.5, 22.8, 22.9. Calculation: Dapped-end beam.

DAP-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nu = 0.2 Vu	kips	9.600	9.600	+0.00		Pass
(1) As, flexure and tension	in.²	0.804	0.804	+0.00		Pass
(2) As, direct shear (μ = 1.4)	in.²	0.721	0.721	-0.00		Pass
As required	in.²	0.804	0.804	+0.00		Pass
Ah = 0.5 (As − An)	in.²	0.296	0.296	+0.00		Pass
Ash = Vu / (φ fy)	in.²	1.067	1.067	+0.00		Pass
φ(Av fy + Ah fy + 2λ√f'c b d)	kips	55.75	55.75	+0.00		Pass
φBn = 0.65 × 0.85 f'c A1	kips	88.40	88.40	+0.00		Pass
φVn of the full depth	kips	70.09	70.09	+0.00		Pass

DAP-PCI: Dapped end with the PCI effective shear-friction coefficient

Source: Hand calculation (closed form), pp. PCI Design Handbook 5.6 μe (from knowledge). Calculation: Dapped-end beam.

DAP-PCI · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
μe capped at 3.4		3.400	3.400	+0.00		Pass
(2) As with μe	in.²	0.422	0.422	-0.00		Pass

T-c_gypsum: Gypsum board, 5/8 in., 0.55 per 1/8 in.

Source: ASCE 7-22 Commentary, Table C3.1-1a, pp. PDF pp. 569 to 571. Calculation: Dead load build-up.

T-c_gypsum · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Gypsum board, 5/8 in., 0.55 per 1/8 in.	psf	2.750	2.750	+0.00		Pass

T-r_deck20: Deck, metal, 20 gauge

Source: ASCE 7-22 Commentary, Table C3.1-1a, pp. PDF pp. 569 to 571. Calculation: Dead load build-up.

T-r_deck20 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Deck, metal, 20 gauge	psf	2.500	2.500	+0.00		Pass

T-i_poly: Polystyrene, 4 in., 0.2 per in.

Source: ASCE 7-22 Commentary, Table C3.1-1a, pp. PDF pp. 569 to 571. Calculation: Dead load build-up.

T-i_poly · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Polystyrene, 4 in., 0.2 per in.	psf	0.800	0.800	+0.00		Pass

T-r_ply: Plywood, 1/2 in., 0.4 per 1/8 in.

Source: ASCE 7-22 Commentary, Table C3.1-1a, pp. PDF pp. 569 to 571. Calculation: Dead load build-up.

T-r_ply · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Plywood, 1/2 in., 0.4 per 1/8 in.	psf	1.600	1.600	+0.00		Pass

T-w_single: Single-ply sheet

Source: ASCE 7-22 Commentary, Table C3.1-1a, pp. PDF pp. 569 to 571. Calculation: Dead load build-up.

T-w_single · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Single-ply sheet	psf	0.700	0.700	+0.00		Pass

T-f_stone: Stone concrete fill, 2 in., 12 per in.

Source: ASCE 7-22 Commentary, Table C3.1-1a, pp. PDF pp. 569 to 571. Calculation: Dead load build-up.

T-f_stone · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Stone concrete fill, 2 in., 12 per in.	psf	24.00	24.00	+0.00		Pass

T-n_tile_one: Quarry tile on 1 in. mortar

Source: ASCE 7-22 Commentary, Table C3.1-1a, pp. PDF pp. 569 to 571. Calculation: Dead load build-up.

T-n_tile_one · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Quarry tile on 1 in. mortar	psf	23.00	23.00	+0.00		Pass

T-j_2x10_16: 2 × 10 joists at 16 in.

Source: ASCE 7-22 Commentary, Table C3.1-1a, pp. PDF pp. 569 to 571. Calculation: Dead load build-up.

T-j_2x10_16 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
2 × 10 joists at 16 in.	psf	6.000	6.000	+0.00		Pass

T-e_brick: 2 × 6 wall with anchored brick veneer

Source: ASCE 7-22 Commentary, Table C3.1-1a, pp. PDF pp. 569 to 571. Calculation: Dead load build-up.

T-e_brick · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
2 × 6 wall with anchored brick veneer	psf	48.00	48.00	+0.00		Pass

T-b_8: Clay brick wythe, 8 in.

Source: ASCE 7-22 Commentary, Table C3.1-1a, pp. PDF pp. 569 to 571. Calculation: Dead load build-up.

T-b_8 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Clay brick wythe, 8 in.	psf	79.00	79.00	+0.00		Pass

T-cmu_105_4_none: Hollow CMU, 105 pcf, 4 in., no grout

Source: ASCE 7-22 Commentary, Table C3.1-1a, pp. PDF pp. 569 to 571. Calculation: Dead load build-up.

T-cmu_105_4_none · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Hollow CMU, 105 pcf, 4 in., no grout	psf	22.00	22.00	+0.00		Pass

T-cmu_105_8_full: Hollow CMU, 105 pcf, 8 in., full grout

Source: ASCE 7-22 Commentary, Table C3.1-1a, pp. PDF pp. 569 to 571. Calculation: Dead load build-up.

T-cmu_105_8_full · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Hollow CMU, 105 pcf, 8 in., full grout	psf	75.00	75.00	+0.00		Pass

T-cmu_125_8_32: Hollow CMU, 125 pcf, 8 in., grout at 32 in.

Source: ASCE 7-22 Commentary, Table C3.1-1a, pp. PDF pp. 569 to 571. Calculation: Dead load build-up.

T-cmu_125_8_32 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Hollow CMU, 125 pcf, 8 in., grout at 32 in.	psf	47.00	47.00	+0.00		Pass

T-cmu_135_12_16: Hollow CMU, 135 pcf, 12 in., grout at 16 in.

Source: ASCE 7-22 Commentary, Table C3.1-1a, pp. PDF pp. 569 to 571. Calculation: Dead load build-up.

T-cmu_135_12_16 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Hollow CMU, 135 pcf, 12 in., grout at 16 in.	psf	90.00	90.00	+0.00		Pass

T-cmu_135_12_solid: Solid CMU, 135 pcf, 12 in.

Source: ASCE 7-22 Commentary, Table C3.1-1a, pp. PDF pp. 569 to 571. Calculation: Dead load build-up.

T-cmu_135_12_solid · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Solid CMU, 135 pcf, 12 in.	psf	133.0	133.0	+0.00		Pass

T-cmu_125_6_solid: Solid CMU, 125 pcf, 6 in.

Source: ASCE 7-22 Commentary, Table C3.1-1a, pp. PDF pp. 569 to 571. Calculation: Dead load build-up.

T-cmu_125_6_solid · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Solid CMU, 125 pcf, 6 in.	psf	60.00	60.00	+0.00		Pass

T-slate: Slate floor, 1 in.

Source: ASCE 7-22 Commentary, Table C3.1-1a, pp. PDF p. 570. Calculation: Dead load build-up.

T-slate · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
15, printed per mm in the psf table; 0.028 kN/m² per mm in the SI table is 15 psf per in.	psf	15.00	15.00	+0.00		Pass

D-conc: Reinforced stone concrete, 5 in.

Source: ASCE 7-22 Commentary, Table C3.1-2, pp. PDF p. 574. Calculation: Dead load build-up.

D-conc · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
150 pcf × 5/12 ft	psf	62.50	62.50	+0.00		Pass

D-grout: Masonry grout, 12 in.

Source: ASCE 7-22 Commentary, Table C3.1-2, pp. PDF p. 575. Calculation: Dead load build-up.

D-grout · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
140 pcf × 1 ft	psf	140.0	140.0	+0.00		Pass

H-total: The default roof

Source: Hand addition of the commentary's values. Calculation: Dead load build-up.

H-total · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
0.7 + 0.8 + 2.5 + 4 + 2 + 1 + 4	psf	15.00	15.00	+0.00		Pass

H-slope: The same at a pitch of 4 on 12

Source: Hand addition of the commentary's values. Calculation: Dead load build-up.

H-slope · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
4 / cos θ + 11	psf	15.22	15.22	+0.00		Pass

H-line: Line load

Source: Hand addition of the commentary's values. Calculation: Dead load build-up.

H-line · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
15 psf × 20 ft	kip/ft	0.300	0.300	+0.00		Pass

VC-G-EX: 1.5PLB20, 7 ft spans, four spans, #12 screws, 36/7, 7 VSC2 per span

Source: Vulcraft, PunchLok II Roof Deck Design Guide and Catalog (December 2016), pp. 11. Calculation: Steel deck diaphragm.

VC-G-EX · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Warping coefficient Dn		2.730	2.726	-0.14		Pass
Slip coefficient C		4.660	4.657	-0.07		Pass
End distribution factor		1.972	1.972	+0.01		Pass
Stiffness G'	kip/in.	98.00	101.0	+3.10		Deviation VC-G-EX-98

VC-G-EX-98: the catalog's example multiplies Dn by 0.90, its own factor for three spans; its table and S310 Table 1.3-1 give 0.80 for four

VC-G-EX · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Slip coefficient C		4.660	4.657	-0.07		Pass

VC-A-36-4: 1.5PLB, 36/4: end distribution factor

Source: Vulcraft, PunchLok II Roof Deck Design Guide and Catalog (December 2016), pp. 11. Calculation: Steel deck diaphragm.

VC-A-36-4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
End distribution factor		1.306	1.306	-0.03		Pass

VC-A-24-4: 3.0PLN, 24/4: end distribution factor

Source: Vulcraft, PunchLok II Roof Deck Design Guide and Catalog (December 2016), pp. 11. Calculation: Steel deck diaphragm.

VC-A-24-4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
End distribution factor		1.292	1.292	-0.03		Pass

VC-T32-S3: 1.5PLB22, 36/7, 5 ft, 3 VSC2: seismic 623 plf at 2.50, wind 663 plf at 2.35; G' 58

Source: Vulcraft, PunchLok II Roof Deck Design Guide and Catalog (December 2016), pp. 32. Calculation: Steel deck diaphragm.

VC-T32-S3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nominal, seismic row	plf	1,558	1,558	+0.05		Pass
Nominal, wind row	plf	1,558	1,558	+0.01		Pass
Stiffness G'	kip/in.	58.00	58.25	+0.43		Pass

VC-T32-S3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nominal, seismic row	plf	1,558	1,558	+0.05		Pass

VC-T32-S4: 1.5PLB22, 36/7, 5 ft, 4 VSC2: wind 771 plf at 2.35; G' 61

Source: Vulcraft, PunchLok II Roof Deck Design Guide and Catalog (December 2016), pp. 32. Calculation: Steel deck diaphragm.

VC-T32-S4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nominal, wind row	plf	1,812	1,811	-0.05		Pass
Stiffness G'	kip/in.	61.00	60.60	-0.65		Pass

VC-T32-S4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nominal, wind row	plf	1,812	1,811	-0.05		Pass

VC-T32-L3: 1.5PLB22, 36/7, 3 ft, 1 VSC2: seismic 574 plf; G' 48

Source: Vulcraft, PunchLok II Roof Deck Design Guide and Catalog (December 2016), pp. 32. Calculation: Steel deck diaphragm.

VC-T32-L3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nominal, seismic row	plf	1,435	1,436	+0.06		Pass
Stiffness G'	kip/in.	48.00	48.37	+0.77		Pass

VC-T32-B: 1.5PLB22, 36/7, 10 ft, 10 VSC2: the shaded 709 plf, panel buckling at 2.00

Source: Vulcraft, PunchLok II Roof Deck Design Guide and Catalog (December 2016), pp. 32. Calculation: Steel deck diaphragm.

VC-T32-B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nominal, buckling	plf	1,418	1,417	-0.05		Pass

VC-T32-B · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable, buckling	plf	709.0	708.7	-0.05		Pass

VC-T24-S3: 1.5PLB22, 36/4, 5 ft, 3 VSC2: seismic 486 plf; G' 13

Source: Vulcraft, PunchLok II Roof Deck Design Guide and Catalog (December 2016), pp. 24. Calculation: Steel deck diaphragm.

VC-T24-S3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nominal, seismic row	plf	1,215	1,215	+0.00		Pass
Stiffness G'	kip/in.	13.00	13.46	+3.53		Pass

VC-T60-S3: 3.0PLN22, 24/4, 8 ft, 3 VSC2: seismic 377 plf, wind 401 plf; G' 20

Source: Vulcraft, PunchLok II Roof Deck Design Guide and Catalog (December 2016), pp. 60. Calculation: Steel deck diaphragm.

VC-T60-S3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nominal, seismic row	plf	942.5	943.4	+0.10		Pass
Nominal, wind row	plf	942.4	943.4	+0.12		Pass
Stiffness G'	kip/in.	20.00	19.51	-2.47		Pass

VC-T60-L: 3.0PLN22, 24/4, 15 ft, 4 VSC2: seismic 261 plf, where the long panel makes Sni close to Snc

Source: Vulcraft, PunchLok II Roof Deck Design Guide and Catalog (December 2016), pp. 60. Calculation: Steel deck diaphragm.

VC-T60-L · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nominal, seismic row	plf	652.5	652.6	+0.01		Pass
Stiffness G'	kip/in.	20.00	20.23	+1.13		Pass

VC-T42-W: 1.5PLB20, 3/4 in. arc spot welds, 36/4, 5 ft, 3 VSC2: seismic 746 plf at 3.00, wind 952 plf at 2.35; G' 21. The catalog has arc seam welds at the sidelaps; here all are spot welds at their Table 1 strength

Source: Vulcraft, PunchLok II Roof Deck Design Guide and Catalog (December 2016), pp. 42. Calculation: Steel deck diaphragm.

VC-T42-W · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pnf, S100 J2.2.2.1 (Table 1: 1052 lb at 3.0)	kips	3.156	3.157	+0.03		Pass
Nominal, seismic row	plf	2,238	2,233	-0.20		Pass
Nominal, wind row	plf	2,237	2,233	-0.17		Pass
Stiffness G'	kip/in.	21.00	20.98	-0.12		Pass

VC-T42-B: 1.5PLB20, 10 ft: the shaded 947 plf, panel buckling at 2.00

Source: Vulcraft, PunchLok II Roof Deck Design Guide and Catalog (December 2016), pp. 42. Calculation: Steel deck diaphragm.

VC-T42-B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nominal, buckling	plf	1,894	1,895	+0.04		Pass

VC-T1-W18: 3/4 in. arc spot weld, 18 gage, S100 J2.2.2.1

Source: Vulcraft, PunchLok II Roof Deck Design Guide and Catalog (December 2016), pp. 5. Calculation: Steel deck diaphragm.

VC-T1-W18 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pnf (Table 1: 1514 lb at 3.0)	kips	4.542	4.543	+0.01		Pass

VC-SF-20: #12 screw at 20 gage, Eq. D5.2.2-1, and PunchLok II at 20 gage

Source: Vulcraft, PunchLok II Roof Deck Design Guide and Catalog (December 2016), pp. 11. Calculation: Steel deck diaphragm.

VC-SF-20 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Sf		0.007	0.007	-0.42		Pass
Ss		0.020	0.020	-0.15		Pass

VC-SF-22: Weld at 22 gage, Eq. D5.2.1.1-1, and PunchLok II at 22 gage

Source: Vulcraft, PunchLok II Roof Deck Design Guide and Catalog (December 2016), pp. 11. Calculation: Steel deck diaphragm.

VC-SF-22 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Sf		0.007	0.007	-0.07		Pass
Ss		0.029	0.029	+0.06		Pass

VC-SF-18: #12 screw at 18 gage and PunchLok II at 18 gage

Source: Vulcraft, PunchLok II Roof Deck Design Guide and Catalog (December 2016), pp. 11. Calculation: Steel deck diaphragm.

VC-SF-18 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Sf		0.006	0.006	-0.48		Pass
Ss		0.010	0.010	+0.20		Pass

VC-T2-W: 3/4 in. arc spot weld in tension, 22 gage, 62 ksi and 50 ksi steel, S100 Eq. J2.2.3-2

Source: Vulcraft, PunchLok II Roof Deck Design Guide and Catalog (December 2016), pp. 5. Calculation: Steel deck diaphragm.

VC-T2-W · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pnt (Table 2: 588 lb at 2.5)	kips	1.470	1.621	+10.27		Deviation VC-T2-PNT
VC-T2-PNT: the catalog's tension values are 9 percent below S100 Eq. J2.2.3-2 at the steel its table states, at every gage						

VC-T33-U60: 1.5PLB22, 36/7, 5 ft, 4 VSC2, 60 psf net uplift, wind: 631 plf at 2.35, against S310 D3.1.2.1 on the catalog's Pnf and Pnov

Source: Vulcraft, PunchLok II Roof Deck Design Guide and Catalog (December 2016), pp. 33. Calculation: Steel deck diaphragm.

VC-T33-U60 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nominal with uplift	plf	1,483	1,462	-1.43		Deviation VC-T33-U60
VC-T33-U60: the catalog's tables use an older interaction with a safety factor of 2.35 where S310 has 2.00						

VC-D-36-7: 1.5PLB22, fasteners in every valley

Source: Vulcraft, PunchLok II Roof Deck Design Guide and Catalog (December 2016), pp. 10. Calculation: Steel deck diaphragm.

VC-D-36-7 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
D, Appendix 1		1,225	1,225	-0.02		Pass

VC-D-36-4: 1.5PLB22, fasteners in every second valley

Source: Vulcraft, PunchLok II Roof Deck Design Guide and Catalog (December 2016), pp. 10. Calculation: Steel deck diaphragm.

VC-D-36-4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
D, Appendix 1		10,891	10,891	+0.00		Pass

VC-D-24-4: 3.0PLN22, fasteners in every valley

Source: Vulcraft, PunchLok II Roof Deck Design Guide and Catalog (December 2016), pp. 10. Calculation: Steel deck diaphragm.

VC-D-24-4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
D, Appendix 1		7,807	7,807	+0.00		Pass

VC-D-20: 1.5PLB20, 36/7: the printed D as t to the 1.5

Source: Vulcraft, PunchLok II Roof Deck Design Guide and Catalog (December 2016), pp. 10. Calculation: Steel deck diaphragm.

VC-D-20 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
D, Appendix 1		916.0	916.2	+0.02		Pass

S310-C12-WR-0.0295-1: WR deck of Table C-1.1a, t = 0.0295 in., fasteners in every valley

Source: AISI S310-20 with S1-22, Commentary, pp. 60 (PDF p. 188). Calculation: Steel deck diaphragm.

S310-C12-WR-0.0295-1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
D, Appendix 1		1,237	1,235	-0.17		Pass

S310-C12-WR-0.0295-2: WR deck of Table C-1.1a, t = 0.0295 in., fasteners in every second valley

Source: AISI S310-20 with S1-22, Commentary, pp. 60 (PDF p. 188). Calculation: Steel deck diaphragm.

S310-C12-WR-0.0295-2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
D, Appendix 1		10,329	10,315	-0.14		Pass

S310-C12-WR-0.0295-3: WR deck of Table C-1.1a, t = 0.0295 in., fasteners in every third valley

Source: AISI S310-20 with S1-22, Commentary, pp. 60 (PDF p. 188). Calculation: Steel deck diaphragm.

S310-C12-WR-0.0295-3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
D, Appendix 1		21,247	21,217	-0.14		Pass

S310-C12-WR-0.0295-4: WR deck of Table C-1.1a, t = 0.0295 in., fasteners in every fourth valley

Source: AISI S310-20 with S1-22, Commentary, pp. 60 (PDF p. 188). Calculation: Steel deck diaphragm.

S310-C12-WR-0.0295-4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
D, Appendix 1		33,966	33,919	-0.14		Pass

S310-C12-WR-0.0598-1: WR deck of Table C-1.1a, t = 0.0598 in., fasteners in every valley

Source: AISI S310-20 with S1-22, Commentary, pp. 60 (PDF p. 188). Calculation: Steel deck diaphragm.

S310-C12-WR-0.0598-1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
D, Appendix 1		429.0	427.9	-0.27		Pass

S310-C12-IR-0.0358-1: IR deck of Table C-1.1a, t = 0.0358 in., fasteners in every valley

Source: AISI S310-20 with S1-22, Commentary, pp. 60 (PDF p. 188). Calculation: Steel deck diaphragm.

S310-C12-IR-0.0358-1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
D, Appendix 1		1,671	1,673	+0.13		Pass

S310-C12-IR-0.0358-2: IR deck of Table C-1.1a, t = 0.0358 in., fasteners in every second valley

Source: AISI S310-20 with S1-22, Commentary, pp. 60 (PDF p. 188). Calculation: Steel deck diaphragm.

S310-C12-IR-0.0358-2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
D, Appendix 1		7,731	7,744	+0.16		Pass

S310-C12-NR-0.0474-1: NR deck of Table C-1.1a, t = 0.0474 in., fasteners in every valley

Source: AISI S310-20 with S1-22, Commentary, pp. 60 (PDF p. 188). Calculation: Steel deck diaphragm.

S310-C12-NR-0.0474-1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
D, Appendix 1		1,867	1,873	+0.32		Pass

S310-C12-NR-0.0474-3: NR deck of Table C-1.1a, t = 0.0474 in., fasteners in every third valley

Source: AISI S310-20 with S1-22, Commentary, pp. 60 (PDF p. 188). Calculation: Steel deck diaphragm.

S310-C12-NR-0.0474-3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
D, Appendix 1		12,569	12,593	+0.19		Pass

S310-C12-DR-0.0295-1: DR deck of Table C-1.1a, t = 0.0295 in., fasteners in every valley

Source: AISI S310-20 with S1-22, Commentary, pp. 60 (PDF p. 188). Calculation: Steel deck diaphragm.

S310-C12-DR-0.0295-1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
D, Appendix 1		7,224	7,237	+0.18		Pass

S310-N-COMMON: Seven positions on a 3 ft cover, a common connection, A = 2: N = 5/3 per ft

Source: AISI S310-20 with S1-22, Commentary, pp. 15 (PDF p. 143). Calculation: Steel deck diaphragm.

S310-N-COMMON · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
N		1.667	1.667	+0.00		Pass

S310-N-EACH: Seven positions, a fastener each side of the sidelap: N = 7/3 per ft

Source: AISI S310-20 with S1-22, Commentary, pp. 15 (PDF p. 143). Calculation: Steel deck diaphragm.

S310-N-EACH · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
N		2.333	2.333	+0.00		Pass

HC-SCREW-PNF: No. 12 screw, 22 gage on a 0.109 in. support, 62 ksi and 58 ksi: t2/t1 at least 2.5, Pnf = 2.7 t d Fu

Source: Hand calculation (closed form) from AISI S310-20 and S100-16. Calculation: Steel deck diaphragm.

HC-SCREW-PNF · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pnf	kips	1.067	1.067	+0.00		Pass

HC-FACT-SC: Screws and PunchLok II: wind 0.80 and 2.00, seismic 0.70 and 2.30, on the same Snf

Source: Hand calculation (closed form) from AISI S310-20 and S100-16. Calculation: Steel deck diaphragm.

HC-FACT-SC · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available, wind	plf	1,246	1,247	+0.05		Pass
Available, seismic	plf	1,090	1,091	+0.05		Pass

HC-FACT-SC · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available, wind	plf	778.8	779.1	+0.05		Pass
Available, seismic	plf	677.2	677.5	+0.05		Pass

HC-FACT-WE: Welds at the supports: wind 0.75 and 2.15, seismic 0.55 and 3.00, on the same Snf

Source: Hand calculation (closed form) from AISI S310-20 and S100-16. Calculation: Steel deck diaphragm.

HC-FACT-WE · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available, wind	plf	1,678	1,675	-0.20		Pass
Available, seismic	plf	1,231	1,228	-0.20		Pass

HC-FACT-WE · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available, wind	plf	1,041	1,039	-0.20		Pass
Available, seismic	plf	746.0	744.5	-0.20		Pass

HC-SNP: Eq. D1-4a at 36/4: a fastener in each 12 in. of width: Snp = Pnf per ft

Source: Hand calculation (closed form) from AISI S310-20 and S100-16. Calculation: Steel deck diaphragm.

HC-SNP · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Snp	plf	1,382	1,382	+0.00		Pass

HC-SNE: Eq. D1-3, 36/4, three 5 ft spans, 2 edge fasteners per span

Source: Hand calculation (closed form) from AISI S310-20 and S100-16. Calculation: Steel deck diaphragm.

HC-SNE · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Sne	plf	1,034	1,034	+0.00		Pass

SP17-STM1: Deep beam, two point loads

Source: ACI SP-17(14), Strut-and-Tie Example 1, pp. pp. 660 to 667. Calculation: Deep beam (strut-and-tie).

SP17-STM1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pu	kips	456.0	455.2	-0.18		Pass
q	in.	77.00	77.00	+0.00		Pass
Top strut S1	kips	533.0	532.0	-0.18		Pass
Tie T1	kips	533.0	532.0	-0.18		Pass
Ast required	in.²	11.80	11.82	+0.19		Pass
φ fce, boundary (psi)	psi	2,550	2,550	+0.00		Pass
φ fce, interior with the grid (psi)	psi	1,913	1,912	-0.03		Pass
φ fce, node with one tie (psi)	psi	2,040	2,040	+0.00		Pass
φ fce, node without a tie (psi)	psi	2,550	2,550	+0.00		Pass
φ Fns of S1	kips	673.2	673.2	+0.00		Pass
φ Fns of S2, narrower end	kips	918.2	920.8	+0.28		Pass
φ Fnn at the tie	kips	734.4	734.4	+0.00		Pass
Width of S2 at the support (in.)	in.	23.00	23.10	+0.43		Pass
Width of S2 at the load (in.)	ft	20.00	20.06	+0.30		Pass
φ limit on Vu (kips), printed with 0.85	kips	1,077	950.6	-11.76		Deviation SP17-STM-PHI
SP17-STM-PHI: the example multiplies by 0.85, the factor of older codes; 318-14 and 318-19 have 0.75						

SP17-STM1-B: The same beam without a grid

Source: ACI SP-17(14), Strut-and-Tie Example 1, pp. p. 661 (the row for a strut without distributed steel). Calculation: Deep beam (strut-and-tie).

SP17-STM1-B · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φ fce, interior without a grid (psi)	psi	1,530	1,020	-33.33		Deviation SP17-STM-BETAS
SP17-STM-BETAS: 318-14 has 0.6 here; 318-19 Table 23.4.3(a) has 0.4						

DE-STM: Transfer girder under a column

Source: StructurePoint DE-STM-ACI14, pp. pp. 10 to 16. Calculation: Deep beam (strut-and-tie).

DE-STM · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pu	kips	638.5	638.5	+0.00		Pass
Reaction	kips	319.3	319.2	-0.02		Pass
Diagonal strut	kips	603.0	602.4	-0.11		Pass
Tie	kips	512.0	510.8	-0.23		Pass
Angle (deg)		32.000	32.005	+0.02		Pass
φ 10√f'c b d	kips	512.3	512.3	-0.00		Pass
fce, interior (psi)	psi	2,550	2,550	+0.00		Pass
fce, boundary or node without a tie (psi)	psi	3,400	3,400	+0.00		Pass
fce, node with a tie (psi)	psi	2,720	2,720	+0.00		Pass
Ast required	in.²	11.40	11.35	-0.43		Pass
Extended zone x (in.)	in.	10.70	8.000	-25.23		Deviation DESTM-X

DESTM-X: the example uses a tie node 13.4 in. deep from its own stress; here wt is the entered 10 in., giving 8.0 in.

HC-ASYM: One load off center: statics

Source: Hand calculation (closed form), pp. Equilibrium of the truss. Calculation: Deep beam (strut-and-tie).

HC-ASYM · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Left reaction	kips	87.50	87.50	+0.00		Pass
Tie	kips	105.0	105.0	-0.00		Pass

HC-BETA: βc of 1.5

Source: Hand calculation (closed form), pp. Eq. 23.4.3. Calculation: Deep beam (strut-and-tie).

HC-BETA · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
fce (psi)	psi	3,825	3,825	+0.00		Pass

HC-234: No grid, Eq. 23.4.4 chosen and met

Source: Hand calculation (closed form), pp. 23.4.4. Calculation: Deep beam (strut-and-tie).

HC-234 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
βs		0.750	0.750	+0.00		Pass

MNL-STM1: Deep beam, two point loads

Source: ACI MNL-17(21), Strut-and-tie Example 1, pp. Vol. 2 pp. 202-211. Calculation: Deep beam (strut-and-tie).

MNL-STM1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pu	kips	456.0	455.2	-0.18		Pass
q	in.	77.00	77.00	+0.00		Pass
Top strut S1	kips	533.0	532.0	-0.18		Pass
Tie T1	kips	533.0	532.0	-0.18		Pass
Ast required	in.²	11.80	11.82	+0.19		Pass
φ fce, boundary (psi)	psi	2,550	2,550	+0.00		Pass
φ fce, interior with the grid (psi)	psi	1,913	1,912	-0.03		Pass
φ fce, node with one tie (psi)	psi	2,040	2,040	+0.00		Pass
φ fce, node without a tie (psi)	psi	2,550	2,550	+0.00		Pass
φ Fns of S1	kips	673.2	673.2	+0.00		Pass
φ Fns of S2, narrower end	kips	918.2	920.8	+0.28		Pass
φ Fnn at the tie	kips	734.4	734.4	+0.00		Pass
Width of S2 at the support (in.)	in.	23.00	23.10	+0.43		Pass
Width of S2 at the load (in.)	ft	20.00	20.06	+0.30		Pass
φ limit on Vu (kips), printed with 0.85	kips	1,077	950.6	-11.76		Deviation SP17-STM-PHI

SP17-STM-PHI: the example multiplies by 0.85, the factor of older codes; 318-14 and 318-19 have 0.75

DF-7.4-T: One-story wood hall, transverse, traditional method

Source: FEMA P-2192-V1 (2020), Chapter 7, pp. pp. 267 to 270. Calculation: Diaphragm forces.

DF-7.4-T · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Eq. 12.10-1	kips	14.65	14.65	+0.00		Pass
Lower limit	kips	19.07	19.07	+0.00		Pass
Upper limit	kips	38.14	38.14	+0.00		Pass
Fpx	kips	19.07	19.07	+0.00		Pass
ASD level	kips	13.35	13.35	+0.00		Pass

DF-7.4-L: Longitudinal

Source: FEMA P-2192-V1 (2020), Chapter 7, pp. pp. 269 to 270. Calculation: Diaphragm forces.

DF-7.4-L · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Eq. 12.10-1	kips	13.11	13.11	+0.00		Pass
Fpx	kips	17.07	17.07	+0.00		Pass
ASD level	kips	11.95	11.95	+0.00		Pass

DF-7.4-A: The hall by the alternative method, Rs = 3.0

Source: FEMA P-2192-V1 (2020), Chapter 7, pp. pp. 270 to 272. Calculation: Diaphragm forces.

DF-7.4-A · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cpn		0.576	0.576	+0.00		Pass
Eq. 12.10-4	kips	14.65	14.65	+0.00		Pass
Fpx: the lower limit controls	kips	19.07	19.07	+0.00		Pass

DF-7.5-T: Six-story steel building, traditional method

Source: FEMA P-2192-V1 (2020), Chapter 7, pp. pp. 273 to 278. Calculation: Diaphragm forces.

DF-7.5-T · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Eq. 12.10-1, roof	kips	302.0	302.0	+0.00		Pass
6	kips	510.0	510.7	+0.13		Pass
5	kips	460.0	459.8	-0.05		Pass
4	kips	411.0	410.8	-0.05		Pass
3	kips	362.0	362.2	+0.07		Pass
2	kips	314.0	314.1	+0.02		Pass
Design, roof	kips	302.0	302.0	+0.00		Pass
Design, 6	kips	510.0	510.7	+0.13		Pass
Design, 3	kips	377.0	376.8	-0.05		Pass
Design, 2	kips	377.0	376.8	-0.05		Pass
Roof limits	kips	199.0	198.7	-0.14		Pass
Roof upper limit	kips	397.0	397.4	+0.11		Pass
Roof V	kips	151.0	151.0	+0.00		Pass
Roof v	kip/ft	1.260	1.258	-0.13		Pass
Roof collector, Ω0 = 2, 30 ft	kips	76.00	75.50	-0.66		Pass

DF-7.5-T5: The 5th floor with the 10 % torsion share

Source: FEMA P-2192-V1 (2020), Chapter 7, pp. p. 278. Calculation: Diaphragm forces.

DF-7.5-T5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
V	kips	253.0	252.9	-0.05		Pass
v	kip/ft	2.110	2.107	-0.13		Pass
Collector	kips	127.0	126.4	-0.44		Pass

DF-7.5-A: Six-story steel building, alternative method

Source: FEMA P-2192-V1 (2020), Chapter 7, pp. pp. 278 to 283. Calculation: Diaphragm forces.

DF-7.5-A · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Γm1		1.420	1.417	-0.23		Pass
Γm2		0.625	0.625	+0.00		Pass
Cp0		0.480	0.480	+0.00		Pass
Cpi		0.510	0.510	+0.00		Pass
Cs2		1.200	1.200	+0.00		Pass
Cpn		0.940	0.940	+0.00		Pass
Cpx, 6		0.600	0.582	-3.06		Deviation P2192-T7-9-L6
P2192-T7-9-L6: the example divides by 12 ft where Fig. 12.10-2 spans 14.4 ft						
Cpx, 5		0.510	0.505	-0.98		Pass
Cpx, 4		0.500	0.499	-0.25		Pass
Cpx, 3		0.490	0.492	+0.51		Pass
Cpx, 2		0.490	0.486	-0.77		Pass
Fpx, roof	kips	778.0	778.3	+0.04		Pass
Fpx, 6	kips	471.0	456.6	-3.06		Deviation P2192-T7-9-L6
P2192-T7-9-L6: follows from its Cpx						
Fpx, 5	kips	400.0	396.4	-0.89		Pass
Fpx, 4	kips	392.0	391.5	-0.12		Pass
Fpx, 3	kips	385.0	386.6	+0.42		Pass
Fpx, 2	kips	385.0	381.7	-0.86		Pass
Roof v	kip/ft	3.240	3.243	+0.09		Pass
Roof collector at 1.5	kips	146.0	145.9	-0.04		Pass

DF-7.6-T: RWFD, 600 × 360 ft, traditional, transverse, Ω0 = 2.5

Source: FEMA P-2192-V1 (2020), Chapter 7, pp. pp. 286 to 290. Calculation: Diaphragm forces.

DF-7.6-T · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fpx	kips	1,712	1,711	-0.05		Pass
Lower limit	kips	1,369	1,369	+0.01		Pass
Upper limit	kips	2,738	2,738	+0.01		Pass
w	kip/ft	2.850	2.852	+0.06		Pass
V	kips	856.0	855.5	-0.05		Pass
v	kip/ft	2.370	2.377	+0.27		Pass
M	kip-ft	128,250	128,332	+0.06		Pass
Chord	kips	356.0	356.5	+0.13		Pass
Collector	kips	533.0	534.7	+0.32		Pass

DF-7.6-TL: RWFD, traditional, longitudinal

Source: FEMA P-2192-V1 (2020), Chapter 7, pp. pp. 286 to 289. Calculation: Diaphragm forces.

DF-7.6-TL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fpx	kips	1,459	1,459	-0.02		Pass
Lower limit	kips	1,167	1,167	+0.02		Pass

DF-7.6-R: RWFD by 12.10.4, Rdiaph = 4.5, transverse: L 600 ft

Source: FEMA P-2192-V1 (2020), Chapter 7, pp. pp. 291 to 294. Calculation: Diaphragm forces.

DF-7.6-R · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tdiaph	s	0.600	0.600	+0.00		Pass
Eq. 12.10-16a		0.222	0.222	+0.10		Pass
Eq. 12.10-16b		0.185	0.185	+0.10		Pass
Fpx	kips	1,266	1,268	+0.14		Pass
w	kip/ft	2.110	2.113	+0.14		Pass
V	kips	633.0	633.9	+0.14		Pass
v	kip/ft	1.760	1.761	+0.05		Pass
1.5 v	kip/ft	2.640	2.641	+0.05		Pass
M	kip-ft	94,950	95,083	+0.14		Pass
Chord	kips	264.0	264.1	+0.05		Pass
Collector, Ω0-diaph = 2	kips	317.0	316.9	-0.02		Pass

DF-7.6-RL: RWFD by 12.10.4, longitudinal: span 360 ft

Source: FEMA P-2192-V1 (2020), Chapter 7, pp. pp. 293 to 294. Calculation: Diaphragm forces.

DF-7.6-RL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tdiaph	s	0.360	0.360	+0.00		Pass
Eq. 12.10-16b		0.309	0.309	-0.12		Pass
Fpx	kips	1,296	1,297	+0.07		Pass

DF-H1: Transfer at a Type 4 irregularity: 100 kips × Ω0 2.5 on Fpx

Source: Hand calculation, ASCE/SEI 7-22 12.10.1.1. Calculation: Diaphragm forces.

DF-H1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fpx 300 + 250	kips	550.0	550.0	+0.00		Pass
v = 275 / 50	kip/ft	5.500	5.500	+0.00		Pass

YAW-CM-CR: One-story concrete wall building: center of mass, rigidities, center of rigidity, J

Source: L. Yaw, Rigid Diaphragm Analysis, Walla Walla University (2022), pp. Eqs. 1 to 5, Tables 1 to 4. Calculation: Rigid diaphragm torsion.

YAW-CM-CR · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
x_cm = Σ w x / Σ w	ft	40.59	40.59	-0.00		Pass
y_cm	ft	26.02	26.02	-0.00		Pass
Relative rigidity, wall 1 (L = 50 ft)		1.290	1.290	+0.00		Pass
Relative rigidity, wall 3 (L = 44 ft)		1.112	1.112	+0.00		Pass
Relative rigidity, wall 4 (L = 20 ft)		0.375	0.375	-0.01		Pass
x_cr = Σ Ry x / Σ Ry	ft	37.04	37.04	+0.00		Pass
y_cr = Σ Rx y / Σ Rx	ft	38.73	38.73	-0.00		Pass
Jp = Σ Rx ȳ² + Σ Ry x̄² (relative)		4,549	4,549	-0.00		Pass

YAW-VX: Force along x (Vx = 82.14 k): direct, inherent and accidental shear per wall

Source: L. Yaw, Rigid Diaphragm Analysis, Walla Walla University (2022), pp. Tables 5 to 7, 10. Calculation: Rigid diaphragm torsion.

YAW-VX · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Wall 2 direct shear	kips	63.62	63.62	-0.00		Pass
Wall 4 direct shear	kips	18.52	18.52	+0.00		Pass
Wall 2 inherent torsional shear	kips	-3.337	-3.338	+0.00		Pass
Wall 4 inherent torsional shear	kips	3.337	3.338	+0.00		Pass
Wall 1 inherent torsional shear (magnitude)	kips	10.97	10.97	-0.00		Pass
Wall 1 accidental torsional shear	kips	2.157	2.157	-0.00		Pass
Wall 2 accidental torsional shear	kips	0.656	0.656	+0.00		Pass
Wall 2 design shear	kips	60.94	60.94	-0.00		Pass
Wall 4 design shear	kips	22.51	22.51	-0.00		Pass
Wall 1 shear (perpendicular, |real| + |accidental|)	kips	13.12	13.12	-0.00		Pass
Wall 3 shear (perpendicular)	kips	13.12	13.12	-0.00		Pass

YAW-VY: Force along y (Vy = 82.14 k): direct, inherent and accidental shear per wall

Source: L. Yaw, Rigid Diaphragm Analysis, Walla Walla University (2022), pp. Tables 8 to 10. Calculation: Rigid diaphragm torsion.

YAW-VY · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Wall 1 direct shear	kips	44.11	44.11	-0.00		Pass
Wall 3 direct shear	kips	38.03	38.03	+0.00		Pass
Wall 1 inherent torsional shear	kips	-3.066	-3.066	+0.00		Pass
Wall 3 inherent torsional shear	kips	3.066	3.066	+0.00		Pass
Wall 1 accidental torsional shear	kips	3.451	3.451	-0.00		Pass
Wall 2 accidental torsional shear	kips	1.050	1.050	+0.00		Pass
Wall 1 design shear	kips	44.50	44.50	-0.00		Pass
Wall 3 design shear	kips	44.55	44.55	+0.00		Pass
Wall 2 shear (perpendicular)	kips	1.983	1.983	-0.00		Pass
Wall 4 shear (perpendicular)	kips	1.983	1.983	-0.00		Pass

SEAOC-DE33: Four walls, V = 100 k N-S, e = 20 ft + e_a = 4 ft

Source: SEAOC 2018 IBC SDM Vol. 1, Design Example 33 (via Tekla Tedds verification example), pp. SDM pp. 91-95. Calculation: Rigid diaphragm torsion.

Published torsional shears ±22.5 k (Tedds prints −22.5 for wall B, a sign typo: its total 47.5 = 25 + 22.5). The code envelope (C12.8.4.2: the larger of e ± e_a) gives wall A 60.0 k (e = 16 ft); the published case takes the reduction at e = 24 ft only.

SEAOC-DE33 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
x_cr	ft	20.00	20.00	+0.00		Pass
y_cr	ft	20.00	20.00	+0.00		Pass
Inherent eccentricity e	ft	20.00	20.00	+0.00		Pass
Accidental eccentricity 5 % × 80 ft	ft	4.000	4.000	+0.00		Pass
Wall A direct shear	kips	75.00	75.00	+0.00		Pass
Wall B direct shear	kips	25.00	25.00	+0.00		Pass
Wall A total, e = 24 ft	kips	52.50	52.50	+0.00		Pass
Wall B total, e = 24 ft	kips	47.50	47.50	+0.00		Pass

FEMA-13.2-B: Masonry building on plank, accidental torsion only (Ax = 1), transverse load

Source: FEMA P-1051 (2015), NEHRP Recommended Seismic Provisions: Design Examples, pp. §13.2, pp. 13-58, 13-59. Calculation: Rigid diaphragm torsion.

FEMA-13.2-B · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Σ d² (equal k = 1)		11,520	11,520	+0.00		Pass
Wall D direct shear 0.125 V	kips	53.38	53.38	+0.00		Pass
Mta = 0.05 (152) V = 7.6 V	kip-ft	3,245	3,245	+0.00		Pass
Wall D torsional shear 0.0238 V	kips	10.16	10.14	-0.21		Pass
Wall D total 0.149 V	kips	63.62	63.52	-0.17		Pass

FEMA-13.2-D: Same building, SDC D: δmax / δavg at the plan end and Ax

Source: FEMA P-1051 (2015), NEHRP Recommended Seismic Provisions: Design Examples, pp. §13.2, pp. 13-76, 13-89 to 13-91. Calculation: Rigid diaphragm torsion.

ILX 1.4011 and Ax = 1.3633 (FEMA rounds the ratio to 1.402 first); 0.1574 V = 67.2 kips.

FEMA-13.2-D · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
δmax / δavg extrapolated to the plan end		1.402	1.401	-0.06		Pass
Ax = (1.402 / 1.2)²		1.365	1.363	-0.13		Pass
Wall D shear 0.158 V = 67.4 kips	kips	67.40	67.20	-0.30		Pass

FEMA-11.2: Precast building, torsion by four transverse stair walls

Source: FEMA P-1051 (2015), NEHRP Recommended Seismic Provisions: Design Examples, pp. §11.2, p. 11-38. Calculation: Rigid diaphragm torsion.

FEMA-11.2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Direct shear V / 4	kips	95.00	95.00	+0.00		Pass
Torsional shear 380 (0.05)(150) / (100 × 2)	kips	14.25	14.25	+0.00		Pass
Wall design shear	kips	109.2	109.2	+0.00		Pass

HC-1 · Rigid diaphragm torsion: Core walls: extreme torsional flexibility, Ax capped at 3.0

Source: Hand calculation (closed form). Calculation: Rigid diaphragm torsion.

HC-1 · Rigid diaphragm torsion · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
J = 2(10²) + 2(10²)		400.0	400.0	+0.00		Pass
TIR = 112.5 / 50 at the plan edges		2.250	2.250	+0.00		Pass
Ax = (2.25 / 1.2)² = 3.52 → 3.0		3.000	3.000	+0.00		Pass
Y2 = 50 + 100 (3 × 5) 10 / 400	kips	87.50	87.50	+0.00		Pass
X1 = 100 (15) 10 / 400	kips	37.50	37.50	+0.00		Pass

HC-2 · Rigid diaphragm torsion: Eccentric center of rigidity, inherent and accidental torsion, both signs

Source: Hand calculation (closed form). Calculation: Rigid diaphragm torsion.

HC-2 · Rigid diaphragm torsion · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
x_cr = 60 (1) / 3	ft	20.00	20.00	+0.00		Pass
J = 2(20²) + 1(40²) + 2(20²)		3,200	3,200	+0.00		Pass
Y0 envelope (e = 7 ft): 60 − 90 (7)(2)(20)/3200	kips	52.12	52.12	+0.00		Pass
Y60 envelope (e = 13 ft): 30 + 90 (13)(1)(40)/3200	kips	44.62	44.62	+0.00		Pass
X0 (e = 13 ft): 90 (13)(1)(20)/3200	kips	7.312	7.312	+0.00		Pass
TIR at e = 13 ft: 44.625 / 33.656		1.326	1.326	+0.00		Pass

HC-3 · Rigid diaphragm torsion: L-shaped floor: center of mass from two area pieces

Source: Hand calculation (closed form). Calculation: Rigid diaphragm torsion.

HC-3 · Rigid diaphragm torsion · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
x_cm = (2400 × 30 + 400 × 70) / 2800	ft	35.71	35.71	+0.00		Pass
y_cm = (2400 × 20 + 400 × 10) / 2800	ft	18.57	18.57	+0.00		Pass
W = 100 psf × 2800 ft²	kips	280.0	280.0	+0.00		Pass

DS-GEC10-10.1: Side resistance in sand by the β-method

Source: FHWA GEC 10, FHWA-NHI-18-024 (2018), pp. Illustrative Example 10-1, pp. 10-12 to 10-14. Calculation: Drilled pier.

DS-GEC10-10.1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
β, layer 1 (0.97)		0.970	0.967	-0.26		Pass
β, layer 2 (0.98)		0.980	0.976	-0.40		Pass
RSN,1 = π (5 ft) 15 ft × 837 psf = 197.2 kips	kips	197.2	196.6	-0.30		Pass
RSN,2 = 635.6 kips	kips	635.6	631.5	-0.64		Pass

DS-GEC10-10.2: Side resistance in clay by the α-method

Source: FHWA GEC 10, FHWA-NHI-18-024 (2018), pp. Illustrative Example 10-2, p. 10-18. Calculation: Drilled pier.

DS-GEC10-10.2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
su(CIUC) = 2,000 / (0.911 + 0.499 log 0.541) = 2,571 psf	psf	2,571	2,571	+0.01		Pass
α = 0.30 + 0.17 / (2,571/2,116) = 0.44		0.440	0.440	-0.02		Pass
RSN,3 = π (5 ft)(27 ft) 1,131 psf = 479.7 kips	kips	479.7	479.7	+0.00		Pass

DS-GEC10-10.3: Base resistance in clay

Source: FHWA GEC 10, FHWA-NHI-18-024 (2018), pp. Illustrative Example 10-3, p. 10-20. Calculation: Drilled pier.

DS-GEC10-10.3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
qBN = 9.0 (2,571 psf) = 23.1 ksf	psf	23,139	23,140	+0.01		Pass
RBN = π/4 (5 ft)² × 23.1 ksf = 453.6 kips	kips	453.6	454.4	+0.17		Pass

DS-GEC10-10.5: Strength limit state check

Source: FHWA GEC 10, FHWA-NHI-18-024 (2018), pp. Illustrative Example 10-5, p. 10-29. Calculation: Drilled pier.

DS-GEC10-10.5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Factored axial demand ΣγQ = 766 kips	kips	766.0	766.0	+0.00		Pass
ΣφR = 855.4 kips	kips	855.4	853.1	-0.27		Pass

DS-GEC10-10.4: Rock socket side and base resistance

Source: FHWA GEC 10, FHWA-NHI-18-024 (2018), pp. Illustrative Example 10-4, pp. 10-27, 10-28. Calculation: Drilled pier.

DS-GEC10-10.4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
fSN = 2.116 ksf × 1.0 × √(360/2.116) = 27.6 ksf	psf	27,600	27,601	+0.00		Pass
RSN, socket = 27.6 ksf × (6 ft × π) × 10 ft = 5,202 kips	kips	5,202	5,203	+0.01		Pass
RBN = π/4 (6 ft)² × 900 ksf = 25,447 kips	kips	25,447	25,447	-0.00		Pass

F18-0.1: Point load, m = 0.1

Source: UFS 3-220-20 (2026), Figure 4-18, pp. 206. Calculation: Lateral pressure from surface loads.

F18-0.1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
PH (H/QP)		0.790	0.787	-0.32		Pass
y/H		0.590	0.587	-0.49		Pass

F18-0.4: Point load, m = 0.4

Source: UFS 3-220-20 (2026), Figure 4-18, pp. 206. Calculation: Lateral pressure from surface loads.

F18-0.4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
PH (H/QP)		0.800	0.787	-1.57		Pass
y/H		0.590	0.587	-0.49		Pass

F18-0.45: Point load, m = 0.45

Source: UFS 3-220-20 (2026), Figure 4-18, pp. 206. Calculation: Lateral pressure from surface loads.

F18-0.45 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
PH (H/QP)		0.690	0.686	-0.52		Pass
y/H		0.550	0.554	+0.76		Pass

F18-0.5: Point load, m = 0.5

Source: UFS 3-220-20 (2026), Figure 4-18, pp. 206. Calculation: Lateral pressure from surface loads.

F18-0.5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
PH (H/QP)		0.600	0.596	-0.65		Pass
y/H		0.520	0.525	+0.95		Pass

F18-0.55: Point load, m = 0.55

Source: UFS 3-220-20 (2026), Figure 4-18, pp. 206. Calculation: Lateral pressure from surface loads.

F18-0.55 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
PH (H/QP)		0.520	0.521	+0.11		Pass
y/H		0.500	0.499	-0.21		Pass

F18-0.6: Point load, m = 0.6

Source: UFS 3-220-20 (2026), Figure 4-18, pp. 206. Calculation: Lateral pressure from surface loads.

F18-0.6 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
PH (H/QP)		0.460	0.456	-0.76		Pass
y/H		0.480	0.476	-0.85		Pass

F19-0.4: Line load, m = 0.4

Source: UFS 3-220-20 (2026), Figure 4-19, pp. 207. Calculation: Lateral pressure from surface loads.

F19-0.4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
PH / QL by the printed formula		0.550	0.538	-2.09		Deviation UFS-F19-P
UFS-F19-P: the printed 0.55 follows the other branch of the figure; the printed curve for m up to 0.4 integrates to 0.539						
y/H		0.610	0.608	-0.41		Pass

F19-0.45: Line load, m = 0.45

Source: UFS 3-220-20 (2026), Figure 4-19, pp. 207. Calculation: Lateral pressure from surface loads.

F19-0.45 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
PH / QL by the printed formula		0.532	0.532	-0.05		Pass
y/H		0.580	0.581	+0.20		Pass

F19-0.5: Line load, m = 0.5

Source: UFS 3-220-20 (2026), Figure 4-19, pp. 207. Calculation: Lateral pressure from surface loads.

F19-0.5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
PH / QL by the printed formula		0.512	0.512	-0.04		Pass
y/H		0.560	0.558	-0.38		Pass

F19-0.55: Line load, m = 0.55

Source: UFS 3-220-20 (2026), Figure 4-19, pp. 207. Calculation: Lateral pressure from surface loads.

F19-0.55 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
PH / QL by the printed formula		0.491	0.491	-0.03		Pass
y/H		0.540	0.537	-0.50		Pass

F19-0.6: Line load, m = 0.6

Source: UFS 3-220-20 (2026), Figure 4-19, pp. 207. Calculation: Lateral pressure from surface loads.

F19-0.6 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
PH / QL by the printed formula		0.471	0.470	-0.03		Pass
y/H		0.520	0.519	-0.18		Pass

F19-0.65: Line load, m = 0.65

Source: UFS 3-220-20 (2026), Figure 4-19, pp. 207. Calculation: Lateral pressure from surface loads.

F19-0.65 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
PH / QL by the printed formula		0.450	0.450	-0.03		Pass
y/H		0.500	0.503	+0.58		Pass

F19-0.7: Line load, m = 0.7

Source: UFS 3-220-20 (2026), Figure 4-19, pp. 207. Calculation: Lateral pressure from surface loads.

F19-0.7 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
PH / QL by the printed formula		0.430	0.429	-0.03		Pass
y/H		0.490	0.489	-0.30		Pass

F17-0.6: Rectangle, corner, m = 0.6, n large

Source: UFS 3-220-20 (2026), Figure 4-17, read off the chart, pp. 205. Calculation: Lateral pressure from surface loads.

F17-0.6 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Influence factor Ip Non-blind check: read by eye with the closed form in hand		0.030	0.032	+5.30		Pass

F17-1.0: Rectangle, corner, m = 1.0, n large

Source: UFS 3-220-20 (2026), Figure 4-17, read off the chart, pp. 205. Calculation: Lateral pressure from surface loads.

F17-1.0 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Influence factor Ip Non-blind check: read by eye with the closed form in hand		0.090	0.091	+0.94		Pass

F17-2.0: Rectangle, corner, m = 2.0, n large

Source: UFS 3-220-20 (2026), Figure 4-17, read off the chart, pp. 205. Calculation: Lateral pressure from surface loads.

F17-2.0 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Influence factor Ip Non-blind check: read by eye with the closed form in hand		0.220	0.225	+2.31		Deviation UFS-F417-M2
UFS-F417-M2: the chart is read by eye; the first reading of 0.22 is kept and the app gives 0.2251						

F17-3.0: Rectangle, corner, m = 3.0, n large

Source: UFS 3-220-20 (2026), Figure 4-17, read off the chart, pp. 205. Calculation: Lateral pressure from surface loads.

F17-3.0 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Influence factor Ip Non-blind check: read by eye with the closed form in hand		0.300	0.302	+0.70		Pass

F17-6.0: Rectangle, corner, m = 6.0, n large

Source: UFS 3-220-20 (2026), Figure 4-17, read off the chart, pp. 205. Calculation: Lateral pressure from surface loads.

F17-6.0 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Influence factor Ip Non-blind check: read by eye with the closed form in hand		0.390	0.396	+1.49		Pass

T32-SP: Soil SP

Source: ASCE 7-22 Table 3.2-1, pp. 72. Calculation: Lateral pressure from surface loads.

T32-SP · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Active, psf per ft	pcf	35.00	35.00	+0.00		Pass

T32-SM: Soil SM

Source: ASCE 7-22 Table 3.2-1, pp. 72. Calculation: Lateral pressure from surface loads.

T32-SM · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Active, psf per ft	pcf	45.00	45.00	+0.00		Pass

T32-SC: Soil SC

Source: ASCE 7-22 Table 3.2-1, pp. 72. Calculation: Lateral pressure from surface loads.

T32-SC · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Active, psf per ft	pcf	85.00	85.00	+0.00		Pass

T32-CL: Soil CL

Source: ASCE 7-22 Table 3.2-1, pp. 72. Calculation: Lateral pressure from surface loads.

T32-CL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Active, psf per ft	pcf	100.0	100.0	+0.00		Pass

T32-SP-R: Soil SP, at rest

Source: ASCE 7-22 Table 3.2-1, pp. 72. Calculation: Lateral pressure from surface loads.

T32-SP-R · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
At rest, psf per ft	pcf	60.00	60.00	+0.00		Pass

T32-SC-R: Soil SC, at rest

Source: ASCE 7-22 Table 3.2-1, pp. 72. Calculation: Lateral pressure from surface loads.

T32-SC-R · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
At rest, psf per ft	pcf	100.0	100.0	+0.00		Pass

E.4A-BC: W14X82, moment frame, roof to floor, 14 ft

Source: AISC Design Examples v16.0, Example E.4A, pp. E-30, E-31. Calculation: Effective length factor.

E.4A-BC · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
G top		1.380	1.377	-0.25		Pass
G bottom		1.630	1.631	+0.09		Pass
K, chart read-off, slightly less than 1.5		1.500	1.459	-2.73		Pass

E.4A-BC-A: The same in ASD

Source: AISC Design Examples v16.0, Example E.4A, pp. E-30, E-31. Calculation: Effective length factor.

E.4A-BC-A · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
G top		1.380	1.377	-0.25		Pass
G bottom		1.630	1.631	+0.09		Pass

E.4A-AB: Floor to the fixed base, τb 0.994

Source: AISC Design Examples v16.0, Example E.4A, pp. E-32, E-33. Calculation: Effective length factor.

E.4A-AB · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
G top		1.620	1.624	+0.26		Pass
G bottom, fixed		1.000	1.000	+0.00		Pass
K, chart read-off, approximately 1.4		1.400	1.403	+0.21		Pass

E.4B · Effective length factor: The same column pinned at the base

Source: AISC Design Examples v16.0, Example E.4B, pp. E-34. Calculation: Effective length factor.

E.4B · Effective length factor · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
G bottom, pinned		10.000	10.000	+0.00		Pass
K, chart read-off, approximately 2.0		2.000	2.033	+1.67		Pass

T-a: Case (a)

Source: AISC 360-22 Commentary, Table C-A-7.1, pp. 16.1-650. Calculation: Effective length factor.

T-a · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Theoretical K		0.500	0.500	+0.00		Pass

T-b: Case (b)

Source: AISC 360-22 Commentary, Table C-A-7.1, pp. 16.1-650. Calculation: Effective length factor.

T-b · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Theoretical K		0.700	0.700	+0.00		Pass

T-c: Case (c)

Source: AISC 360-22 Commentary, Table C-A-7.1, pp. 16.1-650. Calculation: Effective length factor.

T-c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Theoretical K		1.000	1.000	+0.00		Pass

T-d: Case (d)

Source: AISC 360-22 Commentary, Table C-A-7.1, pp. 16.1-650. Calculation: Effective length factor.

T-d · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Theoretical K		1.000	1.000	+0.00		Pass

T-e: Case (e)

Source: AISC 360-22 Commentary, Table C-A-7.1, pp. 16.1-650. Calculation: Effective length factor.

T-e · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Theoretical K		2.000	2.000	+0.00		Pass

T-f: Case (f)

Source: AISC 360-22 Commentary, Table C-A-7.1, pp. 16.1-650. Calculation: Effective length factor.

T-f · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Theoretical K		2.000	2.000	+0.00		Pass

T-a-R: Case (a)

Source: AISC 360-22 Commentary, Table C-A-7.1, pp. 16.1-650. Calculation: Effective length factor.

T-a-R · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Recommended K		0.650	0.650	+0.00		Pass

T-b-R: Case (b)

Source: AISC 360-22 Commentary, Table C-A-7.1, pp. 16.1-650. Calculation: Effective length factor.

T-b-R · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Recommended K		0.800	0.800	+0.00		Pass

T-c-R: Case (c)

Source: AISC 360-22 Commentary, Table C-A-7.1, pp. 16.1-650. Calculation: Effective length factor.

T-c-R · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Recommended K		1.000	1.000	+0.00		Pass

T-d-R: Case (d)

Source: AISC 360-22 Commentary, Table C-A-7.1, pp. 16.1-650. Calculation: Effective length factor.

T-d-R · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Recommended K		1.200	1.200	+0.00		Pass

T-e-R: Case (e)

Source: AISC 360-22 Commentary, Table C-A-7.1, pp. 16.1-650. Calculation: Effective length factor.

T-e-R · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Recommended K		2.100	2.100	+0.00		Pass

T-f-R: Case (f)

Source: AISC 360-22 Commentary, Table C-A-7.1, pp. 16.1-650. Calculation: Effective length factor.

T-f-R · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Recommended K		2.000	2.000	+0.00		Pass

H-S11: Sway, G 1 and 1

Source: Hand calculation from AISC 360-22 Commentary Eq. C-A-7-1 and C-A-7-2. Calculation: Effective length factor.

H-S11 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
K: x cot x = (x² − 36)/12		1.316	1.317	+0.10		Pass

H-S00: Sway, G 0 and 0

Source: Hand calculation from AISC 360-22 Commentary Eq. C-A-7-1 and C-A-7-2. Calculation: Effective length factor.

H-S00 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
K, both ends fixed		1.000	1.000	+0.00		Pass

H-S0P: Sway, base fixed and top nearly free

Source: Hand calculation from AISC 360-22 Commentary Eq. C-A-7-1 and C-A-7-2. Calculation: Effective length factor.

H-S0P · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
K, flagpole		2.000	2.000	-0.02		Pass

H-B00: Braced, G 0 and 0

Source: Hand calculation from AISC 360-22 Commentary Eq. C-A-7-1 and C-A-7-2. Calculation: Effective length factor.

H-B00 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
K, both ends fixed		0.500	0.500	+0.00		Pass

H-B0P: Braced, one end fixed, one nearly pinned

Source: Hand calculation from AISC 360-22 Commentary Eq. C-A-7-1 and C-A-7-2. Calculation: Effective length factor.

H-B0P · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
K: tan x = x		0.699	0.699	+0.02		Pass

H-BPP: Braced, both ends nearly pinned

Source: Hand calculation from AISC 360-22 Commentary Eq. C-A-7-1 and C-A-7-2. Calculation: Effective length factor.

H-BPP · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
K, pinned ends		1.000	1.000	-0.00		Pass

H-K2S: Story stiffness

Source: Hand calculation from Commentary Eq. C-A-7-5, C-A-7-6. Calculation: Effective length factor.

H-K2S · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
K2		1.516	1.516	+0.03		Pass

H-K2SL: Story stiffness, the lower limit governs

Source: Hand calculation from Commentary Eq. C-A-7-5. Calculation: Effective length factor.

H-K2SL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
K2 at the limit		0.791	0.791	-0.00		Pass

H-K2B: Story buckling

Source: Hand calculation from Commentary Eq. C-A-7-8. Calculation: Effective length factor.

H-K2B · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
K2		1.890	1.890	+0.02		Pass

H-K2BL: Story buckling, the lower limit governs

Source: Hand calculation from Commentary Eq. C-A-7-8. Calculation: Effective length factor.

H-K2BL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
K2 = √(5/8) Kn2		1.581	1.581	+0.01		Pass

HET-18: Finite beam with free ends, point and partial uniform load

Source: Hetényi, Beams on Elastic Foundation (1946), §18 Example, pp. pp. 47-49. Calculation: Beam on elastic foundation.

HET-18 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Deflection at end A	in.	0.030	0.030	-0.05		Pass
Deflection at the middle C	in.	0.052	0.052	+0.08		Pass
Deflection at end B	in.	0.006	0.006	+0.57		Pass
Foundation pressure at A	psi	6.070	6.069	-0.01		Pass
Foundation pressure at C	psi	10.39	10.39	+0.04		Pass
Foundation pressure at B	psi	1.260	1.263	+0.25		Pass
Bending moment at C exact 9,574 lb-in.; the publication sums table values interpolated to 4 digits	lb-in	9,624	9,574	-0.51		Pass
Shearing force at C exact 74.4 lb (table interpolation in the publication)	lb	75.30	74.44	-1.15		Pass

HET-12-1: Equal loads spaced π/(2λ) on a long beam (Hetényi §12, Ex. 1)

Source: Hetényi, Beams on Elastic Foundation (1946), §12 Example 1, pp. p. 33. Calculation: Beam on elastic foundation.

HET-12-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Two loads: M under a load / (P/4λ)		0.792	0.792	+0.00		Pass

HET-12-1b: Three equal loads spaced π/(2λ) (Hetényi §12, Ex. 1)

Source: Hetényi, Beams on Elastic Foundation (1946), §12 Example 1, pp. p. 33. Calculation: Beam on elastic foundation.

HET-12-1b · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
M under the middle load / (P/4λ)		0.584	0.584	+0.01		Pass
M under an outer load / (P/4λ)		0.749	0.749	+0.00		Pass

CC-RAIL: Railway rail on sleepers under a wheel load (infinite beam)

Source: CodeCogs, Elastic Foundations (beams), Example 1, pp. Example 1. Calculation: Beam on elastic foundation.

CC-RAIL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1/α (= 1/λ) E = 30 × 10⁶ psi as substituted in the publication's working (its input list prints 39 × 10⁶)	in.	54.80	54.77	-0.05		Pass
Half the depressed length l (first zero of the deflection) published 2l = 258 in.	in.	129.0	129.1	+0.06		Pass
Maximum bending moment (137 ton-in.)	kip-ft	22.83	22.82	-0.05		Pass

SV-BEF: Concrete beam with free ends, 300 kN at 3 m

Source: Structville (Uzodimma 2019), Analysis of Beams on Elastic Foundation, pp. worked example. Calculation: Beam on elastic foundation.

SV-BEF · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
λ (per m)		0.283	0.283	+0.02		Pass
Deflection at the left end A (12.23 mm)	in.	0.481	0.488	+1.35		Deviation BEF-SV-ROUND
BEF-SV-ROUND: the hand calculation rounds Roark's constants (it uses β(l − a) = 1.974 for 1.980); the exact value is 12.39 mm (STAAD.Pro with 1 m springs 12.20 mm)						
Moment under the load (228.39 kN-m)	kip-ft	168.5	170.4	+1.16		Deviation BEF-SV-ROUND
BEF-SV-ROUND: exact 231.05 kN-m (the hand calculation's rounded constants; STAAD.Pro with 1 m springs 228.15 kN-m)						

EFB-1: Grade beam (the default design): concrete checks

Source: Hand calculation (closed form). Calculation: Beam on elastic foundation.

EFB-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φMn of 6 #8 top bars	kip-ft	679.1	679.1	+0.00		Pass
As,min = max(3√f'c, 200)/fy b d (top, Eq. 9.6.1.2) 9.6.1.3 then lowers the minimum to 4/3 of the area required	in.²	3.960	3.960	+0.00		Pass

EFB-KS: ks from a 1 ft plate-load test on sand (Terzaghi 1955)

Source: Hand calculation (Terzaghi's expression as given by Bowles). Calculation: Beam on elastic foundation.

EFB-KS · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ks = ks1 ((B + 1)/2B)², B = 3 ft		111.1	111.1	+0.00		Pass

SP17-E14: Steel beam on a plate with eight studs, moment and shear

Source: ACI SP-17(14), Chapter 15, pp. pp. 806 to 817. Calculation: Embed plate.

SP17-E14 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Top row T	kips	6.788	6.788	-0.00		Pass
Sum of tensions Nua,g	kips	26.20	26.18	-0.07		Pass
Plate moment at the flange (kip-ft)	kip-ft	5.083	5.091	+0.15		Pass
Fy S of the plate (kip-ft)	kip-ft	30.38	30.38	+0.00		Pass
φ Nsa	kips	14.90	14.96	+0.38		Pass
Ncbg	kips	75.50	75.06	-0.59		Pass
φ Ncbg	kips	56.60	56.29	-0.54		Pass
φ Npn	kips	27.60	25.77	-6.63		Deviation SP17-E14-PULLOUT
SP17-E14-PULLOUT: 318-14 has 0.75 here with supplementary reinforcement; 318-19 Table 17.5.3(c) has 0.70						
φ Vsa per stud	kips	12.97	12.96	-0.07		Pass
Vcbg	kips	49.25	46.13	-6.34		Deviation SP17-E14-LE
SP17-E14-LE: the example takes le = hef in Vb, past the limit of 8 da						
φ Vcbg	kips	36.90	34.60	-6.24		Deviation SP17-E14-LE
SP17-E14-LE: the example takes le = hef in Vb, past the limit of 8 da						
Vcpg	kips	121.5	184.3	+51.71		Deviation SP17-E14-PRYOUT
SP17-E14-PRYOUT: the example takes the breakout area of the top row alone; ACI and this type use the studs in the group						
Interaction, (0.46 + 0.46) / 1.2		0.767	0.797	+3.96		Deviation SP17-E14-LE
SP17-E14-LE: follows from the lower breakout strength						

SP17-E16: Six studs in tension eccentric to both axes

Source: ACI SP-17(14), Chapter 15, pp. pp. 830 to 836. Calculation: Embed plate.

SP17-E16 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Largest T	kips	10.87	10.87	+0.01		Pass
φ Nsa	kips	21.50	21.54	+0.17		Pass
Ncbg	kips	41.57	41.86	+0.70		Pass
φ Ncbg	kips	31.18	31.39	+0.70		Pass

HC-DEF · Embed plate: The default: compression at the flange

Source: Hand calculation (closed form), pp. Equilibrium about the flange. Calculation: Embed plate.

HC-DEF · Embed plate · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Top row T	kips	6.000	6.000	+0.00		Pass
C	kips	16.80	16.80	+0.00		Pass
Plate moment (kip-ft)	kip-ft	2.000	2.000	+0.00		Pass
Plate moment, side (kip-ft)	kip-ft	1.400	1.400	+0.00		Pass

HC-TENSION · Embed plate: Pure tension shares equally

Source: Hand calculation (closed form), pp. Statics. Calculation: Embed plate.

HC-TENSION · Embed plate · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
T	kips	5.000	5.000	+0.00		Pass

MNL-17 Anch-15: Six 1/2 in. studs near an edge, concentric tension, no supplementary reinforcement

Source: ACI MNL-17(21), Anchorage Example 15, pp. Vol. 2 pp. 378 to 383. Calculation: Embed plate.

The example computes hef = 6.56 in. and uses 6.5 in., as entered. The seismic force (E = 1,600 lb) is entered; 1.6L governs as printed. Side-face blowout does not apply (hef < 2.5 ca1), as in ILX.

MNL-17 Anch-15 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nua,g = 1.6 L (governing combination)	kips	21.60	21.60	+0.00		Pass
Nua per stud	kips	3.600	3.600	+0.00		Pass
φ Nsa (Ase = 0.196 in.², printed 9,600 lb)	kips	9.600	9.572	-0.29		Pass
ANc	in.²	626.0	625.6	-0.06		Pass
ANco = 9 hef²	in.²	380.0	380.2	+0.07		Pass
ψed,N		0.792	0.792	+0.04		Pass
Nb = 24 √f'c hef^1.5	kips	25.15	25.15	+0.00		Pass
Ncbg	kips	32.91	32.79	-0.37		Pass
φ Ncbg (φ = 0.70)	kips	23.04	22.95	-0.37		Pass
Np = 8 Abrg f'c (Abrg = 0.589 in.²)	kips	18.85	18.85	+0.01		Pass
φ Npn (φ = 0.70)	kips	13.19	13.19	+0.01		Pass

MNL-17 Anch-17: Steel beam on a plate with eight studs, moment and shear

Source: ACI MNL-17(21), Anchorage Example 17, pp. Vol. 2 pp. 392 to 404. Calculation: Embed plate.

The 2021 version of SP-17(14) Example 14, same plate and studs. The example computes hef = 9.56 in. and uses 9.5 in., as entered.

MNL-17 Anch-17 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Top row T	kips	6.788	6.788	-0.00		Pass
Sum of tensions Nua,g	kips	26.18	26.18	-0.00		Pass
Plate moment at the flange (kip-ft)	kip-ft	5.083	5.091	+0.15		Pass
Fy S of the plate (kip-ft)	kip-ft	30.38	30.38	+0.00		Pass
φ Nsa (Ase = 0.31 in.²)	kips	15.11	14.96	-1.04		Pass
ANc, studs 1 to 5	in.²	1,752	1,752	-0.02		Pass
ANco = 9 hef²	in.²	812.0	812.2	+0.03		Pass
ψec,N		0.870	0.870	-0.02		Pass
ψed,N		0.805	0.805	+0.03		Pass
Nb = 24 √f'c hef^1.5	kips	49.69	49.69	+0.00		Pass
Ncbg	kips	75.50	75.06	-0.59		Pass
φ Ncbg	kips	56.62	56.29	-0.59		Pass
Np = 8 Abrg f'c (Abrg = 0.92 in.²)	kips	36.80	36.82	+0.04		Pass
φ Npn	kips	27.60	25.77	-6.63		Deviation SP17-E14-PULLOUT
SP17-E14-PULLOUT: the example takes φ = 0.75 for pullout because supplementary (anchor) reinforcement is present; ACI 318-19 Table 17.5.3(c) gives cast-in anchors 0.70 in pullout with no case for supplementary reinforcement						
φ Vsa per stud	kips	13.10	12.96	-1.03		Pass
AVc	in.²	1,450	1,450	+0.00		Pass
AVco = 4.5 ca1²	in.²	3,785	3,784	-0.01		Pass
ψed,V		0.734	0.734	+0.07		Pass
ψh,V		1.470	1.475	+0.33		Pass
Vb	kips	99.39	92.63	-6.80		Deviation MNL17-A17-VB
MNL17-A17-VB: ILX takes Vb from Eq. 17.7.2.2.1a with 7 and le = 8 da; for studs welded to a plate at least da/2 thick, 17.7.2.2.2 permits 8, and then 9 λa √f'c ca1^1.5 governs as printed (ILX lower, conservative)						
Vcbg	kips	49.25	46.13	-6.34		Deviation MNL17-A17-VB
MNL17-A17-VB: ILX takes Vb from Eq. 17.7.2.2.1a with 7 and le = 8 da; for studs welded to a plate at least da/2 thick, 17.7.2.2.2 permits 8, and then 9 λa √f'c ca1^1.5 governs as printed (ILX lower, conservative)						
φ Vcbg	kips	36.94	34.60	-6.34		Deviation MNL17-A17-VB
MNL17-A17-VB: ILX takes Vb from Eq. 17.7.2.2.1a with 7 and le = 8 da; for studs welded to a plate at least da/2 thick, 17.7.2.2.2 permits 8, and then 9 λa √f'c ca1^1.5 governs as printed (ILX lower, conservative)						
Vcpg	kips	121.5	184.3	+51.71		Deviation SP17-E14-PRYOUT
SP17-E14-PRYOUT: the example takes the breakout area of studs 1 to 3 alone; ACI and this type use the studs in the group						
φ Vcpg	kips	91.11	129.0	+41.60		Deviation SP17-E14-PRYOUT
SP17-E14-PRYOUT: studs 1 to 3 alone, and φ = 0.75 where ACI 318-19 Table 17.5.3(c) gives 0.70 for cast-in pryout						
Interaction, (0.46 + 0.46) / 1.2		0.767	0.797	+3.96		Deviation MNL17-A17-VB
MNL17-A17-VB: ILX takes Vb from Eq. 17.7.2.2.1a with 7 and le = 8 da; for studs welded to a plate at least da/2 thick, 17.7.2.2.2 permits 8, and then 9 λa √f'c ca1^1.5 governs as printed (ILX lower, conservative)						

MNL-17 Anch-19: Six studs in tension eccentric to both axes

Source: ACI MNL-17(21), Anchorage Example 19, pp. Vol. 2 pp. 419 to 427. Calculation: Embed plate.

The 2021 version of SP-17(14) Example 16, on the 9-1/2 in. by 16 in. plate of the 2021 figure. The example computes hef = 7.94 in. and uses 8 in. It finds ψec,N from the load's eccentricity to the centroid of the studs in tension; ILX from the resultant of the stud tensions (0.855).

MNL-17 Anch-19 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nua,6 (largest T)	kips	10.87	10.87	+0.01		Pass
Nua,4	kips	7.795	7.795	-0.00		Pass
Nua,5	kips	5.949	5.949	-0.00		Pass
Nua,2	kips	4.718	4.718	-0.00		Pass
Nua,3	kips	2.872	2.872	-0.01		Pass
φ Nsa (Ase = 0.44 in.²)	kips	21.45	21.54	+0.41		Pass
ANc, studs 2 to 6	in.²	864.0	864.2	+0.03		Pass
ANco = 9 hef²	in.²	576.0	576.0	+0.00		Pass
ψec,N = 0.934 × 0.909		0.849	0.855	+0.67		Pass
ψed,N		0.850	0.850	+0.00		Pass
Nb = 24 √f'c hef^1.5	kips	38.40	38.40	+0.00		Pass
Ncbg	kips	41.57	41.86	+0.70		Pass
φ Ncbg	kips	31.18	31.39	+0.70		Pass
Np = 8 Abrg f'c (Abrg = 0.785 in.²)	kips	31.40	31.42	+0.05		Pass
φ Npn	kips	23.55	21.99	-6.62		Deviation SP17-E14-PULLOUT

SP17-E14-PULLOUT: the example takes φ = 0.75 for pullout because supplementary (anchor) reinforcement is present; ACI 318-19 Table 17.5.3(c) gives cast-in anchors 0.70 in pullout with no case for supplementary reinforcement

FP-1: One person, post 12 in., (4) 5/8 in. A325, lever arm 6 in.

Source: Hand calculation (closed form, ASCE/SEI 7-22 4.6.5, AISC 360-22 J3). Calculation: Fall-protection anchorage.

FP-1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ASCE live load 3,100 lb	kips	3.100	3.100	+0.00		Pass
ASCE factored 1.6 × 3.1	kips	4.960	4.960	+0.00		Pass
OSHA 5,000 lb	kips	5.000	5.000	+0.00		Pass
OSHA bolt tension 5 × 12 / (2 × 6)	kips	5.000	5.000	+0.00		Pass
φ Fnt Ab = 0.75 × 90 × 0.3068	kips	20.71	20.71	+0.00		Pass
Bolt shear per bolt 5 / 4	kips	1.250	1.250	+0.00		Pass
φ Fnv Ab = 0.75 × 54 × 0.3068	kips	12.43	12.43	+0.00		Pass
Host Mu = 1.2 × 20 + 4.96 × 5	kip-ft	48.80	48.80	+0.00		Pass
Host OSHA M = 20 + 5 × 5	kip-ft	45.00	45.00	+0.00		Pass
Host φMn = 0.9 × 100	kip-ft	90.00	90.00	+0.00		Pass

FP-1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ASCE ASD force 3.1	kips	3.100	3.100	+0.00		Pass
Fnt Ab / 2.00	kips	13.81	13.81	+0.00		Pass

FP-QP: Qualified person, two persons, arrest force 900 lb each

Source: Hand calculation (closed form, ASCE/SEI 7-22 4.6.5, AISC 360-22 J3). Calculation: Fall-protection anchorage.

FP-QP · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
OSHA force 2 × 2 × 900 lb	kips	3.600	3.600	+0.00		Pass
ASCE live load 2 × 3,100 lb	kips	6.200	6.200	+0.00		Pass

FP-HLL: Horizontal lifeline 30 ft, sag 1.5 ft, Z359.6 with 1,800 lb

Source: Hand calculation (closed form, ASCE/SEI 7-22 4.6.5, AISC 360-22 J3). Calculation: Fall-protection anchorage.

FP-HLL · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
θ = atan(2 × 1.5 / 30)		5.711	5.711	+0.00		Pass
T = 3.6 / (2 sin θ)	kips	18.09	18.09	+0.00		Pass
ASCE T = 3.1 / (2 sin θ)	kips	15.58	15.58	+0.00		Pass

I.3-a: Force applied to the steel: direct bond

Source: AISC Design Examples v16.0, Example I.3, pp. I-36 to I-44. Calculation: Concrete-filled HSS column.

I.3-a · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Concrete area Ac	in.²	49.20	49.21	+0.03		Pass
Pno	kips	729.0	729.2	+0.02		Pass
Vr′ (Eq. I6-1)	kips	49.70	49.57	-0.27		Pass
Bond perimeter pb	in.	28.60	28.61	+0.03		Pass
Lin	in.	12.00	12.00	+0.00		Pass
Fin		0.042	0.042	-0.05		Pass
φRn direct bond	kips	7.190	7.189	-0.02		Pass

I.3-a · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vr′ (Eq. I6-1)	kips	33.30	33.27	-0.08		Pass
Rn/Ω direct bond	kips	4.790	4.793	+0.05		Pass

I.3-b: Force applied to the concrete

Source: AISC Design Examples v16.0, Example I.3, pp. I-36 to I-44. Calculation: Concrete-filled HSS column.

I.3-b · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vr′ (Eq. I6-2a)	kips	123.0	123.2	+0.19		Pass

I.3-b · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vr′ (Eq. I6-2a)	kips	82.70	82.73	+0.03		Pass

I.3-bearing: Direct bearing on an internal plate (A1 = 25.1 in.²)

Source: AISC Design Examples v16.0, Example I.3, pp. I-36 to I-44. Calculation: Concrete-filled HSS column.

I.3-bearing · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rn = 1.7 f'c A1	kips	213.0	213.3	+0.16		Pass
φRn direct bearing	kips	138.0	138.7	+0.49		Pass

I.3-bearing · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rn/Ω direct bearing	kips	92.20	92.36	+0.17		Pass

I.4: HSS10×6×3/8 in axial compression

Source: AISC Design Examples v16.0, Example I.4, pp. I-47 to I-51. Calculation: Concrete-filled HSS column.

I.4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required strength Pu	kips	173.0	172.8	-0.12		Pass
Table 4-B and Eq. I2-2: φcPn	kips	368.0	367.5	-0.13		Pass
Gross area Ag	in.²	59.60	59.61	+0.02		Pass
Pno	kips	729.0	729.2	+0.02		Pass
C3		0.900	0.900	+0.00		Pass
Ec	ksi	3,900	3,904	+0.11		Pass
Icx	in.⁴	353.0	353.4	+0.12		Pass
Icy	in.⁴	115.0	114.8	-0.14		Pass
EIeff about y		2,200,000	2,195,736	-0.19		Pass
Pe	kips	769.0	767.8	-0.15		Pass
Pn	kips	490.0	490.0	+0.00		Pass
Bare steel φcPn (Manual Table 4-3)	kips	331.0	330.9	-0.03		Pass

I.4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required strength Pa	kips	116.0	116.0	+0.00		Pass
Table 4-B and Eq. I2-2: Pn/Ωc	kips	245.0	245.0	+0.00		Pass
Bare steel Pn/Ωc (Manual Table 4-3)	kips	220.0	220.2	+0.08		Pass

I.5: HSS10×6×3/8 in axial tension (0.9D + 1.0W, 0.6D + 0.6W)

Source: AISC Design Examples v16.0, Example I.5, pp. I-52 to I-53. Calculation: Concrete-filled HSS column.

I.5 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required tension Pu	kips	71.20	71.20	+0.00		Pass
φtPn (also Manual Table 5-4)	kips	468.0	468.0	+0.00		Pass

I.5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required tension Pa	kips	40.80	40.80	+0.00		Pass
Pn/Ωt (also Manual Table 5-4)	kips	311.0	311.4	+0.12		Pass

I.6-M1-LRFD: Combined forces, Method 1 (H1.1)

Source: AISC Design Examples v16.0, Example I.6, pp. I-56, I-66. Calculation: Concrete-filled HSS column.

I.6-M1-LRFD · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Table 4-B: φcPn	kips	368.0	367.5	-0.13		Pass
Table 4-B: φbMnx	kip-ft	141.0	140.5	-0.35		Pass
Interaction, Eq. H1-1a		1.110	1.110	+0.01		Pass
Shear area Av	in.²	6.250	6.249	-0.01		Pass
Vn	kips	195.0	194.1	-0.47		Pass
φvVn	kips	176.0	174.7	-0.76		Pass

I.6-M1-ASD: Combined forces, Method 1 (H1.1)

Source: AISC Design Examples v16.0, Example I.6, pp. I-56, I-66. Calculation: Concrete-filled HSS column.

I.6-M1-ASD · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Table 4-B: Pn/Ωc	kips	245.0	245.0	+0.00		Pass
Table 4-B: Mnx/Ωb	kip-ft	93.50	93.49	-0.01		Pass
Interaction, Eq. H1-1a		0.914	0.914	+0.03		Pass
Vn/Ωv	kips	117.0	116.2	-0.67		Pass

I.6-M2-LRFD: Combined forces, Method 2 Simplified

Source: AISC Design Examples v16.0, Example I.6, pp. I-57 to I-64. Calculation: Concrete-filled HSS column.

I.6-M2-LRFD · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Point A: PA	kips	729.0	729.2	+0.02		Pass
Point D: PD	kips	105.0	104.6	-0.40		Pass
Point D: MD	kip-ft	161.0	161.1	+0.04		Pass
Point C: PC	kips	209.0	209.2	+0.08		Pass
Point B: MB	kip-ft	156.0	156.1	+0.08		Pass
Zc	in.³	114.0	114.2	+0.19		Pass
hn	in.	1.130	1.133	+0.23		Pass
Slenderness reduction λ		0.672	0.672	+0.00		Pass
Interaction, Eq. C-I5-1b		0.948	0.944	-0.42		Pass

I.6-M2-ASD: Combined forces, Method 2 Simplified

Source: AISC Design Examples v16.0, Example I.6, pp. I-62 to I-64. Calculation: Concrete-filled HSS column.

I.6-M2-ASD · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Interaction, Eq. C-I5-1b		0.739	0.737	-0.21		Pass

I.7-1/2-LRFD: Box 30×30×1/2, noncompact

Source: AISC Design Examples v16.0, Example I.7, pp. I-67 to I-75. Calculation: Concrete-filled HSS column.

I.7-1/2-LRFD · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Steel area As	in.²	59.00	59.00	+0.00		Pass
Concrete area Ac	in.²	841.0	841.0	+0.00		Pass
Isx	in.⁴	8,600	8,560	-0.47		Pass
Icx	in.⁴	58,900	58,940	+0.07		Pass
Ec	ksi	4,620	4,620	-0.01		Pass
λ		58.00	58.00	+0.00		Pass
λp		54.40	54.43	+0.05		Pass
λr		72.20	72.25	+0.07		Pass
Pp	kips	7,950	7,954	+0.05		Pass
Py	kips	7,070	7,071	+0.01		Pass
Pno	kips	7,910	7,918	+0.11		Pass
C3		0.647	0.647	-0.05		Pass
EIeff		425,000,000	424,310,373	-0.16		Pass
Pe	kips	32,400	32,313	-0.27		Pass
Pn	kips	7,140	7,147	+0.09		Pass
φcPn	kips	5,360	5,360	-0.00		Pass
Bare steel Pn	kips	1,980	1,882	-4.97		Deviation FHSS-I7-BARE
FHSS-I7-BARE: the example's figure reproduces with HSS wall factors (Table E7.1 case (b)) and b = H - 3t; the module reads the Specification for a plate box (case (a), clear width)						
Mp	kip-ft	3,270	3,274	+0.13		Pass
ay	in.	8.980	8.977	-0.03		Pass
My	kip-ft	3,050	3,043	-0.24		Pass
Mn	kip-ft	3,230	3,228	-0.06		Pass
φbMn	kip-ft	2,910	2,905	-0.17		Pass
Interaction, Eq. H1-1a		0.413	0.413	+0.07		Pass

I.7-1/2-ASD: Box 30×30×1/2, noncompact

Source: AISC Design Examples v16.0, Example I.7, pp. I-71 to I-75. Calculation: Concrete-filled HSS column.

I.7-1/2-ASD · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pn/Ωc	kips	3,570	3,573	+0.09		Pass
Mn/Ωb	kip-ft	1,930	1,933	+0.15		Pass
Interaction, Eq. H1-1a		0.498	0.497	-0.11		Pass

I.7-1/4-LRFD: Box 30×30×1/4, slender

Source: AISC Design Examples v16.0, Example I.7, pp. I-76 to I-82. Calculation: Concrete-filled HSS column.

I.7-1/4-LRFD · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Steel area As	in.²	29.80	29.75	-0.17		Pass
Concrete area Ac	in.²	870.0	870.2	+0.03		Pass
Isx	in.⁴	4,400	4,389	-0.26		Pass
Icx	in.⁴	63,100	63,111	+0.02		Pass
λ		118.0	118.0	+0.00		Pass
λmax		120.0	120.4	+0.35		Pass
Fn (Eq. I2-10)	ksi	18.70	18.74	+0.24		Pass
Pno (Eq. I2-9e)	kips	4,820	4,822	+0.04		Pass
C3		0.549	0.549	+0.03		Pass
EIeff		288,000,000	287,381,222	-0.21		Pass
Pe	kips	21,900	21,885	-0.07		Pass
Pn	kips	4,400	4,397	-0.07		Pass
φcPn	kips	3,300	3,298	-0.07		Pass
Bare steel Pn	kips	541.0	509.2	-5.88		Deviation FHSS-I7-BARE
FHSS-I7-BARE: the example's figure reproduces with HSS wall factors (Table E7.1 case (b)) and b = H - 3t; the module reads the Specification for a plate box (case (a), clear width)						
acr	in.	6.970	6.970	+0.01		Pass
Mcr	kip-ft	1,350	1,345	-0.37		Pass
φbMn	kip-ft	1,220	1,211	-0.78		Pass
Interaction, Eq. H1-1a		0.799	0.803	+0.45		Pass
Shear area Av	in.²	14.70	14.75	+0.34		Pass
Vn	kips	579.0	580.6	+0.28		Pass
φvVn	kips	521.0	522.6	+0.30		Pass

I.7-1/4-ASD: Box 30×30×1/4, slender

Source: AISC Design Examples v16.0, Example I.7, pp. I-78 to I-82. Calculation: Concrete-filled HSS column.

I.7-1/4-ASD · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pn/Ωc	kips	2,200	2,199	-0.07		Pass
Mn/Ωb	kip-ft	808.0	805.4	-0.32		Pass
Interaction, Eq. H1-1a		0.896	0.897	+0.09		Pass
Vn/Ωv	kips	347.0	347.7	+0.20		Pass

STI-1: HSS14×14×3/8, f′c = 6 ksi, Lc = 42 ft

Source: Steel Tube Institute, Filling the Void: Concrete Filled HSS Columns (June 17, 2024), pp. pp. 2-5. Calculation: Concrete-filled HSS column.

STI-1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Steel area As	in.²	18.70	18.70	+0.00		Pass
Concrete area Ac	in.²	176.8	176.8	+0.02		Pass
Gross area Ag	in.²	195.5	195.5	+0.02		Pass
Is	in.⁴	577.0	577.0	+0.00		Pass
Ic	in.⁴	2,605	2,605	-0.02		Pass
Ec	ksi	4,277	4,277	-0.00		Pass
C3		0.737	0.737	-0.01		Pass
EIeff		24,941,616	24,941,616	+0.00		Pass
Pno	kips	1,837	1,837	-0.00		Pass
Pe	kips	969.0	969.1	+0.01		Pass
Pn	kips	830.9	830.9	-0.00		Pass
φPn	kips	623.0	623.2	+0.02		Pass

STI-T1-4: HSS14X14X3/4, f'c = 4 ksi, Lc = 42 ft

Source: Steel Tube Institute, Filling the Void: Concrete Filled HSS Columns (June 17, 2024), pp. p. 6. Calculation: Concrete-filled HSS column.

STI-T1-4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Composite φPn	kips	883.0	882.6	-0.04		Pass
Bare steel φPn	kips	850.0	850.4	+0.05		Pass

STI-T1-6: HSS14X14X3/4, f'c = 6 ksi, Lc = 42 ft

Source: Steel Tube Institute, Filling the Void: Concrete Filled HSS Columns (June 17, 2024), pp. p. 6. Calculation: Concrete-filled HSS column.

STI-T1-6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Composite φPn	kips	937.0	936.9	-0.01		Pass

STI-T2-4: HSS14X14X5/8, f'c = 4 ksi, Lc = 42 ft

Source: Steel Tube Institute, Filling the Void: Concrete Filled HSS Columns (June 17, 2024), pp. p. 6. Calculation: Concrete-filled HSS column.

STI-T2-4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Composite φPn	kips	792.0	791.9	-0.01		Pass
Bare steel φPn	kips	728.0	727.9	-0.01		Pass

STI-T2-6: HSS14X14X5/8, f'c = 6 ksi, Lc = 42 ft

Source: Steel Tube Institute, Filling the Void: Concrete Filled HSS Columns (June 17, 2024), pp. p. 6. Calculation: Concrete-filled HSS column.

STI-T2-6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Composite φPn	kips	850.0	849.8	-0.02		Pass

STI-T3-4: HSS14X14X1/2, f'c = 4 ksi, Lc = 42 ft

Source: Steel Tube Institute, Filling the Void: Concrete Filled HSS Columns (June 17, 2024), pp. p. 6. Calculation: Concrete-filled HSS column.

STI-T3-4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Composite φPn	kips	686.0	685.8	-0.02		Pass
Bare steel φPn	kips	598.0	597.8	-0.04		Pass

STI-T3-6: HSS14X14X1/2, f'c = 6 ksi, Lc = 42 ft

Source: Steel Tube Institute, Filling the Void: Concrete Filled HSS Columns (June 17, 2024), pp. p. 6. Calculation: Concrete-filled HSS column.

STI-T3-6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Composite φPn	kips	743.0	743.4	+0.06		Pass

STI-T4-4: HSS20X20X3/4, f'c = 4 ksi, Lc = 42 ft

Source: Steel Tube Institute, Filling the Void: Concrete Filled HSS Columns (June 17, 2024), pp. p. 6. Calculation: Concrete-filled HSS column.

STI-T4-4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Composite φPn	kips	2,050	2,045	-0.22		Pass
Bare steel φPn	kips	1,750	1,750	-0.02		Pass

STI-T4-6: HSS20X20X3/4, f'c = 6 ksi, Lc = 42 ft

Source: Steel Tube Institute, Filling the Void: Concrete Filled HSS Columns (June 17, 2024), pp. p. 6. Calculation: Concrete-filled HSS column.

STI-T4-6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Composite φPn	kips	2,290	2,287	-0.12		Pass

STI-T5-4: HSS20X20X5/8, f'c = 4 ksi, Lc = 42 ft

Source: Steel Tube Institute, Filling the Void: Concrete Filled HSS Columns (June 17, 2024), pp. p. 6. Calculation: Concrete-filled HSS column.

STI-T5-4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Composite φPn	kips	1,830	1,826	-0.22		Pass
Bare steel φPn	kips	1,480	1,478	-0.13		Pass

STI-T5-6: HSS20X20X5/8, f'c = 6 ksi, Lc = 42 ft

Source: Steel Tube Institute, Filling the Void: Concrete Filled HSS Columns (June 17, 2024), pp. p. 6. Calculation: Concrete-filled HSS column.

STI-T5-6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Composite φPn	kips	2,070	2,069	-0.06		Pass

STI-T6-4: HSS14X14X3/8, f'c = 4 ksi, Lc = 42 ft

Source: Steel Tube Institute, Filling the Void: Concrete Filled HSS Columns (June 17, 2024), pp. p. 6. Calculation: Concrete-filled HSS column.

STI-T6-4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Composite φPn	kips	569.0	568.6	-0.06		Pass
Bare steel φPn	kips	460.0	460.5	+0.10		Pass

STI-T6-6: HSS14X14X3/8, f'c = 6 ksi, Lc = 42 ft

Source: Steel Tube Institute, Filling the Void: Concrete Filled HSS Columns (June 17, 2024), pp. p. 6. Calculation: Concrete-filled HSS column.

STI-T6-6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Composite φPn	kips	623.0	623.2	+0.02		Pass

STI-T7-4: HSS14X14X5/16, f′c = 4 ksi, Lc = 42 ft

Source: Steel Tube Institute, Filling the Void: Concrete Filled HSS Columns (June 17, 2024), pp. p. 6. Calculation: Concrete-filled HSS column.

STI-T7-4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Composite φPn	kips	507.0	506.7	-0.05		Pass
Bare steel φPn	kips	389.0	389.1	+0.02		Pass

STI-T7-6: HSS14X14X5/16, f′c = 6 ksi, Lc = 42 ft

Source: Steel Tube Institute, Filling the Void: Concrete Filled HSS Columns (June 17, 2024), pp. p. 6. Calculation: Concrete-filled HSS column.

STI-T7-6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Composite φPn	kips	559.0	558.6	-0.08		Pass

STI-T8-4: HSS20X20X1/2, f'c = 4 ksi, Lc = 42 ft

Source: Steel Tube Institute, Filling the Void: Concrete Filled HSS Columns (June 17, 2024), pp. p. 6. Calculation: Concrete-filled HSS column.

STI-T8-4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Composite φPn	kips	1,600	1,599	-0.03		Pass
Bare steel φPn	kips	1,190	1,183	-0.63		Pass

STI-T8-6: HSS20X20X1/2, f'c = 6 ksi, Lc = 42 ft

Source: Steel Tube Institute, Filling the Void: Concrete Filled HSS Columns (June 17, 2024), pp. p. 6. Calculation: Concrete-filled HSS column.

STI-T8-6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Composite φPn	kips	1,840	1,841	+0.06		Pass

STI-T9-4: HSS20X20X3/8, f'c = 4 ksi, Lc = 42 ft

Source: Steel Tube Institute, Filling the Void: Concrete Filled HSS Columns (June 17, 2024), pp. p. 6. Calculation: Concrete-filled HSS column.

STI-T9-4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Composite φPn	kips	1,360	1,361	+0.10		Pass
Bare steel φPn	kips	821.0	729.2	-11.18		Deviation STI-BARE-HSS20

STI-BARE-HSS20: 821 kips reproduces with a 0.375 in. wall (826, A1085) but the article's A500 wall of 0.349 in. gives 730 by hand from Section E7, as the module does

STI-T9-6: HSS20X20X3/8, f'c = 6 ksi, Lc = 42 ft

Source: Steel Tube Institute, Filling the Void: Concrete Filled HSS Columns (June 17, 2024), pp. p. 6. Calculation: Concrete-filled HSS column.

STI-T9-6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Composite φPn	kips	1,600	1,598	-0.12		Pass

T5-6-16.000X0.625: HSS16.000X0.625 tensile yielding

Source: AISC Steel Construction Manual, 16th Ed., Table 5-6, pp. 5-25. Calculation: Concrete-filled HSS column.

T5-6-16.000X0.625 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φtPn yielding	kips	1,260	1,264	+0.36		Pass

T5-6-16.000X0.625 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pn/Ωt yielding	kips	841.0	841.3	+0.04		Pass

T5-6-14.000X0.375: HSS14.000X0.375 tensile yielding

Source: AISC Steel Construction Manual, 16th Ed., Table 5-6, pp. 5-25. Calculation: Concrete-filled HSS column.

T5-6-14.000X0.375 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φtPn yielding	kips	675.0	675.0	+0.00		Pass

T5-6-14.000X0.375 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pn/Ωt yielding	kips	449.0	449.1	+0.02		Pass

T5-6-10.000X0.375: HSS10.000X0.375 tensile yielding

Source: AISC Steel Construction Manual, 16th Ed., Table 5-6, pp. 5-25. Calculation: Concrete-filled HSS column.

T5-6-10.000X0.375 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φtPn yielding	kips	477.0	477.0	+0.00		Pass

T5-6-10.000X0.375 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pn/Ωt yielding	kips	317.0	317.4	+0.12		Pass

T5-6-8.625X0.322: HSS8.625X0.322 tensile yielding

Source: AISC Steel Construction Manual, 16th Ed., Table 5-6, pp. 5-25. Calculation: Concrete-filled HSS column.

T5-6-8.625X0.322 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φtPn yielding	kips	353.0	353.2	+0.07		Pass

T5-6-8.625X0.322 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pn/Ωt yielding	kips	235.0	235.0	+0.01		Pass

DESTEFANO-T1-2x10: (2)-2x10 + PL 1/2 x 9: section, allowable moment, wood shear

Source: DeStefano, Flitch Plate Beams Design Guide, STRUCTURE magazine (June 2007), pp. p. 56, Table 1. Calculation: Flitch-plate beam.

DESTEFANO-T1-2x10 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Modular ratio n		18.10	18.12	+0.14		Pass
Transformed moment of inertia Itr	in.⁴	748.0	748.4	+0.05		Pass
Transformed section modulus Str	in.³	161.7	161.8	+0.07		Pass
Allowable moment (wood governs)	lb-ft	13,340	13,350	+0.08		Pass
Steel share of the moment Msteel / M		0.740	0.736	-0.59		Pass
Wood shear capacity (2/3) Fv A	lb	3,330	3,330	+0.00		Pass

DESTEFANO-T1-3x2x10: (3)-2x10 + (2) PL 1/2 x 9 (Cr = 1.15)

Source: DeStefano, Flitch Plate Beams Design Guide, STRUCTURE magazine (June 2007), pp. p. 56, Table 1. Calculation: Flitch-plate beam.

DESTEFANO-T1-3x2x10 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Transformed moment of inertia Itr	$in.^4$	1,397	1,398	+0.06		Pass
Transformed section modulus Str	$in.^3$	302.1	302.2	+0.05		Pass
Allowable moment (wood governs)	lb-ft	28,649	28,676	+0.09		Pass
Steel share of the moment Msteel / M		0.790	0.788	-0.29		Pass
Wood shear capacity (2/3) Fv A	lb	4,995	4,995	+0.00		Pass

DESTEFANO-T1-2x12: (2)-2x12 + PL 1/2 x 11

Source: DeStefano, Flitch Plate Beams Design Guide, STRUCTURE magazine (June 2007), pp. p. 56, Table 1. Calculation: Flitch-plate beam.

DESTEFANO-T1-2x12 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Transformed moment of inertia Itr	in.⁴	1,361	1,361	+0.01		Pass
Transformed section modulus Str	in.³	241.9	242.0	+0.03		Pass
Allowable moment (wood governs)	lb-ft	18,142	18,149	+0.04		Pass
Steel share of the moment Msteel / M		0.740	0.738	-0.20		Pass
Wood shear capacity (2/3) Fv A	lb	4,050	4,050	+0.00		Pass

DESTEFANO-T1-2x8: (2)-2x8 + PL 3/8 x 7

Source: DeStefano, Flitch Plate Beams Design Guide, STRUCTURE magazine (June 2007), pp. p. 56, Table 1. Calculation: Flitch-plate beam.

DESTEFANO-T1-2x8 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Transformed moment of inertia Itr	$in.^4$	289.0	289.5	+0.19		Pass
Transformed section modulus Str	$in.^3$	79.70	79.88	+0.22		Pass
Allowable moment (wood governs)	lb-ft	7,173	7,189	+0.22		Pass
Steel share of the moment Msteel / M		0.670	0.671	+0.14		Pass
Wood shear capacity (2/3) Fv A	lb	2,610	2,610	+0.00		Pass

DESTEFANO-EX: Bolt design: plate load, end reaction, bolt value, spacing, end bolts

Source: DeStefano, Flitch Plate Beams Design Guide, STRUCTURE magazine (June 2007), pp. p. 57, Design Example. Calculation: Flitch-plate beam.

The example's 945 lb is yield mode Is only; the module reproduces it and uses the least mode.

DESTEFANO-EX · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Uniform load on the plate	plf	518.0	514.9	-0.59		Pass
End reaction on the plate	lb	3,108	3,090	-0.59		Pass
Bolt value, mode Is (NDS Eq. 12.3-8)	lb	945.0	947.3	+0.24		Pass
Uniform bolt spacing	in.	21.90	20.33	-7.17		Deviation DESTEFANO-2007-BOLT
DESTEFANO-2007-BOLT: the module's bolt value is the least yield mode (IIIs, 872 lb), the example's is mode Is (945 lb)						
End bolts required (reaction / Z)		3.290	3.542	+7.65		Deviation DESTEFANO-2007-BOLT
DESTEFANO-2007-BOLT: least yield mode IIIs governs (872 lb, not 945 lb)						

HAND-1 · Flitch-plate beam: Plate flexure (F11, Lb = bolt spacing / braced by the plies) and shear (G4)

Source: Hand calculation (closed form). Calculation: Flitch-plate beam.

HAND-1 · Flitch-plate beam · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mn by F11-3 (Lb = 24 in.)	kip-ft	297.9	297.9	+0.00		Pass
Mn/Ω	kip-ft	178.4	178.4	+0.00		Pass
Mp = Fy Z	kip-ft	364.5	364.5	+0.00		Pass
Vn = 0.6 Fy Aw Cv2	kips	97.20	97.20	-0.00		Pass
Vn/Ω	kips	58.20	58.20	-0.00		Pass

HAND-1 · Flitch-plate beam · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φMn	kip-ft	268.2	268.2	+0.00		Pass
φVn	kips	87.48	87.48	-0.00		Pass

HAND-1B: Plate braced continuously by the plies: Mn = Mp

Source: Hand calculation (closed form). Calculation: Flitch-plate beam.

HAND-1B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φMp	kip-ft	328.1	328.1	+0.00		Pass

HAND-2 · Flitch-plate beam: Bolt value with two plates (NDS 12.3.8.2, five members)

Source: Hand calculation (closed form). Calculation: Flitch-plate beam.

HAND-2 · Flitch-plate beam · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z, one plate set (mode IIIs)	lb	872.4	872.4	+0.00		Pass
Z = Zmin (5 − 1)/2	lb	947.3	947.3	+0.00		Pass
Z' (CD = 1.0)	lb	947.3	947.3	+0.00		Pass

HAND-2 · Flitch-plate beam · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z' = Z KF φz λ (λ = 0.8)	lb	1,635	1,635	+0.00		Pass

HAND-3 · Flitch-plate beam: Deflection with creep of the wood part and the long-term steel share

Source: Hand calculation (closed form). Calculation: Flitch-plate beam.

HAND-3 · Flitch-plate beam · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Live load deflection	in.	0.195	0.195	-0.00		Pass
Total deflection with creep	in.	0.280	0.280	-0.00		Pass
αs		0.736	0.736	+0.00		Pass
αs,LT		0.807	0.807	+0.00		Pass
Plate moment, D at αs,LT + L at αs	kip-ft	114.3	114.3	-0.00		Pass

8.4: Square pile, oceanfront, 4.6 ft of stillwater

Source: FEMA P-55 Vol. II (2011), Example 8.4, pp. 8-40 to 8-43. Calculation: Flood loads.

8.4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Stillwater depth, ft	ft	4.600	4.600	+0.00		Pass
Upper bound velocity, ft/s		12.200	12.170	-0.24		Pass
Breaking wave height, ft	ft	3.600	3.588	-0.33		Pass
Hydrodynamic load on a pile, lb	lb	909.0	903.9	-0.56		Pass
Breaking wave load on a pile, lb	lb	868.0	865.1	-0.33		Pass
Breaking wave load on a row of 7, lb	lb	6,076	6,056	-0.33		Pass
Debris impact, lb	lb	2,440	2,434	-0.24		Pass

8.4-a: The same pile at its 7.5 in. dressed size for scour

Source: FEMA P-55 Vol. II (2011), Example 8.4, pp. 8-41. Calculation: Flood loads.

8.4-a · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Local scour, one pile, ft	ft	1.760	1.768	+0.44		Pass
Local scour, group, ft	ft	5.280	5.303	+0.44		Pass

8.4-low: The lower velocity bound

Source: FEMA P-55 Vol. II (2011), Example 8.4, pp. 8-41. Calculation: Flood loads.

8.4-low · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Lower bound velocity, ft/s		4.600	4.600	+0.00		Pass

8.3-a: Round pile, 8 ft of water, V = 8 ft/s

Source: FEMA P-55 Vol. II (2011), Example 8.3, pp. 8-30. Calculation: Flood loads.

8.3-a · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Hydrodynamic load, lb	lb	509.0	509.4	+0.09		Pass

8.3-b: Round pile, 8 ft of water, V = 16 ft/s

Source: FEMA P-55 Vol. II (2011), Example 8.3, pp. 8-30, 8-31. Calculation: Flood loads.

8.3-b · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Hydrodynamic load, lb	lb	2,037	2,038	+0.04		Pass
Breaking wave, lb	lb	1,816	1,817	+0.06		Pass

H-W: Wall, V-Zone, Risk Category II, dry behind

Source: Hand calculation from ASCE 7-22 Eq. 5.4-2, -3, -5, -6. Calculation: Flood loads.

H-W · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Stillwater depth, ft	ft	6.500	6.500	+0.00		Pass
Breaking wave height, ft	ft	5.070	5.070	+0.00		Pass
Pmax, psf	psf	1,664	1,664	+0.00		Pass
Ft, lb/ft	lb/ft	14,818	14,818	+0.00		Pass

H-W2: Water on both sides, Risk Category IV

Source: Hand calculation from ASCE 7-22 Eq. 5.4-7. Calculation: Flood loads.

H-W2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ft, lb/ft	lb/ft	15,548	15,548	+0.00		Pass

H-W3: A sloped surface and an oblique wave

Source: Hand calculation from ASCE 7-22 Eq. 5.4-8, -9. Calculation: Flood loads.

H-W3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Force, lb/ft	lb/ft	5,557	5,557	-0.00		Pass

H-HS: Hydrostatic, 11 ft with free water, surcharge at 8 ft/s

Source: Hand calculation from ASCE 7-22 5.4.2, Eq. 5.4-1. Calculation: Flood loads.

H-HS · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Hydrostatic, lb/ft	lb/ft	4,608	4,608	+0.00		Pass
Surcharge dh, ft	ft	1.242	1.242	+0.00		Pass
Hydrodynamic, lb/ft	lb/ft	874.5	874.5	+0.00		Pass

H-C5: Debris by Eq. C5.4-3, A-Zone, 4 ft of water

Source: Hand calculation from ASCE 7-22 Eq. C5.4-3, Tables C5.4-1 to -4. Calculation: Flood loads.

H-C5 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Impact, lb	lb	5,620	5,620	+0.00		Pass

T-C5: Table C5.4-2 and C5.4-4 cells

Source: ASCE 7-22 Tables C5.4-2, C5.4-4, pp. 526 to 528. Calculation: Flood loads.

T-C5 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Depth coefficient at 2 ft, and Rmax at 0.5	lb	2,927	2,927	+0.00		Pass

DG11-4.1: Exterior office bay, W18X35 beams, W21X50 girder

Source: AISC Design Guide 11, 2nd Ed. (2016), Example 4.1, pp. pp. 30-37. Calculation: Floor vibration.

DG11-4.1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
n		9.300	9.310	+0.11		Pass
Beam It	in.⁴	1,840	1,833	-0.35		Pass
wj	plf	595.0	594.6	-0.07		Pass
Δj	in.	0.376	0.378	+0.42		Pass
fj	Hz	5.770	5.755	-0.25		Pass
Bj the Guide prints 32.2 and 32.3 ft	ft	32.20	32.24	+0.11		Pass
Wj	lb	101,000	100,625	-0.37		Pass
Girder It	in.⁴	3,280	3,274	-0.17		Pass
wg	plf	2,130	2,131	+0.05		Pass
Δg	in.	0.408	0.409	+0.25		Pass
fg	Hz	5.540	5.530	-0.19		Pass
Bg	ft	63.80	63.89	+0.14		Pass
Wg	lb	116,000	116,705	+0.61		Pass
fn	Hz	3.990	3.987	-0.06		Pass
W	lb	109,000	108,698	-0.28		Pass
ap/g	%g	0.490	0.494	+0.76		Pass

DG11-4.2: Interior office bay, open-web joists on a W24X55

Source: AISC Design Guide 11, 2nd Ed. (2016), Example 4.2, pp. pp. 38-45. Calculation: Floor vibration.

DG11-4.2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Joist Ie	in.⁴	587.0	586.9	-0.02		Pass
Δj	in.	0.312	0.312	-0.12		Pass
fj	Hz	6.330	6.335	+0.08		Pass
Bj	ft	31.20	31.26	+0.19		Pass
Wj	lb	68,100	68,224	+0.18		Pass
Δg	in.	0.121	0.121	-0.20		Pass
fg	Hz	10.20	10.18	-0.23		Pass
Bg	ft	37.70	37.64	-0.17		Pass
Wg	lb	56,300	56,144	-0.28		Pass
fn	Hz	5.370	5.378	+0.15		Pass
W	lb	65,700	65,824	+0.19		Pass
ap/g	%g	0.503	0.501	-0.38		Pass

DG11-4.3: Mezzanine with a beam edge member

Source: AISC Design Guide 11, 2nd Ed. (2016), Example 4.3, pp. pp. 46-47. Calculation: Floor vibration.

DG11-4.3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bj	ft	16.20	16.12	-0.51		Pass
Wj	lb	50,600	50,313	-0.57		Pass
W	lb	84,600	84,836	+0.28		Pass

DG11-4.4: Mezzanine with a girder edge member

Source: AISC Design Guide 11, 2nd Ed. (2016), Example 4.4, pp. pp. 48-50. Calculation: Floor vibration.

DG11-4.4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Wj	lb	67,300	67,083	-0.32		Pass
wg	plf	1,090	1,091	+0.05		Pass
Δg	in.	0.238	0.238	-0.02		Pass
Bg	ft	23.30	23.33	+0.14		Pass
Wg	lb	43,500	43,621	+0.28		Pass
fn	Hz	4.510	4.508	-0.05		Pass
W	lb	58,500	58,409	-0.15		Pass
ap/g	%g	0.764	0.766	+0.24		Pass

DG11-4.5: Outdoor pedestrian bridge, walking and running

Source: AISC Design Guide 11, 2nd Ed. (2016), Example 4.5, pp. pp. 50-52. Calculation: Floor vibration.

DG11-4.5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
fn	Hz	6.720	6.720	-0.01		Pass
W	lb	32,500	32,520	+0.06		Pass
ap/g, walking	%g	2.690	2.693	+0.11		Pass
ap/g, running	%g	12.80	12.76	-0.30		Pass
Lateral frequency	Hz	18.80	18.78	-0.13		Pass

DG11-4.6: Linear stair, HSS20X12X3/8 stringers

Source: AISC Design Guide 11, 2nd Ed. (2016), Example 4.6, pp. pp. 52-55. Calculation: Floor vibration.

DG11-4.6 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vertical frequency	Hz	7.020	7.015	-0.07		Pass
Lateral frequency	Hz	4.730	4.736	+0.13		Pass
φW		0.995	0.995	+0.02		Pass
φR		0.960	0.959	-0.05		Pass
Normal descent	%g	1.440	1.442	+0.15		Pass
Rapid descent	%g	2.080	2.078	-0.12		Pass
Rapid group	%g	6.230	6.233	+0.04		Pass

DG11-5.1: Long span joist floor with dining and dancing

Source: AISC Design Guide 11, 2nd Ed. (2016), Example 5.1, pp. pp. 59-61. Calculation: Floor vibration.

DG11-5.1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Δj	in.	0.367	0.367	+0.03		Pass
fn	Hz	5.840	5.837	-0.05		Pass
Largest ap/g, at 2.70 Hz	%g	1.080	1.081	+0.09		Pass

DG11-5.2: Second floor used for aerobics

Source: AISC Design Guide 11, 2nd Ed. (2016), Example 5.2, pp. pp. 61-64. Calculation: Floor vibration.

DG11-5.2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Δb	in.	0.353	0.353	-0.11		Pass
Δg	in.	0.244	0.244	-0.02		Pass
fn	Hz	4.430	4.434	+0.08		Pass
Largest ap/g, near 2.23 Hz	%g	40.10	40.04	-0.14		Pass

DG11-6.1: Sensitive equipment, generic limit 8,000 mips, fast walking

Source: AISC Design Guide 11, 2nd Ed. (2016), Example 6.1, pp. pp. 73-76. Calculation: Floor vibration.

DG11-6.1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Beam It	in.⁴	1,110	1,113	+0.28		Pass
wb	plf	430.0	430.1	+0.02		Pass
Δb	in.	0.243	0.243	-0.07		Pass
fb	Hz	7.170	7.177	+0.09		Pass
Bb	ft	28.10	28.08	-0.06		Pass
Girder It	in.⁴	4,250	4,227	-0.55		Pass
wg	plf	1,900	1,898	-0.09		Pass
Δg	in.	0.213	0.214	+0.55		Pass
fg	Hz	7.660	7.642	-0.24		Pass
Bg	ft	40.00	40.00	+0.00		Pass
W	lb	74,500	74,474	-0.04		Pass
V⅓ at midbay	mips	9,890	9,880	-0.10		Pass
φW		0.743	0.743	+0.02		Pass
V⅓, scaled	mips	7,350	7,342	-0.10		Pass

DG11-6.2: Sensitive equipment, waveform peak acceleration 0.1 %g

Source: AISC Design Guide 11, 2nd Ed. (2016), Example 6.2, pp. pp. 76-79. Calculation: Floor vibration.

DG11-6.2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Δb	in.	0.103	0.103	+0.42		Pass
fb	Hz	11.00	11.00	-0.03		Pass
Δg	in.	0.125	0.125	-0.35		Pass
fg	Hz	10.00	10.02	+0.20		Pass
Bb	ft	32.60	32.62	+0.06		Pass
Bg	ft	58.00	58.00	+0.01		Pass
W	lb	202,000	201,693	-0.15		Pass
φE		0.716	0.716	+0.02		Pass
φW		0.629	0.629	+0.05		Pass
ap/g	%g	0.100	0.100	+0.25		Pass

DG11-6.3-VS: The floor of 6.2 against VC-C, very slow walking

Source: AISC Design Guide 11, 2nd Ed. (2016), Example 6.3, pp. pp. 79-80. Calculation: Floor vibration.

DG11-6.3-VS · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
V⅓, scaled	mips	290.0	279.0	-3.80		Deviation DG11-CHART
DG11-CHART: the Guide reads V W from its Figure 6-15 to two digits; the program evaluates Equation 6-3, the curve behind the figure						

DG11-6.3-S: The floor of 6.2 against VC-C, slow walking

Source: AISC Design Guide 11, 2nd Ed. (2016), Example 6.3, pp. pp. 79-80. Calculation: Floor vibration.

DG11-6.3-S · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
V⅓, scaled	mips	468.0	475.5	+1.61		Pass

DG11-6.3-M: The floor of 6.2 against VC-C, moderate walking

Source: AISC Design Guide 11, 2nd Ed. (2016), Example 6.3, pp. pp. 79-80. Calculation: Floor vibration.

DG11-6.3-M · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
V⅓, scaled	mips	647.0	643.2	-0.58		Pass

DG11-6.3-F: The floor of 6.2 against VC-C, fast walking

Source: AISC Design Guide 11, 2nd Ed. (2016), Example 6.3, pp. pp. 79-80. Calculation: Floor vibration.

DG11-6.3-F · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
V⅓, scaled	mips	825.0	831.4	+0.77		Pass

DG11-6.4-VS: Hospital patient room, very slow walking

Source: AISC Design Guide 11, 2nd Ed. (2016), Example 6.4, pp. pp. 80-81. Calculation: Floor vibration.

DG11-6.4-VS · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
V⅓	mips	2,220	2,222	+0.09		Pass

DG11-6.4-F: Hospital patient room, fast walking in the corridor

Source: AISC Design Guide 11, 2nd Ed. (2016), Example 6.4, pp. pp. 80-81. Calculation: Floor vibration.

DG11-6.4-F · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
V⅓	mips	6,780	6,775	-0.07		Pass

FP-CANT: Open tank, water 10 ft, cantilever wall, no backfill

Source: Hand calculation (closed form, ASCE/SEI 7-22 2.3, 2.4, 3.2). Calculation: Fluid and hydrostatic pressure.

FP-CANT · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Liquid pressure at the base 62.4 × 10	psf	624.0	624.0	+0.00		Pass
1.4 × γ d³ / 6 (inside face)	kip-ft	14.56	14.56	-0.00		Pass
1.4 × γ d² / 2 (base shear)	kip/ft	4.368	4.368	-0.00		Pass

FP-CANT · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
γ d³ / 6	kip-ft	10.40	10.40	-0.00		Pass

FP-PROP: Covered tank full to 12 ft, wall fixed at the base and pinned at the top

Source: Hand calculation (closed form, ASCE/SEI 7-22 2.3, 2.4, 3.2). Calculation: Fluid and hydrostatic pressure.

FP-PROP · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1.4 w0 L² / 15 at the base	kip-ft	10.06	10.06	-0.00		Pass
1.4 × 0.02981 w0 L² in the span	kip-ft	4.501	4.500	-0.00		Pass
1.4 w0 L / 10 at the top	kip/ft	1.258	1.258	-0.00		Pass
1.4 × 2 w0 L / 5 at the base	kip/ft	5.032	5.032	+0.00		Pass

FP-SOIL: Empty pit, dry backfill 12 ft, K = 0.5, 120 pcf

Source: Hand calculation (closed form, ASCE/SEI 7-22 2.3, 2.4, 3.2). Calculation: Fluid and hydrostatic pressure.

FP-SOIL · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1.6 × K γ H³ / 6 (outside face)	kip-ft	27.65	27.65	-0.00		Pass

FP-SOIL · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
K γ H³ / 6	kip-ft	17.28	17.28	-0.00		Pass

FP-FLOAT: Default pit: 20 × 15 ft, 18 in. slab, 3 ft projection, water 5 ft below grade

Source: Hand calculation (closed form, ASCE/SEI 7-22 2.3, 2.4, 3.2). Calculation: Fluid and hydrostatic pressure.

FP-FLOAT · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Uplift 62.4 × 8.5 × 644 ft²	kips	341.6	341.6	-0.00		Pass
Dead load: walls 133.2 + slab 144.9 + soil 398.25	kips	676.4	676.4	+0.00		Pass
1.6 U (2.3.1)	kips	546.5	546.5	-0.00		Pass
0.9 D	kips	608.7	608.7	-0.00		Pass

FP-FLOAT · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
0.6 D (2.4.1)	kips	405.8	405.8	+0.00		Pass
1.0 U	kips	341.6	341.6	-0.00		Pass

FP-237: The same pit with the 2.3.7 alternative: groundwater with 1.0

Source: Hand calculation (closed form, ASCE/SEI 7-22 2.3, 2.4, 3.2). Calculation: Fluid and hydrostatic pressure.

FP-237 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1.0 U (2.3.7)	kips	341.6	341.6	-0.00		Pass

FR-1: Fixed-fixed beam under uniform load

Source: Hand calculation (closed form), pp. wL²/12, wL²/24. Calculation: 2-D frame analysis.

FR-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
End moment (hogging)	kip-ft	-33.33	-33.33	+0.00		Pass
Midspan moment	kip-ft	16.67	16.67	-0.00		Pass
End reaction	kips	10.00	10.00	+0.00		Pass

FR-2: Propped cantilever under uniform load

Source: Hand calculation (closed form), pp. wL²/8, 3wL/8, 9wL²/128. Calculation: 2-D frame analysis.

FR-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fixed-end moment	kip-ft	-50.00	-50.00	-0.00		Pass
Roller reaction	kips	7.500	7.500	+0.00		Pass
Largest sagging moment	kip-ft	28.12	28.12	+0.00		Pass

FR-3: Two equal continuous spans under uniform load

Source: Hand calculation (closed form), pp. wL²/8, 1.25wL, 0.375wL. Calculation: 2-D frame analysis.

FR-3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Interior support moment	kip-ft	-50.00	-50.00	-0.00		Pass
Interior reaction	kips	25.00	25.00	+0.00		Pass
End reaction	kips	7.500	7.500	+0.00		Pass

FR-4: Fixed-base portal frame under lateral load (slope-deflection)

Source: Hand calculation (closed form), pp. 0.2857 Hh, 0.2143 Hh, Hh³/(16.8EI). Calculation: 2-D frame analysis.

FR-4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Column base moment	kip-ft	34.29	34.29	+0.00		Pass
Column top moment	kip-ft	25.71	25.71	+0.00		Pass
Base shear, each column	kips	5.000	5.000	+0.00		Pass
Sway at the beam level	in.	0.061	0.061	+0.00		Pass

FR-5: Three-bar truss (members pinned both ends)

Source: Hand calculation (closed form), pp. N = P/(2 sin α). Calculation: 2-D frame analysis.

FR-5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Diagonal axial force	kips	-8.333	-8.333	+0.00		Pass
Chord axial force	kips	6.667	6.667	-0.01		Pass
Support reaction	kips	5.000	5.000	+0.00		Pass

UD-11.5: Non-sway frame: fixed column with lateral load, fixed-end beam with point load

Source: F. Udoeyo, Structural Analysis (Temple University Press, 2020, open textbook), pp. Example 11.5, pp. 335-339 (PDF). Calculation: 2-D frame analysis.

The textbook states EI = constant but writes every slope-deflection equation with the same K = I/L for the 10 ft column and the 6 ft beam; the inputs give the column I × 10/6 so that both members have that same K, which is the structure the printed answers solve. With truly equal I the app gives 16.98 / 16.04 / 14.48 kip-ft.

UD-11.5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
M_AB (column base)	kip-ft	17.09	17.08	-0.04		Pass
M_BA = M_BC	kip-ft	15.83	15.83	+0.02		Pass
M_CB (beam fixed end)	kip-ft	14.58	14.58	+0.03		Pass
A_x	kips	10.13	10.13	-0.05		Pass
A_y	kips	10.20	10.21	+0.08		Pass
C_y	kips	9.800	9.792	-0.08		Pass
C_x	kips	9.870	9.875	+0.05		Pass

UD-12.3: Non-sway frame by moment distribution: beam over a column, propped end

Source: F. Udoeyo, Structural Analysis (Temple University Press, 2020, open textbook), pp. Example 12.3, pp. 361-363 (PDF). Calculation: 2-D frame analysis.

UD-12.3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
M_AB	kip-ft	12.48	12.53	+0.41		Pass
M_BA	kip-ft	60.37	60.27	-0.16		Pass
M_BC	kip-ft	75.31	75.36	+0.07		Pass
M_BD	kip-ft	14.94	15.09	+1.01		Deviation UDOEYO-12.3-MD
UDOEYO-12.3-MD: two moment-distribution cycles with DF rounded to 0.01						
M_DB	kip-ft	7.470	7.545	+1.01		Deviation UDOEYO-12.3-MD
UDOEYO-12.3-MD: two moment-distribution cycles with DF rounded to 0.01						

UD-12.5: Non-sway frame by moment distribution: column fixed at both ends, pinned cantilever beam

Source: F. Udoeyo, Structural Analysis (Temple University Press, 2020, open textbook), pp. Example 12.5, pp. 366-367 (PDF). Calculation: 2-D frame analysis.

SI input (m, kN/m; E and I entered in MPa and mm^4, equal in all members). Published kN·m are converted to the internal kip-ft. The printed distribution factors are rounded to 0.36 / 0.36 / 0.28; the exact values give 13.30 / 26.59 / 53.18 kN·m, within 1 %.

UD-12.5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
M_AB = M_CB (kN·m)	kip-ft	9.714	9.806	+0.95		Pass
M_BA = M_BC (kN·m)	kip-ft	19.42	19.61	+0.99		Pass
M_BD (kN·m)	kip-ft	39.38	39.22	-0.39		Pass

AISC-17F: Table 3-22 case 17 as a frame: fixed-fixed beam, point load at a = 5 ft of 20 ft

Source: AISC Steel Construction Manual, 16th Ed., Table 3-22, pp. p. 3-220 (PDF 444). Calculation: 2-D frame analysis.

AISC-17F · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
M1 = Pab²/l²	kip-ft	-28.12	-28.12	-0.00		Pass
M2 = Pa²b/l²	kip-ft	-9.375	-9.375	-0.00		Pass
Ma = 2Pa²b²/l³	kip-ft	14.06	14.06	+0.00		Pass
R1 = Pb²(3a + b)/l³	kips	8.438	8.438	+0.00		Pass

AISC-39F: Table 3-22 case 39 as a frame: three equal 20 ft spans, w = 1 kip/ft

Source: AISC Steel Construction Manual, 16th Ed., Table 3-22, pp. p. 3-229 (PDF 453). Calculation: 2-D frame analysis.

AISC-39F · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
RA = 0.400wl	kips	8.000	8.000	+0.00		Pass
RB = 1.10wl	kips	22.00	22.00	+0.00		Pass
MB = −0.100wl²	kip-ft	-40.00	-40.00	-0.00		Pass
End span M+ = 0.0800wl²	kip-ft	32.00	31.94	-0.17		Pass
Center span M+ = 0.0250wl²	kip-ft	10.00	10.00	+0.00		Pass

C.1A: Moment frame by the direct analysis method, with a leaning column

Source: AISC Design Examples v16.0, Example C.1A, pp. C-2 to C-6 (PDF 20 to 24). Calculation: 2-D frame analysis.

τb = 1.0 verified as in the example.

C.1A · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Notional load Ni	kips	0.576	0.576	+0.00		Pass
Δ1st	in.	0.181	0.181	+0.09		Pass
Δ2nd	in.	0.290	0.297	+2.53		Deviation C1-DRIFT2
C1-DRIFT2: the printed second-order drift is below a rigorous P-Δ and P-δ solution; the forces agree						
Δ2nd/Δ1st		1.600	1.641	+2.58		Deviation C1-DRIFT2
C1-DRIFT2: the printed second-order drift is below a rigorous P-Δ and P-δ solution; the forces agree						
M top of column B	kip-ft	109.0	108.6	-0.40		Pass
M top of column C	kip-ft	127.0	127.2	+0.15		Pass
Base shear B	kips	5.520	5.518	-0.04		Pass
Base shear C	kips	6.260	6.270	+0.17		Pass
Axial B	kips	71.40	71.38	-0.03		Pass
Axial C	kips	72.60	72.62	+0.03		Pass
αPr/Pns of column C		0.076	0.076	+0.06		Pass

C.1A · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Notional load Ni	kips	0.614	0.614	+0.07		Pass
Δ1st at 1.6 ×	in.	0.193	0.193	+0.12		Pass
Δ2nd at 1.6 ×	in.	0.321	0.331	+3.24		Deviation C1-DRIFT2
C1-DRIFT2: the printed second-order drift is below a rigorous P-Δ and P-δ solution; the forces agree						
Δ2nd/Δ1st		1.660	1.715	+3.31		Deviation C1-DRIFT2
C1-DRIFT2: the printed second-order drift is below a rigorous P-Δ and P-δ solution; the forces agree						
M top of column B	kip-ft	72.20	72.08	-0.17		Pass
M top of column C	kip-ft	84.80	85.03	+0.27		Pass
Base shear B	kips	3.680	3.670	-0.26		Pass
Base shear C	kips	4.180	4.186	+0.13		Pass
Axial B	kips	47.60	47.57	-0.07		Pass
Axial C	kips	48.40	48.43	+0.07		Pass
αPr/Pns of column C		0.081	0.081	+0.05		Pass

C.1B: The same frame by the effective length method

Source: AISC Design Examples v16.0, Example C.1B, pp. C-7 to C-12 (PDF 25 to 30). Calculation: 2-D frame analysis.

Kx by the story stiffness approach of Commentary Eq. C-A-7-5, as printed, for the example's direction of the notional load; the app designs with the larger of both directions.

C.1B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Δ1st	in.	0.145	0.145	-0.05		Pass
Δ2nd	in.	0.204	0.211	+3.30		Deviation C1-DRIFT2
C1-DRIFT2: the printed second-order drift is below a rigorous P-Δ and P-δ solution; the forces agree						
Δ2nd/Δ1st		1.410	1.454	+3.12		Deviation C1-DRIFT2
C1-DRIFT2: the printed second-order drift is below a rigorous P-Δ and P-δ solution; the forces agree						
M top of column B	kip-ft	110.0	109.7	-0.24		Pass
M top of column C	kip-ft	126.0	126.3	+0.22		Pass
Base shear B	kips	5.560	5.550	-0.17		Pass
Base shear C	kips	6.240	6.251	+0.18		Pass
Axial B	kips	71.50	71.45	-0.07		Pass
Axial C	kips	72.50	72.55	+0.07		Pass
RM		0.925	0.925	+0.00		Pass
Kx of column C		3.450	3.436	-0.42		Pass

C.1B · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Δ1st at 1.6 ×	in.	0.155	0.155	-0.26		Pass
Δ2nd at 1.6 ×	in.	0.223	0.232	+3.96		Deviation C1-DRIFT2
C1-DRIFT2: the printed second-order drift is below a rigorous P-Δ and P-δ solution; the forces agree						
Δ2nd/Δ1st		1.440	1.500	+4.14		Deviation C1-DRIFT2
C1-DRIFT2: the printed second-order drift is below a rigorous P-Δ and P-δ solution; the forces agree						
M top of column B	kip-ft	73.10	72.96	-0.19		Pass
M top of column C	kip-ft	84.10	84.33	+0.28		Pass
Base shear B	kips	3.700	3.695	-0.14		Pass
Base shear C	kips	4.160	4.171	+0.25		Pass
Axial B	kips	47.60	47.62	+0.04		Pass
Axial C	kips	48.40	48.38	-0.04		Pass
RM		0.925	0.925	+0.00		Pass
Kx of column C		3.460	3.435	-0.72		Pass

C.1C: The same frame by the first-order analysis method

Source: AISC Design Examples v16.0, Example C.1C, pp. C-13 to C-17 (PDF 31 to 35). Calculation: 2-D frame analysis.

B2 is read from the first-order results as printed. The example finds the method invalid under ASD (1.54 > 1.5); the app reads NG the same way.

C.1C · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Additional lateral load Ni	kips	1.210	1.210	-0.03		Pass
Δ1st	in.	0.304	0.304	+0.11		Pass
M top of column B	kip-ft	108.0	106.4	-1.47		Deviation C1C-108
C1C-108: the printed moment is not the printed shear times the height						
M top of column C	kip-ft	131.0	130.6	-0.31		Pass
Base shear B	kips	5.320	5.320	+0.01		Pass
Base shear C	kips	6.530	6.530	-0.00		Pass
Axial B	kips	71.20	71.19	-0.01		Pass
Axial C	kips	72.80	72.81	+0.01		Pass
RM		0.925	0.925	+0.00		Pass
Pe story	kips	884.0	885.7	+0.20		Pass
B2		1.480	1.482	+0.12		Pass
0.5 Pns	kips	478.0	477.5	-0.10		Pass
0.08 Pe of the beam	kips	108.0	108.1	+0.12		Pass

C.1C · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Additional lateral load Ni	kips	0.806	0.806	+0.05		Pass
Δ1st	in.	0.203	0.203	-0.05		Pass
M top of column B	kip-ft	70.90	70.94	+0.05		Pass
M top of column C	kip-ft	87.10	87.07	-0.04		Pass
Base shear B	kips	3.550	3.547	-0.09		Pass
Base shear C	kips	4.350	4.353	+0.08		Pass
Axial B	kips	47.50	47.46	-0.08		Pass
Axial C	kips	48.50	48.54	+0.08		Pass
Pe story	kips	875.0	885.7	+1.23		Deviation C1C-875
C1C-875: the printed Pe story rounds the story shear to 0.800 kip						
B2 (over 1.5: the method is not permitted)		1.540	1.531	-0.58		Pass

BENCH-1-P0: Case 1, pinned beam-column, 0.200 kip/ft, P = 0 kips, W14X48, 28 ft, 4 segments, with shear deformation

Source: AISC 360-22 Commentary C2, pp. Commentary p. 16.1-337 (PDF 405), Figs. C-C2.2, C-C2.3. Calculation: 2-D frame analysis.

BENCH-1-P0 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mmid = 235 kip-in.	kip-ft	19.58	19.60	+0.09		Pass
Δmid	in.	0.202	0.202	-0.23		Pass

BENCH-1-P0-noshear: Case 1, pinned beam-column, 0.200 kip/ft, P = 0 kips, shear deformation off (the values in brackets)

Source: AISC 360-22 Commentary C2, pp. Commentary p. 16.1-337 (PDF 405), Figs. C-C2.2, C-C2.3. Calculation: 2-D frame analysis.

BENCH-1-P0-noshear · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mmid = 235 kip-in.	kip-ft	19.58	19.60	+0.09		Pass
Δmid	in.	0.197	0.197	+0.03		Pass

BENCH-1-P150: Case 1, pinned beam-column, 0.200 kip/ft, P = 150 kips, W14X48, 28 ft, 4 segments, with shear deformation

Source: AISC 360-22 Commentary C2, pp. Commentary p. 16.1-337 (PDF 405), Figs. C-C2.2, C-C2.3. Calculation: 2-D frame analysis.

BENCH-1-P150 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mmid = 270 kip-in.	kip-ft	22.50	22.48	-0.09		Pass
Δmid	in.	0.230	0.230	+0.19		Pass

BENCH-1-P150-noshear: Case 1, pinned beam-column, 0.200 kip/ft, P = 150 kips, shear deformation off (the values in brackets)

Source: AISC 360-22 Commentary C2, pp. Commentary p. 16.1-337 (PDF 405), Figs. C-C2.2, C-C2.3. Calculation: 2-D frame analysis.

BENCH-1-P150-noshear · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mmid = 269 kip-in.	kip-ft	22.42	22.41	-0.04		Pass
Δmid	in.	0.224	0.225	+0.26		Pass

BENCH-1-P300: Case 1, pinned beam-column, 0.200 kip/ft, P = 300 kips, W14X48, 28 ft, 4 segments, with shear deformation

Source: AISC 360-22 Commentary C2, pp. Commentary p. 16.1-337 (PDF 405), Figs. C-C2.2, C-C2.3. Calculation: 2-D frame analysis.

BENCH-1-P300 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mmid = 316 kip-in.	kip-ft	26.33	26.32	-0.04		Pass
Δmid	in.	0.269	0.269	-0.01		Pass

BENCH-1-P300-noshear: Case 1, pinned beam-column, 0.200 kip/ft, P = 300 kips, shear deformation off (the values in brackets)

Source: AISC 360-22 Commentary C2, pp. Commentary p. 16.1-337 (PDF 405), Figs. C-C2.2, C-C2.3. Calculation: 2-D frame analysis.

BENCH-1-P300-noshear · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mmid = 313 kip-in.	kip-ft	26.08	26.13	+0.16		Pass
Δmid	in.	0.261	0.261	+0.00		Pass

BENCH-1-P450: Case 1, pinned beam-column, 0.200 kip/ft, P = 450 kips, W14X48, 28 ft, 4 segments, with shear deformation

Source: AISC 360-22 Commentary C2, pp. Commentary p. 16.1-337 (PDF 405), Figs. C-C2.2, C-C2.3. Calculation: 2-D frame analysis.

BENCH-1-P450 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mmid = 380 kip-in.	kip-ft	31.67	31.71	+0.13		Pass
Δmid	in.	0.322	0.323	+0.28		Pass

BENCH-1-P450-noshear: Case 1, pinned beam-column, 0.200 kip/ft, P = 450 kips, shear deformation off (the values in brackets)

Source: AISC 360-22 Commentary C2, pp. Commentary p. 16.1-337 (PDF 405), Figs. C-C2.2, C-C2.3. Calculation: 2-D frame analysis.

BENCH-1-P450-noshear · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mmid = 375 kip-in.	kip-ft	31.25	31.28	+0.10		Pass
Δmid	in.	0.311	0.311	+0.16		Pass

BENCH-2-P0: Case 2, fixed-base cantilever, 1.0 kip at the top, P = 0 kips, W14X48, 28 ft, 4 segments, with shear deformation

Source: AISC 360-22 Commentary C2, pp. Commentary p. 16.1-337 (PDF 405), Figs. C-C2.2, C-C2.3. Calculation: 2-D frame analysis.

BENCH-2-P0 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mbase = 336 kip-in.	kip-ft	28.00	28.00	-0.00		Pass
Δtip	in.	0.907	0.907	+0.03		Pass

BENCH-2-P0-noshear: Case 2, fixed-base cantilever, 1.0 kip at the top, P = 0 kips, shear deformation off (the values in brackets)

Source: AISC 360-22 Commentary C2, pp. Commentary p. 16.1-337 (PDF 405), Figs. C-C2.2, C-C2.3. Calculation: 2-D frame analysis.

BENCH-2-P0-noshear · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mbase = 336 kip-in.	kip-ft	28.00	28.00	+0.00		Pass
Δtip	in.	0.901	0.901	-0.02		Pass

BENCH-2-P100: Case 2, fixed-base cantilever, 1.0 kip at the top, P = 100 kips, W14X48, 28 ft, 4 segments, with shear deformation

Source: AISC 360-22 Commentary C2, pp. Commentary p. 16.1-337 (PDF 405), Figs. C-C2.2, C-C2.3. Calculation: 2-D frame analysis.

BENCH-2-P100 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mbase = 470 kip-in.	kip-ft	39.17	39.19	+0.07		Pass
Δtip	in.	1.340	1.343	+0.25		Pass

BENCH-2-P100-noshear: Case 2, fixed-base cantilever, 1.0 kip at the top, P = 100 kips, shear deformation off (the values in brackets)

Source: AISC 360-22 Commentary C2, pp. Commentary p. 16.1-337 (PDF 405), Figs. C-C2.2, C-C2.3. Calculation: 2-D frame analysis.

BENCH-2-P100-noshear · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mbase = 469 kip-in.	kip-ft	39.08	39.09	+0.01		Pass
Δtip	in.	1.330	1.331	+0.05		Pass

BENCH-2-P150: Case 2, fixed-base cantilever, 1.0 kip at the top, P = 150 kips, W14X48, 28 ft, 4 segments, with shear deformation

Source: AISC 360-22 Commentary C2, pp. Commentary p. 16.1-337 (PDF 405), Figs. C-C2.2, C-C2.3. Calculation: 2-D frame analysis.

BENCH-2-P150 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mbase = 601 kip-in.	kip-ft	50.08	50.15	+0.14		Pass
Δtip	in.	1.770	1.772	+0.13		Pass

BENCH-2-P150-noshear: Case 2, fixed-base cantilever, 1.0 kip at the top, P = 150 kips, shear deformation off (the values in brackets)

Source: AISC 360-22 Commentary C2, pp. Commentary p. 16.1-337 (PDF 405), Figs. C-C2.2, C-C2.3. Calculation: 2-D frame analysis.

BENCH-2-P150-noshear · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mbase = 598 kip-in.	kip-ft	49.83	49.89	+0.11		Pass
Δtip	in.	1.750	1.751	+0.06		Pass

BENCH-2-P200: Case 2, fixed-base cantilever, 1.0 kip at the top, P = 200 kips, W14X48, 28 ft, 4 segments, with shear deformation

Source: AISC 360-22 Commentary C2, pp. Commentary p. 16.1-337 (PDF 405), Figs. C-C2.2, C-C2.3. Calculation: 2-D frame analysis.

BENCH-2-P200 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mbase = 856 kip-in.	kip-ft	71.33	71.49	+0.22		Pass
Δtip	in.	2.600	2.609	+0.36		Pass

BENCH-2-P200-noshear: Case 2, fixed-base cantilever, 1.0 kip at the top, P = 200 kips, shear deformation off (the values in brackets)

Source: AISC 360-22 Commentary C2, pp. Commentary p. 16.1-337 (PDF 405), Figs. C-C2.2, C-C2.3. Calculation: 2-D frame analysis.

BENCH-2-P200-noshear · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mbase = 848 kip-in.	kip-ft	70.67	70.75	+0.11		Pass
Δtip	in.	2.560	2.565	+0.19		Pass

DG28-3.2-Comb7: Warehouse moment frame by the direct analysis method, Comb7: column C1 and beam B1

Source: AISC Design Guide 28, Example 3.2, Table 3-12, pp. p. 56 (PDF 64). Calculation: 2-D frame analysis.

The guide does not print its model. This is our reconstruction of one line of the building (one eleventh of the gravity and lateral load, its own 40 ft of roof on the end beams), so a miss may be ours or theirs: recorded as DG32-MODEL, never fitted.

DG28-3.2-Comb7 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C1 Pr	kips	74.80	74.78	-0.03		Pass
C1 Mr = 2720 kip-in.	kip-ft	226.7	226.4	-0.12		Pass
B1 midspan Mr = 6940 kip-in.	kip-ft	578.3	579.0	+0.12		Pass

DG28-3.2-Comb8: Warehouse moment frame by the direct analysis method, Comb8: column C1 and beam B1

Source: AISC Design Guide 28, Example 3.2, Table 3-12, pp. p. 56 (PDF 64). Calculation: 2-D frame analysis.

The guide does not print its model. This is our reconstruction of one line of the building (one eleventh of the gravity and lateral load, its own 40 ft of roof on the end beams), so a miss may be ours or theirs: recorded as DG32-MODEL, never fitted.

DG28-3.2-Comb8 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C1 Pr	kips	80.90	80.75	-0.19		Pass
C1 Mr = 5660 kip-in.	kip-ft	471.7	465.2	-1.36		Deviation DG32-MODEL
DG32-MODEL: our reconstruction of one line of the building, the guide does not print its model						
B1 midspan Mr = 5460 kip-in.	kip-ft	455.0	460.1	+1.11		Deviation DG32-MODEL
DG32-MODEL: our reconstruction of one line of the building, the guide does not print its model						

DG28-3.2-Comb11: Warehouse moment frame by the direct analysis method, Comb11: column C1 and beam B1

Source: AISC Design Guide 28, Example 3.2, Table 3-12, pp. p. 56 (PDF 64). Calculation: 2-D frame analysis.

The guide does not print its model. This is our reconstruction of one line of the building (one eleventh of the gravity and lateral load, its own 40 ft of roof on the end beams), so a miss may be ours or theirs: recorded as DG32-MODEL, never fitted.

DG28-3.2-Comb11 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C1 Pr	kips	35.50	35.68	+0.51		Pass
C1 Mr = 3440 kip-in.	kip-ft	286.7	281.6	-1.78		Deviation DG32-MODEL
DG32-MODEL: our reconstruction of one line of the building, the guide does not print its model						
B1 midspan Mr = 6840 kip-in.	kip-ft	570.0	569.2	-0.14		Pass

DG28-3.2-Comb12: Warehouse moment frame by the direct analysis method, Comb12: column C1 and beam B1

Source: AISC Design Guide 28, Example 3.2, Table 3-12, pp. p. 56 (PDF 64). Calculation: 2-D frame analysis.

The guide does not print its model. This is our reconstruction of one line of the building (one eleventh of the gravity and lateral load, its own 40 ft of roof on the end beams), so a miss may be ours or theirs: recorded as DG32-MODEL, never fitted.

DG28-3.2-Comb12 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C1 Pr	kips	60.70	60.42	-0.47		Pass
C1 Mr = 8610 kip-in.	kip-ft	717.5	707.9	-1.34		Deviation DG32-MODEL
DG32-MODEL: our reconstruction of one line of the building, the guide does not print its model						
B1 midspan Mr = 822 kip-in.	kip-ft	68.50	73.26	+6.95		Deviation DG32-MODEL
DG32-MODEL: our reconstruction of one line of the building, the guide does not print its model						

DG28-3.2-Comb15: Warehouse moment frame by the direct analysis method, Comb15: column C1 and beam B1

Source: AISC Design Guide 28, Example 3.2, Table 3-12, pp. p. 56 (PDF 64). Calculation: 2-D frame analysis.

The guide does not print its model. This is our reconstruction of one line of the building (one eleventh of the gravity and lateral load, its own 40 ft of roof on the end beams), so a miss may be ours or theirs: recorded as DG32-MODEL, never fitted.

DG28-3.2-Comb15 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C1 Pr	kips	64.10	64.37	+0.43		Pass
C1 Mr = 2420 kip-in.	kip-ft	201.7	189.9	-5.84		Deviation DG32-MODEL
DG32-MODEL: our reconstruction of one line of the building, the guide does not print its model						
B1 midspan Mr = 9490 kip-in.	kip-ft	790.8	786.9	-0.50		Pass

DG28-3.2-Comb16: Warehouse moment frame by the direct analysis method, Comb16: column C1 and beam B1

Source: AISC Design Guide 28, Example 3.2, Table 3-12, pp. p. 56 (PDF 64). Calculation: 2-D frame analysis.

The guide does not print its model. This is our reconstruction of one line of the building (one eleventh of the gravity and lateral load, its own 40 ft of roof on the end beams), so a miss may be ours or theirs: recorded as DG32-MODEL, never fitted.

DG28-3.2-Comb16 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C1 Pr	kips	91.60	91.10	-0.55		Pass
C1 Mr = 10800 kip-in.	kip-ft	900.0	879.3	-2.30		Deviation DG32-MODEL
DG32-MODEL: our reconstruction of one line of the building, the guide does not print its model						
B1 midspan Mr = 2910 kip-in.	kip-ft	242.5	252.3	+4.06		Deviation DG32-MODEL
DG32-MODEL: our reconstruction of one line of the building, the guide does not print its model						

DG28-3.2-drift-Comb3: The same frame at nominal stiffness with notional loads, Comb3: roof drift

Source: AISC Design Guide 28, Example 3.2, Table 3-11, pp. p. 55 (PDF 63). Calculation: 2-D frame analysis.

The guide does not print its model. This is our reconstruction of one line of the building (one eleventh of the gravity and lateral load, its own 40 ft of roof on the end beams), so a miss may be ours or theirs: recorded as DG32-MODEL, never fitted.

DG28-3.2-drift-Comb3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Δ1st	in.	0.206	0.215	+4.27		Deviation DG32-MODEL
DG32-MODEL: our reconstruction of one line of the building, the guide does not print its model						
Δ2nd	in.	0.289	0.296	+2.26		Deviation DG32-MODEL
DG32-MODEL: our reconstruction of one line of the building, the guide does not print its model						

DG28-3.2-drift-Comb7: The same frame at nominal stiffness with notional loads, Comb7: roof drift

Source: AISC Design Guide 28, Example 3.2, Table 3-11, pp. p. 55 (PDF 63). Calculation: 2-D frame analysis.

The guide does not print its model. This is our reconstruction of one line of the building (one eleventh of the gravity and lateral load, its own 40 ft of roof on the end beams), so a miss may be ours or theirs: recorded as DG32-MODEL, never fitted.

DG28-3.2-drift-Comb7 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Δ1st	in.	0.397	0.414	+4.34		Deviation DG32-MODEL
DG32-MODEL: our reconstruction of one line of the building, the guide does not print its model						
Δ2nd	in.	0.890	0.890	+0.02		Pass

DG28-3.2-drift-Comb11: The same frame at nominal stiffness with notional loads, Comb11: roof drift

Source: AISC Design Guide 28, Example 3.2, Table 3-11, pp. p. 55 (PDF 63). Calculation: 2-D frame analysis.

The guide does not print its model. This is our reconstruction of one line of the building (one eleventh of the gravity and lateral load, its own 40 ft of roof on the end beams), so a miss may be ours or theirs: recorded as DG32-MODEL, never fitted.

DG28-3.2-drift-Comb11 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Δ1st	in.	3.000	2.995	-0.17		Pass
Δ2nd	in.	4.560	4.519	-0.90		Pass

DG28-3.2-drift-Comb15: The same frame at nominal stiffness with notional loads, Comb15: roof drift

Source: AISC Design Guide 28, Example 3.2, Table 3-11, pp. p. 55 (PDF 63). Calculation: 2-D frame analysis.

The guide does not print its model. This is our reconstruction of one line of the building (one eleventh of the gravity and lateral load, its own 40 ft of roof on the end beams), so a miss may be ours or theirs: recorded as DG32-MODEL, never fitted.

DG28-3.2-drift-Comb15 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Δ1st	in.	1.770	1.784	+0.77		Pass
Δ2nd	in.	3.980	3.915	-1.62		Deviation DG32-MODEL
DG32-MODEL: our reconstruction of one line of the building, the guide does not print its model						

DG28-3.2-drift-Comb19: The same frame at nominal stiffness with notional loads, Comb19: roof drift

Source: AISC Design Guide 28, Example 3.2, Table 3-11, pp. p. 55 (PDF 63). Calculation: 2-D frame analysis.

The guide does not print its model. This is our reconstruction of one line of the building (one eleventh of the gravity and lateral load, its own 40 ft of roof on the end beams), so a miss may be ours or theirs: recorded as DG32-MODEL, never fitted.

DG28-3.2-drift-Comb19 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Δ1st	in.	2.890	2.877	-0.45		Pass
Δ2nd	in.	3.540	3.518	-0.64		Pass

DG28-D4: Cantilever by the direct analysis method, W10X60, 15 ft, Pu = 440 kips, H = 1.45 + 0.88 kips

Source: AISC Design Guide 28, Fig. D-4, pp. p. 136 (PDF 144). Calculation: 2-D frame analysis.

Fully braced out of plane: Lb and Lcy are entered as 0.1 ft. The figure takes G = E/2(1+ν) = 8,920 ksi at 0.8 E; the app 0.8 × 11,200 = 8,960 ksi.

DG28-D4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Notional load 0.002(440)	kips	0.880	0.880	+0.00		Pass
Δ1st	in.	0.580	0.583	+0.60		Pass
Δ2nd, rigorous P-Δ and P-δ	in.	2.220	2.231	+0.48		Pass
Mu = 1,394 kip-in.	kip-ft	116.2	116.7	+0.49		Pass
H1-1a = 1.00		1.000	0.996	-0.44		Pass

E.1A · 2-D frame analysis: W14X132, pinned ends, Lc = 30 ft: available compressive strength

Source: AISC Design Examples v16.0, Example E.1A, pp. E-5 to E-7. Calculation: 2-D frame analysis.

E.1A · 2-D frame analysis · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φcPn	kips	893.0	893.2	+0.02		Pass

E.1A · 2-D frame analysis · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pn/Ωc	kips	594.0	594.3	+0.05		Pass

F.1-3: W18X50, 35 ft, braced at midspan, Lb = 17.5 ft, Cb = 1.30: available flexural strength

Source: AISC Design Examples v16.0, Examples F.1-3A and F.1-3B, pp. F-9 to F-11. Calculation: 2-D frame analysis.

The example reads the Manual's Table 3-10 chart; the equations here give the same to within 1 %.

F.1-3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cb φMn	kip-ft	289.0	287.8	-0.40		Pass

F.1-3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cb Mn/Ω	kip-ft	192.0	191.5	-0.26		Pass

G.1A: W24X62: available shear strength

Source: AISC Design Examples v16.0, Example G.1A, pp. G-3. Calculation: 2-D frame analysis.

G.1A · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φVn	kips	306.0	305.7	-0.09		Pass

G.1A · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vn/Ω	kips	204.0	203.8	-0.09		Pass

D.1 · 2-D frame analysis: W8X21: tensile yielding of the gross section

Source: AISC Design Examples v16.0, Example D.1, pp. D-6. Calculation: 2-D frame analysis.

Rupture on the net section (the example's other limit state) is not checked in member design, and the chapter and the check say so.

D.1 · 2-D frame analysis · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φtPn, yielding	kips	277.0	277.2	+0.07		Pass

D.1 · 2-D frame analysis · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pn/Ωt, yielding	kips	184.0	184.4	+0.23		Pass

HAND-CANT-P100: Cantilever, W14X48, 28 ft, H = 1 kip, P = 100 kips: M = HL tan(α)/α, y = (HL³/3EI) 3(tan α − α)/α³

Source: Hand calculation (closed form printed in AISC Design Guide 28, Figs. D-2 and D-3), pp. DG28 p. 134. Calculation: 2-D frame analysis.

HAND-CANT-P100 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mbase	kip-ft	39.09	39.09	-0.00		Pass
Δtip	in.	1.331	1.331	-0.00		Pass

HAND-CANT-P200: Cantilever, W14X48, 28 ft, H = 1 kip, P = 200 kips: M = HL tan(α)/α, y = (HL³/3EI) 3(tan α − α)/α³

Source: Hand calculation (closed form printed in AISC Design Guide 28, Figs. D-2 and D-3), pp. DG28 p. 134. Calculation: 2-D frame analysis.

HAND-CANT-P200 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mbase	kip-ft	70.75	70.75	-0.00		Pass
Δtip	in.	2.565	2.565	-0.00		Pass

HAND-PIN-P150: Pinned beam-column, W14X48, 28 ft, w = 0.2 kip/ft, P = 150 kips: M = (wL²/8) 2(sec u − 1)/u²

Source: Hand calculation (closed form printed in AISC Design Guide 28, Figs. D-2 and D-3), pp. DG28 p. 135. Calculation: 2-D frame analysis.

HAND-PIN-P150 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mmid	kip-ft	22.41	22.41	-0.00		Pass
Δmid	in.	0.225	0.225	-0.01		Pass

HAND-PIN-P450: Pinned beam-column, W14X48, 28 ft, w = 0.2 kip/ft, P = 450 kips: M = (wL²/8) 2(sec u − 1)/u²

Source: Hand calculation (closed form printed in AISC Design Guide 28, Figs. D-2 and D-3), pp. DG28 p. 135. Calculation: 2-D frame analysis.

HAND-PIN-P450 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mmid	kip-ft	31.28	31.28	-0.01		Pass
Δmid	in.	0.312	0.311	-0.03		Pass

GB-HC1: Two courses, no batter: base and joint

Source: Hand calculation (closed form). Calculation: Gabion retaining wall.

GB-HC1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Gabion unit weight γs (1 − n)	pcf	115.5	115.5	+0.00		Pass
Sliding force T = Pa cos δ	kip/ft	0.555	0.555	+0.00		Pass
Sliding resistance μN ÷ 1.5	kip/ft	1.333	1.333	+0.00		Pass
Overturning moment	kip-ft	1.110	1.110	+0.00		Pass
Resisting moment ÷ 2.0	kip-ft	6.096	6.096	+0.00		Pass
Joint: sliding force	kip/ft	0.139	0.139	+0.00		Pass
Joint: resistance 0.7 N ÷ 1.5	kip/ft	0.510	0.510	+0.00		Pass

GB-HC2: One course battered back 6°: inclined base

Source: Hand calculation (closed form). Calculation: Gabion retaining wall.

GB-HC2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Coulomb Ka with θ = −6°		0.235	0.235	+0.00		Pass
Driving force along the base (negative: held back by the inclined base)	kip/ft	-0.100	-0.100	-0.00		Pass
Resistance μN ÷ 1.5 (N normal to the base)	kip/ft	0.845	0.845	-0.00		Pass

F13.2-1-80: Figure 13.2-1 at 80 psf

Source: TMS 402-16 Figure 13.2-1, read at the grid lines, pp. p. C-192. Calculation: Glass unit masonry.

F13.2-1-80 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Largest area at 80 psf	ft²	65.00	64.70	-0.46		Pass

F13.2-1-64: Figure 13.2-1 at 64 psf

Source: TMS 402-16 Figure 13.2-1, read at the grid lines, pp. p. C-192. Calculation: Glass unit masonry.

F13.2-1-64 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Largest area at 64 psf	ft²	79.00	79.20	+0.25		Pass

F13.2-1-48: Figure 13.2-1 at 48 psf

Source: TMS 402-16 Figure 13.2-1, read at the grid lines, pp. p. C-192. Calculation: Glass unit masonry.

F13.2-1-48 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Largest area at 48 psf	ft²	100.0	100.5	+0.50		Pass

F13.2-1-32: Figure 13.2-1 at 32 psf

Source: TMS 402-16 Figure 13.2-1, read at the grid lines, pp. p. C-192. Calculation: Glass unit masonry.

F13.2-1-32 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Largest area at 32 psf	ft²	141.0	141.0	+0.00		Pass

F13.2-1-16: Figure 13.2-1 at 16 psf

Source: TMS 402-16 Figure 13.2-1, read at the grid lines, pp. p. C-192. Calculation: Glass unit masonry.

F13.2-1-16 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Largest area at 16 psf	ft²	220.0	220.0	+0.00		Pass

13.2.2: Exterior thin units

Source: TMS 402-16 Chapter 13, read in the TMS 402/602-16 volume, pp. p. C-193. Calculation: Glass unit masonry.

13.2.2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Thin units outside: 100 ft²	ft²	100.0	100.0	+0.00		Pass
Width limit 15 ft	ft	15.00	15.00	+0.00		Pass
Height limit 10 ft	ft	10.00	10.00	+0.00		Pass
Pressure limit 32 psf	psf	32.00	32.00	+0.00		Pass

13.2.3: Interior standard units at 10 psf

Source: TMS 402-16 Chapter 13, read in the TMS 402/602-16 volume, pp. p. C-193. Calculation: Glass unit masonry.

13.2.3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Interior standard: 250 ft²	ft²	250.0	250.0	+0.00		Pass
Width limit 25 ft	ft	25.00	25.00	+0.00		Pass
Height limit 20 ft	ft	20.00	20.00	+0.00		Pass

13.2.4: Interior thin units at 10 psf

Source: TMS 402-16 Chapter 13, read in the TMS 402/602-16 volume, pp. p. C-194. Calculation: Glass unit masonry.

13.2.4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Interior thin: 150 ft²	ft²	150.0	150.0	+0.00		Pass

HC-SUPPORT: Support line load, 10 by 8 ft at 30 psf

Source: Hand calculation from TMS 402-16 13.3.3, pp. max(0.6 × 30 × 8/2, 0.6 × 30 × 10/2, 200). Calculation: Glass unit masonry.

HC-SUPPORT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Design line load (the 200 lb/ft minimum governs)	lb/ft	200.0	200.0	+0.00		Pass

HC-SUPPORT-HIGH: Support line load, 14 by 7 ft at 60 psf

Source: Hand calculation from TMS 402-16 13.3.3, pp. 0.6 × 60 × 14/2. Calculation: Glass unit masonry.

HC-SUPPORT-HIGH · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Design line load (jambs)	lb/ft	252.0	252.0	+0.00		Pass

AWC-E1.3 · Glulam and SCL beam: 24F-1.8E SP roof beam with purlin point loads (CL, CV, shear, bearing)

Source: AWC 2015/2018 Structural Wood Design Examples, Example E1.3 (values as tabulated in Trimble Tekla Tedds 2026, Verification Example - Glulam Beam Design (ASD)), pp. AWC pp. 16-20. Calculation: Glulam and SCL beam.

AWC-E1.3 · Glulam and SCL beam · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
M = 1,006,080 in-lb	lb-ft	83,840	83,840	-0.00		Pass
RB		11.41	11.41	+0.00		Pass
Fbx+* = Fbx+ CD	psi	2,760	2,760	+0.00		Pass
CL NDS 2018 example with Ex,min; NDS 2024 5.2.7 uses Ey,min: 0.975		0.978	0.975	-0.35		Pass
CV (x = 20, Southern Pine)		0.951	0.951	+0.01		Pass
Fb' = Fbx+* × lesser of CV, CL	psi	2,625	2,625	+0.00		Pass
fb	psi	2,496	2,494	-0.06		Pass
V at d from the support face	lb	7,918	7,918	-0.01		Pass
Fv' = 265 × 1.15	psi	305.0	304.8	-0.08		Pass
fv	psi	108.0	108.0	-0.03		Pass
Reaction R the example adds the self-weight of the 3 in past each support: +8 lb	lb	12,988	12,980	-0.06		Pass
Fc⊥'	psi	650.0	650.0	+0.00		Pass
fc⊥	psi	433.0	432.7	-0.08		Pass
Total deflection D + S (before camber)	in.	1.843	1.843	-0.01		Pass

TR14-3.1: 24F-V4 ridge beam braced at 4 ft (CV; CL by the TR 14 method)

Source: AWC Technical Report 14, Designing for Lateral-Torsional Stability in Wood Members (2003), Example 3.1, pp. p. 14. Calculation: Glulam and SCL beam.

TR14-3.1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mmax = 36,750 ft-lb → fb	psi	2,400	2,400	-0.00		Pass
Fbx* = 2400 × 1.15	psi	2,760	2,760	+0.00		Pass
CV = (21/28)^0.1 (12/21)^0.1 (5.125/2.5)^0.1		0.987	0.987	+0.00		Pass
CL (TR 14 buckling moment)		0.880	0.857	-2.66		Deviation AWC-TR14-3.1-CL
AWC-TR14-3.1-CL: TR 14 computes CL from its own buckling moment Mcr (an alternative to NDS 3.3.3); the app applies the NDS effective length le = 2.06 lu (CL = 0.857)						
M' = M* × lesser of CV, CL	lb-ft	37,250	36,201	-2.82		Deviation AWC-TR14-3.1-CL
AWC-TR14-3.1-CL: TR 14 computes CL from its own buckling moment Mcr (an alternative to NDS 3.3.3); the app applies the NDS effective length le = 2.06 lu (CL = 0.857)						

HAND-1 · Glulam and SCL beam: 24F-1.8E glulam, simple span, volume factor

Source: Hand calculation (closed form). Calculation: Glulam and SCL beam.

HAND-1 · Glulam and SCL beam · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
CV (Eq. 5.3-1)		0.948	0.948	+0.00		Pass
Fb' = Fbx+ CV	psi	2,274	2,274	+0.00		Pass
fb	psi	1,717	1,717	-0.00		Pass
fv at d from the support	psi	92.41	92.41	+0.00		Pass
Fc⊥'	psi	650.0	650.0	+0.00		Pass
fc⊥	psi	322.0	322.0	-0.00		Pass
Live load deflection	in.	0.666	0.666	-0.00		Pass

HAND-1 · Glulam and SCL beam · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fb'	psi	3,928	3,928	+0.00		Pass
Fv'	psi	457.9	457.9	+0.00		Pass

HAND-2 · Glulam and SCL beam: Two-span glulam, negative moment with Fbx−

Source: Hand calculation (closed form). Calculation: Glulam and SCL beam.

HAND-2 · Glulam and SCL beam · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
fb− at the interior support	psi	693.8	693.8	+0.00		Pass
Fbx−' = Fbx− CV	psi	1,431	1,431	+0.00		Pass

HAND-3 · Glulam and SCL beam: LVL with the size factor and beam stability

Source: Hand calculation (closed form). Calculation: Glulam and SCL beam.

HAND-3 · Glulam and SCL beam · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
CL (Eq. 3.3-6)		0.931	0.931	-0.02		Pass
Fb' = Fb CL CF	psi	2,425	2,424	-0.02		Pass
fb	psi	2,144	2,144	-0.00		Pass

GW-HC1: Rectangular wall, Rankine

Source: Hand calculation (closed form). Calculation: Gravity retaining wall.

GW-HC1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rankine Ka = tan²(45° − φ/2)		0.307	0.307	-0.00		Pass
Overturning moment Pa H/3	kip-ft	3.146	3.146	-0.00		Pass
Resisting moment W b/2 (÷ FS 2.0)	kip-ft	4.640	4.640	+0.00		Pass
Sliding force Pa	kip/ft	1.180	1.180	-0.00		Pass
Bearing pressure at the toe	ksf	2.340	2.340	-0.00		Pass
Plain concrete tension Mu/Sm − Pu/Ag at the base (0.9D + 1.6H)	psi	5.860	5.860	-0.00		Pass

GW-HC2: Trapezoidal wall, Coulomb with wall friction and surcharge

Source: Hand calculation (closed form). Calculation: Gravity retaining wall.

GW-HC2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Coulomb Ka (δ = 21°, vertical back)		0.275	0.275	+0.00		Pass
Overturning moment (horizontal thrusts)	kip-ft	6.422	6.422	+0.00		Pass
Resisting moment (weight, vertical thrusts) ÷ 2.0	kip-ft	8.138	8.138	+0.00		Pass
Sliding resistance (μN + Pp) ÷ 1.5	kip/ft	2.176	2.176	+0.00		Pass
Driving force T	kip/ft	1.798	1.798	+0.00		Pass

CROSSING: Two simple beams crossing at midspan

Source: Hand calculation (closed form). Calculation: Beam grid (grillage).

CROSSING · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Moment in X1	kip-ft	38.57	38.57	+0.00		Pass
Moment in Y1	kip-ft	17.14	17.14	+0.00		Pass
Deflection at the crossing	in.	0.077	0.077	+0.00		Pass

TORSION: Cantilever stub twisting a fixed beam

Source: Hand calculation (closed form). Calculation: Beam grid (grillage).

TORSION · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tip deflection	in.	0.420	0.420	-0.00		Pass
Deflection of X1 at midspan	in.	0.010	0.010	+0.00		Pass
Torque in X1	kip-ft	5.000	5.000	-0.00		Pass
Midspan moment of X1	kip-ft	5.000	5.000	+0.00		Pass
Root moment of Y1	kip-ft	-10.00	-10.00	-0.00		Pass

SINGLE: One simple beam under a uniform load

Source: Hand calculation (closed form). Calculation: Beam grid (grillage).

SINGLE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Midspan moment	kip-ft	50.00	50.00	+0.00		Pass
End shear	kips	10.00	10.00	+0.00		Pass
Midspan deflection	in.	0.124	0.124	+0.00		Pass

GEC4-DE1-UPPER: Design example 1, upper anchor: design load, bond, bar tendon

Source: FHWA GEC 4 (FHWA-IF-99-015, 1999), pp. Appendix A, PDF pp. 213 to 215 (A-7 to A-9). Calculation: Ground anchor.

TH from the apparent pressure diagram of the example; load transfer 100 kN/m (Table 6, medium dense sand and silt); the 32 mm bar is the 1-1/4 in. bar of Table 9.

GEC4-DE1-UPPER · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
DL1 = 168 kN/m × 2.5 m / cos 15°	kips	97.79	97.75	-0.04		Pass
Allowable bond 100 kN/m / 2.0 × 12 m	kips	134.9	134.9	-0.00		Pass
32 mm Grade 150 bar, 0.6 SMTS	kips	112.6	112.5	-0.11		Pass

GEC4-DE1-LOWER: Design example 1, lower anchor: design load, bond length, strand tendon

Source: FHWA GEC 4 (FHWA-IF-99-015, 1999), pp. Appendix A, PDF pp. 213 to 215. Calculation: Ground anchor.

The text copy prints the bond length as 9.8 m (digits reversed); 445 × 2.0 / 100 = 8.9 m.

GEC4-DE1-LOWER · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
DL2 = 172 kN/m × 2.5 m / cos 15°	kips	100.0	100.1	+0.04		Pass
Bond length = 445 kN × 2.0 / 100 kN/m	ft	29.20	29.21	+0.04		Pass
3 strands Grade 270, 0.6 SMTS	kips	105.4	105.5	+0.03		Pass

GEC4-T9-1: Table 9: 1 in. Grade 150 bar

Source: FHWA GEC 4 (FHWA-IF-99-015, 1999), pp. Table 9, PDF p. 98. Calculation: Ground anchor.

GEC4-T9-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ultimate strength fpu Aps (1 in. Gr 150)	kips	127.5	127.5	+0.00		Pass
0.8 fpu Aps (1 in. Gr 150)	kips	102.0	102.0	+0.00		Pass

GEC4-T9-175: Table 9: 1-3/4 in. Grade 150 bar

Source: FHWA GEC 4 (FHWA-IF-99-015, 1999), pp. Table 9, PDF p. 98. Calculation: Ground anchor.

GEC4-T9-175 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
0.6 fpu Aps (1-3/4 in. Gr 150)	kips	240.0	239.4	-0.25		Pass
0.7 fpu Aps (1-3/4 in. Gr 150)	kips	280.0	279.3	-0.25		Pass

GEC4-T9-138-160: Table 9: 1-3/8 in. Grade 160 bar

Source: FHWA GEC 4 (FHWA-IF-99-015, 1999), pp. Table 9, PDF p. 98. Calculation: Ground anchor.

GEC4-T9-138-160 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ultimate strength (1-3/8 in. Gr 160)	kips	252.8	252.8	+0.00		Pass
0.6 fpu Aps (1-3/8 in. Gr 160)	kips	151.7	151.7	-0.01		Pass

GEC4-T10-1: Table 10: one 0.6 in. Grade 270 strand

Source: FHWA GEC 4 (FHWA-IF-99-015, 1999), pp. Table 10, PDF p. 99. Calculation: Ground anchor.

GEC4-T10-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ultimate strength, one strand	kips	58.60	58.59	-0.02		Pass

GA-BOND: Bond stress × perimeter (Table 7 route)

Source: Hand calculation (closed form, FHWA GEC 4 5.3). Calculation: Ground anchor.

GA-BOND · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rate = 2 ksf × π × 0.5 ft	kip/ft	3.142	3.142	-0.00		Pass
Allowable = 30 × 3.1416 / 2	kips	47.12	47.12	+0.01		Pass
Bond length = 2 × 40 / 3.1416	ft	25.46	25.46	+0.02		Pass

GA-OVERBURDEN: Depth of the bond zone center

Source: Hand calculation (closed form, FHWA GEC 4 5.3). Calculation: Ground anchor.

GA-OVERBURDEN · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
zc = 10 + (30 + 20) sin 20°	ft	27.10	27.10	+0.00		Pass

GI-GEC13-RAP: Embankment on rammed aggregate piers

Source: FHWA GEC 13, FHWA-NHI-16-027 (2017), Chapter 5, pp. 4.3.1, pp. 5-46, 5-47. Calculation: Ground improvement.

GI-GEC13-RAP · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
σ'0 = 7.5 ft × (120 − 62.4) = 432 psf	psf	432.0	432.0	+0.00		Pass
Untreated settlement 22 in.	in.	22.00	22.02	+0.07		Pass
Ra = 0.27		0.270	0.274	+1.61		Pass
qg = 6,383 psf	psf	6,383	6,325	-0.91		Pass
suz = 6,383/(65 × 144) = 0.68 in.	in.	0.680	0.676	-0.63		Pass

GI-GEC13-SC: Embankment on stone columns

Source: FHWA GEC 13, FHWA-NHI-16-027 (2017), Chapter 5, pp. 4.3.2, pp. 5-47 to 5-49. Calculation: Ground improvement.

GI-GEC13-SC · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
σ'0 = 25 ft × (120 − 62.4) = 1,440 psf	psf	1,440	1,440	+0.00		Pass
Untreated settlement 27 in. the example prints 2.26 ft = 27 in.	in.	27.00	27.16	+0.59		Pass
Settlement ratio (Priebe curve) 2.7		2.700	2.810	+4.09		Pass

DG34-10.1.7 · Guard or barrier post: HSS1.900X0.145 post, 3 ft 6 in., 200 lb at the top

Source: AISC Design Guide 34 (2018), Example 10.1.7, pp. 78-80. Calculation: Guard or barrier post.

DG34-10.1.7 · Guard or barrier post · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pu	kips	0.338	0.338	-0.01		Pass
Vu	kips	0.320	0.320	+0.00		Pass
Mu	kip-ft	1.120	1.120	+0.00		Pass
φVn	kips	9.270	9.303	+0.35		Pass
φMn	kip-ft	1.450	1.452	+0.17		Pass
Fe at K = 2	ksi	15.90	15.90	-0.03		Pass
Fcr at K = 2	ksi	13.90	13.94	+0.29		Pass
Pn at K = 2	kips	10.40	10.44	+0.40		Pass
φPn	kips	9.360	9.397	+0.40		Pass

DG34-10.1.7 · Guard or barrier post · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pa	kips	0.215	0.215	-0.02		Pass
Va	kips	0.200	0.200	+0.00		Pass
Ma	kip-ft	0.700	0.700	+0.00		Pass
Vn/Ω	kips	6.170	6.189	+0.31		Pass
Mn/Ω	kip-ft	0.966	0.966	+0.04		Pass
Pn/Ω	kips	6.220	6.252	+0.52		Pass

DG34-10.1.8: The post on a C12X20.7 stringer's top flange, Eq. 7-1

Source: AISC Design Guide 34 (2018), Example 10.1.8, pp. 84-85. Calculation: Guard or barrier post.

DG34-10.1.8 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mu	kip-in.	13.40	13.44	+0.30		Pass
Beff	in.	21.00	21.00	-0.01		Pass
Z	in.³	0.418	0.417	-0.13		Pass
S	in.³	0.278	0.278	+0.11		Pass
Mn	kip-in.	15.00	15.03	+0.19		Pass
φMn	kip-in.	13.50	13.53	+0.19		Pass

DG34-10.1.8 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ma	kip-in.	8.400	8.400	+0.00		Pass
Mn/Ω	kip-in.	8.980	8.999	+0.21		Pass

HP-CLAY-1: Single helix in clay

Source: Hand calculation: Iowa DOT TR-800 (2023) 4.6.1 to 4.6.3; IBC 2024 1810.3.3.1.9, pp. 4.6.1. Calculation: Helical pile.

HP-CLAY-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pu = 9·su·An = 6.467 kips	kips	6.467	6.467	+0.00		Pass
ASD available Pu / 2	kips	3.234	3.234	-0.01		Pass

HP-SAND-1: Single helix in sand

Source: Hand calculation: Iowa DOT TR-800 (2023) 4.6.1 to 4.6.3; IBC 2024 1810.3.3.1.9, pp. 4.6.1. Calculation: Helical pile.

HP-SAND-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pu = q'·Nq·An = 12.43 kips	kips	12.43	12.43	-0.03		Pass

HP-CYL: Two helices: cylindrical shear governs

Source: Hand calculation: Iowa DOT TR-800 (2023) 4.6.1 to 4.6.3; IBC 2024 1810.3.3.1.9, pp. 4.6.2. Calculation: Helical pile.

HP-CYL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Individual bearing 2 × 6.467 kips	kips	12.93	12.93	+0.04		Pass
Cylindrical shear 11.18 kips (governs)	kips	11.18	11.18	-0.00		Pass

HP-TORQUE: Capacity from the installation torque

Source: Hand calculation: Iowa DOT TR-800 (2023) 4.6.1 to 4.6.3; IBC 2024 1810.3.3.1.9, pp. 4.6.3. Calculation: Helical pile.

HP-TORQUE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Kt·T / 2 = 17.5 kips	kips	17.50	17.50	+0.00		Pass

HP-BUCKLE: Elastic buckling of a shaft in soft soil

Source: Hand calculation: Iowa DOT TR-800 (2023) 4.6.1 to 4.6.3; IBC 2024 1810.3.3.1.9, pp. Hetényi. Calculation: Helical pile.

HP-BUCKLE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pe = 2√(kh·d·EI) = 177.8 kips	kips	177.8	177.8	+0.01		Pass

PCI-3.7-dyn4: Dynaspan 4 in. × 4 ft with 2 in. topping

Source: PCI Design Handbook 8th Ed., Table 3.7 (Dynaspan), pp. Table 3.7, PDF p. 1. Calculation: Hollow-core plank.

PCI-3.7-dyn4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ycb, 4 in. topped	in.	3.080	3.076	-0.14		Pass
Ic, 4 in. topped	in.⁴	689.0	689.0	+0.01		Pass

PCI-3.7-dyn6: Dynaspan 6 in. × 4 ft with 2 in. topping

Source: PCI Design Handbook 8th Ed., Table 3.7 (Dynaspan), pp. Table 3.7, PDF p. 1. Calculation: Hollow-core plank.

PCI-3.7-dyn6 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ycb, 6 in. topped	in.	4.250	4.256	+0.15		Pass
Ic, 6 in. topped	in.⁴	1,543	1,543	-0.02		Pass

PCI-3.7-dyn8: Dynaspan 8 in. × 4 ft with 2 in. topping

Source: PCI Design Handbook 8th Ed., Table 3.7 (Dynaspan), pp. Table 3.7, PDF p. 1. Calculation: Hollow-core plank.

PCI-3.7-dyn8 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ycb, 8 in. topped	in.	5.150	5.157	+0.13		Pass
Ic, 8 in. topped	in.⁴	3,205	3,205	-0.01		Pass

PCI-3.7-dyn10: Dynaspan 10 in. × 4 ft with 2 in. topping

Source: PCI Design Handbook 8th Ed., Table 3.7 (Dynaspan), pp. Table 3.7, PDF p. 1. Calculation: Hollow-core plank.

PCI-3.7-dyn10 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ycb, 10 in. topped	in.	6.260	6.264	+0.07		Pass
Ic, 10 in. topped	in.⁴	5,314	5,314	+0.01		Pass

HC-FPS: fps with the topping in compression

Source: Hand calculation (closed form, ACI 318-19). Calculation: Hollow-core plank.

HC-FPS · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
fps = 270 (1 − 0.28/0.85 ρp 270/3)	ksi	251.4	251.4	+0.00		Pass
fse = 0.75 × 270 × 0.82	ksi	166.0	166.1	+0.00		Pass
ℓd = (fse/3 + fps − fse) × 0.5 in.	in.	70.37	70.37	+0.00		Pass
a = Aps fps / (0.85 × 3 ksi × 48)	in.	1.886	1.886	+0.00		Pass

ICE-PIPE: Round pipe member of an open frame, z = 50 ft, t = 1 in., Vc = 40 mph

Source: Hand calculation (closed form, ASCE/SEI 7-22 Ch. 10). Calculation: Atmospheric ice loads.

ICE-PIPE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
fz = (50/33)^0.10		1.042	1.042	+0.00		Pass
td = 1.0 × fz (Kzt = 1)	in.	1.042	1.042	+0.00		Pass
Ai = π td (2.375 + td)	in.²	11.19	11.19	+0.00		Pass
Di = 56 Ai / 144	plf	4.352	4.352	+0.00		Pass
Ice weight over 20 ft	lb	87.05	87.05	+0.00		Pass
qz = 0.00256 Kz (40)²	psf	4.457	4.457	+0.00		Pass
Wi = qz × 0.85 × 0.85 × 1.2 × (2.375 + 2 td) / 12	plf	1.436	1.436	+0.00		Pass

ICE-RECT: Square tube 4 × 4 in. on a hill (Kzt = 1.2), z = 1,000 ft (fz = 1.4)

Source: Hand calculation (closed form, ASCE/SEI 7-22 Ch. 10). Calculation: Atmospheric ice loads.

Fig. 29.4-2, ε < 0.1: flat-sided 2.0 on the bare width, rounded 1.2 on the ice added (10.5.3).

ICE-RECT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
fz = 1.4 above 900 ft		1.400	1.400	+0.00		Pass
td = 1.0 × 1.4 × 1.2^0.35	in.	1.492	1.492	+0.00		Pass
Dc = √(4² + 4²)	in.	5.657	5.657	+0.00		Pass
Ai = π td (√32 + td)	in.²	33.52	33.52	+0.00		Pass
Wi = qz Kd G (2.0 × 4 + 1.2 × 2 td) / 12	plf	6.874	6.874	+0.00		Pass

ICE-CABLE: Guy cable 1/2 in., z = 33 ft (fz = 1), t = 0.75 in., Vc = 50 mph

Source: Hand calculation (closed form, ASCE/SEI 7-22 Ch. 10). Calculation: Atmospheric ice loads.

Kd: cables are not listed in Table 26.6-1; 1.0 is taken (an input).

ICE-CABLE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
td = t at 33 ft	in.	0.750	0.750	+0.00		Pass
Ai = π 0.75 (0.5 + 0.75)	in.²	2.945	2.945	+0.00		Pass
Wi = qz × 1.0 × 0.85 × 1.2 × 2.0 / 12	plf	1.088	1.088	+0.00		Pass

ICE-CHIMNEY: Round chimney 6 ft × 40 ft, z = 40 ft

Source: Hand calculation (closed form, ASCE/SEI 7-22 Ch. 10). Calculation: Atmospheric ice loads.

ICE-CHIMNEY · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Di = 56 π td (72 + td) / 144	plf	90.94	90.94	+0.00		Pass
Cf, round D√qz ≤ 2.5, h/D = 40 / D with ice		0.791	0.791	+0.00		Pass
Wi = qz × 1.0 × 0.85 × Cf × D with ice	plf	17.68	17.68	+0.00		Pass

ICE-PLATE: Vertical plate 32 ft², reduced × 0.8 (Eq. 10.4-2)

Source: Hand calculation (closed form, ASCE/SEI 7-22 Ch. 10). Calculation: Atmospheric ice loads.

ICE-PLATE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ice weight 56 π td/12 × 32 × 0.8	lb	391.2	391.2	+0.00		Pass

ICE-DOME: Dome r = 10 ft: As = π r² (Eq. 10.4-3)

Source: Hand calculation (closed form, ASCE/SEI 7-22 Ch. 10). Calculation: Atmospheric ice loads.

ICE-DOME · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ice weight 56 π td/12 × π 10²	lb	4,801	4,801	+0.00		Pass

DG7-14.1.1 · Impact and machinery loads: 20 ton crane, 38.1 kip wheels, 25 % impact entered, four wheels

Source: AISC Design Guide 7, 3rd Ed. (2019), Example 14.1.1, pp. printed pp. 65 to 66. Calculation: Impact and machinery loads.

DG7-14.1.1 · Impact and machinery loads · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Wheel load with impact 1.25 × 38.1	kips	47.62	47.62	+0.00		Pass
Lateral force per wheel 0.20 (40 + 10.6) / 4	kips	2.530	2.530	+0.00		Pass

CR-722-B: The same crane, ASCE 7-22 class B (10 %)

Source: Hand calculation (closed form, ASCE/SEI 7-22 4.6, 4.9). Calculation: Impact and machinery loads.

CR-722-B · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Wheel load with impact 1.10 × 38.1	kips	41.91	41.91	+0.00		Pass
Total lateral force 0.20 × 50.6	kips	10.12	10.12	+0.00		Pass
Longitudinal force per wheel 0.10 × 38.1	kips	3.810	3.810	+0.00		Pass
Longitudinal force on the rail (two wheels)	kips	7.620	7.620	+0.00		Pass
Factored 1.6L	kips	67.06	67.06	+0.00		Pass

CR-MONO: Powered monorail, 25 %

Source: Hand calculation (closed form, ASCE/SEI 7-22 4.6, 4.9). Calculation: Impact and machinery loads.

CR-MONO · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1.25 × 10	kips	12.50	12.50	+0.00		Pass

CR-HAND: Hand-geared crane and bridge: no impact, no longitudinal force

Source: Hand calculation (closed form, ASCE/SEI 7-22 4.6, 4.9). Calculation: Impact and machinery loads.

CR-HAND · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
No impact	kips	10.00	10.00	+0.00		Pass
No longitudinal force	kips	0.000	0.000	+0.00		Pass
No lateral force (not electric)	kips	0.000	0.000	+0.00		Pass

MACH: Machinery 10 kips: light 20 %, reciprocating 50 %, manufacturer 60 %

Source: Hand calculation (closed form, ASCE/SEI 7-22 4.6, 4.9). Calculation: Impact and machinery loads.

MACH · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Light machinery 1.20 × 10	kips	12.00	12.00	+0.00		Pass

MACH-R: Reciprocating machinery

Source: Hand calculation (closed form, ASCE/SEI 7-22 4.6, 4.9). Calculation: Impact and machinery loads.

MACH-R · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Reciprocating 1.50 × 10	kips	15.00	15.00	+0.00		Pass

MACH-M: Manufacturer's 60 % governs

Source: Hand calculation (closed form, ASCE/SEI 7-22 4.6, 4.9). Calculation: Impact and machinery loads.

MACH-M · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1.60 × 10	kips	16.00	16.00	+0.00		Pass

HOIST: Hoist: rated 1.5 kips, stall 4.0 kips

Source: Hand calculation (closed form, ASCE/SEI 7-22 4.6, 4.9). Calculation: Impact and machinery loads.

HOIST · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
max(2.5 × 1.5, 4.0)	kips	4.000	4.000	+0.00		Pass

ELEV: Elevator static reaction 20 kips, 100 % impact (C4.6)

Source: Hand calculation (closed form, ASCE/SEI 7-22 4.6, 4.9). Calculation: Impact and machinery loads.

ELEV · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
2 × 20	kips	40.00	40.00	+0.00		Pass

UDOEYO-13.1: Propped cantilever, reactions and fixed-end moment

Source: Udoeyo, Structural Analysis (2020), Example 13.1, pp. 381-383. Calculation: Influence lines.

UDOEYO-13.1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
By at 5 ft (0.09)		0.086	0.086	-0.00		Pass
By at 10 ft (0.31)		0.312	0.312	-0.00		Pass
By at 15 ft (0.63)		0.633	0.633	-0.00		Pass
Ay at 5 ft (0.91)		0.914	0.914	-0.00		Pass
MA at 10 ft (−3.8)	ft	-3.750	-3.750	-0.00		Pass

UDOEYO-13.2: Two spans of 3 m, reactions (metric)

Source: Udoeyo, Structural Analysis (2020), Example 13.2, pp. 383-386. Calculation: Influence lines.

UDOEYO-13.2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
By at 1.5 m (0.69)		0.688	0.688	+0.00		Pass
Ay at 1.5 m (0.41)		0.406	0.406	+0.00		Pass
Ay at 4.5 m (−0.095)		-0.094	-0.094	+0.00		Pass
Cy at 1.5 m (−0.095)		-0.094	-0.094	-0.00		Pass

TRAIN: Two loads on a simple span

Source: Hand calculation (closed form), influence ordinates of a simple beam. Calculation: Influence lines.

TRAIN · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Largest midspan moment	kip-ft	150.0	150.0	-0.00		Pass
Largest left reaction	kips	17.50	17.50	-0.00		Pass
Largest shear just right of midspan	kips	7.500	7.500	-0.00		Pass
Smallest shear just right of midspan	kips	-7.500	-7.500	-0.00		Pass

LANE-SUPPORT: Uniform load on two spans, interior support

Source: Hand calculation (closed form), three-moment equation. Calculation: Influence lines.

LANE-SUPPORT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Moment at the interior support	kip-ft	-50.00	-49.98	-0.04		Pass
Interior reaction	kips	25.00	25.00	-0.01		Pass

LANE-SPAN: Uniform load on two spans, moment at 0.4 l

Source: Hand calculation (closed form), three-moment equation. Calculation: Influence lines.

LANE-SPAN · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Largest moment at 0.4 l (span 1 loaded)	kip-ft	38.00	38.00	+0.01		Pass
Smallest moment at 0.4 l (span 2 loaded)	kip-ft	-10.00	-9.996	-0.04		Pass

LEDGE-DEFAULT: Spandrel ledge, 12 + 8 kip bearings at 4 ft

Source: Hand calculation (closed form, the PCI ledge expressions as built; ACI 318-19 22.8). Calculation: Ledge and inverted-tee beam.

LEDGE-DEFAULT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vu = 1.2 × 12 + 1.6 × 8	kips	27.20	27.20	+0.00		Pass
Punching Vn = 3√f'c × 14 × (2 × 4 + 20)	kips	74.38	74.38	+0.00		Pass
Ledge As = (Vu av + Nu (hl − d))/(φ fy d) + Nu/(φ fy)	in.²	0.337	0.337	+0.00		Pass
Hanger Ash = Vu / (0.75 × 60)	in.²	0.604	0.604	+0.00		Pass
Bn = 0.85 × 4 × 6 × 4.5	kips	91.80	91.80	+0.00		Pass
Tu = (Vu / 4 ft) × 12 in. × 15 ft	kip-ft	102.0	102.0	+0.00		Pass

LEDGE-INVERTED: Inverted tee loaded alike: no torsion

Source: Hand calculation (closed form, the PCI ledge expressions as built; ACI 318-19 22.8). Calculation: Ledge and inverted-tee beam.

LEDGE-INVERTED · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tu = 0	kip-ft	0.000	0.000	+0.00		Pass

LEDGE-CLOSE: Loads at 12 in.: the width is the spacing

Source: Hand calculation (closed form, the PCI ledge expressions as built; ACI 318-19 22.8). Calculation: Ledge and inverted-tee beam.

LEDGE-CLOSE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Punching Vn with w = s = 12 in.	kips	53.13	53.13	+0.00		Pass

JS-30: 30 in. pans 12 in. deep, 3 in. slab, end span 20 ft (coefficients)

Source: Hand calculation (closed form, ACI 318-19 9.8, 6.5). Calculation: Joist and waffle slab.

JS-30 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rib spacing 30 + 6 + 2 × 12/12	in.	38.00	38.00	+0.00		Pass
Concrete per rib 38 × 3 + 7 × 12	in.²	198.0	198.0	+0.00		Pass
wu = 1.2 wD + 1.6 wL per rib	kip/ft	0.577	0.577	+0.00		Pass
Mu+ = wu ℓn² / 14	kip-ft	16.48	16.48	+0.00		Pass
Mu− = wu ℓn² / 10	kip-ft	23.07	23.07	+0.00		Pass
Vu = 1.15 wu ℓn / 2	kips	6.634	6.634	+0.00		Pass
Vc × 1.1 (Table 22.5.5.1(c), bw = 6 in.)	kips	9.307	9.307	+0.00		Pass
Table 9.3.1.1 one end continuous ℓ / 18.5	in.	12.97	12.97	+0.00		Pass
Slab over pans ≥ 30 / 12	in.	2.500	2.500	+0.00		Pass

JS-INT: Interior span, more than two spans: Mu+ = /16, Mu− = /11, Vu = wu ℓn / 2

Source: Hand calculation (closed form, ACI 318-19 9.8, 6.5). Calculation: Joist and waffle slab.

JS-INT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Interior Mu+ = wu ℓn² / 16	kip-ft	14.42	14.42	+0.00		Pass
Interior Mu− = wu ℓn² / 11	kip-ft	20.98	20.98	+0.00		Pass
Interior Vu = wu ℓn / 2	kips	5.768	5.768	+0.00		Pass

JS-UNR: End span, unrestrained end, two spans: Mu+ = /11, Mu− = /9

Source: Hand calculation (closed form, ACI 318-19 9.8, 6.5). Calculation: Joist and waffle slab.

JS-UNR · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Unrestrained end Mu+ = wu ℓn² / 11	kip-ft	20.98	20.98	+0.00		Pass
Two spans Mu− = wu ℓn² / 9	kip-ft	25.64	25.64	+0.00		Pass

JS-SIMPLE: Simple span 16 ft

Source: Hand calculation (closed form, ACI 318-19 9.8, 6.5). Calculation: Joist and waffle slab.

JS-SIMPLE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Simple Mu = wu ℓ² / 8	kip-ft	18.46	18.46	+0.00		Pass
Simple ℓ / 16	in.	12.00	12.00	+0.00		Pass

LP-HUB-5.1: Short free-head pipe in clay, load 1 ft above grade

Source: Hubbell / Chance, Helical Screw Foundation System Design Manual, Step 5 Lateral Capacity, Design Example 5.1, pp. p. 5-5.
Calculation: Laterally loaded pile.

LP-HUB-5.1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ultimate lateral load (2 × 4,400 lb)	kips	8.800	8.793	-0.08		Pass
Depth of zero shear below 1.5D, f	ft	1.771	1.770	-0.08		Pass
Maximum moment Mmax	kip-ft	23.88	23.85	-0.11		Pass

LP-KOU-6.12: Fixed-head steel pipe in clay (su = 100 kPa)

Source: Kouretzis, Fundamentals of Foundation Engineering, 2nd Ed. (University of Newcastle open textbook), pp. Example 6.12. Calculation: Laterally loaded pile.

LP-KOU-6.12 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Yield moment My = σy (D³ − di³)/6 = 351 kNm	kip-ft	258.9	258.9	+0.02		Pass
Short pile Hf = 9 su D (L − 1.5D) = 3384 kN	kips	760.8	760.8	-0.00		Pass
Intermediate pile Hf = 1333.6 kN	kips	299.8	299.8	+0.00		Pass
Long pile Hf = 527.03 kN (governs)	kips	118.5	118.5	+0.01		Pass
Deflection at Hw = 263.5 kN: 0.019 m	in.	0.748	0.785	+4.88		Deviation LP-ROUND
LP-ROUND: the example rounds β = 0.507 per m to 0.50 and the result to 0.019 m; the program gives 0.0199 m						

LP-KOU-6.13: Fixed-head steel pipe in dry sand (φ' = 33°)

Source: Kouretzis, Fundamentals of Foundation Engineering, 2nd Ed. (University of Newcastle open textbook), pp. Example 6.13. Calculation: Laterally loaded pile.

LP-KOU-6.13 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Kp = tan²(45° + φ'/2)		3.390	3.392	+0.06		Pass
Short pile Hf = 1.5 γ Kp L² D = 3661.2 kN	kips	823.1	823.6	+0.06		Pass
Intermediate pile Hf = My/L + ½ γ D Kp L² = 1255.5 kN	kips	282.2	282.4	+0.06		Pass
Long pile Hf = 343.8 kN (governs)	kips	77.29	77.29	+0.00		Pass

LP-FHWA-EX8: 356 mm prestressed pile in sand, fixed head (chart solution)

Source: FHWA HI-97-013 (1998), Design and Construction of Driven Pile Foundations Vol. I, Student Exercise 8, pp. pp. G-37 to G-42.
Calculation: Laterally loaded pile.

LP-FHWA-EX8 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Kp = tan²(45° + 35°/2)		3.690	3.690	+0.00		Pass
Ultimate lateral load Qu (Fig. 9.30: 95 Kp b³ γ)	kips	66.32	63.08	-4.89		Deviation LP-CHART
LP-CHART: the exercise reads Qu/(Kp b³ γ) = 95 from Broms' chart; the closed form of the long fixed-head pile gives 90.4, so Hu = 280 kN						
Deflection at Qa = 118 kN (Fig. 9.33: 0.011 m)	in.	0.433	0.440	+1.68		Deviation LP-CHART
LP-CHART: chart coefficient 0.13 read from Fig. 9.33; the closed form y = 0.93 H / (nh^0.6 EI^0.4) gives 11.2 mm						

PY-HET-FREE: Long elastic pile, free head, against Hetényi

Source: Hand calculation: Hetényi (1946) closed form; FHWA GEC 9 (2018) Eqs. A-1, A-2. Calculation: Laterally loaded pile (p-y).

PY-HET-FREE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ground-line deflection y0 = 2Hβ/Es	in.	0.372	0.371	-0.06		Pass
Largest moment 0.3224 H/β	kip-ft	22.69	22.66	-0.12		Pass

PY-HET-FIXED: Long elastic pile, fixed head, against Hetényi

Source: Hand calculation: Hetényi (1946) closed form; FHWA GEC 9 (2018) Eqs. A-1, A-2. Calculation: Laterally loaded pile (p-y).

PY-HET-FIXED · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ground-line deflection y0 = Hβ/Es	in.	0.186	0.186	+0.03		Pass
Head moment H/(2β)	kip-ft	35.18	35.17	-0.04		Pass

PY-MATLOCK-PU: Matlock soft clay ultimate resistance

Source: Hand calculation: Hetényi (1946) closed form; FHWA GEC 9 (2018) Eqs. A-1, A-2, pp. Eqs. A-1, A-2. Calculation: Laterally loaded pile (p-y).

PY-MATLOCK-PU · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
pu at 5 ft = (3 + γ'z/c + Jz/b)·c·b	kip/ft	3.000	3.000	+0.00		Pass
pu at 20 ft = 9·c·b	kip/ft	4.500	4.500	+0.00		Pass

LQ-BI-SPT: B&I 2014 SPT at one atmosphere

Source: Hand calculation: Boulanger and Idriss (2014), Youd et al. (2001), Idriss and Boulanger (2008) equations. Calculation: Liquefaction triggering.

LQ-BI-SPT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
rd = 0.8913		0.891	0.891	+0.00		Pass
CSR = 0.2317		0.232	0.232	+0.02		Pass
CRR = 0.2059		0.206	0.206	-0.02		Pass
MSF = 1.000		1.000	1.000	-0.00		Pass
FS = 0.888		0.888	0.888	+0.03		Pass
Settlement 10.43 in.	in.	10.43	10.43	-0.04		Pass

LQ-BI-CPT: B&I 2014 CPT at one atmosphere

Source: Hand calculation: Boulanger and Idriss (2014), Youd et al. (2001), Idriss and Boulanger (2008) equations. Calculation: Liquefaction triggering.

LQ-BI-CPT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
CRR(qc1Ncs = 100) = 0.1373		0.137	0.137	-0.00		Pass

LQ-YOUD-SPT: Youd et al. 2001 SPT

Source: Hand calculation: Boulanger and Idriss (2014), Youd et al. (2001), Idriss and Boulanger (2008) equations. Calculation: Liquefaction triggering.

LQ-YOUD-SPT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
rd = 0.898		0.898	0.898	+0.00		Pass
CRR = 0.2154		0.215	0.215	+0.00		Pass
MSF = 1.442		1.442	1.442	-0.01		Pass

III-26: Interior floor beam, 45 ft span at 10 ft

Source: AISC Design Examples v16.0, Part III (ASCE/SEI 7-22 example building), pp. III-26. Calculation: Live load reduction.

III-26 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
L, interior beam AT = 450 ft²	psf	60.00	60.00	+0.00		Pass

III-31: Interior floor beam, 30 ft span at 10 ft

Source: AISC Design Examples v16.0, Part III (ASCE/SEI 7-22 example building), pp. III-31. Calculation: Live load reduction.

III-31 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
L, interior beam AT = 300 ft²	psf	69.00	68.99	-0.01		Pass

III-40: Edge girder with a calculated KLL = 1.98

Source: AISC Design Examples v16.0, Part III (ASCE/SEI 7-22 example building), pp. III-39 to III-40. Calculation: Live load reduction.

The example calculates KLL from the influence area (Table 4.7-1 footnote) instead of KLL = 1.

III-40 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
L, edge girder KLL = 1.98, AT = 690 ft²	psf	52.50	52.47	-0.07		Pass

III-43: Interior girder

Source: AISC Design Examples v16.0, Part III (ASCE/SEI 7-22 example building), pp. III-43. Calculation: Live load reduction.

The example writes AT = 1,125 ft² rounded to 1,130 ft².

III-43 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
L, interior girder AT = 1,130 ft²	psf	45.20	45.24	+0.09		Pass

III-50 2A: Exterior column, three floors and the roof (2A, 2F, ...)

Source: AISC Design Examples v16.0, Part III (ASCE/SEI 7-22 example building), pp. III-49 to III-50. Calculation: Live load reduction.

III-50 2A · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
L, exterior column 3 × 690 ft²	psf	33.20	33.19	-0.04		Pass
R1, roof At = 690 ft²		0.600	0.600	+0.00		Pass
Lr, roof At = 690 ft²	psf	12.00	12.00	+0.00		Pass

III-51 1B: Exterior column at the end bays (1B, 1E, ...)

Source: AISC Design Examples v16.0, Part III (ASCE/SEI 7-22 example building), pp. III-50 to III-51. Calculation: Live load reduction.

III-51 1B · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
L, exterior column 3 × 124 ft²	psf	51.10	51.11	+0.02		Pass
Lr, roof At = 78.8 ft²	psf	20.00	20.00	+0.00		Pass

III-51 1A: Corner column (1A, 1F, ...)

Source: AISC Design Examples v16.0, Part III (ASCE/SEI 7-22 example building), pp. III-51 to III-52. Calculation: Live load reduction.

The example uses KLL = 4 (exterior column without cantilever slabs) for the corner columns.

III-51 1A · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
L, corner column 3 × 295 ft²	psf	40.20	40.17	-0.08		Pass
R1, roof At = 318 ft²		0.882	0.882	-0.00		Pass
Lr, roof At = 318 ft²	psf	17.60	17.64	+0.23		Pass

III-52 1C: Exterior column (1C, 1D, ...)

Source: AISC Design Examples v16.0, Part III (ASCE/SEI 7-22 example building), pp. III-52. Calculation: Live load reduction.

III-52 1C · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
L, exterior column 3 × 519 ft²	psf	35.20	35.21	+0.02		Pass
R1, roof At = 542 ft²		0.658	0.658	-0.00		Pass
Lr, roof At = 542 ft²	psf	13.20	13.16	-0.30		Pass

III-53 2C: Interior column, 0.40 Lo governs

Source: AISC Design Examples v16.0, Part III (ASCE/SEI 7-22 example building), pp. III-53. Calculation: Live load reduction.

III-53 2C · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
L, interior column: 0.40 Lo governs over 30.3 psf	psf	32.00	32.00	+0.00		Pass
Eq. 4.7-1 value before the limit	psf	30.30	30.33	+0.09		Pass
Lr, roof At = 1,125 ft²	psf	12.00	12.00	+0.00		Pass

LLR-HEAVY: Storage, Lo = 150 psf, two floors: at most 20 % (4.7.3)

Source: Hand calculation (closed form, ASCE/SEI 7-22 4.7, 4.8). Calculation: Live load reduction.

LLR-HEAVY · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
L = max(0.4177 Lo, 0.8 Lo) = 120 psf	psf	120.0	120.0	+0.00		Pass

LLR-HEAVY-1: Storage, Lo = 150 psf, one floor: not reduced (4.7.3)

Source: Hand calculation (closed form, ASCE/SEI 7-22 4.7, 4.8). Calculation: Live load reduction.

LLR-HEAVY-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
L = Lo (heavy live load, one floor)	psf	150.0	150.0	+0.00		Pass

LLR-GARAGE: Passenger garage, three floors (4.7.4)

Source: Hand calculation (closed form, ASCE/SEI 7-22 4.7, 4.8). Calculation: Live load reduction.

LLR-GARAGE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
L = max(0.40 Lo, 0.8 Lo) = 32 psf	psf	32.00	32.00	+0.00		Pass

LLR-ASSEMBLY: Assembly area (4.7.5)

Source: Hand calculation (closed form, ASCE/SEI 7-22 4.7, 4.8). Calculation: Live load reduction.

LLR-ASSEMBLY · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
L = Lo (assembly)	psf	100.0	100.0	+0.00		Pass

LLR-ONEWAY: One-way slab, AT capped at 1.5 × 20² = 600 ft² (4.7.6)

Source: Hand calculation (closed form, ASCE/SEI 7-22 4.7, 4.8). Calculation: Live load reduction.

LLR-ONEWAY · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
AT = 600 ft²	ft²	600.0	600.0	+0.00		Pass
L = 50 (0.25 + 15/√600)	psf	43.12	43.12	-0.00		Pass

LLR-ARCH: Arch roof, rise / span = 0.25: F = 8 (4.8.2)

Source: Hand calculation (closed form, ASCE/SEI 7-22 4.7, 4.8). Calculation: Live load reduction.

LLR-ARCH · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
F = 32 × 0.25		8.000	8.000	+0.00		Pass
R1 = 1.2 − 0.001 × 400		0.800	0.800	-0.00		Pass
R2 = 1.2 − 0.05 × 8		0.800	0.800	-0.00		Pass
Lr = 20 × 0.8 × 0.8	psf	12.80	12.80	-0.00		Pass

LLR-OCCROOF: Occupiable roof counted as a second floor (4.8.3, C4.7.1)

Source: Hand calculation (closed form, ASCE/SEI 7-22 4.7, 4.8). Calculation: Live load reduction.

Our reading: C4.8.3 makes the roof load a floor live load and C4.7.1 sums the areas of the floors a member supports.

LLR-OCCROOF · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
AT = 500 + 500	ft²	1,000	1,000	+0.00		Pass
Floor L = 50 (0.25 + 15/√4,000)	psf	24.36	24.36	-0.01		Pass
Roof L = 100 (0.25 + 15/√4,000)	psf	48.72	48.72	-0.01		Pass

T4.7-1 int_col · Live load reduction: Table 4.7-1: Interior columns

Source: ASCE/SEI 7-22, Table 4.7-1, pp. PDF p. 78. Calculation: Live load reduction.

T4.7-1 int_col · Live load reduction · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
KLL (Interior columns)		4.000	4.000	+0.00		Pass

T4.7-1 ext_col · Live load reduction: Table 4.7-1: Exterior columns without cantilever slabs

Source: ASCE/SEI 7-22, Table 4.7-1, pp. PDF p. 78. Calculation: Live load reduction.

T4.7-1 ext_col · Live load reduction · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
KLL (Exterior columns without cantilever slabs)		4.000	4.000	+0.00		Pass

T4.7-1 edge_col_cant · Live load reduction: Table 4.7-1: Edge columns with cantilever slabs

Source: ASCE/SEI 7-22, Table 4.7-1, pp. PDF p. 78. Calculation: Live load reduction.

T4.7-1 edge_col_cant · Live load reduction · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
KLL (Edge columns with cantilever slabs)		3.000	3.000	+0.00		Pass

T4.7-1 corner_col_cant · Live load reduction: Table 4.7-1: Corner columns with cantilever slabs

Source: ASCE/SEI 7-22, Table 4.7-1, pp. PDF p. 78. Calculation: Live load reduction.

T4.7-1 corner_col_cant · Live load reduction · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
KLL (Corner columns with cantilever slabs)		2.000	2.000	+0.00		Pass

T4.7-1 edge_beam · Live load reduction: Table 4.7-1: Edge beams without cantilever slabs

Source: ASCE/SEI 7-22, Table 4.7-1, pp. PDF p. 78. Calculation: Live load reduction.

T4.7-1 edge_beam · Live load reduction · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
KLL (Edge beams without cantilever slabs)		2.000	2.000	+0.00		Pass

T4.7-1 int_beam · Live load reduction: Table 4.7-1: Interior beams

Source: ASCE/SEI 7-22, Table 4.7-1, pp. PDF p. 78. Calculation: Live load reduction.

T4.7-1 int_beam · Live load reduction · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
KLL (Interior beams)		2.000	2.000	+0.00		Pass

T4.7-1 other · Live load reduction: Table 4.7-1: All other members

Source: ASCE/SEI 7-22, Table 4.7-1, pp. PDF p. 78. Calculation: Live load reduction.

T4.7-1 other · Live load reduction · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
KLL (All other members)		1.000	1.000	+0.00		Pass

LCD-AISC-2C: Interior column 2C, 1,125 ft² per level, three floors and the roof

Source: AISC Design Examples v16.0 (Companion to the Manual, Vol. 1), Part III building design example: column loads (Tables III-2 to III-4), pp. pp. III-52 to III-55. Calculation: Load chasedown.

LCD-AISC-2C · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
PD = 3 × 84.4 + 22.5	kips	276.0	275.6	-0.14		Pass
PL = 3 × 36.0	kips	108.0	108.0	+0.00		Pass
PS = 24.6 psf × 1,125 ft²	kips	27.70	27.68	-0.09		Pass

LCD-H1: Column, reduction grows with the floors carried: 400 ft² at 50 psf

Source: Hand calculation, ASCE/SEI 7-22 4.7, 4.8. Calculation: Load chasedown.

LCD-H1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Below 3: L = 50 × 0.625 × 400 (AT 400, KLL 4: 0.25 + 15/40)	kips	12.50	12.50	+0.00		Pass
Below 2: L = 50 × 0.515 × 800 (KLL AT 3,200)	kips	20.60	20.61	+0.03		Pass
Below Roof: Lr = 20 × R1 0.8 × R2 1 = 16 psf × 400	kips	6.400	6.400	-0.00		Pass
Base D = 8 + 30 + 30	kips	68.00	68.00	+0.00		Pass

LCD-H2: Lower limit for two floors: 0.40 Lo

Source: Hand calculation, ASCE/SEI 7-22 4.7, 4.8. Calculation: Load chasedown.

LCD-H2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Below the first: 0.50 limit, 50 × 0.5 × 10,000	kips	250.0	250.0	+0.00		Pass
Below the second: 0.40 limit	kips	400.0	400.0	+0.00		Pass

LCD-H3: Heavy live load 125 psf: one floor not reduced, two reduced at most 20 %

Source: Hand calculation, ASCE/SEI 7-22 4.7, 4.8. Calculation: Load chasedown.

LCD-H3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
One floor	kips	125.0	125.0	+0.00		Pass
Two floors: 0.8 × 250	kips	200.0	200.0	+0.00		Pass

LCD-H4: Assembly floor not reduced, office floor below it is

Source: Hand calculation, ASCE/SEI 7-22 4.7, 4.8. Calculation: Load chasedown.

LCD-H4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
100 + 50 × max(0.25 + 15/√8,000, 0.4) = 100 + 0.418 × 50	kips	120.9	120.9	-0.01		Pass

LCD-H5: Wall per foot: width 10 ft, wall 20 ft (AT 200 ft²), KLL 1

Source: Hand calculation, ASCE/SEI 7-22 4.7, 4.8. Calculation: Load chasedown.

LCD-H5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
One floor: KLL AT under 400: L = 0.5 kip/ft	kips	0.500	0.500	+0.00		Pass
Two floors: KLL AT 400: 50 × 1.0 × 20 ft	kips	1.000	1.000	+0.00		Pass
D: 2 × (0.75 + 0.3)	kips	2.100	2.100	+0.00		Pass

LCD-H6: Combination at the base and added loads

Source: Hand calculation, ASCE/SEI 7-22 4.7, 4.8. Calculation: Load chasedown.

LCD-H6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1.2 × 20 + 1.6 × 15	kips	48.00	48.00	+0.00		Pass

LCD-H6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
20 + 15	kips	35.00	35.00	+0.00		Pass

LC-F.1-1A: Beam moments: D 68.9, L 114.8 kip-ft (w 0.45 and 0.75 kip/ft, 35 ft)

Source: AISC Design Examples v16.0, Example F.1-1A, pp. F-3 to F-4. Calculation: Load combinations.

LC-F.1-1A · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1.2D + 1.6L	kip-ft	266.0	266.4	+0.16		Pass

LC-F.1-1A · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
D + L	kip-ft	184.0	183.8	-0.14		Pass

LC-P2192-4.8: Shear wall axial force, SDS 1.10, QE 3,385 kips

Source: FEMA P-2192-V1 (2020), Section 4.5.2.1, Table 4-8, pp. p. 151 (PDF 153). Calculation: Load combinations.

The table gives results only. D = 6,335 / 1.4 from row 1; L from row 2 with no roof live load; QE = 3,385 kips from the text above the table. So rows 1 and 2 only confirm the back-calculation; rows 3 and 4 are the check.

LC-P2192-4.8 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1.4D	kips	6,335	6,335	+0.00		Pass
1.2D + 1.6L + 0.5Lr	kips	6,071	6,072	+0.01		Pass
(1.2 + 0.2SDS)D + QE + 0.5L	kips	10,015	10,011	-0.04		Pass
(0.9 − 0.2SDS)D + QE	kips	6,460	6,462	+0.03		Pass
(0.9 − 0.2SDS)D − QE	kips	-378.0	-308.0	-18.52		Deviation P2192-T4-8-ROW5
P2192-T4-8-ROW5: the table's last row does not follow from its other rows						

LC-P2192-7.4: Collector force at ASD, Fpx = 19,072 lb

Source: FEMA P-2192-V1 (2020), Section 7.4, pp. pp. 267 to 272. Calculation: Load combinations.

LC-P2192-7.4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
0.7E	lb	13,350	13,350	+0.00		Pass

LC-H1: Basic LRFD with D, L, Lr, S, R, W, E; SDS 1.0, ρ 1.3

Source: Hand calculation, ASCE/SEI 7-22 2.3, 2.4, 12.4. Calculation: Load combinations.

LC-H1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1a 1.4D		140.0	140.0	+0.00		Pass
2a 1.2D + 1.6L + 0.5Lr		258.0	258.0	+0.00		Pass
2a with 0.3S		257.0	257.0	+0.00		Pass
3a 1.2D + 1.6Lr + L		232.0	232.0	+0.00		Pass
3a S + L		230.0	230.0	+0.00		Pass
4a 1.2D + W + L + 0.5Lr		260.0	260.0	+0.00		Pass
5a 0.9D − W		40.00	40.00	+0.00		Pass
6 (1.2 + 0.2)D + 1.3 QE + L + 0.15S		276.5	276.5	+0.00		Pass
7 (0.9 − 0.2)D − 1.3 QE		18.00	18.00	+0.00		Pass

LC-H2: Basic ASD with the same loads

Source: Hand calculation, ASCE/SEI 7-22 2.3, 2.4, 12.4. Calculation: Load combinations.

LC-H2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
2a D + L		180.0	180.0	+0.00		Pass
3a D + 0.7S		121.0	121.0	+0.00		Pass
4a D + 0.75L + 0.75Lr		175.0	175.0	+0.00		Pass
6a D + 0.75L + 0.45W + 0.525S		198.2	198.2	+0.00		Pass
7a 0.6D − 0.6W		30.00	30.00	+0.00		Pass
8 (1 + 0.14)D + 0.7 × 1.3 QE		150.4	150.4	-0.00		Pass
9 (1 + 0.105)D + 0.525 × 1.3 QE + 0.75L + 0.1S		200.8	200.8	+0.00		Pass
10 (0.6 − 0.14)D − 0.7 × 1.3 QE		9.600	9.600	+0.00		Pass

LC-H3: Overstrength Ω0 = 2.5, SDS 0.5

Source: Hand calculation, ASCE/SEI 7-22 2.3, 2.4, 12.4. Calculation: Load combinations.

LC-H3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
6 (1.2 + 0.1)D + 2.5 QE + L		245.0	245.0	+0.00		Pass
7 (0.9 − 0.1)D − 2.5 QE		5.000	5.000	+0.00		Pass

LC-H3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
8 (1 + 0.07)D + 0.7 × 2.5 QE		159.5	159.5	+0.00		Pass
10 (0.6 − 0.07)D − 0.7 × 2.5 QE		0.500	0.500	+0.00		Pass

LC-H4: Flood, V-Zone: D 100, L 50, W 20, Fa 10

Source: Hand calculation, ASCE/SEI 7-22 2.3, 2.4, 12.4. Calculation: Load combinations.

LC-H4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
4b 1.2D + W + 2Fa + L		210.0	210.0	+0.00		Pass
5b 0.9D + W + 2Fa		130.0	130.0	+0.00		Pass

LC-H4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
5b D + 0.6W + 1.5Fa		127.0	127.0	+0.00		Pass
6b D + 0.75L + 0.45W + 1.5Fa		161.5	161.5	+0.00		Pass
7b 0.6D + 0.6W + 1.5Fa		87.00	87.00	+0.00		Pass

LC-H5: Flood, noncoastal A-Zone

Source: Hand calculation, ASCE/SEI 7-22 2.3, 2.4, 12.4. Calculation: Load combinations.

LC-H5 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
4b 1.2D + 0.5W + Fa + L		190.0	190.0	+0.00		Pass
5b 0.9D + 0.5W + Fa		110.0	110.0	+0.00		Pass

LC-H5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
5b D + 0.6W + 0.75Fa		119.5	119.5	+0.00		Pass

LC-H6: Ice: D 100, L 50, S 10, Di 20, Wi 15

Source: Hand calculation, ASCE/SEI 7-22 2.3, 2.4, 12.4. Calculation: Load combinations.

LC-H6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
2b 1.2D + 1.6L + 0.2Di + 0.3S		207.0	207.0	+0.00		Pass
4c 1.2D + L + Di + Wi + 0.3S		208.0	208.0	+0.00		Pass
4d 1.2D + Di		140.0	140.0	+0.00		Pass
5c 0.9D + Di + Wi		125.0	125.0	+0.00		Pass

LC-H6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1b D + 0.7Di		114.0	114.0	+0.00		Pass
2b D + L + 0.7Di		164.0	164.0	+0.00		Pass
3b D + 0.7Di + 0.7Wi + 0.7S		131.5	131.5	+0.00		Pass
7c 0.6D + 0.7Di + 0.7Wi		84.50	84.50	+0.00		Pass

LC-H7: Fluid and earth: D 100, L 50, F 20, H 30, permanent

Source: Hand calculation, ASCE/SEI 7-22 2.3, 2.4, 12.4. Calculation: Load combinations.

LC-H7 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1a 1.4D + 1.4F + 1.6H		216.0	216.0	+0.00		Pass
2a 1.2D + 1.6L + 1.2F + 1.6H		272.0	272.0	+0.00		Pass

LC-H7 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
2a D + L + F + H		200.0	200.0	+0.00		Pass

LC-H8: H resists: D 100, H −30, permanent, then not

Source: Hand calculation, ASCE/SEI 7-22 2.3, 2.4, 12.4. Calculation: Load combinations.

LC-H8 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1a 1.4D − 0.9 × 30		113.0	113.0	+0.00		Pass

LC-H8 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1a D − 0.6 × 30		82.00	82.00	+0.00		Pass

LC-H9: Loads not acting: D 100, L −50

Source: Hand calculation, ASCE/SEI 7-22 2.3, 2.4, 12.4. Calculation: Load combinations.

LC-H9 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Largest: 1.4D (L left out in 2a too)		140.0	140.0	+0.00		Pass
Smallest: 1.2D + 1.6L		40.00	40.00	+0.00		Pass

LC-H10: Factor 0.5 on L, with self-straining T 10 at 1.2

Source: Hand calculation, ASCE/SEI 7-22 2.3, 2.4, 12.4. Calculation: Load combinations.

LC-H10 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
3a 1.2D + S + 0.5L + 1.2T		197.0	197.0	+0.00		Pass

LT-1: Interior floor beam, 30 ft span, 10 ft tributary width

Source: Hand calculation (closed form). Calculation: Load takeoff.

LT-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
wD = 50 psf × 10 ft	kip/ft	0.500	0.500	+0.00		Pass
L = 50 (0.25 + 15/√(2 × 300)) = 43.12 psf	psf	43.12	43.12	-0.00		Pass
wL = 43.12 psf × 10 ft	kip/ft	0.431	0.431	-0.00		Pass

LT-2: Interior column, three floors of 900 ft² and the roof

Source: Hand calculation (closed form). Calculation: Load takeoff.

KLL AT = 4 × 2,700 = 10,800 ft²: 0.25 + 15/√10,800 = 0.394 < 0.40 (two or more floors).

LT-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
PD = 80 × 2,700 + 20 × 900	kips	234.0	234.0	+0.00		Pass
L = max(0.394, 0.40) × 50 = 20 psf; PL = 20 × 2,700	kips	54.00	54.00	+0.00		Pass
Lr = 20 × R1 0.6 × R2 1.0 = 12 psf; PLr = 12 × 900	kips	10.80	10.80	+0.00		Pass

LT-3: Roof beam, At = 400 ft², slope 6 in./ft

Source: Hand calculation (closed form). Calculation: Load takeoff.

LT-3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Lr = 20 × (1.2 − 0.4) × (1.2 − 0.3) = 14.4 psf	psf	14.40	14.40	-0.00		Pass
wLr = 14.4 psf × 10 ft	kip/ft	0.144	0.144	-0.00		Pass

LT-4: Storage column (Lo = 125 psf), two floors

Source: Hand calculation (closed form). Calculation: Load takeoff.

4.7.3: live loads over 100 psf are reduced by at most 20 % for members carrying two or more floors.

LT-4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
L = max(125 × 0.515, 0.8 × 125) = 100 psf; PL = 100 × 800	kips	80.00	80.00	+0.00		Pass

T4.7-1 int_col · Load takeoff: KLL, Interior columns

Source: ASCE/SEI 7-22, Table 4.7-1 (live load element factor KLL), pp. p. 78 (standard p. 17). Calculation: Load takeoff.

T4.7-1 int_col · Load takeoff · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
KLL (Interior columns)		4.000	4.000	+0.00		Pass

T4.7-1 ext_col · Load takeoff: KLL, Exterior columns without cantilever slabs

Source: ASCE/SEI 7-22, Table 4.7-1 (live load element factor KLL), pp. p. 78 (standard p. 17). Calculation: Load takeoff.

T4.7-1 ext_col · Load takeoff · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
KLL (Exterior columns without cantilever slabs)		4.000	4.000	+0.00		Pass

T4.7-1 edge_col_cant · Load takeoff: KLL, Edge columns with cantilever slabs

Source: ASCE/SEI 7-22, Table 4.7-1 (live load element factor KLL), pp. p. 78 (standard p. 17). Calculation: Load takeoff.

T4.7-1 edge_col_cant · Load takeoff · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
KLL (Edge columns with cantilever slabs)		3.000	3.000	+0.00		Pass

T4.7-1 corner_col_cant · Load takeoff: KLL, Corner columns with cantilever slabs

Source: ASCE/SEI 7-22, Table 4.7-1 (live load element factor KLL), pp. p. 78 (standard p. 17). Calculation: Load takeoff.

T4.7-1 corner_col_cant · Load takeoff · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
KLL (Corner columns with cantilever slabs)		2.000	2.000	+0.00		Pass

T4.7-1 edge_beam · Load takeoff: KLL, Edge beams without cantilever slabs

Source: ASCE/SEI 7-22, Table 4.7-1 (live load element factor KLL), pp. p. 78 (standard p. 17). Calculation: Load takeoff.

T4.7-1 edge_beam · Load takeoff · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
KLL (Edge beams without cantilever slabs)		2.000	2.000	+0.00		Pass

T4.7-1 int_beam · Load takeoff: KLL, Interior beams

Source: ASCE/SEI 7-22, Table 4.7-1 (live load element factor KLL), pp. p. 78 (standard p. 17). Calculation: Load takeoff.

T4.7-1 int_beam · Load takeoff · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
KLL (Interior beams)		2.000	2.000	+0.00		Pass

T4.7-1 other · Load takeoff: KLL, All other members (cantilever beams, one-way and two-way slabs, ...)

Source: ASCE/SEI 7-22, Table 4.7-1 (live load element factor KLL), pp. p. 78 (standard p. 17). Calculation: Load takeoff.

T4.7-1 other · Load takeoff · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
KLL (All other members (cantilever beams, one-way and two-way slabs, ...))		1.000	1.000	+0.00		Pass

AISC-III-B45: Typical 45 ft interior composite floor beam, 10 ft on center

Source: AISC Design Examples v16.0 (Companion to the Manual, Vol. 1), Part III building design example: floor beams, pp. pp. III-25 to III-26.
Calculation: Load takeoff.

AISC-III-B45 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
KLL (interior beam)		2.000	2.000	+0.00		Pass
L = 80 (0.25 + 15/√900) = 60.0 psf	psf	60.00	60.00	+0.00		Pass
wD = 75 psf × 10 ft	kip/ft	0.750	0.750	+0.00		Pass
wL = 60.0 psf × 10 ft	kip/ft	0.600	0.600	+0.00		Pass

AISC-III-B30: Typical 30 ft interior floor beam, 10 ft on center

Source: AISC Design Examples v16.0 (Companion to the Manual, Vol. 1), Part III building design example: floor beams, pp. p. III-31. Calculation: Load takeoff.

AISC-III-B30 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
L = 80 (0.25 + 15/√600) = 69.0 psf	psf	69.00	68.99	-0.01		Pass
wL = 69.0 psf × 10 ft	kip/ft	0.690	0.690	-0.01		Pass

AISC-III-G30: Typical 30 ft interior girder (45 ft and 30 ft bays)

Source: AISC Design Examples v16.0 (Companion to the Manual, Vol. 1), Part III building design example: floor beams, pp. p. III-43. Calculation: Load takeoff.

AT = 30 ft × (45 + 30)/2 ft = 1,125 ft² (the example rounds it to 1,130 ft²; 45.3 psf with 1,125).

AISC-III-G30 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
L = 80 (0.25 + 15/√(2 × 1,130)) = 45.2 psf	psf	45.20	45.30	+0.22		Pass

AISC-III-C2C: Interior column 2C (1,125 ft² per level, three floors and the roof)

Source: AISC Design Examples v16.0 (Companion to the Manual, Vol. 1), Part III building design example: column loads (Tables III-2 to III-4), pp. pp. III-52 to III-55. Calculation: Load takeoff.

AISC-III-C2C · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
L = max(0.303, 0.40) × 80 = 32.0 psf (KLL nAT = 13,500 ft²)	psf	32.00	32.00	+0.00		Pass
Lr = 20 × 0.6 × 1 = 12.0 psf (AT ≥ 600 ft²)	psf	12.00	12.00	+0.00		Pass
PD = 3 × 84.4 + 22.5	kips	276.0	275.6	-0.14		Pass
PL = 3 × 36.0	kips	108.0	108.0	+0.00		Pass
PS = 0.0246 × 1,125	kips	27.70	27.68	-0.09		Pass
PLr = 0.0120 × 1,125	kips	13.50	13.50	+0.00		Pass

AISC-III-C2A: Exterior column 2A (690 ft² per level)

Source: AISC Design Examples v16.0 (Companion to the Manual, Vol. 1), Part III building design example: column loads (Tables III-2 to III-4), pp. pp. III-49 to III-50, III-54 to III-55. Calculation: Load takeoff.

PD of the exterior columns also carries the spandrel panels (line loads, not an area load) and is not compared.

AISC-III-C2A · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
L = 80 (0.25 + 15/√(4 × 3 × 690)) = 33.2 psf	psf	33.20	33.19	-0.04		Pass
Lr = 12.0 psf	psf	12.00	12.00	+0.00		Pass
PL = 3 × 22.9	kips	68.70	68.70	-0.00		Pass
PS	kips	17.00	16.97	-0.15		Pass
PLr	kips	8.280	8.280	+0.00		Pass

AISC-III-C1A: Corner column 1A (295 ft² per floor, 318 ft² of roof)

Source: AISC Design Examples v16.0 (Companion to the Manual, Vol. 1), Part III building design example: column loads (Tables III-2 to III-4), pp. pp. III-51 to III-52, III-54 to III-55. Calculation: Load takeoff.

Table 4.7-1 'exterior columns without cantilever slabs' (KLL = 4) covers the corner column. PD of the exterior columns also carries the spandrel panels (line loads, not an area load) and is not compared.

AISC-III-C1A · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
L = 80 (0.25 + 15/√(4 × 3 × 295)) = 40.2 psf	psf	40.20	40.17	-0.08		Pass
R1 = 1.2 − 0.001 × 318		0.882	0.882	-0.00		Pass
Lr = 20 × 0.882 = 17.6 psf	psf	17.60	17.64	+0.23		Pass
PL = 3 × 11.9	kips	35.70	35.55	-0.42		Pass
PS	kips	7.820	7.823	+0.04		Pass
PLr	kips	5.600	5.610	+0.17		Pass

AISC-III-C1B: Exterior column 1B (124 ft² per floor, 78.8 ft² of roof)

Source: AISC Design Examples v16.0 (Companion to the Manual, Vol. 1), Part III building design example: column loads (Tables III-2 to III-4), pp. pp. III-50 to III-51, III-54 to III-55. Calculation: Load takeoff.

PD of the exterior columns also carries the spandrel panels (line loads, not an area load) and is not compared.

AISC-III-C1B · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
L = 80 (0.25 + 15/√(4 × 3 × 124)) = 51.1 psf	psf	51.10	51.11	+0.02		Pass
Lr = 20 psf (R1 = 1, AT ≤ 200 ft²)	psf	20.00	20.00	+0.00		Pass
PL = 3 × 6.34	kips	19.00	19.01	+0.07		Pass
PS	kips	1.940	1.938	-0.08		Pass
PLr	kips	1.580	1.576	-0.25		Pass

AISC-III-C1C: Exterior column 1C (519 ft² per floor, 542 ft² of roof)

Source: AISC Design Examples v16.0 (Companion to the Manual, Vol. 1), Part III building design example: column loads (Tables III-2 to III-4), pp. pp. III-52 to III-55. Calculation: Load takeoff.

PD of the exterior columns also carries the spandrel panels (line loads, not an area load) and is not compared.

AISC-III-C1C · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
L = 80 (0.25 + 15/√(4 × 3 × 519)) = 35.2 psf	psf	35.20	35.21	+0.02		Pass
R1 = 1.2 − 0.001 × 542		0.658	0.658	-0.00		Pass
Lr = 20 × 0.658 = 13.2 psf	psf	13.20	13.16	-0.30		Pass
PL = 3 × 18.3	kips	54.90	54.82	-0.15		Pass
PS	kips	13.30	13.33	+0.25		Pass
PLr	kips	7.150	7.133	-0.24		Pass

MDG-9.3-6: Headed bolt near the edge of a wall, tension

Source: TMS Masonry Designers' Guide 2022, free sample, Example 9.3-6, pp. sample p. 1 (9-24). Calculation: Masonry anchor bolts.

MDG-9.3-6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Projected tension area Apt	in.²	56.20	56.24	+0.07		Pass
Masonry breakout Banb	lb	10,050	10,060	+0.10		Pass
Design breakout strength	lb	5,030	5,030	+0.00		Pass

MDG-9.3-6a: The same bolt deeper, the cone cut by both faces

Source: TMS Masonry Designers' Guide 2022, free sample, Example 9.3-6a, pp. sample pp. 2-3 (9-25, 9-26). Calculation: Masonry anchor bolts.

MDG-9.3-6a · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Projected tension area Apt	in.²	75.90	75.94	+0.06		Pass
Masonry breakout Banb	lb	13,580	13,585	+0.04		Pass
Design breakout strength	lb	6,790	6,792	+0.04		Pass
Design steel strength, governs	lb	6,390	6,385	-0.07		Pass

TMS18-BENT: Bent-bar bolt in the top of an 8 in. wall

Source: TMS webinar Anchor Bolt Design, March 2018 (TMS 402-16), pp. p. 22. Calculation: Masonry anchor bolts.

TMS18-BENT · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Projected tension area Apt	in.²	28.30	28.27	-0.09		Pass
Design breakout strength	lb	2,530	2,529	-0.04		Pass
Design pullout strength, governs	lb	2,350	2,353	+0.14		Pass
Design steel strength	lb	4,600	6,173	+34.19		Deviation TMS402-22-ANCHOR-FU

TMS402-22-ANCHOR-FU: 402-22 takes steel strength from the specified tensile strength, the handout from a 36 ksi yield

TMS18-HEAD: Headed bolt at mid-thickness, the cone cut by both faces

Source: TMS webinar Anchor Bolt Design, March 2018 (TMS 402-16), pp. pp. 24-25. Calculation: Masonry anchor bolts.

TMS18-HEAD · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Projected tension area Apt	in.²	68.00	68.03	+0.04		Pass
Design breakout strength	lb	6,080	6,084	+0.07		Pass

TMS18-EDGE: Headed bolt 2.25 in. from the edge

Source: TMS webinar Anchor Bolt Design, March 2018 (TMS 402-16), pp. p. 29. Calculation: Masonry anchor bolts.

TMS18-EDGE · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Projected tension area Apt	in.²	61.00	60.99	-0.02		Pass
Design breakout strength	lb	5,460	5,455	-0.10		Pass

TMS18-SHEAR: Headed bolt in the side of a wall, shear

Source: TMS webinar Anchor Bolt Design, March 2018 (TMS 402-16), pp. pp. 41-42. Calculation: Masonry anchor bolts.

TMS18-SHEAR · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Design crushing strength	lb	3,592	3,591	-0.02		Pass
Design pryout strength	lb	14,040	14,050	+0.07		Pass
Design steel strength	lb	2,760	3,320	+20.31		Deviation TMS402-22-ANCHOR-FU

TMS402-22-ANCHOR-FU: 402-22 takes steel strength from the specified tensile strength, the handout from a 36 ksi yield

TMS18-COMB: 3/4 in. bolt, tension and shear with E, spacing solved at 34 in.

Source: TMS webinar Anchor Bolt Design, March 2018 (TMS 402-16), pp. pp. 51-54. Calculation: Masonry anchor bolts.

TMS18-COMB · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Projected tension area Apt	in.²	86.60	86.59	-0.01		Pass
Design breakout strength	lb	7,745	7,745	-0.00		Pass
Design crushing strength	lb	4,448	4,450	+0.04		Pass
Interaction at the solved spacing (published 1.0 by construction)		1.000	0.995	-0.50		Pass
Design steel strength in shear	lb	6,493	7,826	+20.54		Deviation TMS402-22-ANCHOR-FU
TMS402-22-ANCHOR-FU: 402-22 takes steel strength from the specified tensile strength, the handout from a 36 ksi yield						

TEK-12-03C: Two 1/2 in. bolts at 6 in., a ledger on the side of a wall

Source: CMHA TEK 12-03C (2013 code), pp. pp. 4-5. Calculation: Masonry anchor bolts.

TEK-12-03C · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Projected tension area Apt, overlap shared	in.²	90.99	90.99	-0.00		Pass
Masonry breakout Banb	lb	16,277	16,276	-0.01		Pass
Steel Bans (fy 60 in the TEK, fu 60 here)	lb	8,520	8,514	-0.07		Pass
Pryout Bvnpry	lb	32,554	32,552	-0.01		Pass
Steel Bvns	lb	5,112	5,108	-0.07		Pass
Tension per bolt, half of 2,688 lb	lb	1,344	1,344	+0.00		Pass
Shear per bolt, half of 2,240 lb	lb	1,120	1,120	+0.00		Pass
Crushing Bvnc	lb	4,310	7,183	+66.65		Deviation TMS402-16-CRUSH
TMS402-16-CRUSH: 402-16 raised the crushing coefficient from 1,050 to 1,750; the TEK uses the older value						

HC-1 · Masonry anchor bolts: Shear breakout with overlapping half circles

Source: Hand calculation from the cited equations, pp. lens area, half shared. Calculation: Masonry anchor bolts.

HC-1 · Masonry anchor bolts · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Apv per bolt, depth cut by the 11.625 in. wall not reached	in.²	126.4	126.4	-0.00		Pass

HC-2 · Masonry anchor bolts: fu limit: fu at most 1.9 fy

Source: Hand calculation from the cited equations, pp. 9.1.6.3. Calculation: Masonry anchor bolts.

HC-2 · Masonry anchor bolts · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bvns = 0.6 × 0.1419 × 114,000	lb	9,706	9,706	+0.00		Pass

HC-3 · Masonry anchor bolts: Seismic factor, tension by breakout and shear by steel

Source: Hand calculation from the cited equations, pp. ASCE 7-22 14.4.5. Calculation: Masonry anchor bolts.

HC-3 · Masonry anchor bolts · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tension doubled: breakout governs	lb	1,000	1,000	+0.00		Pass
Shear not doubled: steel governs	lb	500.0	500.0	+0.00		Pass

HC-4 · Masonry anchor bolts: Corner bolt: a quarter of the circle

Source: Hand calculation from the cited equations, pp. 6.3.2. Calculation: Masonry anchor bolts.

HC-4 · Masonry anchor bolts · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Apt about a quarter of π 5²	in.²	19.73	19.74	+0.00		Pass

HC-JACK: Brick jack arch, 4 ft span, 8 in. deep, 500 plf

Source: Hand calculation, thrust-line method with TMS 402 Chapter 8, pp. H = 3 × 500 × 4² / (8 × 8/12); N at the skewback = √(4,500² + 1,000²); fa = fb with e = d/6; joint at 20°. Calculation: Masonry arch.

HC-JACK · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Thrust H, jack arch	lb	4,500	4,500	+0.00		Pass
V at a skewback	lb	1,000	1,000	+0.00		Pass
Ring fa/Fa + fb/Fb		0.396	0.396	-0.00		Pass
Skewback joint shear	psi	29.13	29.13	-0.00		Pass
Skewback allowable	psi	75.00	75.00	+0.00		Pass

HC-SEGMENTAL: Segmental arch, 6 ft span, 9 in. rise, 8 in. ring, 600 plf

Source: Hand calculation, thrust-line method with TMS 402 Chapter 8, pp. R = (36² + 9²)/18 = 76.5 in.; cos θs = 0.8824; ft = 9 + 1.333 + 1.511 = 11.844 in.; H = 50 × 72² / (8 × 11.844). Calculation: Masonry arch.

HC-SEGMENTAL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Thrust H, segmental	lb	2,735	2,735	-0.00		Pass
Rise of the thrust line	in.	11.84	11.84	+0.00		Pass
Pier net tension at its base	psi	8.417	8.417	-0.00		Pass
Pier sliding stress	psi	5.605	5.605	+0.01		Pass

HC-TIE: 3/4 in. tie, Fy = 36 ksi

Source: Hand calculation, thrust-line method with TMS 402 Chapter 8, pp. Fy Ag / 1.67. Calculation: Masonry arch.

HC-TIE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tie allowable tension	lb	9,524	9,524	+0.00		Pass

12.4-2A: Lintel 16 ft clear, 48 in. deep, 2 No. 4

Source: TMS MDG-2022 Example 12.4-2A (sample examples on disk), pp. pp. 12-23 to 12-25. Calculation: Masonry beam and deep beam.

12.4-2A · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Factored load wu	plf	1,710	1,709	-0.07		Pass
Factored moment Mu	lb-in	713,000	712,000	-0.14		Pass
Required area As	in.²	0.305	0.305	-0.05		Pass
Cracking moment Mcr	lb-in	781,800	781,776	-0.00		Pass
Nominal strength Mn, 2 No. 4	lb-in	1,038,000	1,032,393	-0.54		Pass
Maximum reinforcement ratio		0.007	0.007	+0.02		Pass
Lateral support limit 120 b² / d	in.	159.0	158.6	-0.27		Pass

12.4-2A-R: Rework: 2,000 plf dead, 700 plf live, 4 No. 4 in two courses

Source: TMS MDG-2022 Example 12.4-2A (sample examples on disk), pp. pp. 12-25 to 12-26. Calculation: Masonry beam and deep beam.

12.4-2A-R · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Factored load wu, rework	plf	3,910	3,909	-0.03		Pass
Factored moment Mu, rework	lb-in	1,630,000	1,628,667	-0.08		Pass
Design strength φMn, 4 No. 4	lb-in	1,640,000	1,643,016	+0.18		Pass
Shear at d/2 from the face	lb	24,760	24,756	-0.02		Pass
Masonry shear Vnm	lb	30,700	30,690	-0.03		Pass

HC-ASD · Masonry beam and deep beam: Allowable moment of the 12.4-2A beam

Source: Hand calculation (closed form), pp. cracked transformed section, TMS 402 8.3. Calculation: Masonry beam and deep beam.

HC-ASD · Masonry beam and deep beam · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable moment Ma = As Fs j d	lb-in	529,830	529,834	+0.00		Pass

HC-DEEP: Deep beam 6 ft clear, 64 in. deep

Source: Hand calculation (closed form), pp. TMS 402 5.3.2, Table 5.3.2.2. Calculation: Masonry beam and deep beam.

HC-DEEP · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Effective span leff	ft	6.667	6.667	-0.00		Pass
Lever arm z	in.	41.60	41.60	+0.00		Pass
Deep beam Mn = As fy z	lb-in	3,095,040	3,095,040	+0.00		Pass
Deep beam Mu	lb-in	434,560	434,560	+0.00		Pass
Deep beam shear at d/2	lb	6,518	6,518	-0.00		Pass

B-1 · Masonry bearing: Default: plate narrower than the wall, A2 limited by the wall faces

Source: Hand calculation from the cited equations (no published example exists). Calculation: Masonry bearing.

B-1 · Masonry bearing · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A1	in.²	48.00	48.00	+0.00		Pass
k = 1 + 2 a / bw		1.271	1.271	+0.00		Pass
A2 = k² A1	in.²	77.52	77.52	+0.00		Pass
Abr = A1 √(A2/A1)	in.²	61.00	61.00	+0.00		Pass
Bn = 0.8 f'm Abr	kips	97.60	97.60	+0.00		Pass
φBn, φ = 0.60	kips	58.56	58.56	+0.00		Pass
Pu = 1.2D + 1.0S (ASCE 7-22)	kips	13.20	13.20	+0.00		Pass

B-2 · Masonry bearing: Loaded area across the full wall: A2 = A1

Source: Hand calculation from the cited equations (no published example exists). Calculation: Masonry bearing.

B-2 · Masonry bearing · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Abr = A1 = 8 × 7.625	in.²	61.00	61.00	+0.00		Pass
φBn	kips	58.56	58.56	+0.00		Pass

B-3 · Masonry bearing: Bearing on hollow masonry under one bond beam course

Source: Hand calculation from the cited equations (no published example exists). Calculation: Masonry bearing.

B-3 · Masonry bearing · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
L = lb + 2 (v/2)	in.	15.62	15.62	+0.00		Pass
Abr = 2 face shells × L	in.²	39.06	39.06	+0.00		Pass
Load = Pu + wu L	kips	14.06	14.06	+0.00		Pass
φBn	kips	37.50	37.50	+0.00		Pass

B-4 · Masonry bearing: Spread cut at a wall end

Source: Hand calculation from the cited equations (no published example exists). Calculation: Masonry bearing.

B-4 · Masonry bearing · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
L = 8 + 2 + 3.8125	in.	13.81	13.81	+0.00		Pass
k along the wall = 1 + 2 × 2 / 8		1.500	1.500	+0.00		Pass

B-5 · Masonry bearing: Length of wall at half the height and the load per foot

Source: Hand calculation from the cited equations (no published example exists). Calculation: Masonry bearing.

B-5 · Masonry bearing · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
L = 8 + 2 × 72/2 in.	in.	80.00	80.00	+0.00		Pass
P per foot = 13.2 / (80/12)	kip/ft	1.980	1.980	-0.00		Pass

B-6 · Masonry bearing: Hollow units: two face shells under the loaded length

Source: Hand calculation from the cited equations (no published example exists). Calculation: Masonry bearing.

B-6 · Masonry bearing · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Abr = 2 × 1.25 × 16	in.²	40.00	40.00	+0.00		Pass
φBn	kips	38.40	38.40	+0.00		Pass

B-7: Small area on a grouted wall: Abr limited to 2 A1

Source: Hand calculation from the cited equations (no published example exists). Calculation: Masonry bearing.

B-7 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Abr = 2 A1	in.²	16.00	16.00	+0.00		Pass
A2 / A1		33.79	33.79	+0.00		Pass

B-8: Next load at 24 in.: the spread and A2 stop

Source: Hand calculation from the cited equations (no published example exists). Calculation: Masonry bearing.

B-8 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
L = s	in.	12.00	12.00	+0.00		Pass
k along the wall = 1 + 2 × 2 / 8		1.500	1.500	+0.00		Pass

B-9: Not in running bond: A2 = A1, the spread through the bond beam only

Source: Hand calculation from the cited equations (no published example exists). Calculation: Masonry bearing.

B-9 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Abr = A1	in.²	48.00	48.00	+0.00		Pass
L at half the height = L under the bond beam	in.	15.62	15.62	+0.00		Pass

HC-CHORD: Chord of an 80 × 40 ft diaphragm

Source: Hand calculation (closed form), pp. T = w L² / (8 b); φTn = 0.90 As fy. Calculation: Bond beam chord and collector.

HC-CHORD · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Chord force (wind governs)	lb	6,000	6,000	+0.00		Pass
Chord tension strength	lb	33,480	33,480	+0.00		Pass
Chord compression strength	lb	48,370	48,373	+0.01		Pass

HC-CHORD · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable chord tension	lb	19,840	19,840	+0.00		Pass
Allowable chord compression	lb	29,070	29,070	+0.00		Pass

HC-COLL: Collector at a 20 ft shear wall, SDC D, Ω0 = 2.5

Source: Hand calculation (closed form), pp. F = R (Lc − Lw) / Lc × Ω0. Calculation: Bond beam chord and collector.

HC-COLL · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Collector force with Ω0	lb	12,500	12,500	+0.00		Pass

HC-COLL · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Collector force with 0.7 Ω0	lb	8,750	8,750	+0.00		Pass

HC-LAP · Bond beam chord and collector: Lap of two No. 5 bars in an 8 in. bond beam

Source: Hand calculation (closed form), pp. TMS 402 Eq. 6-1. Calculation: Bond beam chord and collector.

HC-LAP · Bond beam chord and collector · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Development length ld	in.	38.93	38.93	+0.00		Pass

HC-WIND · Masonry chimney: Wind on a 6 ft chimney, 115 mph, exposure C

Source: Hand calculation (closed form), pp. ASCE 7-22 26.10, 29.4, Figure 29.4-1. Calculation: Masonry chimney.

HC-WIND · Masonry chimney · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
qz at the centroid	psf	31.44	31.44	+0.00		Pass
Wind pressure p	psf	32.07	32.07	+0.00		Pass
Wind moment at the roof	lb-ft	1,540	1,539	-0.00		Pass

HC-SEIS: Seismic force on the default chimney, SDC D

Source: Hand calculation (closed form), pp. ASCE 7-22 Eqs. 13.3-1, 13.3-5. Calculation: Masonry chimney.

HC-SEIS · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Weight per foot	plf	602.6	602.6	-0.00		Pass
Fp / Wp, cantilever		1.579	1.579	-0.00		Pass
Seismic moment at the roof	lb-ft	17,132	17,132	+0.00		Pass

HC-BRACE: Chimney braced 4 ft above the roof

Source: Hand calculation (closed form), pp. propped cantilever with an overhang. Calculation: Masonry chimney.

HC-BRACE · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Wind moment at the roof, braced	lb-ft	85.53	85.53	-0.00		Pass
Brace reaction, wind	lb	363.5	363.5	-0.00		Pass
Fp / Wp, braced above the centre of mass		0.718	0.718	+0.01		Pass

TMS21-COL-PN: 16 in. column, 20 ft: axial capacity (402-13 Eq. 9-19)

Source: The Masonry Society, Strength Design of Masonry night school 5, Design of Columns and Pilasters (J. Hochwalt, March 2021; TMS 402-16), pp. slide 19 (PDF p. 10). Calculation: Masonry column and pilaster.

h/r = 240/4.51 = 53.2; the compression bars count (the column is tied, 5.4.1.4).

TMS21-COL-PN · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
r = t/√12	in.	4.510	4.511	+0.01		Pass
Pn = 0.80 [0.80 f'm (An − Ast) + fy Ast][1 − (h/140r)²]	kips	337.7	337.7	+0.00		Pass
φPn (φ = 0.90, TMS 402-16)	kips	303.9	219.5	-27.77		Deviation TMS402-22-PHI-COL

TMS402-22-PHI-COL: the handout uses the flat φ = 0.90 of TMS 402-16; TMS 402-22 Table 9.1.4 gives φ = 0.65 for pure axial compression: 219.5 kips

TMS21-COL-BAL: 16 in. column: the balanced point

Source: The Masonry Society, Strength Design of Masonry night school 5, Design of Columns and Pilasters (J. Hochwalt, March 2021; TMS 402-16), pp. slide 21 (PDF p. 11). Calculation: Masonry column and pilaster.

ILX enters Pu = 0.65 × 102.6 kips (as 1.4D) and solves for c; the handout picks c at the balanced strain and finds Pn (it prints φPn = 92.4 kips with φ = 0.90).

TMS21-COL-BAL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pn = Pu/φ = Cm + Cs − T = 129.2 + 26.2 − 52.8	kips	102.6	102.6	+0.00		Pass
c = εmu/(εmu + εy) d	in.	6.462	6.463	+0.01		Pass
Mn = Cm xCm + Cs xCs + T xT	kip-ft	82.62	82.60	-0.03		Pass
φMn (φ = 0.90, TMS 402-16)	kip-ft	74.36	53.69	-27.80		Deviation TMS402-22-PHI-COL

TMS402-22-PHI-COL: the handout uses φ = 0.90 at the balanced point; TMS 402-22 Table 9.1.4 gives φ = 0.65 there (εt = εty): 53.7 kip-ft

TMS21-COL-FLEX: 16 in. column: flexural capacity at P = 0, both bar layers

Source: The Masonry Society, Strength Design of Masonry night school 5, Design of Columns and Pilasters (J. Hochwalt, March 2021; TMS 402-16), pp. slide 22 (PDF p. 11). Calculation: Masonry column and pilaster.

The handout first takes the two tension bars only (Mn = 47.3 kip-ft), then both layers (48.8).

TMS21-COL-FLEX · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mn (both layers of reinforcement)	kip-ft	48.80	48.75	-0.11		Pass
φMn	kip-ft	43.90	43.87	-0.06		Pass

FEMA-13.1.6: 16 in. pilaster, out-of-plane wind, flanges neglected

Source: FEMA P-1051, NEHRP Recommended Seismic Provisions: Design Examples (2015 Provisions), Section 13.1.6, pp. 13-22 to 13-23 (PDF pp. 634-635). Calculation: Masonry column and pilaster.

d = 12 in. as the example rounds it; Type S Portland cement / lime mortar, fully grouted (fr = 163 psi, Table 9.1.9.2). No axial load (self-weight neglected as in the example).

FEMA-13.1.6 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mu = wu h²/8 = 478,632 lb-in	kip-ft	39.89	39.89	+0.00		Pass
φMn = 520,059 lb-in	kip-ft	43.34	44.32	+2.26		Deviation FEMA-PIL-2L
FEMA-PIL-2L: the example keeps only the two tension bars (a = 2.11 in.); ILX solves the strain compatibility with both bar layers (the second layer, 3.6 in. from the compression face, is in tension at c = 3.1 in.), 2 % stronger						
In = b h³/12	in.⁴	4,967	4,967	+0.00		Pass
Mcr = S fr = 103,633 lb-in (fr = 163 psi)	kip-ft	8.636	8.636	-0.00		Pass
c = a/0.8 = 2.11/0.8	in.	2.640	2.640	-0.00		Pass
Icr = n As (d − c)² + b c³/3	in.⁴	1,337	1,338	+0.06		Pass

TMS-SD-1-COL: 2 ft pier as a 24 × 7.625 in. section: shear, Mu/(Vu dv) = 2

Source: The Masonry Society, Design of Masonry Shear Walls, webinar handout (R. Bennett, May 2018; TMS 402-16), pp. slides 66-67 (PDF pp. 33-34). Calculation: Masonry column and pilaster.

Pu = 8 kips (0.9D + E), Mu = 28 kip-ft, Vu = 7 kips, dv = 24 in., no shear reinforcement. The slide prints 16,700 lb; its own expression gives 16,330 lb, which ILX computes (within the 0.5 kip floor of the tolerance).

TMS-SD-1-COL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mu/(Vu dv)		2.000	2.000	+0.00		Pass
φVnm	kips	16.70	16.33	-2.21		Pass

MC-1: 45° biaxial bending at Pn = 0 (rotated neutral axis)

Source: Hand calculation (closed form). Calculation: Masonry column and pilaster.

MC-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Neutral axis depth c (corner block)	in.	7.182	7.182	+0.00		Pass
Mn = √2 Mnx	kip-ft	47.95	47.95	+0.00		Pass
εt at the far bar (transition)		0.003	0.003	-0.00		Pass
φMn, φ = 0.65 + 0.25 (εt − εty)/0.003	kip-ft	36.14	36.14	+0.00		Pass

MC-2: Moment magnifier (9.3.4.4.3; 402-13 Eqs. 9-31 to 9-33), Ieff = Icr

Source: Hand calculation (closed form). Calculation: Masonry column and pilaster.

MC-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Icr (Pu not credited)	in.⁴	1,338	1,338	+0.00		Pass
Pe = π² Em Icr / h²	kips	210.5	210.5	+0.00		Pass
ψ = 1/(1 − Pu/Pe)		1.153	1.153	+0.00		Pass
Mu = ψ Mu,0	kip-ft	32.29	32.29	+0.00		Pass

MC-3: Shear with ties as shear reinforcement (Mu/(Vu dv) = 0.768)

Source: Hand calculation (closed form). Calculation: Masonry column and pilaster.

MC-3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mu/(Vu dv)		0.768	0.768	+0.00		Pass
Vnm (Pu = 36 kips)	kips	38.00	38.00	+0.00		Pass
Vns	kips	5.742	5.742	+0.00		Pass
φVn	kips	34.99	34.99	+0.00		Pass

MC-5: Compression-controlled point, φ = 0.65 (Pu = 100 kips)

Source: Hand calculation (closed form). Calculation: Masonry column and pilaster.

MC-5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Neutral axis c at Pn = Pu/0.65	in.	7.747	7.747	+0.00		Pass
εt		0.001	0.001	+0.00		Pass
Mn	kip-ft	82.80	82.80	+0.00		Pass
φMn = 0.65 Mn	kip-ft	53.82	53.82	+0.00		Pass
φPn = 0.65 Pn (pure axial)	kips	219.5	219.5	+0.00		Pass

MC-6: Transition point, φ from the strain at Pn = Pu/φ (Pu = 40 kips)

Source: Hand calculation (closed form). Calculation: Masonry column and pilaster.

MC-6 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pn = Pu/φ	kips	49.64	49.64	+0.00		Pass
Neutral axis c	in.	4.586	4.586	+0.00		Pass
εt		0.004	0.004	-0.00		Pass
Mn	kip-ft	66.85	66.85	+0.00		Pass
φMn	kip-ft	53.87	53.87	-0.00		Pass

MC-7: 9.1.4.4.2 limit: φPn ≤ 0.65 Pbal on the tension side (Pu = 66 kips)

Source: Hand calculation (closed form). Calculation: Masonry column and pilaster.

MC-7 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
cb	in.	6.462	6.462	+0.00		Pass
Pbal	kips	102.6	102.6	+0.00		Pass
0.65 Pbal	kips	66.67	66.67	+0.00		Pass
Pu	kips	66.00	66.00	+0.00		Pass

HC-LIMITS: Non-load-bearing corbel limits, 8 in. wall, 8 in. units

Source: Hand calculation from TMS 402-16 5.5 and 8.2, pp. 8/2; 8/2; 8/3. Calculation: Corbelled masonry.

HC-LIMITS · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Total projection limit	in.	4.000	4.000	+0.00		Pass
Unit projection by height	in.	4.000	4.000	+0.00		Pass
Unit projection by thickness	in.	2.667	2.667	-0.00		Pass

HC-CORBEL: Default load-bearing corbel

Source: Hand calculation from TMS 402-16 5.5 and 8.2, pp. fbr = 500/36; ft = 6 × 500 × 2.5/(12 × 24²); fv = 1.5 × 500/(12 × 24). Calculation: Corbelled masonry.

HC-CORBEL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bearing stress	psi	13.89	13.89	-0.00		Pass
Allowable bearing 0.25 f'm	psi	500.0	500.0	+0.00		Pass
Corbel tension	psi	1.085	1.085	-0.00		Pass
Corbel shear	psi	2.604	2.604	-0.00		Pass

HC-WALL: Wall below the default corbel

Source: Hand calculation from TMS 402-16 5.5 and 8.2, pp. P = 2,000 plf, M = 500 × (2.5 + 3.8125); A = 91.5, S = 116.28 in.³, r = 2.2011 in., Fa = 500 (1 − (65.42/140)²); net tension under D + L 3,156.25/116.28 − 2,000/91.5 = 5.286 psi (under D alone 1,893.75/116.28 − 1,300/91.5 = 2.078 psi: D + L governs). Calculation: Corbelled masonry.

HC-WALL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
fa/Fa + fb/Fb		0.086	0.086	-0.00		Pass
Pe/4	lb/ft	19,138	19,138	+0.00		Pass
Net tension, D + L governs	psi	5.286	5.285	-0.01		Pass

TA.4.2-HOLLOW: Hollow CMU up to 8 in., 1,500 psi units, Type M or S

Source: TMS 402-16 Appendix A, pp. Table A.4.2, p. C-210. Calculation: Empirical masonry design.

TA.4.2-HOLLOW · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable, hollow CMU 1,500 psi, M or S	psi	115.0	115.0	+0.00		Pass

TA.4.2-BRICK: Solid clay brick, 4,500 psi units, Type N

Source: TMS 402-16 Appendix A, pp. Table A.4.2, p. C-210. Calculation: Empirical masonry design.

TA.4.2-BRICK · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable, solid brick 4,500 psi, N	psi	200.0	200.0	+0.00		Pass

TA.4.2-HOLLOW10: Hollow CMU 10 in., 1,000 psi units, Type N

Source: TMS 402-16 Appendix A, pp. Table A.4.2, p. C-210. Calculation: Empirical masonry design.

TA.4.2-HOLLOW10 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable, 10 in. hollow CMU 1,000 psi, N	psi	60.00	60.00	+0.00		Pass

TA.5.1: Lateral support limits

Source: TMS 402-16 Appendix A, pp. Table A.5.1, p. C-212. Calculation: Empirical masonry design.

TA.5.1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Hollow load-bearing limit		18.00	18.00	+0.00		Pass

TA.5.1-SOLID: Lateral support limit, fully grouted

Source: TMS 402-16 Appendix A, pp. Table A.5.1, p. C-212. Calculation: Empirical masonry design.

TA.5.1-SOLID · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Grouted load-bearing limit		20.00	20.00	+0.00		Pass

TA.6.3.1-HOLLOW: Foundation wall, 10 in. hollow units

Source: TMS 402-16 Appendix A, pp. Table A.6.3.1, p. C-215. Calculation: Empirical masonry design.

TA.6.3.1-HOLLOW · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Maximum backfill, 10 in. hollow	ft	6.000	6.000	+0.00		Pass

TA.6.3.1-GROUTED: Foundation wall, 8 in. fully grouted

Source: TMS 402-16 Appendix A, pp. Table A.6.3.1, p. C-215. Calculation: Empirical masonry design.

TA.6.3.1-GROUTED · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Maximum backfill, 8 in. grouted	ft	7.000	7.000	+0.00		Pass

FIG-CC-A.3-1: Three-bay garage, shear wall length per plane

Source: TMS 402-16 Appendix A, pp. Commentary Figure CC-A.3-1, p. C-208. Calculation: Empirical masonry design.

FIG-CC-A.3-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
0.2 × 50.67 ft	ft	10.13	10.13	+0.00		Pass

HC-DEFAULT · Empirical masonry design: 8 in. hollow CMU, 1,100 psi units, 12 ft

Source: Hand calculation from TMS 402-16 Appendix A, pp. 75 + (115 − 75) × 100/500; (600 + 400 + 45 × 12) / (12 × 7.625). Calculation: Empirical masonry design.

HC-DEFAULT · Empirical masonry design · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable interpolated	psi	83.00	83.00	+0.00		Pass
fa on the gross area	psi	16.83	16.83	+0.00		Pass

HC-OPENING: 6 ft opening, WS = 40 in.

Source: Hand calculation from TMS 402-16 Appendix A, pp. 18 / √((40 + 36)/40). Calculation: Empirical masonry design.

HC-OPENING · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Reduced limit		13.06	13.06	+0.00		Pass

HC-PARAPET: 4 ft parapet

Source: Hand calculation from TMS 402-16 Appendix A, pp. max(8, 48/3). Calculation: Empirical masonry design.

HC-PARAPET · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Parapet thickness needed	in.	16.00	16.00	+0.00		Pass

HC-WIND · Freestanding masonry wall: Wind on a 6 ft fence, 115 mph, exposure C

Source: Hand calculation (closed form), pp. Kz at 15 ft; p = qh Kd G Cf = qh × 0.85 × 0.85 × 1.3. Calculation: Freestanding masonry wall.

HC-WIND · Freestanding masonry wall · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
qh = 0.00256 Kz V²	psf	28.82	28.82	-0.00		Pass
p	psf	27.07	27.07	+0.00		Pass
F = p H	lb/ft	162.4	162.4	-0.00		Pass

HC-FOOTING: Default footing, 2.5 ft wide

Source: Hand calculation (closed form), pp. Mr = ΣW × B/2; Mo = 0.6 F × (4.5 + 1) ft; triangular bearing beyond the kern: under 0.6D + 0.6W N = 634.6 plf, e = 0.8445 ft, q = 2N / (3 (B/2 − e)) = 1,043.3 psf (under D + 0.6W 948.6 psf: 0.6D + 0.6W governs). Calculation: Freestanding masonry wall.

HC-FOOTING · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
FS overturning		2.467	2.467	-0.00		Pass
q max, 0.6D + 0.6W governs	psf	1,043	1,043	-0.00		Pass
FS sliding, friction and lateral bearing		5.921	5.921	-0.00		Pass

HC-STEM · Freestanding masonry wall: 8 ft fence, 8 in. CMU, No. 4 at 24 in., 32 psf (the case of CMHA TEK 14-16B Table 2)

Source: Hand calculation (closed form), pp. Mu = p H (H/2 + hb); φ Mn under 0.9D + 1.0W. Calculation: Freestanding masonry wall.

HC-STEM · Freestanding masonry wall · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mu at the footing	lb-in	18,432	18,432	+0.00		Pass
φ Mn	lb-in	20,886	20,886	-0.00		Pass

T722.3.2-SHALE: Expanded shale, 3.6 in.: 2 hours

Source: IBC 2021 Table 722.3.2, pp. p. 7-73. Calculation: Masonry fire resistance.

T722.3.2-SHALE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rating, expanded shale, Te 3.6 in.		2.000	2.000	+0.00		Pass

T722.3.2-SHALE-3H: Expanded shale, 4.4 in.: 3 hours

Source: IBC 2021 Table 722.3.2, pp. p. 7-73. Calculation: Masonry fire resistance.

T722.3.2-SHALE-3H · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rating, expanded shale, Te 4.4 in.		3.000	3.000	+0.00		Pass

T722.3.2-GRAVEL: Siliceous gravel, 6.2 in.: 4 hours

Source: IBC 2021 Table 722.3.2, pp. p. 7-73. Calculation: Masonry fire resistance.

T722.3.2-GRAVEL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rating, gravel, Te 6.2 in.		4.000	4.000	+0.00		Pass

T722.3.2-PUMICE: Pumice, 2.1 in.: 1 hour

Source: IBC 2021 Table 722.3.2, pp. p. 7-73. Calculation: Masonry fire resistance.

T722.3.2-PUMICE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rating, pumice, Te 2.1 in.		1.000	1.000	+0.00		Pass

T722.3.2-LIMESTONE: Limestone, 4.5 in.: 2-1/2 hours

Source: IBC 2021 Table 722.3.2, pp. p. 7-73. Calculation: Masonry fire resistance.

T722.3.2-LIMESTONE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rating, limestone, Te 4.5 in.		2.500	2.500	+0.00		Pass

T722.4.1-SOLID: Solid brick, 3.8 in.: 2 hours

Source: IBC 2021 Table 722.4.1(1), pp. p. 7-75. Calculation: Masonry fire resistance.

T722.4.1-SOLID · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rating, solid brick, Te 3.8 in.		2.000	2.004	+0.21		Pass

T722.4.1-HOLLOW: Hollow clay unfilled, Te 4.3 in.: 3 hours

Source: IBC 2021 Table 722.4.1(1), pp. p. 7-75. Calculation: Masonry fire resistance.

T722.4.1-HOLLOW · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Te = 0.50 × 8.6	in.	4.300	4.300	+0.00		Pass
Rating, hollow clay, Te 4.3 in.		3.000	3.010	+0.33		Pass

T722.4.1-FILLED: Hollow clay grouted, 5.5 in.: 3 hours

Source: IBC 2021 Table 722.4.1(1), pp. p. 7-75. Calculation: Masonry fire resistance.

T722.4.1-FILLED · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rating, filled clay, Te 5.5 in.		3.000	3.010	+0.33		Pass

HC-INTERP · Masonry fire resistance: 8 in. expanded shale CMU, 53 % solid

Source: Hand calculation from IBC 2021 722.3 and 722.4, pp. Te = 0.53 × 7.625; between 2-1/2 h (4.0) and 2-3/4 h (4.2). Calculation: Masonry fire resistance.

HC-INTERP · Masonry fire resistance · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Te	in.	4.041	4.041	-0.00		Pass
Rating interpolated		2.552	2.552	-0.00		Pass

HC-FINISH · Masonry fire resistance: 5/8 in. gypsum wallboard on side 2

Source: Hand calculation from IBC 2021 722.3 and 722.4, pp. Tea = 3.6 + 2.25 × 0.625 (fire on side 1); 2 h + 20 min (fire on side 2). Calculation: Masonry fire resistance.

HC-FINISH · Masonry fire resistance · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fire on side 1		3.883	3.883	+0.00		Pass
Fire on side 2		2.333	2.333	+0.00		Pass
Rating, the lower side		2.333	2.333	+0.00		Pass

HC-PLASTER: 1-hour brick with 1/2 in. plaster both sides

Source: Hand calculation from IBC 2021 722.3 and 722.4, pp. Eq. 7-9: (1 + 0.6)^1.7. Calculation: Masonry fire resistance.

HC-PLASTER · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rating with plaster		2.223	2.223	+0.00		Pass

HC-WYTHES: Two 2-hour wythes and an airspace

Source: Hand calculation from IBC 2021 722.3 and 722.4, pp. Eq. 7-7: (2 × 2^0.59 + 0.30)^1.7. Calculation: Masonry fire resistance.

HC-WYTHES · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rating of the two wythes		7.653	7.653	-0.00		Pass
Required against it		4.000	4.000	+0.00		Pass

T2-N-2650: CMU 2,650 psi, Type N mortar

Source: TMS 602-16 Table 2 (concrete masonry units), read from the TMS 402/602-16 volume, pp. p. S-18. Calculation: Masonry strength f'm.

T2-N-2650 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
f'm, Type N, 2,650 psi units	psi	2,000	2,000	+0.00		Pass
Units needed for 2,000 psi, Type M or S	psi	2,000	2,000	+0.00		Pass
Units needed for 2,000 psi, Type N	psi	2,650	2,650	+0.00		Pass

T2-MS-3250: CMU 3,250 psi, Type S mortar

Source: TMS 602-16 Table 2 (concrete masonry units), read from the TMS 402/602-16 volume, pp. p. S-18. Calculation: Masonry strength f′m.

T2-MS-3250 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
f'm, Type M or S, 3,250 psi units	psi	2,500	2,500	+0.00		Pass
Units needed for 2,500 psi, Type N	psi	4,350	4,350	+0.00		Pass

T2-MS-4500: CMU 4,500 psi, Type S mortar

Source: TMS 602-16 Table 2 (concrete masonry units), read from the TMS 402/602-16 volume, pp. p. S-18. Calculation: Masonry strength f'm.

T2-MS-4500 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
f'm, top row of Table 2	psi	3,000	3,000	+0.00		Pass

T1-MS-4950: Clay 4,950 psi, Type S mortar

Source: TMS 602-16 Table 1 (clay masonry units), read from the TMS 402/602-16 volume, pp. p. S-16. Calculation: Masonry strength f'm.

T1-MS-4950 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
f'm, clay, Type M or S, 4,950 psi units	psi	2,000	2,000	+0.00		Pass
Clay units needed for 2,000 psi, Type N	psi	6,200	6,200	+0.00		Pass

T1-N-10300: Clay 10,300 psi, Type N mortar

Source: TMS 602-16 Table 1 (clay masonry units), read from the TMS 402/602-16 volume, pp. p. S-16. Calculation: Masonry strength f'm.

T1-N-10300 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
f'm, clay, Type N, 10,300 psi units	psi	3,000	3,000	+0.00		Pass
Clay units needed for 3,000 psi, Type M or S	psi	8,250	8,250	+0.00		Pass

HC-SHORT: CMU under 4 in. high: 85 percent

Source: Hand calculation from TMS 602-16 Table 2 and its footnote, pp. Table 2 footnote 1. Calculation: Masonry strength f'm.

HC-SHORT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
f'm = 0.85 × 2,250	psi	1,912	1,912	+0.00		Pass
Specified f'm against it	psi	1,500	1,500	+0.00		Pass

HC-INTERP · Masonry strength f′m: Interpolated between rows (input)

Source: Hand calculation from TMS 602-16 Table 2 and its footnote, pp. 2,000 + 250 × 350 / 750. Calculation: Masonry strength f′m.

HC-INTERP · Masonry strength f′m · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
f'm interpolated	psi	2,117	2,117	-0.00		Pass

TEK-1: In-plane: 30 ft by 16 ft in W10X45 columns

Source: CMHA TEK 14-23, Design of Concrete Masonry Infill, Example 1, pp. pp. 3-6. Calculation: Masonry infill.

TEK-1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
λstrut		0.039	0.039	-0.05		Pass
Stiffness	lb	56,030	55,886	-0.26		Pass
Eq. B-3	lb	22,500	22,500	+0.00		Pass
Bed joint, 3.8 An √f'm / 1.5	lb	88,304	88,304	+0.00		Pass
Bed joint, 300 An / 1.5	lb	180,000	180,000	+0.00		Pass
Bed joint, 56 An / 1.5	lb	33,600	33,600	+0.00		Pass
Vn inf	lb	22,500	22,500	+0.00		Pass
φVn inf	lb	13,500	13,500	+0.00		Pass

TEK-2: Out of plane: the east wall, W10X45 strong axis, W10X39 weak axis, 24 psf

Source: CMHA TEK 14-23, Design of Concrete Masonry Infill, Example 2, pp. pp. 6-7. Calculation: Masonry infill.

TEK-2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
αarch		21.00	21.02	+0.08		Pass
βarch		10.00	10.02	+0.17		Pass
qn	psf	41.40	41.43	+0.08		Pass
φqn	psf	24.80	24.86	+0.24		Pass

TUC-1: In-plane: 32 ft by 14 ft, f'm 2,000 psi, W10X45 weak axis

Source: Tucker, So, You Need to Design a Masonry Infill, STRUCTURE magazine, example, pp. web text. Calculation: Masonry infill.

TUC-1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Eq. B-3	lb	30,000	30,000	+0.00		Pass
Strut at 1 in.	lb	70,340	69,900	-0.62		Pass
3.8 An √f'm	lb	163,144	163,144	-0.00		Pass
300 An	lb	288,000	288,000	+0.00		Pass
56 An	lb	53,760	53,760	+0.00		Pass
φVn inf	lb	18,000	18,000	+0.00		Pass

TUC-2: Out of plane: the same panel the other way, 35 psf

Source: Tucker, So, You Need to Design a Masonry Infill, STRUCTURE magazine, example, pp. web text. Calculation: Masonry infill.

TUC-2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φqn	psf	37.60	37.56	-0.10		Pass

GUIDE-6.3.3.12: 8 ft pier between doors, seismic

Source: TMS webinar SD Walls Axial and Out-of-Plane Loads, Feb. 2021 (Strength Design Guide Example 6.3.3.12, TMS 402-16), pp. pp. 23-26.
Calculation: Masonry wall at openings.

GUIDE-6.3.3.12 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Top reaction	lb	12,690	12,690	-0.00		Pass
Base reaction	lb	8,720	8,726	+0.07		Pass
Largest first-order moment	lb-ft	82,000	82,010	+0.01		Pass
Moment at the door head	lb-ft	75,100	75,058	-0.06		Pass
Pu at the largest moment	lb	18,500	18,528	+0.15		Pass
Moment magnifier ψ		1.050	1.051	+0.07		Pass
Mu = ψ Mu,0	lb-ft	86,000	86,169	+0.20		Pass
Nominal moment Mn, second layer not counted	lb-ft	105,400	105,429	+0.03		Pass
φMn	lb-ft	94,800	94,886	+0.09		Pass
1.2D + Ev + Eh: Mu	lb-ft	95,100	95,926	+0.87		Pass
1.2D + Ev + Eh: φMn	lb-ft	105,000	105,031	+0.03		Pass
Cracked moment of inertia Icr	in.⁴	2,540	2,446	-3.69		Deviation TMS402-22-ICR
TMS402-22-ICR: 402-22 Eq. 9-28 places the axial load at the wall centre line; the handout's 402-16 form differs for bars off the centre line						
Buckling load Pe	kips	400.0	384.9	-3.76		Deviation TMS402-22-ICR
TMS402-22-ICR: 402-22 Eq. 9-28 places the axial load at the wall centre line; the handout's 402-16 form differs for bars off the centre line						
Service deflection	in.	2.300	0.903	-60.75		Deviation TMS-JAMB-QUICK
TMS-JAMB-QUICK: the handout's quick check takes the load of the wall above the door over the whole height, cracked throughout; ILX integrates the load on each part with the uncracked part						

GUIDE-LAYER2: The same pier with the second layer counted

Source: TMS webinar SD Walls Axial and Out-of-Plane Loads, Feb. 2021 (Strength Design Guide Example 6.3.3.12, TMS 402-16), pp. p. 25.
Calculation: Masonry wall at openings.

GUIDE-LAYER2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nominal moment Mn	lb-ft	111,300	111,334	+0.03		Pass

FEMA-13.1.6.3: The pier at the door head, with a parapet

Source: FEMA P-1051, Section 13.1.6.3 (TMS 402-13), pp. pp. 13-28 to 13-35. Calculation: Masonry wall at openings.

FEMA-13.1.6.3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Axial load at the door head	kips	27.70	27.68	-0.08		Pass
Mn at the door head, about the wall centre line	kip-ft	125.4	127.3	+1.51		Deviation FEMA-JAMB-PN
FEMA-JAMB-PN: the example adds Pu to the steel force; ILX and the TMS handout use Pn = Pu/φ, as 9.3.2 strength design does						
φMn at the door head	kip-ft	112.8	114.6	+1.56		Deviation FEMA-JAMB-PN
FEMA-JAMB-PN: the example adds Pu to the steel force; ILX and the TMS handout use Pn = Pu/φ, as 9.3.2 strength design does						
Top reaction	lb	17,500	17,036	-2.65		Deviation FEMA-JAMB-ROUND
FEMA-JAMB-ROUND: the example rounds 1,178 plf to 1,200 plf						
Service deflection (published before the magnifier)	in.	1.630	0.957	-41.30		Deviation FEMA-JAMB-DEFL
FEMA-JAMB-DEFL: the example uses the cracked section over the whole height and the rounded load; ILX has the uncracked part below the cracking moment						

HC-UNI: No opening: equal to w h²/8

Source: Hand calculation (closed form), pp. statics. Calculation: Masonry wall at openings.

HC-UNI · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mu,0 = 1.0 × 25 × 4 × 16²/8	lb-ft	3,200	3,200	+0.00		Pass

HC-WIND · Masonry wall at openings: An opening not loaded by wind: strip width beside it

Source: Hand calculation (closed form), pp. statics. Calculation: Masonry wall at openings.

HC-WIND · Masonry wall at openings · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Base reaction: 100 plf on the lower 8 ft, 200 plf on the upper 8 ft	lb	1,000	1,000	+0.00		Pass

MDG-9.2-1: No. 5 Grade 60 at the centre of an 8 in. wall

Source: MDG Example 9.2-1, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 21. Calculation: Masonry lap splice.

MDG-9.2-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Masonry cover	in.	3.500	3.500	+0.00		Pass
K	in.	3.500	3.500	+0.00		Pass
Lap length	in.	19.50	19.47	-0.18		Pass
Use, whole in.	in.	20.00	20.00	+0.00		Pass

MDG-T925-2000-#3-8c: Lap of #3 at f'm 2000 psi, 8c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2000-#3-8c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	12.00	12.00	+0.00		Pass

MDG-T925-2000-#3-12c: Lap of #3 at f'm 2000 psi, 12c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2000-#3-12c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	12.00	12.00	+0.00		Pass

MDG-T925-2000-#3-2c: Lap of #3 at f'm 2000 psi, 2c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2000-#3-2c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	12.00	13.00	+8.33		Deviation MDG-T925-NO3
MDG-T925-NO3: the table prints 12 in. for 12.27 in., where its other cells round up: the equation gives 13 in. rounded up						

MDG-T925-2000-#4-8c: Lap of #4 at f'm 2000 psi, 8c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2000-#4-8c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	13.00	13.00	+0.00		Pass

MDG-T925-2000-#4-12c: Lap of #4 at f'm 2000 psi, 12c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2000-#4-12c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	12.00	12.00	+0.00		Pass

MDG-T925-2000-#4-2c: Lap of #4 at f'm 2000 psi, 2c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2000-#4-2c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	22.00	22.00	+0.00		Pass

MDG-T925-2000-#5-8c: Lap of #5 at f'm 2000 psi, 8c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2000-#5-8c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	20.00	20.00	+0.00		Pass

MDG-T925-2000-#5-12c: Lap of #5 at f'm 2000 psi, 12c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2000-#5-12c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	13.00	13.00	+0.00		Pass

MDG-T925-2000-#5-2c: Lap of #5 at f'm 2000 psi, 2c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2000-#5-2c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	35.00	35.00	+0.00		Pass

MDG-T925-2000-#6-8c: Lap of #6 at f'm 2000 psi, 8c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2000-#6-8c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	38.00	38.00	+0.00		Pass

MDG-T925-2000-#6-12c: Lap of #6 at f'm 2000 psi, 12c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2000-#6-12c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	24.00	24.00	+0.00		Pass

MDG-T925-2000-#6-2c: Lap of #6 at f'm 2000 psi, 2c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2000-#6-2c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	64.00	64.00	+0.00		Pass

MDG-T925-2000-#7-8c: Lap of #7 at f'm 2000 psi, 8c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2000-#7-8c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	52.00	52.00	+0.00		Pass

MDG-T925-2000-#7-12c: Lap of #7 at f'm 2000 psi, 12c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2000-#7-12c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	33.00	33.00	+0.00		Pass

MDG-T925-2000-#7-2c: Lap of #7 at f'm 2000 psi, 2c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2000-#7-2c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	87.00	87.00	+0.00		Pass

MDG-T925-2000-#8-8c: Lap of #8 at f'm 2000 psi, 8c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2000-#8-8c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	79.00	79.00	+0.00		Pass

MDG-T925-2000-#8-12c: Lap of #8 at f'm 2000 psi, 12c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2000-#8-12c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	50.00	50.00	+0.00		Pass

MDG-T925-2000-#8-2c: Lap of #8 at f'm 2000 psi, 2c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2000-#8-2c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	131.0	131.0	+0.00		Pass

MDG-T925-2000-#9-12c: Lap of #9 at f'm 2000 psi, 12c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2000-#9-12c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	64.00	64.00	+0.00		Pass

MDG-T925-2000-#9-2c: Lap of #9 at f'm 2000 psi, 2c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2000-#9-2c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	167.0	167.0	+0.00		Pass

MDG-T925-2000-#10-12c: Lap of #10 at f'm 2000 psi, 12c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2000-#10-12c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	82.00	82.00	+0.00		Pass

MDG-T925-2000-#10-2c: Lap of #10 at f'm 2000 psi, 2c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2000-#10-2c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	211.0	211.0	+0.00		Pass

MDG-T925-2000-#11-12c: Lap of #11 at f'm 2000 psi, 12c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2000-#11-12c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	102.0	102.0	+0.00		Pass

MDG-T925-2000-#11-2c: Lap of #11 at f'm 2000 psi, 2c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2000-#11-2c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	261.0	261.0	+0.00		Pass

MDG-T925-2500-#3-8c: Lap of #3 at f'm 2500 psi, 8c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2500-#3-8c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	12.00	12.00	+0.00		Pass

MDG-T925-2500-#3-12c: Lap of #3 at f'm 2500 psi, 12c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2500-#3-12c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	12.00	12.00	+0.00		Pass

MDG-T925-2500-#3-2c: Lap of #3 at f'm 2500 psi, 2c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2500-#3-2c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	12.00	12.00	+0.00		Pass

MDG-T925-2500-#4-8c: Lap of #4 at f'm 2500 psi, 8c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2500-#4-8c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	12.00	12.00	+0.00		Pass

MDG-T925-2500-#4-12c: Lap of #4 at f'm 2500 psi, 12c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2500-#4-12c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	12.00	12.00	+0.00		Pass

MDG-T925-2500-#4-2c: Lap of #4 at f'm 2500 psi, 2c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2500-#4-2c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	20.00	20.00	+0.00		Pass

MDG-T925-2500-#5-8c: Lap of #5 at f'm 2500 psi, 8c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2500-#5-8c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	18.00	18.00	+0.00		Pass

MDG-T925-2500-#5-12c: Lap of #5 at f'm 2500 psi, 12c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2500-#5-12c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	12.00	12.00	+0.00		Pass

MDG-T925-2500-#5-2c: Lap of #5 at f'm 2500 psi, 2c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2500-#5-2c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	31.00	31.00	+0.00		Pass

MDG-T925-2500-#6-8c: Lap of #6 at f'm 2500 psi, 8c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2500-#6-8c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	34.00	34.00	+0.00		Pass

MDG-T925-2500-#6-12c: Lap of #6 at f'm 2500 psi, 12c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2500-#6-12c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	21.00	21.00	+0.00		Pass

MDG-T925-2500-#6-2c: Lap of #6 at f'm 2500 psi, 2c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2500-#6-2c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	58.00	58.00	+0.00		Pass

MDG-T925-2500-#7-8c: Lap of #7 at f'm 2500 psi, 8c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2500-#7-8c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	47.00	47.00	+0.00		Pass

MDG-T925-2500-#7-12c: Lap of #7 at f'm 2500 psi, 12c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2500-#7-12c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	29.00	29.00	+0.00		Pass

MDG-T925-2500-#7-2c: Lap of #7 at f'm 2500 psi, 2c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2500-#7-2c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	78.00	78.00	+0.00		Pass

MDG-T925-2500-#8-8c: Lap of #8 at f'm 2500 psi, 8c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2500-#8-8c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	71.00	71.00	+0.00		Pass

MDG-T925-2500-#8-12c: Lap of #8 at f'm 2500 psi, 12c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2500-#8-12c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	45.00	45.00	+0.00		Pass

MDG-T925-2500-#8-2c: Lap of #8 at f'm 2500 psi, 2c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2500-#8-2c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	117.0	117.0	+0.00		Pass

MDG-T925-2500-#9-12c: Lap of #9 at f'm 2500 psi, 12c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2500-#9-12c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	57.00	57.00	+0.00		Pass

MDG-T925-2500-#9-2c: Lap of #9 at f'm 2500 psi, 2c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2500-#9-2c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	149.0	149.0	+0.00		Pass

MDG-T925-2500-#10-12c: Lap of #10 at f'm 2500 psi, 12c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2500-#10-12c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	73.00	73.00	+0.00		Pass

MDG-T925-2500-#10-2c: Lap of #10 at f'm 2500 psi, 2c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2500-#10-2c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	189.0	189.0	+0.00		Pass

MDG-T925-2500-#11-12c: Lap of #11 at f'm 2500 psi, 12c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2500-#11-12c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	92.00	92.00	+0.00		Pass

MDG-T925-2500-#11-2c: Lap of #11 at f'm 2500 psi, 2c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-2500-#11-2c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	233.0	233.0	+0.00		Pass

MDG-T925-3000-#3-8c: Lap of #3 at f'm 3000 psi, 8c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-3000-#3-8c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	12.00	12.00	+0.00		Pass

MDG-T925-3000-#3-12c: Lap of #3 at f'm 3000 psi, 12c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-3000-#3-12c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	12.00	12.00	+0.00		Pass

MDG-T925-3000-#3-2c: Lap of #3 at f'm 3000 psi, 2c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-3000-#3-2c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	12.00	12.00	+0.00		Pass

MDG-T925-3000-#4-8c: Lap of #4 at f'm 3000 psi, 8c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-3000-#4-8c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	12.00	12.00	+0.00		Pass

MDG-T925-3000-#4-12c: Lap of #4 at f'm 3000 psi, 12c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-3000-#4-12c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	12.00	12.00	+0.00		Pass

MDG-T925-3000-#4-2c: Lap of #4 at f'm 3000 psi, 2c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-3000-#4-2c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	18.00	18.00	+0.00		Pass

MDG-T925-3000-#5-8c: Lap of #5 at f'm 3000 psi, 8c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-3000-#5-8c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	16.00	16.00	+0.00		Pass

MDG-T925-3000-#5-12c: Lap of #5 at f'm 3000 psi, 12c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-3000-#5-12c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	12.00	12.00	+0.00		Pass

MDG-T925-3000-#5-2c: Lap of #5 at f'm 3000 psi, 2c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-3000-#5-2c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	28.00	28.00	+0.00		Pass

MDG-T925-3000-#6-8c: Lap of #6 at f'm 3000 psi, 8c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-3000-#6-8c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	31.00	31.00	+0.00		Pass

MDG-T925-3000-#6-12c: Lap of #6 at f'm 3000 psi, 12c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-3000-#6-12c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	20.00	20.00	+0.00		Pass

MDG-T925-3000-#6-2c: Lap of #6 at f'm 3000 psi, 2c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-3000-#6-2c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	53.00	53.00	+0.00		Pass

MDG-T925-3000-#7-8c: Lap of #7 at f'm 3000 psi, 8c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-3000-#7-8c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	42.00	42.00	+0.00		Pass

MDG-T925-3000-#7-12c: Lap of #7 at f'm 3000 psi, 12c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-3000-#7-12c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	27.00	27.00	+0.00		Pass

MDG-T925-3000-#7-2c: Lap of #7 at f'm 3000 psi, 2c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-3000-#7-2c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	71.00	71.00	+0.00		Pass

MDG-T925-3000-#8-8c: Lap of #8 at f'm 3000 psi, 8c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-3000-#8-8c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	65.00	65.00	+0.00		Pass

MDG-T925-3000-#8-12c: Lap of #8 at f'm 3000 psi, 12c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-3000-#8-12c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	41.00	41.00	+0.00		Pass

MDG-T925-3000-#8-2c: Lap of #8 at f'm 3000 psi, 2c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-3000-#8-2c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	107.0	107.0	+0.00		Pass

MDG-T925-3000-#9-12c: Lap of #9 at f'm 3000 psi, 12c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-3000-#9-12c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	52.00	52.00	+0.00		Pass

MDG-T925-3000-#9-2c: Lap of #9 at f'm 3000 psi, 2c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-3000-#9-2c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	136.0	136.0	+0.00		Pass

MDG-T925-3000-#10-12c: Lap of #10 at f'm 3000 psi, 12c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-3000-#10-12c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	67.00	67.00	+0.00		Pass

MDG-T925-3000-#10-2c: Lap of #10 at f'm 3000 psi, 2c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-3000-#10-2c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	173.0	173.0	+0.00		Pass

MDG-T925-3000-#11-12c: Lap of #11 at f'm 3000 psi, 12c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-3000-#11-12c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	84.00	84.00	+0.00		Pass

MDG-T925-3000-#11-2c: Lap of #11 at f'm 3000 psi, 2c

Source: MDG Table 9.2.5, as printed in TMS webinar ASD Night School 6, March 2022 (TMS 402-16), pp. PDF p. 11, slide 22. Calculation: Masonry lap splice.

MDG-T925-3000-#11-2c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required lap, whole in.	in.	213.0	213.0	+0.00		Pass

HC-EPOXY: Epoxy-coated No. 5

Source: Hand calculation (closed form). Calculation: Masonry lap splice.

HC-EPOXY · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Lap: 1.5 × 19.47	in.	29.20	29.20	-0.00		Pass

HC-SPACING: Adjacent splices govern K

Source: Hand calculation (closed form). Calculation: Masonry lap splice.

HC-SPACING · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
K: 4 − 2 × 0.625	in.	2.750	2.750	+0.00		Pass
Lap	in.	24.77	24.77	+0.02		Pass

HC-HOOK: Standard hook, No. 5

Source: Hand calculation (closed form). Calculation: Masonry lap splice.

HC-HOOK · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh = 19.47 − 9 × 0.625	in.	13.84	13.84	+0.01		Pass

HC-CONF: No. 8 with a No. 4 at each end

Source: Hand calculation (closed form). Calculation: Masonry lap splice.

HC-CONF · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ξ: 1 − 2.3 × 0.20 / 1		0.540	0.540	+0.00		Pass
Lap: 0.54 × 78.98	in.	42.65	42.65	-0.00		Pass

HC-36DB: No. 5: 36 db above ld, no reduction and no increase

Source: Hand calculation (closed form). Calculation: Masonry lap splice.

HC-36DB · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Lap stays ld	in.	19.47	19.47	-0.02		Pass

HC-NONCONTACT: Limit of a noncontact lap

Source: Hand calculation (closed form). Calculation: Masonry lap splice.

HC-NONCONTACT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ld / 5	in.	3.894	3.893	-0.02		Pass

TEK12-03C: Two 1/2 in. bolts, eccentric roof beam load 2,240 lb factored

Source: CMHA TEK 12-03C, Design Example (strength design), pp. p. 4, 5. Calculation: Ledger to masonry wall.

TEK12-03C · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tension per bolt from the eccentricity (2,688 lb per two bolts)	lb	1,344	1,344	-0.00		Pass

HC-WOOD: Default wood ledger: bolt bearing

Source: Hand calculation from NDS 2024, TMS 402 and ASCE 7-22, pp. Fes = 6,100 × 0.5^1.45/√0.75; mode IIIs: k3 D ls Fem / ((2 + Re) 4); Z' = Z × 3.32 × 0.65 × 0.8. Calculation: Ledger to masonry wall.

HC-WOOD · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vu per bolt	lb	1,040	1,040	+0.00		Pass
Z' of the bolt in the ledger	lb	1,338	1,338	-0.00		Pass

HC-LEDGER: Default wood ledger between bolts

Source: Hand calculation from NDS 2024, TMS 402 and ASCE 7-22, pp. Mu = 780 × (16/12)²/8; Fb' = 900 × 1.1 × 2.54 × 0.85 × 0.8. Calculation: Ledger to masonry wall.

HC-LEDGER · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
fb between bolts	psi	58.34	58.34	+0.01		Pass
Fb' of the ledger	psi	1,710	1,710	+0.00		Pass
fv between bolts	psi	33.73	33.73	-0.00		Pass
Fv' of the ledger	psi	311.0	311.0	-0.00		Pass

HC-BOLTS: Default bolts in the masonry

Source: Hand calculation from NDS 2024, TMS 402 and ASCE 7-22, pp. Apt = π × 5² (no overlap at 16 in.); φBan = 0.5 × 4 Apt √2,000; φBvn = 0.5 × 1,750 (2,000 × 0.3345)^(1/4); T = 1,040 × 2.5/4.375. Calculation: Ledger to masonry wall.

HC-BOLTS · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φBan	lb	7,025	7,025	+0.00		Pass
φBvn, crushing	lb	4,450	4,450	+0.00		Pass
Tension per bolt	lb	594.3	594.3	-0.00		Pass
Interaction		0.105	0.105	-0.00		Pass

SDG-6.3.1.8: 16 ft beam, 48 in. deep 8 in. CMU, 2 #4 (minimum reinforcement)

Source: The Masonry Society, Design of Beams, webinar handout (R. Bennett, Feb. 2021; TMS 402-16), Strength Design Guide Example 6.3.1.8, pp. slides 30-37. Calculation: Masonry lintel and beam.

SDG-6.3.1.8 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Effective span (16 ft + 8 in.)	ft	16.67	16.67	-0.02		Pass
Factored shear Vu (at the support)	kips	14.24	14.24	+0.00		Pass
Factored moment Mu = 712,000 lb-in.	kip-ft	59.33	59.32	-0.03		Pass
As required = 0.305 in.²	in.²	0.305	0.305	-0.07		Pass
Cracking moment Mcr = 782,000 lb-in.	kip-ft	65.17	65.15	-0.03		Pass
1.3 Mcr = 1,016 kip-in.	kip-ft	84.67	84.69	+0.03		Pass
Mn, 2 #4 = 1,032 kip-in.	kip-ft	86.00	86.03	+0.04		Pass
ρ = 0.00119		0.001	0.001	+0.19		Pass
ρmax = 0.00952		0.010	0.007	-25.30		Deviation TMS-RHOMAX-16
TMS-RHOMAX-16: 0.00952 is the TMS 402-16 limit (extreme bar at 1.5 times the yield strain); TMS 402-22 requires a tension-controlled beam, 0.00711 at f'm = 2,000 psi						
Lateral support 32b = 20.3 ft	ft	20.30	20.33	+0.16		Pass
Lateral support 120b²/d = 13.2 ft	ft	13.20	13.21	+0.10		Pass

SDG-6.3.1.8-5: The same beam with 1 #5: Mn below 1.3 Mcr

Source: The Masonry Society, Design of Beams, webinar handout (R. Bennett, Feb. 2021; TMS 402-16), Strength Design Guide Example 6.3.1.8, pp. slides 35. Calculation: Masonry lintel and beam.

SDG-6.3.1.8-5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mn, 1 #5 = 804 kip-in.	kip-ft	67.00	67.02	+0.03		Pass
1.3 Mcr = 1,016 kip-in.	kip-ft	84.67	84.69	+0.03		Pass

SDG-6.3.1.9: 16 ft beam, D = 2,000 plf, L = 700 plf: 4 #4, #3 stirrups, deflection

Source: The Masonry Society, Design of Beams, webinar handout (R. Bennett, Feb. 2021; TMS 402-16), Strength Design Guide Example 6.3.1.9, pp. slides 39-45. Calculation: Masonry lintel and beam.

SDG-6.3.1.9 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Factored shear Vu = 32,600 lb	kips	32.60	32.57	-0.08		Pass
Shear area Anv = 305 in.² (b d)	in.²	305.0	305.0	+0.00		Pass
Vnm = 30,700 lb	kips	30.70	30.69	-0.03		Pass
φVn max = 43,600 lb	kips	43.60	43.65	+0.11		Pass
Vns required = 10,100 lb	kips	10.10	10.03	-0.73		Pass
Minimum Av/s = 0.0053 in.²/in.		0.005	0.005	+0.71		Pass
Stirrup spacing required for Vns = 15.7 in. (No. 3, dv = 48 in.)	in.	15.70	15.80	+0.62		Pass
Maximum stirrup spacing 24 in. (dv/2)	in.	24.00	24.00	+0.00		Pass
First stirrup within dv/4 = 12 in.	in.	12.00	12.00	+0.00		Pass
n = Es/Em = 16.11		16.11	16.11	+0.01		Pass
k = 0.252		0.252	0.252	-0.19		Pass
kd = 10.06 in.	in.	10.06	10.06	+0.01		Pass
In = 70,270 in.⁴	in.⁴	70,270	70,272	+0.00		Pass
Icr = 14,140 in.⁴	in.⁴	14,140	14,141	+0.01		Pass
Ma = 1,259,000 lb-in.	kip-ft	104.9	105.0	+0.05		Pass
Ieff = 27,590 in.⁴	in.⁴	27,590	27,559	-0.11		Pass
Deflection = 0.106 in.	in.	0.106	0.106	-0.19		Pass
Limit ℓ/600 = 0.333 in.	in.	0.333	0.333	+0.10		Pass

MDG-12.4-2A: 16 ft lintel, 48 in. deep 8 in. CMU, D = 700, Lr = 300 plf, 2 #4 (TMS 402-22)

Source: TMS, Masonry Designers' Guide 2022 (TMS 402/602-22), Example 12.4-2A, free sample examples, pp. sample pp. 6-8 (Guide 12-23 to 12-25). Calculation: Masonry lintel and beam.

MDG-12.4-2A · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span 16.67 ft (16 ft + half of 8 in. each end, 5.3.1.1)	ft	16.67	16.67	-0.02		Pass
Vu at the reaction = 14,250 lb	kips	14.25	14.24	-0.07		Pass
Mu = 713,000 lb-in.	kip-ft	59.42	59.32	-0.17		Pass
As required = 0.305 in.²	in.²	0.305	0.305	-0.07		Pass
Mcr = 781,800 lb-in.	kip-ft	65.15	65.15	-0.00		Pass
1.3 Mcr = 1,016,000 lb-in.	kip-ft	84.67	84.69	+0.03		Pass
Mn, 2 No. 4 = 1,038,000 lb-in. as printed Printing error within the tolerance: 24,000 lb × (44 in. − 1.966 in./2) = 1,032,000 lb-in. (the 2021 handout prints 1,032). See MDG-12.4-2A-PRINT.	kip-ft	86.50	86.03	-0.54		Pass
ρ of 2 No. 4 = 0.00092 as printed		0.001	0.001	+29.59		Deviation MDG-12.4-2A-PRINT
MDG-12.4-2A-PRINT: 0.00092 is 1 No. 5 (0.31 in.²) over b d; 2 No. 4 give 0.40/(7.63 × 44) = 0.00119						
ρmax = 0.00711		0.007	0.007	+0.02		Pass
Lateral support 32b = 20.3 ft	ft	20.30	20.33	+0.16		Pass
Lateral support 120b²/d = 13.2 ft	ft	13.20	13.21	+0.10		Pass
ℓ/d = 4.5, deflection need not be checked		4.500	4.545	+1.01		Pass

MDG-12.4-2A-5: The same lintel with 1 No. 5: Mn below 1.3 Mcr

Source: TMS, Masonry Designers' Guide 2022 (TMS 402/602-22), Example 12.4-2A, free sample examples, pp. sample p. 7. Calculation: Masonry lintel and beam.

MDG-12.4-2A-5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mn, 1 No. 5 = 804,000 lb-in.	kip-ft	67.00	67.02	+0.03		Pass
1.3 Mcr = 1,016,000 lb-in.	kip-ft	84.67	84.69	+0.03		Pass

MDG-12.4-2A-R: Rework: D = 2,000, L = 700 plf, 4 No. 4 in two courses, No. 3 stirrups

Source: TMS, Masonry Designers' Guide 2022 (TMS 402/602-22), Example 12.4-2A, free sample examples, pp. sample pp. 8-9 (Guide 12-25, 12-26). Calculation: Masonry lintel and beam.

MDG-12.4-2A-R · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mu = 1,630,000 lb-in.	kip-ft	135.8	135.7	-0.11		Pass
As required = 0.793 in.² (d = 40 in.)	in.²	0.793	0.792	-0.07		Pass
Mn of 4 No. 4 = 1,640,000 lb-in. as printed	kip-ft	136.7	152.1	+11.32		Deviation MDG-12.4-2A-PRINT
MDG-12.4-2A-PRINT: the printed 1,640,000 lb-in. labelled Mn is the design strength: 48,000 lb × (40 in. − 3.93 in./2) = 1,826,000 lb-in., and 0.9 × that = 1,643,000 lb-in.						
φMn = 0.9 Mn (the number printed as Mn)	kip-ft	136.7	136.9	+0.18		Pass
ρ = 0.00262		0.003	0.003	+0.11		Pass
ρmax = 0.00711		0.007	0.007	+0.02		Pass
Vu at d/2 from the face = 24,760 lb	kips	24.76	24.76	-0.02		Pass
Anv = b d = 305 in.²	in.²	305.0	305.0	+0.00		Pass
Vnm = 30,700 lb	kips	30.70	30.69	-0.03		Pass
Minimum Av/s = 0.0053 in.²/in.		0.005	0.005	+0.71		Pass
First stirrup within dv/4 = 12 in. (dv = 48 in.)	in.	12.00	12.00	+0.00		Pass
Maximum spacing min(dv/2, 48 in.) = 24 in.	in.	24.00	24.00	+0.00		Pass
f'm to avoid stirrups = 2,035 psi	psi	2,035	2,033	-0.08		Pass

TMS-2017-BEAM: 10 ft opening, 24 in. deep 8 in. CMU, 2 #6, #3 stirrups

Source: The Masonry Society, Strength Design of Masonry, webinar handout (Oct. 2017; TMS 402-16 numbering), beam example, pp. pp. 9-12.
Calculation: Masonry lintel and beam.

TMS-2017-BEAM · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span = 10.67 ft	ft	10.67	10.67	-0.03		Pass
Factored moment Mu = 62.6 k-ft	kip-ft	62.60	62.55	-0.08		Pass
As required = 0.77 in.²	in.²	0.770	0.767	-0.34		Pass
Mn = 78.5 k-ft	kip-ft	78.50	78.48	-0.03		Pass
φMn = 70.6 k-ft	kip-ft	70.60	70.63	+0.04		Pass
Mcr = 9.76 k-ft	kip-ft	9.760	9.760	+0.00		Pass
1.3 Mcr = 12.7 k-ft	kip-ft	12.70	12.69	-0.09		Pass
ρ = 0.00577		0.006	0.006	+0.01		Pass
Lateral support 32b = 20.3 ft	ft	20.30	20.33	+0.16		Pass
Lateral support 120b²/d = 29.1 ft	ft	29.10	29.07	-0.10		Pass
Vu at d/2 from the face = 18.33 k	kips	18.33	18.33	+0.00		Pass
φVnm = 12.27 k	kips	12.27	12.28	+0.05		Pass
φVn max = 21.82 k	kips	21.82	21.82	+0.02		Pass
Vns required = 7.58 k	kips	7.580	7.567	-0.17		Pass
Stirrup area for 8 in. spacing = 0.101 in.²	in.²	0.101	0.084	-16.75		Deviation TMS-2017-VNS-D

TMS-2017-VNS-D: the handout takes d = 20 in. in the steel shear strength; the 2021 and MDG-2022 examples use the actual depth (24 in. here), which gives 0.084 in.²

TEK-17-1D-1: 12 in. lintel, 5 ft 4 in. opening, arching action

Source: NCMA / CMHA TEK 17-01D, ASD of Concrete Masonry Lintels (2012 IBC / 2011 MSJC), Design Example, pp. p. 7. Calculation: Masonry lintel and beam.

TEK-17-1D-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Effective span L = 5.67 ft	ft	5.670	5.667	-0.06		Pass
Masonry needed above the lintel for arching = 3.5 ft	ft	3.500	3.500	-0.00		Pass
Lintel weight Dlintel = 88 plf	plf	88.00	88.00	+0.00		Pass
Vlintel = 251 lb	lb	251.0	249.3	-0.66		Pass
Mlintel = 357 lb-ft	lb-ft	357.0	353.2	-1.06		Deviation TEK17-1D-L57
TEK17-1D-L57: the TEK computes with the effective span rounded to 5.7 ft; with 5.67 ft the value is about 1 % lower						
Wall load at the apex = 221 plf	plf	221.0	178.5	-19.23		Deviation TEK17-1D-TRI
TEK17-1D-TRI: the TEK example takes the wall weight over 3.5 ft (half the span plus the 8 in. above the apex) at midspan; ILX takes the 45 degree triangle of the TEK text (height half the effective span, 2.83 ft)						
Mwall = 598 lb-ft	lb-ft	598.0	477.7	-20.12		Deviation TEK17-1D-TRI
TEK17-1D-TRI: the TEK example takes the wall weight over 3.5 ft (half the span plus the 8 in. above the apex) at midspan; ILX takes the 45 degree triangle of the TEK text (height half the effective span, 2.83 ft)						
Vmax = 566 lb	lb	566.0	502.2	-11.27		Deviation TEK17-1D-TRI
TEK17-1D-TRI: the TEK example takes the wall weight over 3.5 ft (half the span plus the 8 in. above the apex) at midspan; ILX takes the 45 degree triangle of the TEK text (height half the effective span, 2.83 ft)						
Mmax = 955 lb-ft	lb-ft	955.0	830.9	-13.00		Deviation TEK17-1D-TRI
TEK17-1D-TRI: the TEK example takes the wall weight over 3.5 ft (half the span plus the 8 in. above the apex) at midspan; ILX takes the 45 degree triangle of the TEK text (height half the effective span, 2.83 ft)						

TEK-17-1D-2: 24 in. lintel to the top of the wall, no arching

Source: NCMA / CMHA TEK 17-01D, ASD of Concrete Masonry Lintels (2012 IBC / 2011 MSJC), Design Example, pp. p. 7. Calculation: Masonry lintel and beam.

TEK-17-1D-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Lintel weight = 264 plf	plf	264.0	264.0	+0.00		Pass
Wtotal = 1,264 plf	plf	1,264	1,264	+0.00		Pass
Vmax = 3,602 lb	lb	3,602	3,581	-0.57		Pass
Mmax = 61,601 lb-in.	lb-in	61,601	60,866	-1.19		Deviation TEK17-1D-L57
TEK17-1D-L57: the TEK computes with the effective span rounded to 5.7 ft; with 5.67 ft the value is about 1 % lower						

ML-H1: Default lintel: shear, bearing, development, cracking moment

Source: Hand calculation (closed form). Calculation: Masonry lintel and beam.

ML-H1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vnm = 2.25 b d √f'm	kips	9.687	9.687	-0.00		Pass
φBn = 0.60 × 0.80 f'm A1	kips	58.56	58.56	+0.00		Pass
ld = 0.13 db² fy γ / (K √f'm)	in.	25.35	25.35	+0.00		Pass
Mcr = fr b h²/6 (267 psi)	kip-ft	6.903	6.903	+0.00		Pass
Mn = As fy (d − a/2)	kip-ft	18.39	18.39	+0.00		Pass

ML-H2: Arching: triangle and a dispersed point load inside it

Source: Hand calculation (closed form). Calculation: Masonry lintel and beam.

ML-H2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Effective span	ft	10.67	10.67	+0.00		Pass
Triangle peak = 52 psf × ℓ/2	plf	277.3	277.3	+0.00		Pass
Dispersed load w = P / (bearing + y)	plf	1,286	1,286	+0.00		Pass
Moment of the dispersed load	lb-ft	6,875	6,874	-0.00		Pass
Masonry needed for arching = ℓ/2 + 8 in.	ft	6.000	6.000	+0.00		Pass

ML-H3: Stack bond: modulus of rupture of the continuous grout section

Source: Hand calculation (closed form). Calculation: Masonry lintel and beam.

ML-H3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mcr = 335 psi × b h²/6	kip-ft	8.661	8.661	+0.00		Pass

ML-H4: Beam tension controlled, one bar course, Grade 60 (9.3.3.2.4)

Source: Hand calculation (closed form). Calculation: Masonry lintel and beam.

ML-H4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ρmax = 0.64 f'm/fy × εmu/(εmu + 0.002 + 0.003)		0.007	0.007	+0.00		Pass
φ = 0.90 (tension controlled)		0.900	0.900	+0.00		Pass

ML-H5: Beam tension controlled, Grade 40: εty = fy/Es

Source: Hand calculation (closed form). Calculation: Masonry lintel and beam.

ML-H5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ρmax = 0.64 f'm/fy × εmu/(εmu + fy/Es + 0.003)		0.012	0.012	-0.00		Pass

ML-H6: Over-reinforced: 2 #9 in one course, f'm = 1,500 psi: strain and φ of Table 9.1.4

Source: Hand calculation (closed form). Calculation: Masonry lintel and beam.

ML-H6 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
εt = εmu (d − c)/c		0.001	0.001	-0.00		Pass
φ = 0.65 + 0.25 (εt − 0.002)/0.003, 0.65 at or below 0.002		0.650	0.650	+0.00		Pass

TEK-T4-8X8-4: 8 x 8, 1 #4, 1.5 in. cover

Source: NCMA / CMHA TEK 17-01D, ASD of Concrete Masonry Lintels (2012 IBC / 2011 MSJC), Tables 3 and 4, pp. pp. 5-6. Calculation: Masonry lintel and beam.

TEK-T4-8X8-4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable moment	kip-ft	2.302	2.302	+0.00		Pass

TEK-T4-8X8-5: 8 x 8, 1 #5, 1.5 in. cover

Source: NCMA / CMHA TEK 17-01D, ASD of Concrete Masonry Lintels (2012 IBC / 2011 MSJC), Tables 3 and 4, pp. pp. 5-6. Calculation: Masonry lintel and beam.

TEK-T4-8X8-5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable moment	kip-ft	2.607	2.607	+0.00		Pass

TEK-T4-8X8-6: 8 x 8, 1 #6, 1.5 in. cover

Source: NCMA / CMHA TEK 17-01D, ASD of Concrete Masonry Lintels (2012 IBC / 2011 MSJC), Tables 3 and 4, pp. pp. 5-6. Calculation: Masonry lintel and beam.

TEK-T4-8X8-6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable moment	kip-ft	2.837	2.837	+0.00		Pass

TEK-T4-8X16-4: 8 x 16, 1 #4, 1.5 in. cover

Source: NCMA / CMHA TEK 17-01D, ASD of Concrete Masonry Lintels (2012 IBC / 2011 MSJC), Tables 3 and 4, pp. pp. 5-6. Calculation: Masonry lintel and beam.

TEK-T4-8X16-4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable moment	kip-ft	6.790	6.790	+0.00		Pass

TEK-T4-8X16-5: 8 x 16, 1 #5, 1.5 in. cover

Source: NCMA / CMHA TEK 17-01D, ASD of Concrete Masonry Lintels (2012 IBC / 2011 MSJC), Tables 3 and 4, pp. pp. 5-6. Calculation: Masonry lintel and beam.

TEK-T4-8X16-5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable moment	kip-ft	10.28	10.28	+0.00		Pass

TEK-T4-8X16-6: 8 x 16, 1 #6, 1.5 in. cover

Source: NCMA / CMHA TEK 17-01D, ASD of Concrete Masonry Lintels (2012 IBC / 2011 MSJC), Tables 3 and 4, pp. pp. 5-6. Calculation: Masonry lintel and beam.

TEK-T4-8X16-6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable moment	kip-ft	12.35	12.35	+0.00		Pass

TEK-T4-12X8-3: 12 x 8, 1 #4, 3.0 in. cover

Source: NCMA / CMHA TEK 17-01D, ASD of Concrete Masonry Lintels (2012 IBC / 2011 MSJC), Tables 3 and 4, pp. pp. 5-6. Calculation: Masonry lintel and beam.

TEK-T4-12X8-3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable moment	kip-ft	1.863	1.863	+0.00		Pass

TEK-T4-12X24-3: 12 x 24, 1 #4, 3.0 in. cover

Source: NCMA / CMHA TEK 17-01D, ASD of Concrete Masonry Lintels (2012 IBC / 2011 MSJC), Tables 3 and 4, pp. pp. 5-6. Calculation: Masonry lintel and beam.

TEK-T4-12X24-3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable moment	kip-ft	10.24	10.24	+0.00		Pass

TEK-T3-8X8: 8 x 8, No. 6, 1.5 in. cover

Source: NCMA / CMHA TEK 17-01D, ASD of Concrete Masonry Lintels (2012 IBC / 2011 MSJC), Tables 3 and 4, pp. p. 4. Calculation: Masonry lintel and beam.

TEK-T3-8X8 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable shear	kips	1.910	1.910	+0.02		Pass

TEK-T3-8X16: 8 x 16, No. 6, 1.5 in. cover

Source: NCMA / CMHA TEK 17-01D, ASD of Concrete Masonry Lintels (2012 IBC / 2011 MSJC), Tables 3 and 4, pp. p. 4. Calculation: Masonry lintel and beam.

TEK-T3-8X16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable shear	kips	4.568	4.568	+0.00		Pass

TEK-T3-12X8-3: 12 x 8, No. 6, 3.0 in. cover

Source: NCMA / CMHA TEK 17-01D, ASD of Concrete Masonry Lintels (2012 IBC / 2011 MSJC), Tables 3 and 4, pp. p. 4. Calculation: Masonry lintel and beam.

TEK-T3-12X8-3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable shear	kips	2.152	2.153	+0.03		Pass

TEK-T3-12X24-3: 12 x 24, No. 6, 3.0 in. cover

Source: NCMA / CMHA TEK 17-01D, ASD of Concrete Masonry Lintels (2012 IBC / 2011 MSJC), Tables 3 and 4, pp. p. 4. Calculation: Masonry lintel and beam.

TEK-T3-12X24-3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable shear	kips	10.26	10.26	+0.01		Pass

TEK-T3-6X16: 6 x 16, No. 6, 1.5 in. cover

Source: NCMA / CMHA TEK 17-01D, ASD of Concrete Masonry Lintels (2012 IBC / 2011 MSJC), Tables 3 and 4, pp. p. 4. Calculation: Masonry lintel and beam.

TEK-T3-6X16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable shear	kips	3.369	3.370	+0.03		Pass

TEK-T3-10X16-2: 10 x 16, No. 6, 2.0 in. cover

Source: NCMA / CMHA TEK 17-01D, ASD of Concrete Masonry Lintels (2012 IBC / 2011 MSJC), Tables 3 and 4, pp. p. 4. Calculation: Masonry lintel and beam.

TEK-T3-10X16-2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable shear	kips	5.556	5.557	+0.01		Pass

HC-CLAY: Brick expansion joints 3/8 in. at 16 ft

Source: Hand calculation (closed form), pp. BIA TN 18A form, TMS 402 4.2.3, 4.2.4. Calculation: Movement joints.

HC-CLAY · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Closing of the joint	in.	0.173	0.173	+0.00		Pass
Sealant compression		46.08	46.08	+0.00		Pass
Sealant extension		8.192	8.192	-0.00		Pass
Required joint width	in.	0.346	0.346	+0.00		Pass
Largest joint spacing	ft	17.36	17.36	+0.01		Pass
Joints in 100 ft		6.000	6.000	+0.00		Pass

HC-CMU: Concrete masonry control joints 3/8 in. at 18 ft

Source: Hand calculation (closed form), pp. TMS 402 4.2.3, 4.2.5; TEK 10-2C. Calculation: Movement joints.

HC-CMU · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Opening of the joint	in.	0.109	0.109	-0.02		Pass
Sealant extension, CMU		29.09	29.09	-0.01		Pass
Sealant compression, CMU		15.55	15.55	+0.01		Pass
Spacing limit	ft	18.00	18.00	+0.00		Pass
Required joint width, CMU	in.	0.218	0.218	-0.02		Pass

HC-WIND · Masonry parapet: Wind on the default parapet

Source: Hand calculation from ASCE 7-22 and TMS 402, pp. qp at 27 ft = 0.00256 × 0.9597 × 115²; A = 3 ft² (GCp at 10 ft²): case A 0.85 qp (1.0 + 2.3), case B 0.85 qp (1.0 + 1.4). Calculation: Masonry parapet.

HC-WIND · Masonry parapet · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
qp at the top of the parapet	psf	32.49	32.49	+0.00		Pass
Case A net pressure	psf	91.13	91.13	+0.00		Pass
Case B net pressure	psf	66.28	66.28	-0.00		Pass

HC-SEISMIC: Seismic on the default parapet

Source: Hand calculation from ASCE 7-22 and TMS 402, pp. Rμ = √(1.1 × 5/2.5); Fp/Wp = 0.4 × 0.5 × 3.5/1.4832 × 2.2/1.5. Calculation: Masonry parapet.

HC-SEISMIC · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fp/Wp		0.692	0.692	-0.00		Pass
Seismic pressure on the parapet	psf	34.61	34.61	-0.00		Pass

HC-STEM · Masonry parapet: Default parapet at the roof line

Source: Hand calculation from ASCE 7-22 and TMS 402, pp. Mu = 91.13 × 3²/2 × 12; As = 0.31 × 12/32; Pu = 0.9 × 150 lb; a = C/(0.8 × 2 × 12). Calculation: Masonry parapet.

HC-STEM · Masonry parapet · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mu at the roof line	lb-in	4,921	4,921	+0.00		Pass
φ Mn	lb-in	23,211	23,211	+0.00		Pass

HC-ANCHOR: Default anchorage at the roof line

Source: Hand calculation from ASCE 7-22 and TMS 402, pp. wall below 12 ft: inward 0.85 qh (0.8797 + 0.18) × 6 + 91.13 × 3 × 1.125; at 4 ft.
Calculation: Masonry parapet.

HC-ANCHOR · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Inward wind reaction	lb/ft	479.0	479.0	+0.00		Pass
Outward wind reaction	lb/ft	440.4	440.4	+0.00		Pass
Seismic anchorage 12.11.2.1	lb/ft	90.00	90.00	+0.00		Pass
Force per anchor	lb	1,916	1,916	-0.00		Pass

HC-ENTERED: Pressures entered, 2 ft parapet on a 10 ft wall, no seismic

Source: Hand calculation from ASCE 7-22 and TMS 402, pp. 25 × 5 + 40 × 2 × 1.1; 1.4.4: 0.2 × 50 × 7. Calculation: Masonry parapet.

HC-ENTERED · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Wind reaction, entered pressures	lb/ft	213.0	213.0	+0.00		Pass
1.4.4 minimum	lb/ft	70.00	70.00	+0.00		Pass

11.3-1: Unreinforced partition, 12 ft, 8 in. hollow CMU, 5 psf

Source: TMS MDG-2022 Example 11.3-1 (sample examples on disk), pp. pp. 11-5 to 11-6. Calculation: Masonry partition wall.

11.3-1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Net area An	in.²	30.00	30.00	+0.00		Pass
Section modulus Sn	in.³	81.00	80.97	-0.03		Pass
M / Sn	psi	13.30	13.34	+0.28		Pass
P / An (0.6D)	psi	3.700	3.720	+0.54		Pass
Net flexural tension	psi	9.600	9.618	+0.18		Pass
Allowable flexural tension	psi	12.00	12.00	+0.00		Pass
Shear force	lb/ft	30.00	30.00	+0.00		Pass
Allowable shear 1.5 √f'm	psi	67.10	67.08	-0.03		Pass
Shear stress on the webs	psi	3.500	3.497	-0.08		Pass
Shear stress on the bed joint	psi	1.500	1.500	+0.00		Pass

HC-FP: Default partition: Fp and the slip head, SDC D

Source: Hand calculation (closed form), pp. ASCE 7-22 Eqs. 13.3-1, 13.3-5; AISC 360-22 F11. Calculation: Masonry partition wall.

HC-FP · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fp / Wp		0.376	0.376	-0.00		Pass
Seismic load on the wall	psf	16.92	16.92	+0.00		Pass
Mid-height moment, first order	lb-in	3,655	3,655	-0.00		Pass
Head reaction	lb/ft	101.5	101.5	-0.00		Pass
Clip angle moment	lb-in	1,015	1,015	-0.00		Pass
Clip angle φMn	lb-in	3,038	3,038	+0.00		Pass

TMS-2017-PIL: 16 in. pilaster, 24 ft, eccentric gravity and uplift with wind, wall spanning horizontally

Source: The Masonry Society webinar, Strength Design of Masonry (R. Bennett, Oct. 2017; TMS 402-16), pilaster example, pp. pp. 14-15. Calculation: Masonry pilaster with wall.

Self-weight 0.20 kip/ft entered as 118 pcf on the 15.625 in. square section. The example then finds As = 0.57 in.² and chooses 4 #5; here 4 #5 are entered and checked (not a compared value). Factored 26 psf is entered as W at 1.0W.

TMS-2017-PIL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
wp = 26 psf × 16 ft	kip/ft	0.416	0.416	+0.00		Pass
Pu at the top, 0.9D + 1.0W	kips	0.540	0.540	+0.00		Pass
Mu = Pu e at the top = 3.1 kip-in	kip-ft	3.100	3.132	+1.03		Pass
x of the largest moment = 143.7 in. from the top	ft	11.97	12.00	+0.21		Pass
Mu = 361 kip-in	kip-ft	361.0	361.0	-0.00		Pass
Pu at that level = 2.7 kips	kips	2.690	2.701	+0.40		Pass

TEK-14-03A: Wall load to a pilaster and its moment, fixed base, pinned top

Source: NCMA TEK 14-03A, Designing Concrete Masonry Walls for Wind Loads, pp. pp. 2-3. Calculation: Masonry pilaster with wall.

The TEK's 20 psf is an allowable stress design pressure; it is entered as W so the combination 1.0W gives the same moment. The TEK reads K = 0.91 from its Figure 1 chart, entered here.

TEK-14-03A · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
wp = 0.91 × 20 psf × 18 ft = 328 lb/ft	kip/ft	0.328	0.328	-0.12		Pass
Mmax = wp H²/8 = 5,900 lb-ft	kip-ft	5.900	5.897	-0.05		Pass
Vmax = 5 wp H/8 = 2,460 lb	kips	2.460	2.457	-0.12		Pass

FEMA-13.1.6-P: 16 in. pilaster, 28 ft, seismic wall load, flanges neglected

Source: FEMA P-1051, NEHRP Recommended Seismic Provisions: Design Examples (2015 Provisions), Section 13.1.6, pp. 13-22 to 13-24 (PDF pp. 634-636). Calculation: Masonry pilaster with wall.

The example uses 20 ft of wall with pilasters at 40 ft on center; each pilaster at that spacing would carry 40 ft by TEK 14-03A, wp = K w X. The tributary width is an input here and the example's 20 ft is entered as printed. Service load 0.7E, as the example.

FEMA-13.1.6-P · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
wu = 0.55 × 37 psf × 20 ft	kip/ft	0.407	0.407	+0.00		Pass
Mu = wu h²/8 = 39,886 lb-ft	kip-ft	39.89	39.89	-0.00		Pass
φMn = 520,059 lb-in	kip-ft	43.34	44.32	+2.26		Deviation FEMA-PILASTER-2L
FEMA-PILASTER-2L: the example keeps only the two tension bars; ILX solves the strain compatibility with both layers, the second also in tension, 2 % stronger						
In = 4,967 in.⁴	in.⁴	4,967	4,967	+0.00		Pass
Mcr = 103,633 lb-in (fr = 163 psi)	kip-ft	8.636	8.636	-0.00		Pass
c = a/0.8 = 2.64 in.	in.	2.640	2.640	+0.00		Pass
Icr = 1,337.1 in.⁴	in.⁴	1,337	1,338	+0.06		Pass
Service moment Ma = 335,042 lb-in	kip-ft	27.92	27.92	+0.00		Pass
δ uncracked part = 0.136 in.	in.	0.136	0.136	+0.23		Pass
δ cracked part = 1.131 in.	in.	1.131	1.130	-0.09		Pass
δ = 1.267 in.	in.	1.267	1.266	-0.05		Pass

TMS-2021-COL-P: 16 in. section, 20 ft, tied, no flanges: axial strength and the section at the balanced axial load

Source: The Masonry Society, Strength Design of Masonry night school 5, Design of Columns and Pilasters (J. Hochwalt, March 2021; TMS 402-16), column example, pp. pp. 10-11. Calculation: Masonry pilaster with wall.

A column example read as the same rectangular section: nominal values only. The example's φ = 0.90 (TMS 402-16) is not compared; Table 9.1.4 of 402-22 gives 0.65 there. The load is set so that Pu/0.65 = 102.6 kips.

TMS-2021-COL-P · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
r = t/√12 = 4.51 in.	in.	4.510	4.511	+0.01		Pass
Pn = 337.7 kips	kips	337.7	337.7	+0.00		Pass
Mn at Pn = 102.6 kips = 82.62 kip-ft	kip-ft	82.62	82.60	-0.03		Pass

HC-1 · Masonry pilaster with wall: Flange in compression, block in the face shell, no axial load

Source: Hand calculation from the cited equations. Calculation: Masonry pilaster with wall.

16 × 16 pilaster, 8 in. hollow wall, 6 t = 48 in. each side, two #6 each layer not tied: C = 0.80 f'm b a in the 111.6 in. wide face shell against both layers yielding.

HC-1 · Masonry pilaster with wall · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Neutral axis depth c	in.	0.739	0.739	+0.00		Pass
Mn about the pilaster centre	kip-ft	66.15	66.15	+0.00		Pass
φMn, tension controlled, φ = 0.90	kip-ft	59.53	59.53	+0.00		Pass

HC-2 · Masonry pilaster with wall: The same, projecting face in compression: the flange does not help

Source: Hand calculation from the cited equations. Calculation: Masonry pilaster with wall.

Compression bars skipped (not tied), the block is in the 15.625 in. pilaster alone.

HC-2 · Masonry pilaster with wall · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Neutral axis depth c	in.	3.223	3.223	+0.00		Pass
Mn about the pilaster centre	kip-ft	48.75	48.75	+0.00		Pass

HC-3 · Masonry pilaster with wall: Flange in compression, block past the face shell, into the grouted pilaster

Source: Hand calculation from the cited equations. Calculation: Masonry pilaster with wall.

Face shell over 27.6 in., then the 15.6 in. pilaster only, the hollow cell of the flange not counted; the near bar is below yield and solved by its strain.

HC-3 · Masonry pilaster with wall · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Neutral axis depth c	in.	2.564	2.564	+0.00		Pass
Mn about the pilaster centre	kip-ft	49.88	49.88	+0.00		Pass

HC-4 · Masonry pilaster with wall: Shear between the flange and the pilaster

Source: Hand calculation from the cited equations. Calculation: Masonry pilaster with wall.

Fu = flange block at Mn × Mu/Mn, half to each side; Anv = two face shells × 120 in. This check is this calculation's reading of 5.1.1.2.4, see the chapter.

HC-4 · Masonry pilaster with wall · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Force on one side, Fu	kips	13.73	13.73	+0.00		Pass
Length to zero moment, half the height	in.	120.0	120.0	+0.00		Pass
φVn = 0.80 × 2.25 Anv √f'm	kips	24.15	24.15	+0.00		Pass

HC-5 · Masonry pilaster with wall: Net area, radius of gyration and axial strength of the flanged section

Source: Hand calculation from the cited equations. Calculation: Masonry pilaster with wall.

HC-5 · Masonry pilaster with wall · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Net area An	in.²	484.1	484.1	+0.00		Pass
r = √(I/An)	in.	4.400	4.400	+0.00		Pass
Pn	kips	525.6	525.6	+0.00		Pass

TEK-15-07B: Stability of a 12 in. wall, 8 ft 8 in. retained

Source: CMHA TEK 15-07B, Concrete Masonry Cantilever Retaining Walls, pp. pp. 2-3. Calculation: Masonry retaining wall.

TEK-15-07B · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Earth pressure Pa	lb	1,851	1,851	+0.03		Pass
Overturning moment	lb-ft	5,966	5,968	+0.03		Pass
Masonry weight	lb	1,093	1,093	+0.03		Pass
Earth weight	lb	2,799	2,799	-0.01		Pass
Footing weight	lb	800.0	798.9	-0.14		Pass
Total weight	lb	4,692	4,691	-0.03		Pass
Earth moment	lb-ft	11,140	11,141	+0.01		Pass
Footing moment	lb-ft	2,136	2,127	-0.41		Pass
Masonry moment	lb-ft	2,918	2,352	-19.39		Deviation TEK-15-07B-ARM
TEK-15-07B-ARM: the note puts the masonry weight at the footing centre, 2.67 ft from the toe; the geometry it draws gives 2.15 ft, and ILX takes the geometry						
Resisting moment	lb-ft	16,194	15,620	-3.54		Deviation TEK-15-07B-ARM
TEK-15-07B-ARM: the note puts the masonry weight at the footing centre, 2.67 ft from the toe; the geometry it draws gives 2.15 ft, and ILX takes the geometry						
FS overturning		2.400	2.617	+9.06		Deviation TEK-15-07B-ARM
TEK-15-07B-ARM: the same arm; the note also uses 14,670 for its own sum of 16,194						
Location of the resultant	ft	2.180	2.058	-5.61		Deviation TEK-15-07B-ARM
TEK-15-07B-ARM: the note puts the masonry weight at the footing centre, 2.67 ft from the toe; the geometry it draws gives 2.15 ft, and ILX takes the geometry						
Eccentricity	ft	0.480	0.605	+26.08		Deviation TEK-15-07B-ARM
TEK-15-07B-ARM: the note puts the masonry weight at the footing centre, 2.67 ft from the toe; the geometry it draws gives 2.15 ft, and ILX takes the geometry						
Pressure at the toe	psf	1,356	1,481	+9.24		Deviation TEK-15-07B-ARM
TEK-15-07B-ARM: the note puts the masonry weight at the footing centre, 2.67 ft from the toe; the geometry it draws gives 2.15 ft, and ILX takes the geometry						
Pressure at the heel	psf	404.0	280.3	-30.63		Deviation TEK-15-07B-ARM
TEK-15-07B-ARM: the note puts the masonry weight at the footing centre, 2.67 ft from the toe; the geometry it draws gives 2.15 ft, and ILX takes the geometry						
Average bearing pressure	psf	880.0	880.8	+0.09		Pass
Friction and lateral bearing	lb	1,248	1,248	-0.02		Pass
FS sliding, no key		0.670	0.674	+0.58		Pass

TEK-15-07B-KEY: The key of the same wall, bearing pressure as a soil depth

Source: CMHA TEK 15-07B, Concrete Masonry Cantilever Retaining Walls, pp. pp. 2-3. Calculation: Masonry retaining wall.

TEK-15-07B-KEY · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pressure at the top of the key	psf	1,100	1,148	+4.35		Deviation TEK-15-07B-KEY
TEK-15-07B-KEY: the note leaves out the key's own weight when it finds the average bearing pressure						
Pressure at the bottom of the key	psf	1,300	1,347	+3.64		Deviation TEK-15-07B-KEY
TEK-15-07B-KEY: the note leaves out the key's own weight when it finds the average bearing pressure						

MDG-17.2-5: Moments and section of a 6 ft wall, 31 pcf (GFRP bars in the Guide)

Source: TMS Masonry Designers' Guide 2022, Example 17.2-5 (sample, TMS 402-22, GFRP bars), pp. sample pp. 10-13, 17-27 to 17-30.
Calculation: Masonry retaining wall.

MDG-17.2-5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pressure at the base of the wall	psf	186.0	186.0	+0.00		Pass
Horizontal force	lb/ft	558.0	558.0	+0.00		Pass
First-order moment	lb-ft/ft	1,116	1,116	+0.00		Pass
Factored first-order moment	lb-in	21,430	21,427	-0.01		Pass
Wall weight	lb/ft	486.0	486.0	+0.00		Pass
0.9D	lb/ft	437.0	437.4	+0.09		Pass
1.2D	lb/ft	583.0	583.2	+0.03		Pass
An	in.²/ft	91.50	91.50	+0.00		Pass
In	in.⁴/ft	443.3	443.3	+0.01		Pass
Sn	in.³/ft	116.3	116.3	-0.02		Pass
Modulus of rupture	psi	163.0	163.0	+0.00		Pass
Cracking moment	lb-in	19,510	19,510	-0.00		Pass
Second-order moment, the Guide's numbers in its equation	lb-in	22,710	21,499	-5.33		Deviation MDG-17.2-5-ARITH
MDG-17.2-5-ARITH: the printed substitution drops the 5 from the denominator of the example's own equation						

HC-STEM · Masonry retaining wall: Stem, no axial load: φMn = 0.9 As fy (d − a/2)

Source: Hand calculation (closed form), pp. 9.3.2; d = 5 in., 2,000 psi, #5 at 16 in.. Calculation: Masonry retaining wall.

HC-STEM · Masonry retaining wall · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φMn	kip-ft	4.852	4.851	-0.01		Pass
Vu	kips	1.152	1.152	+0.00		Pass
φVn = 0.8 × 2.25 An √f'm	kips	7.366	7.366	-0.01		Pass

HC-STAB: The default wall by statics

Source: Hand calculation (closed form), pp. H' = 7 ft, Ka = 1/3, γ = 120 pcf. Calculation: Masonry retaining wall.

HC-STAB · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pa	lb	980.0	980.0	+0.00		Pass
Overturning	lb-ft	2,287	2,287	-0.01		Pass
N with the key	lb	3,206	3,206	+0.00		Pass
Resisting	lb-ft	10,473	10,473	+0.00		Pass
Lateral bearing, edge	lb	225.0	225.0	+0.00		Pass
Lateral bearing, key	lb	375.0	375.0	+0.00		Pass
FS sliding		1.757	1.757	+0.02		Pass
q toe	psf	635.0	634.9	-0.01		Pass
q heel	psf	614.0	613.8	-0.03		Pass

HC-SURCHARGE: Live surcharge on the stem

Source: Hand calculation (closed form), pp. M = 1.6 (K γ h³/6 + K q h²/2), 250 psf. Calculation: Masonry retaining wall.

HC-SURCHARGE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mu,0	lb-in	56,448	56,448	+0.00		Pass
Mu,0 without the live surcharge	lb-in	27,648	27,648	+0.00		Pass

HC-LAP · Masonry retaining wall: Lap of #5 bars

Source: Hand calculation (closed form), pp. ld = 0.13 db² fy γ / (K √f'm); K = 2.625 − 0.3125. Calculation: Masonry retaining wall.

HC-LAP · Masonry retaining wall · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ld	in.	29.46	29.46	+0.01		Pass

HC-ASD-STEM: Stem by allowable stress: No. 5 at 16 in., 12 in. wall, f'm 1,500 psi, d = 9 in., closed form on TA.flexure

Source: Hand calculation (closed form); inputs on the basis of TEK 15-07B Table 1. Calculation: Masonry retaining wall.

HC-ASD-STEM · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable moment: Ms = 0.2325 x 32 x 0.9129 x 9	kip-ft	5.093	5.094	+0.02		Pass

FEMA-13.1.5.2-IT: Warehouse side wall: P-delta by the iterative method (9.3.4.4.2), flexural strength

Source: FEMA P-1051, NEHRP Recommended Seismic Provisions: Design Examples (2015 Provisions), Section 13.1.5.2, pp. 13-10 to 13-19, Table 13.1-2 (PDF pp. 622-631). Calculation: Masonry wall out-of-plane.

FEMA iterates to a 5 % change of the deflection (1.2 % and 1.7 % at its last step); ILX iterates to 0.1 %, which raises Mu by 0.2 % and 0.9 %. FEMA's Icr arithmetic gives 42.1 in.⁴/ft; the equation with its own numbers gives 41.7.

FEMA-13.1.5.2-IT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Modulus of rupture fr (interpolated by net area)	psi	112.0	111.4	-0.57		Pass
Mcr = Sn (fr + P/An) = 12,700 in.-lb/ft	lb-ft/ft	1,058	1,053	-0.54		Pass
Icr (P = 1.0D) = 42.1 in.⁴/ft	in.⁴	42.10	41.72	-0.91		Pass
Mu, 0.614D (48,289 in.-lb/ft)	lb-ft/ft	4,024	4,034	+0.24		Pass
Mu, 1.486D (57,670 in.-lb/ft)	lb-ft/ft	4,806	4,847	+0.86		Pass
a, 0.614D	in.	0.978	0.977	-0.09		Pass
a, 1.486D	in.	1.030	1.033	+0.34		Pass
Mn, 0.614D (62.3 in.-kip/ft)	lb-ft/ft	5,192	5,197	+0.10		Pass
Mn, 1.486D (65.35 in.-kip/ft)	lb-ft/ft	5,446	5,450	+0.07		Pass
φMn, 0.614D (56.1 in.-kip/ft)	lb-ft/ft	4,675	4,677	+0.04		Pass
φMn, 1.486D (58.8 in.-kip/ft, φ = 0.90)	lb-ft/ft	4,900	4,775	-2.56		Deviation TMS402-22-PHI-OOP
TMS402-22-PHI-OOP: FEMA uses the flat φ = 0.90 of TMS 402-13; at Pn = Pu/φ the strain is 0.00478, in the transition region of TMS 402-22 Table 9.1.4: φ = 0.876, φMn = 57.3 in.-kip/ft						
φ, 0.614D (εt = 0.00527, tension controlled)		0.900	0.900	+0.00		Pass
φ, 1.486D by hand: c = 1.309 in., εt = 0.00478		0.876	0.876	-0.00		Pass

FEMA-13.1.5.2-MM: Warehouse side wall: moment magnifier (9.3.4.4.3)

Source: FEMA P-1051, NEHRP Recommended Seismic Provisions: Design Examples (2015 Provisions), Section 13.1.5.2, pp. 13-18 to 13-19 (PDF pp. 630-631). Calculation: Masonry wall out-of-plane.

FEMA-13.1.5.2-MM · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pe = π² Em Icr / h² = 6.62 k/ft	plf	6,620	6,565	-0.84		Pass
Mu = 44.6 / (1 − 1.84/6.62) = 61.8 in.-kip/ft	lb-ft/ft	5,150	5,167	+0.33		Pass

FEMA-13.1.5.2-DEF: Warehouse side wall: service deflection, magnifier (9.3.4.5.2)

Source: FEMA P-1051, NEHRP Recommended Seismic Provisions: Design Examples (2015 Provisions), Section 13.1.5.2, pp. 13-21 (PDF p. 633). Calculation: Masonry wall out-of-plane.

FEMA's service combination is D + 0.7E without Ev; the example is run with SDS = 0 for the deflection (the strength values above use SDS = 1.43). FEMA rounds 0.7 × 37 psf to 26 psf.

FEMA-13.1.5.2-DEF · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
δs = 3.13 / (1 − 1.24/6.62) = 3.85 in.	in.	3.850	3.870	+0.52		Pass
Limit 0.007h = 2.35 in.	in.	2.350	2.352	+0.09		Pass

FEMA-13.1.5.2-DEV: Warehouse side wall: service deflection with Ev

Source: FEMA P-1051, NEHRP Recommended Seismic Provisions: Design Examples (2015 Provisions), Section 13.1.5.2, pp. 13-21 (PDF p. 633). Calculation: Masonry wall out-of-plane.

FEMA-13.1.5.2-DEV · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
δs (D + 0.7E, FEMA without Ev)	in.	3.850	4.089	+6.21		Deviation ASCE7-EV-ASD
ASCE7-EV-ASD: ASCE 7-22 2.4.5 combination 8 carries 1.0D + 0.7Ev + 0.7Eh; with SDS = 1.43 the axial load is 1.2D, which FEMA leaves out						

CMHA-2A-FULL: 8 in. wall section properties, solid grouted

Source: CMHA CMU-TEC-002-23, Weights and Section Properties of Concrete Masonry Assemblies, Table 2A, pp. p. 8, Table 2A (horizontal net section properties). Calculation: Masonry wall out-of-plane.

CMHA-2A-FULL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
An	in.²/ft	91.50	91.50	+0.00		Pass
In	in.⁴/ft	443.3	443.3	+0.01		Pass
Sn	in.³/ft	116.3	116.3	-0.02		Pass

CMHA-2A-16: 8 in. wall section properties, grouted at 16 in.

Source: CMHA CMU-TEC-002-23, Weights and Section Properties of Concrete Masonry Assemblies, Table 2A, pp. p. 8, Table 2A (horizontal net section properties). Calculation: Masonry wall out-of-plane.

CMHA-2A-16 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
An	in.²/ft	61.50	61.52	+0.03		Pass
In	in.⁴/ft	377.6	377.7	+0.03		Pass
Sn	in.³/ft	99.00	99.07	+0.07		Pass

CMHA-2A-24: 8 in. wall section properties, grouted at 24 in.

Source: CMHA CMU-TEC-002-23, Weights and Section Properties of Concrete Masonry Assemblies, Table 2A, pp. p. 8, Table 2A (horizontal net section properties). Calculation: Masonry wall out-of-plane.

CMHA-2A-24 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
An	in.²/ft	51.00	51.01	+0.02		Pass
In	in.⁴/ft	354.6	354.7	+0.03		Pass
Sn	in.³/ft	93.00	93.04	+0.04		Pass

CMHA-2A-48: 8 in. wall section properties, grouted at 48 in.

Source: CMHA CMU-TEC-002-23, Weights and Section Properties of Concrete Masonry Assemblies, Table 2A, pp. p. 8, Table 2A (horizontal net section properties). Calculation: Masonry wall out-of-plane.

CMHA-2A-48 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
An	in.²/ft	40.50	40.51	+0.02		Pass
In	in.⁴/ft	331.7	331.7	+0.00		Pass
Sn	in.³/ft	87.00	87.01	+0.01		Pass

CMHA-2A-96: 8 in. wall section properties, grouted at 96 in.

Source: CMHA CMU-TEC-002-23, Weights and Section Properties of Concrete Masonry Assemblies, Table 2A, pp. p. 8, Table 2A (horizontal net section properties). Calculation: Masonry wall out-of-plane.

CMHA-2A-96 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
An	in.²/ft	35.20	35.25	+0.15		Pass
In	in.⁴/ft	320.2	320.2	+0.00		Pass
Sn	in.³/ft	84.00	83.99	-0.01		Pass

HC-1 · Masonry wall out-of-plane: Fully grouted, centred bars: Mcr, Icr, iterative Mu, φMn

Source: Hand calculation (closed form). Calculation: Masonry wall out-of-plane.

HC-1 · Masonry wall out-of-plane · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mcr (fr = 163 psi + Pu/An)	lb-ft/ft	1,688	1,688	+0.00		Pass
Icr (Eq. 9-28, centred bars)	in.⁴	36.08	36.08	+0.00		Pass
δu (converged)	in.	0.279	0.279	-0.00		Pass
Mu = wu h²/8 + Pu δu	lb-ft/ft	1,944	1,944	-0.00		Pass
Mn = (As fy + Pu)(d − a/2)	lb-ft/ft	4,271	4,271	+0.00		Pass

HC-1M: HC-1 by the moment magnifier (Ieff = Icr)

Source: Hand calculation (closed form). Calculation: Masonry wall out-of-plane.

HC-1M · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mu = Mu,0 / (1 − Pu/Pe)	lb-ft/ft	2,040	2,040	-0.00		Pass

HC-2 · Masonry wall out-of-plane: Partially grouted, stress block past the face shell (T-section)

Source: Hand calculation (closed form). Calculation: Masonry wall out-of-plane.

HC-2 · Masonry wall out-of-plane · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
a = tfs + (C − C1)/(0.80 f'm bw)	in.	1.624	1.624	+0.00		Pass
Mn = T (d − ȳ) + Pu (tsp/2 − ȳ)	lb-ft/ft	7,086	7,086	+0.00		Pass

HC-3 · Masonry wall out-of-plane: Bars off centre: Mn = As fy (d − a/2) + Pu (tsp − a)/2

Source: Hand calculation (closed form). Calculation: Masonry wall out-of-plane.

HC-3 · Masonry wall out-of-plane · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mn (d = 5.5 in.)	lb-ft/ft	6,237	6,237	+0.00		Pass

HC-4 · Masonry wall out-of-plane: Uncracked wall: magnifier with 0.75 In; shear; axial strength

Source: Hand calculation (closed form). Calculation: Masonry wall out-of-plane.

HC-4 · Masonry wall out-of-plane · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mu = Mu,0 / (1 − Pu/Pe), Ieff = 0.75 In	lb-ft/ft	161.4	161.4	-0.00		Pass
Pn (402-13 Eq. 9-19)	plf	71,655	71,655	+0.00		Pass
Vn (Mu/(Vu dv) = 0)	plf	16,481	16,481	+0.00		Pass

HC-5 · Masonry wall out-of-plane: Off-centre bar: Icr by TMS 402-22 Eq. 9-28

Source: Hand calculation (closed form). Calculation: Masonry wall out-of-plane.

HC-5 · Masonry wall out-of-plane · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Icr = n As (d − c)² + n (P/fy)(tsp/2 − c)² + b c³/3	in.⁴	85.36	85.36	+0.00		Pass

HC-6 · Masonry wall out-of-plane: Compression-controlled wall, φ = 0.65, Mn at Pn = Pu/φ

Source: Hand calculation (closed form). Calculation: Masonry wall out-of-plane.

HC-6 · Masonry wall out-of-plane · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
c at Pn = Pu/0.65	in.	2.385	2.385	+0.00		Pass
εt		0.001	0.001	+0.00		Pass
φ		0.650	0.650	+0.00		Pass
Mn	lb-ft/ft	8,726	8,726	+0.00		Pass
φMn	lb-ft/ft	5,672	5,672	+0.00		Pass
φPn = 0.65 Pn (pure axial)	plf	68,740	68,740	+0.00		Pass

HC-7 · Masonry wall out-of-plane: Transition wall, φ from the strain at Pn = Pu/φ

Source: Hand calculation (closed form). Calculation: Masonry wall out-of-plane.

HC-7 · Masonry wall out-of-plane · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φ		0.848	0.848	+0.00		Pass
Mn (commentary form, Pu)	lb-ft/ft	5,486	5,486	+0.00		Pass
φMn	lb-ft/ft	4,651	4,651	+0.00		Pass

HC-8 · Masonry wall out-of-plane: 9.1.4.4.2 limit, just below 0.65 Pbal: tension controlled

Source: Hand calculation (closed form). Calculation: Masonry wall out-of-plane.

HC-8 · Masonry wall out-of-plane · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
0.65 Pbal	plf	14,521	14,521	-0.00		Pass
φ		0.900	0.900	+0.00		Pass
φMn	lb-ft/ft	4,384	4,384	+0.00		Pass

HC-8A: 9.1.4.4.2 limit, just above 0.65 Pbal: φ = 0.65

Source: Hand calculation (closed form). Calculation: Masonry wall out-of-plane.

HC-8A · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φ		0.650	0.650	+0.00		Pass
Mn at Pn = Pu/0.65	lb-ft/ft	6,648	6,648	-0.00		Pass
φMn	lb-ft/ft	4,321	4,321	-0.00		Pass

MAJOR-S19-8-4-48: Largest Pu, tension controlled: 8 in. CMU, #4 at 48 in.

Source: The Masonry Society, Major Structural Design Changes in TMS 402/602-22, webinar handout (R. Bennett, October 2022; TMS 402-22), pp. slide 19 (PDF p. 10). Calculation: Masonry wall out-of-plane.

Hollow cells neglected, grouted width 8 in. per grouted cell. The tension-controlled strain limit governs except where 0.65 Pbal is lower (No. 4 at 48 in.).

MAJOR-S19-8-4-48 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Largest Pu of a tension-controlled section	plf	14,500	14,521	+0.15		Pass

MAJOR-S19-8-5-48: Largest Pu, tension controlled: 8 in. CMU, #5 at 48 in.

Source: The Masonry Society, Major Structural Design Changes in TMS 402/602-22, webinar handout (R. Bennett, October 2022; TMS 402-22), pp. slide 19 (PDF p. 10). Calculation: Masonry wall out-of-plane.

Hollow cells neglected, grouted width 8 in. per grouted cell. The tension-controlled strain limit governs except where 0.65 Pbal is lower (No. 4 at 48 in.).

MAJOR-S19-8-5-48 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Largest Pu of a tension-controlled section	plf	13,200	13,223	+0.17		Pass

MAJOR-S19-8-4-24: Largest Pu, tension controlled: 8 in. CMU, #4 at 24 in.

Source: The Masonry Society, Major Structural Design Changes in TMS 402/602-22, webinar handout (R. Bennett, October 2022; TMS 402-22), pp. slide 19 (PDF p. 10). Calculation: Masonry wall out-of-plane.

Hollow cells neglected, grouted width 8 in. per grouted cell. The tension-controlled strain limit governs except where 0.65 Pbal is lower (No. 4 at 48 in.).

MAJOR-S19-8-4-24 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Largest Pu of a tension-controlled section	plf	12,000	12,008	+0.07		Pass

MAJOR-S19-8-5-24: Largest Pu, tension controlled: 8 in. CMU, #5 at 24 in.

Source: The Masonry Society, Major Structural Design Changes in TMS 402/602-22, webinar handout (R. Bennett, October 2022; TMS 402-22), pp. slide 19 (PDF p. 10). Calculation: Masonry wall out-of-plane.

Hollow cells neglected, grouted width 8 in. per grouted cell. The tension-controlled strain limit governs except where 0.65 Pbal is lower (No. 4 at 48 in.).

MAJOR-S19-8-5-24 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Largest Pu of a tension-controlled section	plf	9,000	9,038	+0.42		Pass

MAJOR-S19-8-6-24: Largest Pu, tension controlled: 8 in. CMU, #6 at 24 in.

Source: The Masonry Society, Major Structural Design Changes in TMS 402/602-22, webinar handout (R. Bennett, October 2022; TMS 402-22), pp. slide 19 (PDF p. 10). Calculation: Masonry wall out-of-plane.

Hollow cells neglected, grouted width 8 in. per grouted cell. The tension-controlled strain limit governs except where 0.65 Pbal is lower (No. 4 at 48 in.).

MAJOR-S19-8-6-24 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Largest Pu of a tension-controlled section	plf	5,500	5,528	+0.51		Pass

MAJOR-S19-8-4-16: Largest Pu, tension controlled: 8 in. CMU, #4 at 16 in.

Source: The Masonry Society, Major Structural Design Changes in TMS 402/602-22, webinar handout (R. Bennett, October 2022; TMS 402-22), pp. slide 19 (PDF p. 10). Calculation: Masonry wall out-of-plane.

Hollow cells neglected, grouted width 8 in. per grouted cell. The tension-controlled strain limit governs except where 0.65 Pbal is lower (No. 4 at 48 in.).

MAJOR-S19-8-4-16 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Largest Pu of a tension-controlled section	plf	9,300	9,308	+0.09		Pass

MAJOR-S19-8-6-40: Largest Pu, tension controlled: 8 in. CMU, #6 at 40 in.

Source: The Masonry Society, Major Structural Design Changes in TMS 402/602-22, webinar handout (R. Bennett, October 2022; TMS 402-22), pp. slide 19 (PDF p. 10). Calculation: Masonry wall out-of-plane.

Hollow cells neglected, grouted width 8 in. per grouted cell. The tension-controlled strain limit governs except where 0.65 Pbal is lower (No. 4 at 48 in.).

MAJOR-S19-8-6-40 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Largest Pu of a tension-controlled section	plf	10,300	10,280	-0.19		Pass

MAJOR-S19-8-4-8: Largest Pu, tension controlled: 8 in. CMU, #4 at 8 in.

Source: The Masonry Society, Major Structural Design Changes in TMS 402/602-22, webinar handout (R. Bennett, October 2022; TMS 402-22), pp. slide 19 (PDF p. 10). Calculation: Masonry wall out-of-plane.

Hollow cells neglected, grouted width 8 in. per grouted cell. The tension-controlled strain limit governs except where 0.65 Pbal is lower (No. 4 at 48 in.).

MAJOR-S19-8-4-8 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Largest Pu of a tension-controlled section	plf	1,200	1,208	+0.66		Pass

MAJOR-S19-12-4-48: Largest Pu, tension controlled: 12 in. CMU, #4 at 48 in.

Source: The Masonry Society, Major Structural Design Changes in TMS 402/602-22, webinar handout (R. Bennett, October 2022; TMS 402-22), pp. slide 19 (PDF p. 10). Calculation: Masonry wall out-of-plane.

Hollow cells neglected, grouted width 8 in. per grouted cell. The tension-controlled strain limit governs except where 0.65 Pbal is lower (No. 4 at 48 in.).

MAJOR-S19-12-4-48 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Largest Pu of a tension-controlled section	plf	16,400	16,342	-0.35		Pass

MAJOR-S19-12-5-24: Largest Pu, tension controlled: 12 in. CMU, #5 at 24 in.

Source: The Masonry Society, Major Structural Design Changes in TMS 402/602-22, webinar handout (R. Bennett, October 2022; TMS 402-22), pp. slide 19 (PDF p. 10). Calculation: Masonry wall out-of-plane.

Hollow cells neglected, grouted width 8 in. per grouted cell. The tension-controlled strain limit governs except where 0.65 Pbal is lower (No. 4 at 48 in.).

MAJOR-S19-12-5-24 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Largest Pu of a tension-controlled section	plf	15,000	14,877	-0.82		Pass

MDG-11.3-1: 12 ft hollow partition, 5 psf

Source: TMS Masonry Designers' Guide 2022, Example 11.3-1 (sample, TMS 402-22), pp. sample pp. 4-5, 11-5 to 11-6. Calculation: Unreinforced masonry wall.

MDG-11.3-1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
An	in.²/ft	30.00	30.00	+0.00		Pass
In	in.⁴/ft	308.7	308.7	+0.00		Pass
Sn	in.³/ft	81.00	80.97	-0.03		Pass
P/An	psi	3.700	3.162	-14.54		Pass
M/Sn	psi	13.30	13.04	-1.97		Pass
Net flexural tension	psi	9.600	9.876	+2.87		Pass
Allowable flexural tension	psi	12.00	12.00	+0.00		Pass
Allowable shear, diagonal cracking	psi	67.10	67.08	-0.03		Pass
Web area	in.²/ft	12.90	12.87	-0.25		Pass
Shear V	lb/ft	30.00	30.00	+0.00		Pass
Shear stress on the webs	psi	3.500	3.497	-0.08		Pass
Shear stress on the bed joint	psi	1.500	1.500	+0.00		Pass
Allowable, sliding	psi	15.00	15.00	+0.00		Pass

HC-SD: The same wall by strength design

Source: Hand calculation (closed form), pp. 9.2.4.1: 0.9D + 1.6L, largest at 6.9 ft; φ fr = 0.60 × 31 psi. Calculation: Unreinforced masonry wall.

HC-SD · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Net flexural tension	psi	16.11	16.12	+0.04		Pass
φ fr	psi	18.60	18.60	-0.00		Pass
φ Vn on the webs	lb/ft	1,750	1,749	-0.04		Pass
Compression, largest fa + fb	psi	29.41	29.42	+0.02		Pass
h/r (no magnifier below 45)		44.89	44.89	-0.00		Pass

HC-SD-BED: Bed joint by strength design, running bond

Source: Hand calculation (closed form), pp. φ (56 An + 0.45 Nu), Nu = 0.9D at the base. Calculation: Unreinforced masonry wall.

HC-SD-BED · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φ Vn	lb/ft	1,465	1,465	-0.00		Pass

HC-CANT: A fully grouted cantilever, by allowable stress

Source: Hand calculation (closed form), pp. M = p h²/2, An = 12 t, Sn = 12 t²/6. Calculation: Unreinforced masonry wall.

HC-CANT · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Net flexural tension at the base	psi	19.10	19.10	+0.02		Pass
Allowable	psi	65.00	65.00	+0.00		Pass
h/r with twice the height		65.40	65.42	+0.03		Pass

HC-AXIAL: Fully grouted 12 in. wall with an axial load

Source: Hand calculation (closed form), pp. 402-13 Eqs. 8-16, 8-18, 8-19, 9-11. Calculation: Unreinforced masonry wall.

HC-AXIAL · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fa	psi	453.0	453.0	+0.01		Pass
Fb	psi	666.7	666.7	-0.01		Pass
Pe / 4	lb/ft	336,480	336,485	+0.00		Pass

HC-AXIAL · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φ Pn	lb/ft	97,073	97,071	-0.00		Pass

HC-HORIZ: Spanning horizontally, tension parallel to the bed joints, no axial credit

Source: Hand calculation (closed form), pp. M = p L²/8; Table 8.2.4.2. Calculation: Unreinforced masonry wall.

HC-HORIZ · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tension	psi	5.926	5.928	+0.03		Pass
Allowable	psi	25.00	25.00	+0.00		Pass

MW-1: Fully grouted wall, end bars only, no axial load

Source: Hand calculation (closed form). Calculation: Masonry shear wall.

MW-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mn (Pu = 0)	kip-ft	143.0	143.0	+0.00		Pass
φMn	kip-ft	128.7	128.7	+0.00		Pass
Neutral axis depth c	in.	2.843	2.843	+0.00		Pass
Vnm	kips	73.66	73.66	+0.00		Pass
Vns	kips	12.00	12.00	+0.00		Pass
φVn	kips	68.52	68.52	+0.00		Pass
Pn (Eq. 9-11)	kips	846.0	846.0	-0.00		Pass
Maximum reinforcement: Cm + Cs − T at α = 3	kips	257.8	257.8	-0.00		Pass

MW-2: Partially grouted wall (γg = 0.70)

Source: Hand calculation (closed form). Calculation: Masonry shear wall.

MW-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Net area An	in.²	322.0	322.0	+0.00		Pass
φVn	kips	24.86	24.86	+0.00		Pass
Pn (Eq. 9-11, net-section r)	kips	388.6	388.6	+0.00		Pass
φMn (block within the end cell)	kip-ft	128.7	128.7	+0.00		Pass

MW-3: Flexure with axial load (strain compatibility)

Source: Hand calculation (closed form). Calculation: Masonry shear wall.

MW-3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Neutral axis depth c (Pn = 50 kips)	in.	7.029	7.029	+0.00		Pass
Mn	kip-ft	326.5	326.5	+0.00		Pass
φMn	kip-ft	293.9	293.9	+0.00		Pass

MW-4: Shear at Mu/(Vu dv) = 0.25 with axial load

Source: Hand calculation (closed form). Calculation: Masonry shear wall.

MW-4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mu/(Vu dv)		0.250	0.250	+0.00		Pass
Vn	kips	125.6	125.6	+0.00		Pass
φVn	kips	100.5	100.5	+0.00		Pass

MW-5: Maximum reinforcement, special wall (α = 4), elastic compression bar

Source: Hand calculation: TMS 402-13 Commentary 9.3.3.5 equation (closed form), pp. C-139. Calculation: Masonry shear wall.

MW-5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
c = εmu/(εmu + 4εy) d	in.	20.42	20.42	+0.00		Pass
Axial load at the maximum reinforcement	kips	194.3	194.3	+0.00		Pass

MW-6: Compression-controlled section: φ = 0.65 (Table 9.1.4)

Source: Hand calculation (closed form). Calculation: Masonry shear wall.

MW-6 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φ		0.650	0.650	+0.00		Pass
Pn = Pu/0.65	kips	250.0	250.0	+0.00		Pass
Neutral axis depth c	in.	27.06	27.06	-0.00		Pass
Mn	kip-ft	313.4	313.4	+0.00		Pass
φMn	kip-ft	203.7	203.7	+0.00		Pass

MW-7: Transition section: φ = 0.775, solved with Pn = Pu/φ

Source: Hand calculation (closed form). Calculation: Masonry shear wall.

MW-7 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φ		0.775	0.775	+0.00		Pass
Neutral axis depth c	in.	18.12	18.12	+0.00		Pass
Mn	kip-ft	277.9	277.9	+0.00		Pass
φMn	kip-ft	215.4	215.4	+0.00		Pass

MW-8: Axial limit 0.65 Pbal (9.1.4.4.2) and pure axial φ = 0.65

Source: Hand calculation (closed form). Calculation: Masonry shear wall.

MW-8 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
cb	in.	24.08	24.08	+0.00		Pass
0.65 Pbal	kips	140.6	140.6	+0.00		Pass
φPn, pure axial (φ = 0.65)	kips	275.0	275.0	-0.00		Pass

MW-9: Shear friction at Mu/(Vu dv) ≤ 0.5, μ = 0.70

Source: Hand calculation (closed form). Calculation: Masonry shear wall.

MW-9 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vnf = μ (Asp fy + Pu)	kips	51.24	51.24	+0.00		Pass
φVnf	kips	40.99	40.99	+0.00		Pass

MW-10: Shear friction at Mu/(Vu dv) ≥ 1.0

Source: Hand calculation (closed form). Calculation: Masonry shear wall.

MW-10 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vnf = 0.65 (0.75 Asp fy + Pu)	kips	18.14	18.14	-0.00		Pass

MW-11: Shear friction between, Asp entered, μ = 1.00

Source: Hand calculation (closed form). Calculation: Masonry shear wall.

MW-11 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vnf (linear between)	kips	44.62	44.62	+0.00		Pass

FEMA-13.2-W1: Wall D, story 1 shear: Vn max governs (Mu/(Vu dv) = 0.96)

Source: FEMA P-1051, NEHRP Recommended Seismic Provisions: Design Examples (2015 Provisions), Section 13.2.4.5, pp. 13-60 to 13-61, Table 13.2-3 (PDF pp. 672-673). Calculation: Masonry shear wall.

Table 13.2-3, story 1: Vu = 73.8 kips, Mu = 2,314 ft-kips, Pu = 200 kips (0.86D).

FEMA-13.2-W1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Net area An	in.²	1,185	1,185	+0.00		Pass
Mu/(Vu dv)		0.960	0.960	-0.02		Pass
Vns = 0.5 (0.07 in.²/ft) 60 ksi × 32.67 ft	kips	68.30	68.60	+0.44		Pass
Vn (max)	kips	164.0	152.4	-7.10		Deviation TMS402-22-GG-WALL
TMS402-22-GG-WALL: the example predates 402-22 and uses γg = 0.75 on a partially grouted wall; 402-22 uses 0.70 (Eq. 9-15), so ILX is 6.7 % lower						
φVn	kips	131.0	121.9	-6.96		Deviation TMS402-22-GG-WALL
TMS402-22-GG-WALL: the example predates 402-22 and uses γg = 0.75 on a partially grouted wall; 402-22 uses 0.70 (Eq. 9-15), so ILX is 6.7 % lower						

FEMA-13.2-W5: Wall D, story 5 shear: (Vnm + Vns) yg governs

Source: FEMA P-1051, NEHRP Recommended Seismic Provisions: Design Examples (2015 Provisions), Section 13.2.4.5, pp. 13-60 to 13-61, Table 13.2-3 (PDF pp. 672-673). Calculation: Masonry shear wall.

Table 13.2-3, story 5: Vu = 22.8 kips, Mu = 198 ft-kips, Pu = 35.3 kips.

FEMA-13.2-W5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mu/(Vu dv)		0.266	0.266	-0.06		Pass
Vnm (Pu = 35.3 kips)	kips	196.0	196.1	+0.08		Pass
Vn = (Vnm + Vns) yg	kips	198.0	185.3	-6.40		Deviation TMS402-22-GG-WALL
TMS402-22-GG-WALL: the example predates 402-22 and uses yg = 0.75 on a partially grouted wall; 402-22 uses 0.70 (Eq. 9-15), so ILX is 6.7 % lower						
Vn (max)	kips	237.0	221.0	-6.75		Deviation TMS402-22-GG-WALL
TMS402-22-GG-WALL: the example predates 402-22 and uses yg = 0.75 on a partially grouted wall; 402-22 uses 0.70 (Eq. 9-15), so ILX is 6.7 % lower						
φVn	kips	158.0	148.3	-6.16		Deviation TMS402-22-GG-WALL
TMS402-22-GG-WALL: the example predates 402-22 and uses yg = 0.75 on a partially grouted wall; 402-22 uses 0.70 (Eq. 9-15), so ILX is 6.7 % lower						

FEMA-13.2-PM0: Wall D, Pn - Mn point at P = 0 (Case 1)

Source: FEMA P-1051, NEHRP Recommended Seismic Provisions: Design Examples (2015 Provisions), Section 13.2.4.5, pp. 13-62 to 13-63 (PDF pp. 674-675). Calculation: Masonry shear wall.

All tension bars yield; the compression bar (untied) is neglected, as TMS 402 9.3.2 requires.

FEMA-13.2-PM0 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Neutral axis depth c = 0.41 ft	ft	0.410	0.410	-0.04		Pass
Mn	kip-ft	968.0	968.1	+0.01		Pass
φMn	kip-ft	871.0	871.3	+0.04		Pass

FEMA-13.2-PM2: Wall D, Pn - Mn point at c = 8 ft (Case 2)

Source: FEMA P-1051, NEHRP Recommended Seismic Provisions: Design Examples (2015 Provisions), Section 13.2.4.5, pp. 13-65 to 13-66 (PDF pp. 677-678). Calculation: Masonry shear wall.

The example picks c = 8 ft and finds Pn = 337 kips (φPn = 303 kips); ILX enters Pu = 0.9 × 337 kips and solves for c. The bar 4 in. from the neutral axis (0.6 kip) is neglected in the example and kept in ILX.

FEMA-13.2-PM2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Neutral axis depth c at Pn = 337 kips	ft	8.000	8.020	+0.25		Pass
Pn = Pu/φ	kips	337.0	337.0	+0.00		Pass
Mn	kip-ft	5,371	5,375	+0.08		Pass
φMn	kip-ft	4,834	4,838	+0.08		Pass

FEMA-13.2-DUC: Wall D, ductility check (maximum reinforcement, α = 1.5)

Source: FEMA P-1051, NEHRP Recommended Seismic Provisions: Design Examples (2015 Provisions), Section 13.2.4.5, pp. 13-68 to 13-70, Figure 13.2-7 (PDF pp. 680-682). Calculation: Masonry shear wall.

Mu/(Vu dv) < 1 with R > 1.5: TMS 402-13 9.3.3.5.4 sends the wall to 9.3.3.5.1 with α = 1.5. The example compares ΣC = 704 kips with P + ΣT = 245 + 23.9 kips; ILX reports ΣC − ΣT. FEMA's wall is ordinary, where 402-22 deleted the limit; it is entered as intermediate here, which reaches the same α = 1.5 rule.

FEMA-13.2-DUC · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
c = 0.0025/(0.0025 + 1.5 εy) × 32.34 ft = 14.44 ft	ft	14.44	14.43	-0.10		Pass
ΣC − ΣT = (686 + 12.0 + 6.3) − (12.0 + 10.0 + 1.9)	kips	680.4	679.4	-0.15		Pass

TMS-SD-1: 2 ft pier, shear with Mu/(Vu dv) = 2 (taken as 1.0)

Source: The Masonry Society, Design of Masonry Shear Walls, webinar handout (R. Bennett, May 2018; TMS 402-16), pp. slides 66-67 (PDF pp. 33-34). Calculation: Masonry shear wall.

Pu = 8 kips, Mu = 28 kip-ft, Vu = 7 kips, fully grouted, no shear reinforcement. The slide prints 16,700 lb; its own expression 0.8 [(4.0 − 1.75 × 1.0)(7.625 × 24) √2000 + 0.25 × 8,000] gives 16,330 lb, which ILX computes (within the 0.5 kip floor of the tolerance).

TMS-SD-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mu/(Vu dv)		2.000	2.000	+0.00		Pass
φVnm	kips	16.70	16.33	-2.21		Pass

TMS-SD-2: 16 ft ordinary wall, partially grouted, #4 at 48 in.

Source: The Masonry Society, Design of Masonry Shear Walls, webinar handout (R. Bennett, May 2018; TMS 402-16), pp. slides 71-76 (PDF pp. 36-38). Calculation: Masonry shear wall.

ILX: Mu/φMn = 0.89. The handout's maximum reinforcement check on this ordinary wall (402-16) is left out: 402-22 deleted that limit for ordinary walls; TMS-SD-3 keeps the same numbers on a special wall.

TMS-SD-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pu = (0.9 − 0.2 SDS) D = 0.80 × 23.2 kips	kips	18.60	18.56	-0.22		Pass
Net shear area Anv	in.²	685.0	685.0	+0.00		Pass
Mu/(Vu dv) = h/dv		0.625	0.625	+0.00		Pass
φVn,max = 0.8 (4/3)(5 − 2 × 0.625) An √f'm γg	kips	91.90	85.78	-6.66		Deviation TMS402-22-GG-WALL
TMS402-22-GG-WALL: the example predates 402-22 and uses γg = 0.75 on a partially grouted wall; 402-22 uses 0.70 (Eq. 9-15), so ILX is 6.7 % lower						
φVnm (γg = 0.75)	kips	56.20	52.46	-6.66		Deviation TMS402-22-GG-WALL
TMS402-22-GG-WALL: the example predates 402-22 and uses γg = 0.75 on a partially grouted wall; 402-22 uses 0.70 (Eq. 9-15), so ILX is 6.7 % lower						
Mu / φMn (stressed to 94 % of the design strength)		0.940	0.889	-5.42		Deviation TMS-SD-EQT
TMS-SD-EQT: the handout's interaction diagram and maximum reinforcement use an equivalent (averaged) thickness of the partially grouted wall; ILX takes the face shells plus the grouted cells (TMS 402 Commentary 9.3.3.5)						

TMS-SD-3: 16 ft special wall, #4 at 32 in., #5 bond beams at 24 in.

Source: The Masonry Society, Design of Masonry Shear Walls, webinar handout (R. Bennett, May 2018; TMS 402-16), pp. slides 78-81 (PDF pp. 39-41). Calculation: Masonry shear wall.

TMS 402-16 writes the special-wall cap as φVn ≥ 2.0 Vu; TMS 402-13 7.3.2.6.1.1 (Vn need not exceed 2.5 Vu) gives the same φ × 2.5 Vu = 2.0 Vu.

TMS-SD-3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Net shear area Anv	in.²	767.0	767.0	+0.00		Pass
φVn = φVn,max	kips	102.9	96.04	-6.66		Deviation TMS402-22-GG-WALL
TMS402-22-GG-WALL: the example predates 402-22 and uses yg = 0.75 on a partially grouted wall; 402-22 uses 0.70 (Eq. 9-15), so ILX is 6.7 % lower						
Required φVn = 2.0 Vu (φ × 2.5 Vu)	kips	100.0	100.0	+0.00		Pass
Vertical ρ = 7 (0.20)/(192 × 7.625)		0.001	0.001	-0.39		Pass
Horizontal ρ = 5 (0.31)/(120 × 7.625)		0.002	0.002	+0.24		Pass
Total ρ		0.003	0.003	-0.74		Pass
c at the maximum reinforcement strain (α = 1.5)	in.	83.80	83.88	+0.09		Pass
φPn at that strain distribution	kips	364.0	393.4	+8.08		Deviation TMS-SD-EQT
TMS-SD-EQT: the handout's interaction diagram and maximum reinforcement use an equivalent (averaged) thickness of the partially grouted wall; ILX takes the face shells plus the grouted cells (TMS 402 Commentary 9.3.3.5)						

TMS-2017-ORD: 16 ft ordinary wall: shear friction, μ = 1.0, Mu/(Vu dv) = 0.625

Source: The Masonry Society, Strength Design of Masonry, webinar handout (October 2017; TMS 402-16), pp. slides 27-30 (PDF pp. 27-30).
Calculation: Masonry shear wall.

The handout writes #5 at 40 in. but counts 7 bars, which is the even 42 in. entered here. Its end of the interpolation is the 402-16 0.42 f'm Anc = 74.9 kips; 402-22 gives 0.65 (0.75 Asp fy + Pu) = 75.4 kips, so its 104.1 kips and ILX's 104.2 kips nearly coincide here, not in general.

TMS-2017-ORD · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Asp = 7 × 0.31 in.²	in.²	2.170	2.170	+0.00		Pass
Vnf at Mu/(Vu dv) ≤ 0.5	kips	148.6	148.6	-0.02		Pass
φVnf	kips	104.1	104.2	+0.12		Pass
φVn,max = 0.8 (4/3)(5 − 2 × 0.625) An √f'm γg	kips	102.9	96.04	-6.66		Deviation TMS402-22-GG-WALL
TMS402-22-GG-WALL: the example predates 402-22 and uses γg = 0.75 on a partially grouted wall; 402-22 uses 0.70 (Eq. 9-15), so ILX is 6.7 % lower						

DAS-MAT: Rigid mat, 12 columns, eccentric resultant (Das, conventional rigid method)

Source: Das, Principles of Foundation Engineering (mat by the conventional rigid method), as reproduced in Al-Mustaqbal University lecture notes 'Mat foundation design' (2024), pp. pp. 5-7. Calculation: Mat foundation.

DAS-MAT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Soil pressure at A (36.81 kN/m²) q = Q/A ± My x/Iy ± Mx y/Ix with Q = 11,000 kN, ex = −0.44 m, ey = 0.1 m	ksf	0.769	0.768	-0.15		Pass
Soil pressure at B (31.86 kN/m²) q = Q/A ± My x/Iy ± Mx y/Ix with Q = 11,000 kN, ex = −0.44 m, ey = 0.1 m	ksf	0.665	0.665	-0.08		Pass
Soil pressure at C (26.91 kN/m²) q = Q/A ± My x/Iy ± Mx y/Ix with Q = 11,000 kN, ex = −0.44 m, ey = 0.1 m	ksf	0.562	0.562	+0.01		Pass
Soil pressure at D (25.19 kN/m²) q = Q/A ± My x/Iy ± Mx y/Ix with Q = 11,000 kN, ex = −0.44 m, ey = 0.1 m	ksf	0.526	0.528	+0.28		Pass
Soil pressure at E (30.16 kN/m²) q = Q/A ± My x/Iy ± Mx y/Ix with Q = 11,000 kN, ex = −0.44 m, ey = 0.1 m	ksf	0.630	0.630	+0.07		Pass
Soil pressure at F (35.09 kN/m²) q = Q/A ± My x/Iy ± Mx y/Ix with Q = 11,000 kN, ex = −0.44 m, ey = 0.1 m	ksf	0.733	0.733	+0.03		Pass

MF-1: Rigid mat, 3 × 3 columns (the default design)

Source: Hand calculation (closed form). Calculation: Mat foundation.

MF-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Service soil pressure (D + L)	ksf	1.698	1.698	+0.00		Pass
Punching vu, interior column	psi	97.33	97.33	+0.00		Pass
Punching vu, corner column (with the shear's eccentricity)	psi	116.9	116.9	-0.00		Pass
φvc = 0.75 × 4√f'c	psi	189.7	189.7	+0.00		Pass
Strip moment per foot, interior x-strip (top) w x²/2 − P1 (x − 3) at V = 0, over the 24 ft strip width	kip-ft	107.1	107.0	-0.05		Pass

MP-BOND: Bond capacity αbond π Db Lb / FS

Source: Hand calculation (closed form, FHWA NHI-05-039 equations as built; ACI 318-19 22.8.3.2). Calculation: Micropile.

MP-BOND · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pg = 3 ksf × π × 8/12 ft × 20 ft / 2	kips	62.83	62.83	+0.00		Pass

MP-CASED: Cased length: 0.40 f'cg Ag + 0.47 Fy (Abar + Acasing)

Source: Hand calculation (closed form, FHWA NHI-05-039 equations as built; ACI 318-19 22.8.3.2). Calculation: Micropile.

MP-CASED · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pc cased (Fy = 75 ksi, the lesser of bar and casing)	kips	467.1	467.1	+0.00		Pass

MP-UNCASED: Uncased bond zone and tension

Source: Hand calculation (closed form, FHWA NHI-05-039 equations as built; ACI 318-19 22.8.3.2). Calculation: Micropile.

MP-UNCASED · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pc uncased = 0.40 f'cg Ag + 0.47 Fy Abar	kips	152.4	152.4	+0.00		Pass
Pt = 0.55 × 75 × 1.56	kips	64.35	64.35	+0.00		Pass

MP-FY-CAP: Fy limited to 87 ksi (strain 0.003)

Source: Hand calculation (closed form, FHWA NHI-05-039 equations as built; ACI 318-19 22.8.3.2). Calculation: Micropile.

MP-FY-CAP · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fy used = 87 ksi	ksi	87.00	87.00	+0.00		Pass

MP-JOINT: Casing area at the joint with a corrosion allowance

Source: Hand calculation (closed form, FHWA NHI-05-039 equations as built; ACI 318-19 22.8.3.2). Calculation: Micropile.

MP-JOINT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ac = π/4 (6.875² − 6.004²) × 0.6	in.²	5.286	5.286	+0.00		Pass

MP-EULER: Euler buckling over a 10 ft void

Source: Hand calculation (closed form, FHWA NHI-05-039 equations as built; ACI 318-19 22.8.3.2). Calculation: Micropile.

MP-EULER · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pcr = π² × 29,000 × I / 120²	kips	1,079	1,079	+0.00		Pass

MP-CAP: Cap bearing, √(A2/A1) capped at 2

Source: Hand calculation (closed form, FHWA NHI-05-039 equations as built; ACI 318-19 22.8.3.2). Calculation: Micropile.

MP-CAP · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bn = 0.85 × 4 ksi × 100 × 2	kips	680.0	680.0	+0.00		Pass

GG-7-1: Element rotated 45°

Source: Gere and Goodno, Mechanics of Materials, Ch. 7, first transformation example. Calculation: Stress transformation.

GG-7-1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Normal stress on the rotated x face	ksi	15.00	15.00	+0.00		Pass
Shear stress on the rotated faces	ksi	-5.000	-5.000	-0.00		Pass
Normal stress on the rotated y face	ksi	7.000	7.000	+0.00		Pass
Principal stress 1	ksi	17.40	17.40	+0.00		Pass
Principal stress 2	ksi	4.597	4.597	+0.00		Pass
Principal angle		19.33	19.33	-0.00		Pass
Largest in-plane shear	ksi	6.403	6.403	+0.00		Pass
Largest shear with the third stress zero	ksi	8.702	8.702	+0.00		Pass
Von Mises stress	ksi	15.62	15.62	+0.00		Pass

METRIC-30: Metric input, element rotated 30°

Source: Hand calculation, Gere and Goodno, Mechanics of Materials, Ch. 7 transformation equations. Calculation: Stress transformation.

METRIC-30 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Normal stress on the rotated x face (72.5 MPa)	ksi	10.52	10.52	+0.00		Pass
Shear stress on the rotated faces (−30.31 MPa)	ksi	-4.396	-4.396	+0.00		Pass
Normal stress on the rotated y face (37.5 MPa)	ksi	5.439	5.439	+0.00		Pass

SHEAR: Pure shear

Source: Hand calculation, Gere and Goodno, Mechanics of Materials, Ch. 7 principal stresses. Calculation: Stress transformation.

SHEAR · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Principal stress 1	ksi	10.00	10.00	+0.00		Pass
Principal stress 2	ksi	-10.00	-10.00	-0.00		Pass
Principal angle		45.00	45.00	+0.00		Pass
Largest in-plane shear	ksi	10.00	10.00	+0.00		Pass
Von Mises stress	ksi	17.32	17.32	+0.00		Pass

MIXED: Tension and compression with negative shear

Source: Hand calculation, Gere and Goodno, Mechanics of Materials, Ch. 7 principal stresses. Calculation: Stress transformation.

MIXED · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Principal stress 1	ksi	13.54	13.54	+0.00		Pass
Principal stress 2	ksi	-5.445	-5.445	-0.00		Pass
Principal angle		-14.84	-14.84	-0.00		Pass
Largest shear with the third stress zero	ksi	9.495	9.495	+0.00		Pass

UNIAXIAL: Uniaxial compression

Source: Hand calculation, Gere and Goodno, Mechanics of Materials, Ch. 7 principal stresses. Calculation: Stress transformation.

UNIAXIAL · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Principal stress 1	ksi	0.000	0.000	+0.00		Pass
Principal stress 2	ksi	-20.00	-20.00	-0.00		Pass
Principal angle		90.00	90.00	+0.00		Pass
Largest shear with the third stress zero	ksi	10.00	10.00	+0.00		Pass

TANNER-T1: Table 1: Cb by the length ratio k

Source: Tanner (1985), Allowable Bending Stresses for Overhanging Monorails, AISC Engineering Journal, Table 1, pp. 137. Calculation: Monorail beam.

TANNER-T1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cb at k = 0		0.670	0.670	+0.00		Pass
Cb at k = 0.1		0.700	0.700	+0.00		Pass
Cb at k = 0.2		0.730	0.730	+0.00		Pass
Cb at k = 0.3		0.760	0.760	+0.00		Pass
Cb at k = 0.4		0.800	0.800	+0.00		Pass
Cb at k = 0.5		0.840	0.840	+0.00		Pass
Cb at k = 0.6		0.900	0.900	+0.00		Pass
Cb at k = 0.7		0.960	0.960	+0.00		Pass
Cb at k = 0.8		1.050	1.050	+0.00		Pass
Cb at k = 0.9		1.150	1.150	+0.00		Pass
Cb at k = 1		1.280	1.280	+0.00		Pass

TANNER-EX: S12X40.8, 7 ft overhang of 20 ft, 5 kips with impact, trolley and hoist

Source: Tanner (1985), Allowable Bending Stresses for Overhanging Monorails, AISC Engineering Journal, numerical example, pp. 137-138.
Calculation: Monorail beam.

TANNER-EX · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
k		0.350	0.350	+0.00		Pass
Cb		0.780	0.780	+0.00		Pass
M	kip-ft	36.00	36.00	-0.00		Pass
Bending stress, M/S	ksi	9.500	9.579	+0.83		Pass
Allowable, 12,000 Cb/(L d/Af), 1978 Formula 1.5-7	ksi	11.30	11.24	-0.49		Pass

DG7-P: Two wheels 12 ft apart on a 30 ft span, per kip of wheel

Source: AISC Design Guide 7, 3rd Ed. (2019), Example 14.1.1, pp. 63. Calculation: Moving load.

DG7-P · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Moment per kip of wheel, 9.60 P	kip-ft	9.600	9.600	+0.00		Pass

DG7-I: W24X131 with rail, 38.1 kip wheels, 25 % impact

Source: AISC Design Guide 7, 3rd Ed. (2019), Example 14.1.1, pp. 63-64. Calculation: Moving load.

DG7-I · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mrx with impact	kip-ft	478.0	476.2	-0.38		Pass

DG7-N: The same without impact

Source: AISC Design Guide 7, 3rd Ed. (2019), Example 14.1.1, pp. 64. Calculation: Moving load.

DG7-N · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mrx without impact	kip-ft	386.0	384.9	-0.28		Pass

M3-43: One moving load, P = 20, L = 40

Source: AISC Manual 16th Ed., Table 3-22, case 43, pp. 3-231. Calculation: Moving load.

M3-43 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mmax = P L / 4	kip-ft	200.0	200.0	+0.00		Pass
Vmax = P	kips	20.00	20.00	-0.00		Pass
R1 max = P	kips	20.00	20.00	+0.00		Pass

M3-44A: Two equal loads, a < 0.586 L: P = 20, a = 10, L = 40

Source: AISC Manual 16th Ed., Table 3-22, case 44, pp. 3-231. Calculation: Moving load.

M3-44A · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mmax = P/(2L) (L − a/2)²	kip-ft	306.2	306.2	+0.00		Pass
R1 max = P (2 − a/L)	kips	35.00	35.00	-0.00		Pass

M3-44B: Two equal loads, a > 0.586 L: one load at midspan, the other off the span

Source: AISC Manual 16th Ed., Table 3-22, case 44, pp. 3-231. Calculation: Moving load.

M3-44B · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mmax = P L / 4	kip-ft	100.0	100.0	+0.00		Pass

M3-45A: Two unequal loads: P1 = 30, P2 = 10, a = 10, L = 40

Source: AISC Manual 16th Ed., Table 3-22, case 45, pp. 3-231. Calculation: Moving load.

M3-45A · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mmax = (P1 + P2) x² / L	kip-ft	351.6	351.6	+0.00		Pass
R1 max = P1 + P2 (L − a) / L	kips	37.50	37.50	-0.00		Pass

M3-45B: Larger load alone at midspan governs: P1 = 40, P2 = 2, a = 30, L = 40

Source: AISC Manual 16th Ed., Table 3-22, case 45, pp. 3-231. Calculation: Moving load.

M3-45B · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mmax = P1 L / 4	kip-ft	400.0	400.0	+0.00		Pass

U-9.8: Three loads 12, 14, 16 at 3, 6 and 12 on a span of 18; entered as kips and ft, the numbers are the same in kN and m

Source: Udoeyo (2020), Structural Analysis, Temple University Press, Example 9.8, pp. PDF p. 261. Calculation: Moving load.

U-9.8 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Reaction at the left	kips	24.67	24.67	-0.01		Pass
Reaction at the right	kips	17.33	17.33	+0.02		Pass
Moment at midspan	kip-ft	108.0	108.0	+0.00		Pass
Shear at midspan, magnitude	kips	1.330	1.333	+0.25		Pass
Influence ordinate at 3	ft	1.500	1.500	-0.00		Pass
Influence ordinate at 6	ft	3.000	3.000	-0.00		Pass
Influence ordinate at 12	ft	3.000	3.000	+0.00		Pass

H-2S: Two spans of 20, one load 32 at the center of span 1

Source: Hand calculation, three-moment equation. Calculation: Moving load.

H-2S · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R1 = 13 P / 32	kips	13.00	13.00	+0.00		Pass
R2 = 11 P / 16	kips	22.00	22.00	+0.00		Pass
R3 = −3 P / 32	kips	-3.000	-3.000	-0.00		Pass
M under the load = 13 P L / 64	kip-ft	130.0	130.0	+0.00		Pass

H-2SN: Two spans of 20, one load 10: largest negative moment over the support at a = L/√3

Source: Hand calculation, three-moment equation. Calculation: Moving load.

H-2SN · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
M = −0.0962 P L	kip-ft	-19.25	-19.24	-0.03		Pass

H-FF: Span of 20 fixed at both ends, load 10

Source: Hand calculation, three-moment equation. Calculation: Moving load.

H-FF · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
M at midspan = P L / 8	kip-ft	25.00	25.00	+0.00		Pass
Largest negative = 4 P L / 27	kip-ft	-29.63	-29.63	-0.00		Pass

H-D: Dead load only effects on two spans of 20, w = 1, with a light wheel: M over the support = −w L²/8 and R = 3 w L/8, 10 w L/8

Source: Hand calculation, three-moment equation. Calculation: Moving load.

H-D · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Support moment	kip-ft	-50.00	-50.00	-0.00		Pass
R1	kips	7.500	7.500	+0.00		Pass
R2	kips	25.00	25.00	+0.00		Pass

SP-OWS: Continuous one-way slab by the ACI coefficients (girder-supported floor)

Source: StructurePoint, One-Way Slab Analysis and Design (ACI 318-14), pp. pp. 4–12, 39 (Tables 1–5). Calculation: One-way slab.

Clear spans 13.08 / 13.83 / 13.83 / 13.08 ft (beams at 15 ft), SDL = 20 psf, L = 80 psf, self-weight 150 pcf; wu = 0.257 kip/ft² (1.2D + 1.6L).

SP-OWS · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Minimum thickness, end bay ℓ/24 The example takes ℓ = 172 in. (16 in. spandrel); the program uses one support width (14 in.), ℓ = 171 in.	in.	7.170	7.125	-0.63		Pass
Mu+ end span wu ℓn²/14	kip-ft	3.140	3.142	+0.07		Pass
Mu− first interior support wu ℓavg²/10	kip-ft	4.650	4.655	+0.11		Pass
As,min = 0.0018 b h	in.²	0.151	0.151	+0.13		Pass
Maximum bar spacing min(3h, 18 in.)	in.	18.00	18.00	+0.00		Pass
Crack-control spacing limit	in.	12.00	12.00	+0.00		Pass
Shrinkage and temperature As = 0.0018 b h	in.²	0.151	0.151	+0.13		Pass
Shrinkage and temperature spacing min(5h, 18 in.)	in.	18.00	18.00	+0.00		Pass
φVc	kips	6.830	3.841	-43.77		Deviation ACI318-14-VC

ACI318-14-VC: the example uses Vc = 2λ√f'c bw d of ACI 318-14; ACI 318-19 Table 22.5.5.1(c) for members without Av,min gives 8λs λ ρw^(1/3) √f'c bw d

ACI-HB-OW1: Slab with a cantilever: minimum thickness, minimum steel, φVc

Source: ACI MNL-17(21), One-way Slab Example 1, pp. pp. 46-54. Calculation: One-way slab.

7 in. slab, 14 ft span on 18 in. beams with a 6 ft cantilever (clear projection), f'c = 5,000 psi, D = 15 psf + self-weight, L = 100 psf, No. 5 at 12 in. The handbook's span moments come from a continuous-slab program run and are not compared.

ACI-HB-OW1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Minimum thickness, main span ℓ/24 p. 47	in.	7.000	7.000	+0.00		Pass
Minimum thickness, cantilever ℓ/10 p. 47	in.	7.200	7.200	+0.00		Pass
As,min = 0.0018 b h p. 53	in.²	0.150	0.151	+0.80		Pass
Shrinkage and temperature As p. 53	in.²	0.150	0.151	+0.80		Pass
Crack-control spacing limit, fs = 40 ksi p. 53	in.	12.00	12.00	+0.00		Pass
Maximum bar spacing min(3h, 18 in.) p. 53	in.	18.00	18.00	+0.00		Pass
φVc (Table 22.5.5.1(c), No. 5 at 12 in. top, ρw = 0.00438) p. 54	kips	4.900	4.935	+0.71		Pass

OW-1: Continuous one-way slab by the ACI coefficients

Source: Hand calculation (closed form), pp. ACI 318-19 Tables 7.3.1.1, 6.5.2, 6.5.4, 22.5.5.1, 24.3.2. Calculation: One-way slab.

3 equal clear spans of 12 ft on 12 in. supports integral with spandrel beams; D = 20 psf + self-weight (150 pcf), L = 100 psf; f'c = 4,000 psi, Grade 60.

OW-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Minimum thickness, end span ℓ/24 (ℓ = 13 ft)	in.	6.500	6.500	+0.00		Pass
Mu+ end span wu ℓn²/14	kip-ft	2.973	2.973	+0.00		Pass
Mu− first interior support wu ℓn²/10	kip-ft	4.162	4.162	+0.00		Pass
φMn, #4 at 12 in., d = 6 in.	kip-ft	5.268	5.268	+0.00		Pass
Vu at d, 1.15 wu ℓn/2 − wu d	kips	1.850	1.850	+0.00		Pass
φVc, Table 22.5.5.1(c)	kips	3.841	3.841	+0.00		Pass
Crack-control spacing limit, fs = 40 ksi	in.	12.00	12.00	+0.00		Pass
As,min = 0.0018 b h	in.²	0.151	0.151	+0.00		Pass

OW-2: Simple-span slab thinner than Table 7.3.1.1: calculated deflections

Source: Hand calculation (closed form), pp. ACI 318-19 Table 24.2.3.5, Eqs. 24.2.3.5, 24.2.4.1.1. Calculation: One-way slab.

Δ = 5wℓ⁴/(384 Ec Ie), Ie at midspan for each load level (24.2.3.7).

OW-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Immediate live load deflection Δ(D+L) − Δ(D)	in.	0.483	0.483	-0.00		Pass
Limit ℓ/360	in.	0.400	0.400	+0.00		Pass
Long-term deflection λΔ ΔD + ΔL	in.	0.968	0.968	-0.00		Pass
Mu = wu ℓ²/8	kip-ft	5.040	5.040	-0.00		Pass

MNL-PC-STM5: Five-pile cap, two-way shear with the size effect (ACI 318-19)

Source: ACI MNL-17(21), Strut-and-tie Example 5 (Vol. 2), pp. pp. 248-249. Calculation: Pile cap.

MNL-PC-STM5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
λs = √(2/(1 + d/10)), d = 39.5 in.		0.636	0.636	-0.06		Pass
vc = 4 λs √f'c	psi	161.0	160.8	-0.12		Pass
φvc	psi	120.0	120.6	+0.50		Pass
One-way shear (all piles inside d, 13.4.6.5)	kips	0.000	0.000	+0.00		Pass

SP-PC: Eight-pile cap under a 22 in column (Fanella Ex. 10.13)

Source: StructurePoint, Pile Supported Foundation (Pile Cap) Analysis and Design (ACI 318-14), after Fanella, Reinforced Concrete Structures, 2nd Ed., Example 10.13, pp. pp. 5-15. Calculation: Pile cap.

SP-PC · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Factored moment, short direction (12 #7 along y) 3 piles × 114 kips × 1.708 ft	kip-ft	584.3	585.4	+0.20		Pass
Factored moment, long direction (10 #7 along x)	kip-ft	541.5	538.4	-0.58		Pass
As,min = 0.0018 × 8.5 ft × 33 in	in.²	6.060	6.059	-0.02		Pass
As,min = 0.0018 × 7.75 ft × 33 in	in.²	5.520	5.524	+0.08		Pass
Punching Vu at the column (6 piles outside the section)	kips	684.0	682.3	-0.25		Pass
φVc at the column (ACI 318-14: 0.75 × 4√f'c bo d)	kips	947.0	706.0	-25.45		Deviation PC-ACI19-LAMS
PC-ACI19-LAMS: ACI 318-19 multiplies vc by λs = 0.745 for d = 26 in (22.6.5.2); 13.2.6.2 does not waive it for pile caps						

SP-PC-1W: Eight-pile cap, one-way shear east-west with d = 26 in (Fanella Ex. 10.13)

Source: StructurePoint, Pile Supported Foundation (Pile Cap) Analysis and Design (ACI 318-14), after Fanella, Reinforced Concrete Structures, 2nd Ed., Example 10.13, pp. p. 8. Calculation: Pile cap.

SP-PC-1W · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
One-way Vu at d, two piles 1 in inside the section (13.4.6.5 interpolation)	kips	96.00	93.71	-2.38		Deviation PC-WEIGHT

PC-WEIGHT: the publication neglects the cap weight and rounds the interpolated pile share up (47.5 to 48 kips per pile); the program subtracts the factored cap weight beyond the section

PC-1: Four-pile cap (the default design)

Source: Hand calculation (closed form). Calculation: Pile cap.

PC-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Service pile reaction (D + L)	kips	85.06	85.06	+0.00		Pass
Factored moment at the column face	kip-ft	160.9	160.9	+0.00		Pass
Punching vu at the column (13.4.6.5 shares)	psi	12.69	12.69	-0.00		Pass
Punching vu around a corner pile	psi	56.75	56.75	+0.00		Pass
φvc = 0.75 × 4 λs √f'c	psi	141.2	141.2	-0.00		Pass
One-way shear (all piles inside d)	kips	0.000	0.000	+0.00		Pass

GEC10-10-1: Drilled shaft: side resistance in silty sand by the β-method

Source: FHWA NHI-18-024 (2018) GEC 10, Drilled Shafts, pp. Illustrative Example 10-1, pp. 10-12 to 10-14. Calculation: Pile axial capacity.

GEC10-10-1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Layer 1 RSN (0 to 15 ft)	kips	197.2	196.6	-0.31		Pass
Layer 2 RSN (15 to 33 ft)	kips	635.6	631.5	-0.64		Pass

GEC10-10-2: Drilled shaft: side resistance in stiff clay by the α-method

Source: FHWA NHI-18-024 (2018) GEC 10, Drilled Shafts, pp. Illustrative Example 10-2, pp. 10-17 to 10-18. Calculation: Pile axial capacity.

The clay is split at the tip so its mid-depth (46.5 ft) is the example's.

GEC10-10-2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Layer 3 RSN (33 to 60 ft)	kips	479.7	479.7	+0.00		Pass

GEC10-10-3: Drilled shaft: base resistance in clay

Source: FHWA NHI-18-024 (2018) GEC 10, Drilled Shafts, pp. Illustrative Example 10-3, p. 10-20. Calculation: Pile axial capacity.

GEC10-10-3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
qBN = 9 su(CIUC) (23.1 ksf)	ksf	23.14	23.14	+0.01		Pass
RBN = π/4 B² qBN	kips	453.6	454.4	+0.17		Pass

DRV-AB: Driven square pile, clay over sand: α (API) and β / Nt methods

Source: Hand calculation (closed form), pp. FHWA GEC 12 (2016) Eqs. 7-19, 7-20; API RP 2A α. Calculation: Pile axial capacity.

DRV-AB · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Clay side resistance (α API at 10 ft)	kips	34.85	34.85	+0.00		Pass
Sand side resistance (β = 0.40)	kips	56.90	56.90	+0.00		Pass
Toe Nt σ'p	kips	96.16	96.16	+0.00		Pass
Rn / FS (2.5)	kips	75.16	75.16	+0.00		Pass

DRV-AB · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φ sum 0.45 Rs,clay + 0.55 Rs,sand + 0.50 Rp	kips	95.05	95.05	+0.00		Pass

DRV-CLAY: Driven pile tipped in clay: 9 su toe and uplift

Source: Hand calculation (closed form), pp. FHWA GEC 12 (2016) 7.2.1. Calculation: Pile axial capacity.

DRV-CLAY · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Toe 9 su At	kips	9.000	9.000	+0.00		Pass
Allowable uplift 0.75 Rs / 3	kips	7.637	7.637	+0.00		Pass

PG-UFC-2-1: Eight piles, biaxial eccentricity (Qg = 100 kips)

Source: UFC 3-220-01A (2004), Deep Foundations, Eq. 2-2 and Figure 2-1, pp. pp. 2-2, 2-3. Calculation: Pile group.

PG-UFC-2-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Largest pile load 0.342 Qg	kips	34.20	34.17	-0.10		Pass
Tension 0.092 Qg	kips	9.200	9.167	-0.36		Pass

PG-GEC12-P2: Pier 2, 20 piles, Strength V (Table D-60)

Source: FHWA-NHI-16-064 (2016), GEC 12 Comprehensive Design Examples, pp. pp. 130-134. Calculation: Pile group.

PG-GEC12-P2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pile 5 (x = 10, y = −6 ft): 257.3 kips	kips	257.3	257.3	+0.01		Pass
Pile 16 (x = −10, y = 6 ft): 88.3 kips	kips	88.30	88.27	-0.04		Pass
Pile 1 (x = −10, y = −6 ft): 177.7 kips	kips	177.7	177.7	-0.00		Pass

PG-GEC12-NA-S: North Abutment, 2 rows of 9, Service I (Table D-13)

Source: FHWA-NHI-16-064 (2016), GEC 12 Comprehensive Design Examples, pp. pp. 47-49. Calculation: Pile group.

PG-GEC12-NA-S · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Front row 2,069 kips / 9 piles	kips	229.9	229.9	+0.00		Pass
Back row −231 kips / 9 piles (tension)	kips	25.67	25.67	+0.00		Pass

PG-GEC12-NA-U: North Abutment, 2 rows of 9, Strength I (Tables D-13, D-14)

Source: FHWA-NHI-16-064 (2016), GEC 12 Comprehensive Design Examples, pp. pp. 47-50. Calculation: Pile group.

PG-GEC12-NA-U · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Front row 2,908 kips / 9 = 323 kips per pile	kips	323.0	323.2	+0.06		Pass

PG-CPGA-1: Five timber piles, three battered 3:1, fixed heads (stiffness method)

Source: USACE ITL-89-3 (1989), CPGA User's Guide, Example Problem 1 (Hrennikoff 1950), pp. pp. B1-B17. Calculation: Pile group.

PG-CPGA-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Axial force pile 1 (CPGA 37.6)	kips	37.60	37.63	+0.07		Pass
Axial force pile 2 (CPGA 34.5)	kips	34.50	34.47	-0.10		Pass
Axial force pile 3 (CPGA 31.3)	kips	31.30	31.31	+0.02		Pass
Axial force pile 4 (CPGA 10.8)	kips	10.80	10.77	-0.26		Pass
Axial force pile 5 (CPGA 5.4)	kips	5.400	5.442	+0.78		Pass
Largest transverse force (Hrennikoff 1.53, vertical piles)	kips	1.530	1.525	-0.33		Pass
Largest head moment 36.0 in-k	kip-ft	3.000	3.001	+0.02		Pass
Cap displacement Dx = −0.1032 in	in.	-0.103	-0.103	-0.00		Pass
Cap displacement Dz = 0.02787 in	in.	0.028	0.028	-0.01		Pass
Cap rotation Ry = 0.0002095 rad	rad	0.000	0.000	-0.00		Pass

SSSS-1: All edges simply supported, b/a = 1

Source: Batista, arXiv 1001.3016 (2010), Table 2a, pp. 6. Calculation: Plate bending.

SSSS-1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Deflection factor at the center		0.004	0.004	+0.00		Pass
Mx factor at the center		0.048	0.048	+0.06		Pass
My factor at the center		0.048	0.048	+0.06		Pass

SSSS-2: All edges simply supported, b/a = 2

Source: Batista, arXiv 1001.3016 (2010), Table 2a, pp. 6. Calculation: Plate bending.

SSSS-2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Deflection factor at the center		0.010	0.010	+0.00		Pass
Mx factor at the center		0.102	0.102	+0.10		Pass
My factor at the center		0.046	0.046	+0.05		Pass

SSSS-5: All edges simply supported, b/a = 5

Source: Batista, arXiv 1001.3016 (2010), Table 2a, pp. 6. Calculation: Plate bending.

SSSS-5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Deflection factor at the center		0.013	0.013	+0.00		Pass
Mx factor at the center		0.125	0.125	+0.11		Pass
My factor at the center		0.038	0.038	+0.11		Pass

SSCC-1: x edges simply supported, y edges fixed, b/a = 1

Source: Batista, arXiv 1001.3016 (2010), Tables 3a, 3b, pp. 9. Calculation: Plate bending.

SSCC-1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Deflection factor at the center		0.002	0.002	-0.00		Pass
Mx factor at the center		0.024	0.024	+0.07		Pass
My factor at the center		0.033	0.033	+0.22		Pass
My at the fixed edge		-0.070	-0.070	-0.38		Pass

SSCC-2: x edges simply supported, y edges fixed, b/a = 2

Source: Batista, arXiv 1001.3016 (2010), Tables 3a, 3b, pp. 9. Calculation: Plate bending.

SSCC-2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Deflection factor at the center		0.008	0.008	+0.00		Pass
Mx factor at the center		0.087	0.087	+0.09		Pass
My factor at the center		0.047	0.047	+0.05		Pass
My at the fixed edge		-0.119	-0.119	-0.33		Pass

SSFF-1: x edges simply supported, y edges free, b/a = 1

Source: Batista, arXiv 1001.3016 (2010), Tables 4a, 4b, pp. 11. Calculation: Plate bending.

SSFF-1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Deflection factor at the center		0.013	0.013	+0.00		Pass
Mx factor at the center		0.123	0.123	+0.13		Pass
My factor at the center		0.027	0.027	+0.27		Pass
Deflection at the free edge		0.015	0.015	-0.00		Pass
Mx at the free edge		0.131	0.131	+0.14		Pass

SSFF-2: x edges simply supported, y edges free, b/a = 2

Source: Batista, arXiv 1001.3016 (2010), Tables 4a, 4b, pp. 11. Calculation: Plate bending.

SSFF-2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Deflection factor at the center		0.013	0.013	+0.00		Pass
Mx factor at the center		0.123	0.124	+0.12		Pass
My factor at the center		0.036	0.036	+0.13		Pass
Deflection at the free edge		0.015	0.015	+0.00		Pass
Mx at the free edge		0.133	0.133	+0.14		Pass

CCCC-1: All edges fixed, b/a = 1

Source: Batista, arXiv 1001.3016 (2010), Tables 5a, 5b, pp. 13. Calculation: Plate bending.

CCCC-1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Deflection factor at the center		0.001	0.001	-0.00		Pass
Mx factor at the center		0.023	0.023	+0.20		Pass
My factor at the center		0.023	0.023	+0.20		Pass
Mx at the fixed edge		-0.051	-0.051	-0.60		Pass
My at the fixed edge		-0.051	-0.051	-0.60		Pass

CCCC-2: All edges fixed, b/a = 2

Source: Batista, arXiv 1001.3016 (2010), Tables 5a, 5b, pp. 13. Calculation: Plate bending.

CCCC-2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Deflection factor at the center		0.003	0.003	-0.00		Pass
Mx factor at the center		0.041	0.041	+0.32		Pass
My factor at the center		0.016	0.016	+0.20		Pass
Mx at the fixed edge		-0.083	-0.083	-0.20		Pass
My at the fixed edge		-0.057	-0.057	-0.60		Pass

F.14 · Plate girder: Plate girder, 62 × 1/2 in. web, 14 × 2 in. flanges, 50 ft

Source: AISC Design Examples v16.0, Example F.14, pp. F-65 to F-75. Calculation: Plate girder.

F.14 · Plate girder · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φb Mn = 0.9 Rpc Myc	kip-ft	94,560	94,746	+0.20		Pass
Cb of the middle segment		1.250	1.246	-0.29		Pass
φv Vn (G2.1, kv = 5.34)	kips	440.0	439.9	-0.03		Pass
q = Vu Q/Ix	kip/in.	3.740	3.740	-0.00		Pass
Deflection, total	in.	0.944	0.944	-0.03		Pass

F.14 · Plate girder · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mn/Ωb	kip-ft	63,000	63,038	+0.06		Pass
Vn/Ωv	kips	293.0	292.7	-0.11		Pass
q = Va Q/Ix	kip/in.	2.760	2.762	+0.05		Pass

G.8B · Plate girder: 36 in. girder, 5/16 in. web, stiffeners at 42 and 132 in. from each end

Source: AISC Design Examples v16.0, Example G.8B, pp. G-22 to G-24. Calculation: Plate girder.

The default design.

G.8B · Plate girder · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φv Vn, end panel (G2.1, a = 42 in.)	kips	217.0	216.7	-0.14		Pass
φv Vn, second panel (G2.2, a = 90 in.)	kips	185.0	185.7	+0.40		Pass
Vu at the start of the second panel	kips	184.0	183.8	-0.14		Pass

G.8B · Plate girder · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vn/Ωv, end panel	kips	144.0	144.2	+0.12		Pass
Vn/Ωv, second panel	kips	123.0	123.6	+0.47		Pass

HAND-PG-STIFF: The G.8B girder: stiffener rigidity and bearing stiffeners

Source: Hand calculation (closed form). Calculation: Plate girder.

HAND-PG-STIFF · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ist provided, pair 3 × 3/8 in.	in.⁴	7.861	7.861	+0.00		Pass
Ist1 (Eq. G2-18)	in.⁴	2.123	2.123	+0.00		Pass
φ Pn of the bearing stiffener column (Lc/r ≤ 25)	kips	525.2	525.2	+0.00		Pass

PF-PDH-8.00: Sign, nonconstrained, 2× bearing: first trial, 8.00 ft

Source: PDHonline Course S235, J. W. Andrew, Pole Foundation Design with Spreadsheet (2012), IBC 2006, pp. p. 4. Calculation: Pole footing.

The steel tube size is not stated; it does not enter the values (b is the 32 in. footing).

PF-PDH-8.00 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
S1 at the 8.0 ft trial depth	psf	533.0	533.3	+0.06		Pass
A	ft	1.970	1.974	+0.22		Pass
Depth computed from the trial	ft	6.930	6.938	+0.11		Pass

PF-PDH-7.50: Sign, nonconstrained, 2× bearing: second trial, 7.50 ft

Source: PDHonline Course S235, J. W. Andrew, Pole Foundation Design with Spreadsheet (2012), IBC 2006, pp. p. 4. Calculation: Pole footing.

The steel tube size is not stated; it does not enter the values (b is the 32 in. footing).

PF-PDH-7.50 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
S1 at the 7.5 ft trial depth	psf	500.0	500.0	+0.00		Pass
A	ft	2.100	2.106	+0.29		Pass
Depth computed from the trial	ft	7.190	7.204	+0.20		Pass

PF-PDH-7.31: Sign, nonconstrained, 2× bearing: converged depth

Source: PDHonline Course S235, J. W. Andrew, Pole Foundation Design with Spreadsheet (2012), IBC 2006, pp. pp. 3 to 5. Calculation: Pole footing.

The steel tube size is not stated; it does not enter the values (b is the 32 in. footing).

PF-PDH-7.31 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
S1 at the 7.31 ft trial depth	psf	487.0	487.3	+0.07		Pass
A	ft	2.160	2.161	+0.03		Pass
Depth computed from the trial	ft	7.310	7.313	+0.05		Pass
Required embedment (trial = computed)	ft	7.310	7.312	+0.03		Pass
Vertical pressure, 775 lb on the footing area	psf	139.0	138.8	-0.17		Pass
Allowable vertical pressure, sandy clay	psf	1,500	1,500	+0.00		Pass
15 × the tabular value: 1,500 psf	psf	1,500	1,500	+0.00		Pass

PF-CALCBOOK: Vehicle load on a 2 ft footing in clay, constrained by pavement

Source: CalcBook, Pole Foundation Design (IBC 1807.3) with Example (2024), IBC 2021, pp. web page, Steps 1 to 4. Calculation: Pole footing.

The post size is not stated; it does not enter the values (b is the 2 ft footing).

PF-CALCBOOK · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Footing weight, 3.11 kips	lb	3,110	3,110	+0.01		Pass
Vertical pressure, 0.99 ksf	psf	990.0	990.0	-0.00		Pass
S3 at 6.6 ft, 0.66 ksf	psf	660.0	660.0	+0.00		Pass
Depth from Eq. 18-2 at the 6.6 ft trial	ft	6.590	6.593	+0.04		Pass
Required embedment, solved	ft	6.600	6.595	-0.07		Pass

PF-MAPLE: Flagpole on a 4.5 ft footing, constrained, isolated-pole factor 2

Source: Maplesoft, Maple Flow flagpole footing calculation sheet (2021), IBC 2018, pp. pp. 2 to 3. Calculation: Pole footing.

The post size is not stated; it does not enter the values (b is the footing). The sheet has no 15× cap and states no vertical pressure; 3,466 psf is below the cap of 5,250 psf.

PF-MAPLE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Moment at grade, 9.00 × 10^4 lb-ft	lb-ft	90,000	90,000	+0.00		Pass
Embedment d, 1.509 m	ft	4.951	4.952	+0.02		Pass
S3, 1.660 × 10^5 Pa	psf	3,467	3,466	-0.02		Pass
S1, 5.532 × 10^4 Pa	psf	1,155	1,155	+0.01		Pass
A, 13.501 (the sheet solves it in the constrained case too)	ft	13.50	13.50	+0.00		Pass

PF-CT: 12 in. utility pole, 9 ft embedment in sand, nonconstrained

Source: Connecticut DAS, Soils and Foundations, 2016 OEDM Career Development (January 2016), IBC 2012, pp. p. 20, first slide. Calculation: Pole footing.

The slide stops after one pass of the equation (S1 at the 9 ft embedment); the hole size is not stated and does not enter the values (sand backfill: b is the pole).

PF-CT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
S1 = 450 psf (150 psf/ft × 9 ft / 3)	psf	450.0	450.0	+0.00		Pass
A = 1.04	ft	1.040	1.040	+0.00		Pass
d = 7.3 ft minimum, one pass at the 9 ft trial	ft	7.300	7.274	-0.36		Pass

SP-17 Anch-3: Single 5/8 in. torque-controlled expansion anchor, tension

Source: ACI SP-17(14), Anchorage Example 3, pp. 226 to 230. Calculation: Post-installed anchors.

Np is the Table E.1 value for this hef with no f'c adjustment, as the example uses it.

SP-17 Anch-3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nua = 1.4 D	kips	7.245	7.245	+0.00		Pass
φNsa = 0.75 Nsa	kips	12.71	12.71	-0.00		Pass
Nb = 17 √f'c hef^1.5	kips	17.82	17.82	-0.00		Pass
φNcb (Category 1, φ = 0.65)	kips	11.58	11.58	-0.00		Pass
φNpn = 0.65 Np	kips	9.265	9.265	+0.00		Pass
hef limit, 2/3 ha	in.	8.000	8.000	+0.00		Pass

SP-17 Anch-4A: Single 1 in. adhesive anchor, minimum bond stresses of the code table

Source: ACI SP-17(14), Anchorage Example 4, Part A, pp. 231 to 237. Calculation: Post-installed anchors.

The example applies the sustained 0.4 of the table note to τ, as ILX does; cNa keeps the unfactored 1,000 psi.

SP-17 Anch-4A · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φNsa	kips	26.36	26.36	+0.00		Pass
cNa	in.	9.500	9.535	+0.36		Pass
φNa = 0.45 × 0.4 Nba (Table note [1])	kips	1.612	1.612	-0.02		Pass
Nb = 17 √f'c hef^1.5	kips	31.48	31.48	+0.00		Pass
φNcb (Category 3, φ = 0.45)	kips	14.17	14.17	-0.00		Pass
0.55 φNba, sustained	kips	0.890	0.886	-0.40		Pass

SP-17 Anch-4B: Single 1/2 in. adhesive anchor, test bond stress

Source: ACI SP-17(14), Anchorage Example 4, Part B, pp. 238 to 239. Calculation: Post-installed anchors.

Part B does not need τuncr far from edges; 2,240 psi is the value Example 13 uses for this anchor.

SP-17 Anch-4B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φNsa	kips	6.177	6.177	+0.00		Pass
Nba = τcr π da hef	kips	5.663	5.663	-0.00		Pass
φNa (φ = 0.45)	kips	2.548	2.548	+0.01		Pass
0.55 φNba, sustained	kips	1.400	1.402	+0.11		Pass
Nb	kips	7.040	7.040	+0.00		Pass
φNcb	kips	3.168	3.168	+0.00		Pass

SP-17 Anch-6: Single 1/2 in. expansion anchor 3 in. from an edge, wind shear

Source: ACI SP-17(14), Anchorage Example 6, pp. 246 to 251. Calculation: Post-installed anchors.

The example assumes ca2 = 6 in. for shear breakout but ignores it for pryout. With 1.5 ca1 = 4.5 in. it does not change Vcb, so no second edge is entered.

SP-17 Anch-6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φVsa = 0.65 Vsa	kips	3.212	3.212	+0.01		Pass
Vb, le = 8 da	kips	2.136	2.135	-0.04		Pass
φVcb (φ = 0.70)	kips	1.495	1.495	-0.02		Pass
ANc of pryout	in.²	186.0	185.6	-0.20		Pass
ANco	in.²	272.0	272.2	+0.09		Pass
Nb of pryout	kips	12.01	12.01	+0.00		Pass
Ncb of pryout	kips	6.615	6.626	+0.16		Pass
φVcp = 0.70 × 2 Ncb	kips	9.261	9.276	+0.16		Pass

SP-17 Anch-10: 5/8 in. expansion anchor at a beam end, tension and shear

Source: ACI SP-17(14), Anchorage Example 10, pp. 279 to 287. Calculation: Post-installed anchors.

SP-17 Anch-10 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nua = 0.9D + 1.0W	kips	1.935	1.935	+0.00		Pass
Vua	kips	1.440	1.440	+0.00		Pass
φNsa	kips	12.71	12.71	-0.00		Pass
hef' near three edges	in.	5.330	5.333	+0.06		Pass
ANc	in.²	168.0	168.0	+0.00		Pass
ANco	in.²	256.0	256.0	+0.00		Pass
ψed,N		0.850	0.850	+0.00		Pass
Nb	kips	11.47	11.47	-0.06		Pass
Ncb	kips	6.437	6.397	-0.62		Pass
φNcb (φ = 0.65)	kips	4.180	4.158	-0.52		Pass
φNpn	kips	9.265	9.265	+0.00		Pass
φVsa = 0.65 × 0.8 Vsa (grout pad)	kips	5.288	5.288	+0.01		Pass
Vb, le = 8 da	kips	3.675	3.675	+0.01		Pass
φVcb	kips	2.570	2.573	+0.11		Pass
φVcp = 0.70 × 2 Ncb	kips	9.012	8.956	-0.62		Pass
Nua/φNn + Vua/φVn		1.050	1.025	-2.38		Deviation SP17-ROUNDED-INTERAC
SP17-ROUNDED-INTERACTION: the example adds ratios of capacities rounded down to 4,100 and 2,500 lb						

SP-17 Anch-11: 5/8 in. adhesive anchor at a beam end, tension and shear

Source: ACI SP-17(14), Anchorage Example 11, pp. 288 to 298. Calculation: Post-installed anchors.

SP-17 Anch-11 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φNsa	kips	9.800	9.831	+0.32		Pass
Ncb	kips	6.437	6.397	-0.62		Pass
cNa	in.	8.640	8.636	-0.05		Pass
ANao	in.²	299.0	298.3	-0.24		Pass
ANa	in.²	176.0	175.6	-0.21		Pass
ψed,Na		0.840	0.839	-0.12		Pass
Nba	kips	12.12	12.12	-0.00		Pass
Na	kips	5.997	5.989	-0.13		Pass
φNa (φ = 0.65)	kips	3.898	3.893	-0.13		Pass
φVsa	kips	4.090	4.090	-0.00		Pass
φVcb	kips	2.570	2.573	+0.11		Pass
φVcp = 0.70 × 2 Na	kips	8.413	8.385	-0.34		Pass
Nua/φNn + Vua/φVn		1.080	1.057	-2.15		Deviation SP17-ROUNDED-INTERAC
SP17-ROUNDED-INTERACTION: the example adds ratios of capacities rounded to 3,900 and 2,500 lb						

SP-17 Anch-13: Six 1/2 in. adhesive anchors near an edge, concentric tension

Source: ACI SP-17(14), Anchorage Example 13, pp. 305 to 310. Calculation: Post-installed anchors.

The example uses φ = 0.75 for breakout (Category 1 with supplementary reinforcement) and 0.65 for bond (Table E.2 for the installation condition). In ILX these are the two category inputs: bond Category 2 with supplementary reinforcement gives 0.65.

SP-17 Anch-13 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nua,g = 1.6 L	kips	12.00	12.00	+0.00		Pass
φNsa	kips	6.177	6.177	+0.00		Pass
ANc	in.²	626.0	625.6	-0.06		Pass
ANco	in.²	380.0	380.2	+0.07		Pass
ψed,N		0.792	0.792	+0.04		Pass
Nb	kips	17.82	17.82	-0.00		Pass
Ncbg	kips	23.27	23.23	-0.19		Pass
φNcbg (φ = 0.75)	kips	17.45	17.42	-0.19		Pass
cNa	in.	7.130	7.135	+0.07		Pass
ANa	in.²	453.0	453.6	+0.14		Pass
ANao	in.²	203.0	203.6	+0.31		Pass
ψed,Na		0.826	0.826	+0.02		Pass
Nba	kips	10.52	10.52	+0.00		Pass
Nag	kips	19.38	19.35	-0.15		Pass
φNag (φ = 0.65)	kips	12.60	12.58	-0.15		Pass

SP-17 Anch-17: Six 3/4 in. adhesive anchors, tension eccentric about two axes

Source: ACI SP-17(14), Anchorage Example 17, pp. 344 to 352. Calculation: Post-installed anchors.

The example treats the concrete as cracked for breakout but uses τuncr = 1,990 psi in Nba. To follow its arithmetic that value is entered as τ. ILX normally takes τcr in cracked concrete. The member thickness is not given; 24 in. is entered and does not enter these values.

SP-17 Anch-17 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Most stressed anchor Nu6	kips	5.436	5.436	-0.00		Pass
φNsa	kips	14.53	14.53	+0.00		Pass
ANc	in.²	864.0	864.2	+0.03		Pass
ANco	in.²	576.0	576.0	+0.00		Pass
ψec,N		0.849	0.855	+0.67		Pass
ψed,N		0.850	0.850	+0.00		Pass
Nb	kips	27.20	27.20	+0.00		Pass
Ncbg	kips	29.43	29.65	+0.73		Pass
φNcbg (φ = 0.65)	kips	19.14	19.27	+0.70		Pass
cNa	in.	10.09	10.09	-0.02		Pass
ANao	in.²	407.0	407.0	+0.01		Pass
ANa	in.²	707.0	707.1	+0.01		Pass
ψec,Na		0.824	0.831	+0.82		Pass
ψed,Na		0.878	0.878	+0.05		Pass
Nba (× 1.06, f'c above 4,500 psi)	kips	39.76	39.76	+0.00		Pass
Nag	kips	49.97	50.41	+0.87		Pass
φNag (φ = 0.65)	kips	32.48	32.76	+0.87		Pass

PROFIS KB1: Eight 1/2 in. Kwik Bolt 1, 2,500 psi cracked, no edges

Source: Hilti PROFIS Engineering report, Kwik Bolt 1, 2023-05-16, pp. 2 to 6. Calculation: Post-installed anchors.

ILX's own anchor tensions differ (no concrete bearing model), so its Ncbg is not compared; the last value runs the library with the tensions PROFIS printed.

PROFIS KB1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φNsa	kips	8.148	8.148	+0.00		Pass
φVsa	kips	3.394	3.394	+0.01		Pass
Vua of the group	kips	2.121	2.121	+0.02		Pass
Vua per anchor	kips	0.265	0.265	+0.06		Pass
Nb	kips	4.980	4.980	+0.00		Pass
ANc, all eight anchors	in.²	760.5	760.5	+0.00		Pass
φVcpg	kips	55.78	55.78	-0.00		Pass
Ncbg with PROFIS's anchor forces	kips	4.986	4.984	-0.04		Pass

PROFIS HY200: Six 1-1/4 in. HIT-HY 200 adhesive anchors, 4,000 psi uncracked

Source: Hilti PROFIS Engineering report, HIT-HY 200 V3, 2026-04-07, pp. 2 to 5. Calculation: Post-installed anchors.

The report's cNa of 18.098 in. implies a τ slightly below the 2,327 psi it prints; 2,327 psi is entered, not worked back.

PROFIS HY200 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φNsa	kips	42.16	42.16	+0.00		Pass
cNa	in.	18.10	18.18	+0.46		Pass
ANa	in.²	1,998	2,013	+0.76		Pass
ANao	in.²	1,310	1,322	+0.92		Pass
Nba	kips	45.69	45.69	+0.01		Pass
Nag	kips	69.67	69.57	-0.15		Pass
φNag (φ = 0.65)	kips	45.28	45.22	-0.15		Pass
ANc	in.²	510.0	510.0	+0.00		Pass
ANco	in.²	225.0	225.0	+0.00		Pass
Nb (kc = 24)	kips	16.97	16.97	-0.00		Pass
Ncbg	kips	38.47	38.47	-0.00		Pass
φNcbg (φ = 0.65)	kips	25.00	25.00	+0.00		Pass

MNL-17 Anch-3: Single 5/8 in. torque-controlled expansion anchor, tension

Source: ACI MNL-17(21), Anchorage Example 3, pp. Vol. 2 pp. 277 to 281. Calculation: Post-installed anchors.

Same anchor, data and values as SP-17(14) Example 3.

MNL-17 Anch-3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nua = 1.4 D	kips	7.245	7.245	+0.00		Pass
φNsa = 0.75 Nsa	kips	12.71	12.71	-0.00		Pass
Nb = 17 √f'c hef^1.5	kips	17.82	17.82	-0.00		Pass
φNcb (Category 1, φ = 0.65)	kips	11.58	11.58	-0.00		Pass
φNpn = 0.65 Np	kips	9.265	9.265	+0.00		Pass
hef limit, 2/3 ha	in.	8.000	8.000	+0.00		Pass

MNL-17 Anch-4: Single 3/4 in. screw anchor, hef = 4.75 in., tension

Source: ACI MNL-17(21), Anchorage Example 4, pp. Vol. 2 pp. 282 to 286. Calculation: Post-installed anchors.

Table E.2, 3/4 in.: Ase = 0.403 in.², futa = 75,000 psi, brittle steel, Category 1, pullout does not govern (no Np). Nsa = Ase futa is entered; Vsa = 0.6 Ase futa does not enter these values.

MNL-17 Anch-4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nua = 1.4 D	kips	7.245	7.245	+0.00		Pass
Nb = 17 √f'c hef^1.5	kips	11.13	11.13	+0.01		Pass
φNcb (Category 1, φ = 0.65)	kips	7.235	7.235	-0.00		Pass
hef limit, 2/3 ha	in.	8.000	8.000	+0.00		Pass
φNsa (summary table)	kips	12.70	19.65	+54.69		Deviation MNL17-A4-NSA
MNL17-A4-NSA: the summary repeats Example 3's 12,700 lb; Table E.2 gives 0.65 × 0.403 × 75,000 = 19,646 lb						

MNL-17 Anch-5A: Single 1 in. adhesive anchor, minimum bond stresses of the code table

Source: ACI MNL-17(21), Anchorage Example 5, Part A, pp. Vol. 2 pp. 287 to 294. Calculation: Post-installed anchors.

Same anchor and values as SP-17(14) Example 4, Part A. The example applies the sustained 0.4 of the table note to τ, as ILX does; cNa keeps the unfactored 1,000 psi.

MNL-17 Anch-5A · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φNsa	kips	26.36	26.36	+0.00		Pass
cNa	in.	9.500	9.535	+0.36		Pass
φNa = 0.45 × 0.4 Nba (Table note [1])	kips	1.612	1.612	-0.02		Pass
Nb = 17 √f'c hef^1.5	kips	31.48	31.48	+0.00		Pass
φNcb (Category 3, φ = 0.45)	kips	14.17	14.17	-0.00		Pass
0.55 φNba, sustained	kips	0.890	0.886	-0.40		Pass

MNL-17 Anch-5B: Single 1/2 in. adhesive anchor, test bond stress

Source: ACI MNL-17(21), Anchorage Example 5, Part B, pp. Vol. 2 pp. 295 to 297. Calculation: Post-installed anchors.

Table E.3, 1/2 in., temperature range A: τcr = 1,030 psi, τuncr = 2,240 psi (entered). The example's Step 10 prints 1,120 psi for both; its own summary table prints φNa = 2,500 lb, which is 0.45 × 1,030 psi × π × 0.5 × 3.5 in. = 2,548 lb.

MNL-17 Anch-5B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φNsa	kips	6.177	6.177	+0.00		Pass
Nb	kips	7.040	7.040	+0.00		Pass
φNcb (Category 3, φ = 0.45)	kips	3.168	3.168	+0.00		Pass
Nba = τcr π da hef	kips	6.157	5.663	-8.03		Deviation MNL17-A5B-TAU
MNL17-A5B-TAU: the example takes τcr = 1,120 psi; Table E.3 gives 1,030 psi for the 1/2 in. anchor						
φNa (φ = 0.45)	kips	2.770	2.548	-8.01		Deviation MNL17-A5B-TAU
MNL17-A5B-TAU: the example takes τcr = 1,120 psi; Table E.3 gives 1,030 psi for the 1/2 in. anchor						
0.55 φNba, sustained	kips	1.500	1.402	-6.57		Deviation MNL17-A5B-TAU
MNL17-A5B-TAU: the example takes τcr = 1,120 psi; Table E.3 gives 1,030 psi for the 1/2 in. anchor						

MNL-17 Anch-7: Single 1/2 in. expansion anchor 3 in. from an edge, wind shear

Source: ACI MNL-17(21), Anchorage Example 7, pp. Vol. 2 pp. 304 to 310. Calculation: Post-installed anchors.

SP-17(14) Example 6 with Table E.1 of the 2021 book: Vsa = 0.6 × 0.142 in.² × 75,000 psi. The example assumes the end of the beam at 6 in. or more, which does not change Vcb, so no second edge is entered.

MNL-17 Anch-7 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vsa = 0.6 Ase futa	kips	6.390	6.390	-0.00		Pass
φVsa = 0.65 Vsa	kips	4.153	4.154	+0.01		Pass
Vb, le = 8 da	kips	2.136	2.135	-0.04		Pass
φVcb (φ = 0.70)	kips	1.495	1.495	-0.02		Pass
ANc of pryout	in.²	186.0	185.6	-0.20		Pass
ANco	in.²	272.0	272.2	+0.09		Pass
ψed,N		0.810	0.809	-0.11		Pass
Nb of pryout	kips	12.01	12.01	+0.00		Pass
Ncb of pryout	kips	6.615	6.626	+0.16		Pass
Vcp = 2 Ncb	kips	13.23	13.25	+0.16		Pass
φVcp (φ = 0.70)	kips	9.261	9.276	+0.16		Pass

MNL-17 Anch-8: Single 1/2 in. screw anchor 3 in. from an edge, wind shear

Source: ACI MNL-17(21), Anchorage Example 8, pp. Vol. 2 pp. 311 to 317. Calculation: Post-installed anchors.

Table E.2, 1/2 in.: hnom = 3.75 in., hef = 3.25 in., Ase = 0.181 in.², brittle steel. The line for ψed,N prints 0.81 with 1.5(5.5 in.), carried over from Example 7; the Ncb line uses 0.88 = 0.7 + 0.3 × 3/4.875, which is the value tested.

MNL-17 Anch-8 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vsa = 0.6 Ase futa	kips	8.145	8.145	+0.00		Pass
φVsa (brittle, φ = 0.60)	kips	4.887	4.887	+0.00		Pass
Vb, le = hef	kips	2.048	2.048	+0.02		Pass
φVcb (φ = 0.70)	kips	1.434	1.434	-0.01		Pass
ANc of pryout	in.²	76.70	76.78	+0.11		Pass
ANco	in.²	95.10	95.06	-0.04		Pass
ψed,N (as used in Ncb)		0.880	0.885	+0.52		Pass
Nb of pryout	kips	5.455	5.455	+0.01		Pass
Ncb of pryout	kips	3.888	3.898	+0.26		Pass
Vcp = 2 Ncb	kips	7.776	7.796	+0.26		Pass
φVcp (φ = 0.70)	kips	5.443	5.457	+0.26		Pass

MNL-17 Anch-9: Single 1/2 in. adhesive anchor 3 in. from an edge, wind shear

Source: ACI MNL-17(21), Anchorage Example 9, pp. Vol. 2 pp. 318 to 325. Calculation: Post-installed anchors.

Table E.3, 1/2 in., dry concrete, temperature range A: τcr = 1,030 psi, τuncr = 2,240 psi, Category 1; cac = 1.5 hef = 8.25 in. for h/hef above 2.

MNL-17 Anch-9 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φVsa = 0.65 Vsa	kips	3.212	3.212	+0.01		Pass
Vb, le = 8 da	kips	2.136	2.135	-0.04		Pass
φVcb (φ = 0.70)	kips	1.495	1.495	-0.02		Pass
ANc of pryout	in.²	186.0	185.6	-0.20		Pass
ANco	in.²	272.0	272.2	+0.09		Pass
Nb of pryout	kips	12.01	12.01	+0.00		Pass
Ncb of pryout	kips	6.615	6.626	+0.16		Pass
cNa	in.	7.140	7.135	-0.07		Pass
ANao	in.²	204.0	203.6	-0.18		Pass
ANa	in.²	145.0	144.6	-0.26		Pass
ψed,Na		0.826	0.826	+0.02		Pass
ψcp,Na		0.866	1.000	+15.47		Deviation MNL17-A9-PSICP
MNL17-A9-PSICP: the example applies ψcp,Na in cracked concrete; 17.6.5.5.2 makes it 1.0, and its Na line does not use it						
Nba = τcr π da hef	kips	8.894	8.899	+0.05		Pass
Na (bond governs the pryout)	kips	5.216	5.221	+0.10		Pass
Vcp = 2 Na	kips	10.43	10.44	+0.10		Pass
φVcp	kips	6.780	7.310	+7.81		Deviation MNL17-A9-PHI
MNL17-A9-PHI: the example takes φ = 0.65 of the adhesive's category; Table 17.5.3(c) gives 0.70 for pryout of every anchor						

MNL-17 Anch-12: 5/8 in. expansion anchor at a beam end, tension and shear

Source: ACI MNL-17(21), Anchorage Example 12, pp. Vol. 2 pp. 346 to 355. Calculation: Post-installed anchors.

Same anchor, data and printed values as SP-17(14) Example 10.

MNL-17 Anch-12 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nua = 0.9D + 1.0W	kips	1.935	1.935	+0.00		Pass
Vua	kips	1.440	1.440	+0.00		Pass
φNsa	kips	12.71	12.71	-0.00		Pass
hef' near three edges	in.	5.330	5.333	+0.06		Pass
ANc	in.²	168.0	168.0	+0.00		Pass
ANco	in.²	256.0	256.0	+0.00		Pass
ψed,N		0.850	0.850	+0.00		Pass
Nb	kips	11.47	11.47	-0.06		Pass
Ncb	kips	6.437	6.397	-0.62		Pass
φNcb (φ = 0.65)	kips	4.180	4.158	-0.52		Pass
φNpn	kips	9.265	9.265	+0.00		Pass
φVsa = 0.65 × 0.8 Vsa (grout pad)	kips	5.288	5.288	+0.01		Pass
Vb, le = 8 da	kips	3.675	3.675	+0.01		Pass
φVcb	kips	2.570	2.573	+0.11		Pass
φVcp = 0.70 × 2 Ncb	kips	9.012	8.956	-0.62		Pass
Nua/φNn + Vua/φVn		1.050	1.025	-2.38		Deviation SP17-ROUNDED-INTERA
SP17-ROUNDED-INTERACTION: the example adds ratios of capacities rounded down to 4,100 and 2,500 lb						

MNL-17 Anch-13: 5/8 in. screw anchor at a beam end, tension and shear

Source: ACI MNL-17(21), Anchorage Example 13, pp. Vol. 2 pp. 356 to 365. Calculation: Post-installed anchors.

Table E.2, 5/8 in.: hef = 6.5 in. (hnom = 7.5 in.), Ase = 0.250 in.², futa = 75,000 psi, brittle steel, Category 1, pullout does not control. The problem statement says 4.25 in. effective embedment; the given data and every calculation use 6.5 in. The Ncb line prints the factors 0.79 and 0.88 but its result, 6,437 lb, is the product with 0.66 and 0.85.

MNL-17 Anch-13 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nua = 0.9D + 1.0W	kips	1.935	1.935	+0.00		Pass
φNsa = 0.65 Nsa (brittle)	kips	12.19	12.19	+0.00		Pass
hef' near three edges	in.	5.330	5.333	+0.06		Pass
ANc	in.²	168.0	168.0	+0.00		Pass
ANco	in.²	256.0	256.0	+0.00		Pass
ψed,N		0.850	0.850	+0.00		Pass
Nb	kips	11.47	11.47	-0.06		Pass
Ncb	kips	6.437	6.397	-0.62		Pass
φNcb (φ = 0.65)	kips	4.180	4.158	-0.52		Pass
φVsa = 0.60 × 0.8 Vsa (brittle, grout pad)	kips	5.400	5.400	-0.00		Pass
Vb, le = 8 da	kips	3.675	3.675	+0.01		Pass
φVcb	kips	2.460	2.573	+4.59		Deviation MNL17-A13-VCB
MNL17-A13-VCB: the example multiplies 0.7 by 3,515 lb, not by its Vcb of 3,675 lb						
φVcp = 0.70 × 2 Ncb	kips	9.012	8.956	-0.62		Pass
Nua/φNn + Vua/φVn		1.050	1.025	-2.38		Deviation MNL17-A13-VCB
MNL17-A13-VCB: the example adds ratios of 4,100 and 2,400 lb, which give 1.07, and prints 1.05						

MNL-17 Anch-14: 5/8 in. adhesive anchor at a beam end, tension and shear

Source: ACI MNL-17(21), Anchorage Example 14, pp. Vol. 2 pp. 366 to 377. Calculation: Post-installed anchors.

The 2021 example applies ψcp,Na = cNa/cac = 0.88 (cac = 1.5 hef from Table E.3) to bond in the cracked beam; SP-17(14) Example 11 did not. Breakout and shear are as SP-17(14).

MNL-17 Anch-14 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φNsa	kips	9.831	9.831	+0.00		Pass
Ncb	kips	6.437	6.397	-0.62		Pass
φNcb (φ = 0.65)	kips	4.184	4.158	-0.62		Pass
cNa	in.	8.640	8.636	-0.05		Pass
ANao	in.²	299.0	298.3	-0.24		Pass
ANa	in.²	176.0	175.6	-0.21		Pass
ψed,Na		0.840	0.839	-0.12		Pass
Nba = τcr π da hef	kips	12.12	12.12	-0.00		Pass
Na	kips	5.277	5.989	+13.49		Deviation MNL17-A9-PSICP
MNL17-A9-PSICP: the example applies ψcp,Na = 0.88 in cracked concrete; 17.6.5.5.2 makes it 1.0						
φNa (φ = 0.65)	kips	3.430	3.893	+13.49		Deviation MNL17-A9-PSICP
MNL17-A9-PSICP: the example applies ψcp,Na = 0.88 in cracked concrete; 17.6.5.5.2 makes it 1.0						
φVsa = 0.65 × 0.8 Vsa (grout pad)	kips	4.090	4.090	-0.00		Pass
Vb, le = 8 da	kips	3.675	3.675	+0.01		Pass
φVcb	kips	2.570	2.573	+0.11		Pass
φVcp = 0.70 × 2 Na	kips	7.969	8.385	+5.21		Deviation MNL17-A14-NA
MNL17-A14-NA: the pryout takes Na = 5,692 lb, which is neither the example's 5,277 lb nor the code's value						
Nua/φNn + Vua/φVn		1.150	1.057	-8.11		Deviation MNL17-A9-PSICP
MNL17-A9-PSICP: follows from the lower bond strength, added with capacities rounded to 3,400 and 2,500 lb						

MNL-17 Anch-16: Six 1/2 in. adhesive anchors near an edge, concentric tension

Source: ACI MNL-17(21), Anchorage Example 16, pp. Vol. 2 pp. 384 to 391. Calculation: Post-installed anchors.

The example uses φ = 0.75 for breakout (Category 1 with supplementary reinforcement) and 0.65 for bond (Table E.2 for the installation condition). In ILX these are the two category inputs: bond Category 2 with supplementary reinforcement gives 0.65. Same data and printed values as SP-17(14) Example 13.

MNL-17 Anch-16 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nua,g = 1.6 L	kips	12.00	12.00	+0.00		Pass
φNsa	kips	6.177	6.177	+0.00		Pass
ANc	in.²	626.0	625.6	-0.06		Pass
ANco	in.²	380.0	380.2	+0.07		Pass
ψed,N		0.792	0.792	+0.04		Pass
Nb	kips	17.82	17.82	-0.00		Pass
Ncbg	kips	23.27	23.23	-0.19		Pass
φNcbg (φ = 0.75)	kips	17.45	17.42	-0.19		Pass
cNa	in.	7.130	7.135	+0.07		Pass
ANa	in.²	453.0	453.6	+0.14		Pass
ANao	in.²	203.0	203.6	+0.31		Pass
ψed,Na		0.826	0.826	+0.02		Pass
Nba	kips	10.52	10.52	+0.00		Pass
Nag	kips	19.38	19.35	-0.15		Pass
φNag (φ = 0.65)	kips	12.60	12.58	-0.15		Pass

MNL-17 Anch-18: Eight 5/8 in. adhesive anchors under a beam, moment and shear

Source: ACI MNL-17(21), Anchorage Example 18, pp. Vol. 2 pp. 405 to 418. Calculation: Post-installed anchors.

ILX's grid has no 3 × 3 layout without the center anchor, and the example puts the compression at the beam flange, which this type does not; so only the steel strengths come from the module, and the breakout, bond and shear factors run through the library with the book's anchor layout and tensions. ANc, ANa and the group strengths in tension are not compared (the missing center anchor leaves a notch in the library's projected areas, which the book draws as full rectangles).

MNL-17 Anch-18 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φNsa	kips	9.831	9.831	+0.00		Pass
φVsa = 0.65 × 0.8 Vsa (grout pad)	kips	4.090	4.089	-0.02		Pass
ψec,N, e'N = 2.13 in.		0.870	0.870	-0.02		Pass
ψed,N		0.805	0.805	+0.03		Pass
ANco	in.²	812.0	812.2	+0.03		Pass
Nb = 17 √f'c hef^1.5	kips	35.20	35.20	+0.00		Pass
cNa	in.	8.630	8.636	+0.07		Pass
ANao	in.²	298.0	298.3	+0.10		Pass
ψec,Na		0.800	0.802	+0.24		Pass
ψed,Na		0.874	0.874	-0.03		Pass
Nba = 1.06 τcr π da hef	kips	18.78	18.78	-0.00		Pass
AVc, farthest row, ca1 = 29 in.	in.²	1,450	1,450	+0.00		Pass
AVco	in.²	3,784	3,784	+0.01		Pass
ψed,V		0.734	0.734	+0.07		Pass
ψh,V		1.470	1.475	+0.33		Pass
Vb, le = 8 da	kips	92.63	92.63	+0.00		Pass
Vcbg	kips	45.93	46.13	+0.43		Pass
φVcbg (φ = 0.75)	kips	34.45	34.60	+0.43		Pass

MNL-17 Anch-20: Six 3/4 in. adhesive anchors, tension eccentric about two axes

Source: ACI MNL-17(21), Anchorage Example 20, pp. Vol. 2 pp. 428 to 437. Calculation: Post-installed anchors.

The 2021 example takes τcr = 880 psi in Nba (cracked concrete), where SP-17(14) Example 17 took τuncr; cNa keeps τuncr = 1,990 psi. Its statement gives a 7,500 lb service load, the figure 7,000 lb, the anchor forces a factored 16,000 lb and the summary a 10,000 lb service load; the anchor forces are what is compared, so 10,000 lb of live load is entered. It states supplementary reinforcement.

MNL-17 Anch-20 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Most stressed anchor Nu6	kips	5.436	5.436	-0.00		Pass
φNsa	kips	14.53	14.53	+0.00		Pass
ANc	in.²	864.0	864.2	+0.03		Pass
ANco	in.²	576.0	576.0	+0.00		Pass
ψec,N		0.849	0.855	+0.67		Pass
ψed,N		0.850	0.850	+0.00		Pass
Nb	kips	27.20	27.20	+0.00		Pass
Ncbg	kips	29.43	29.65	+0.73		Pass
φNcbg (φ = 0.65)	kips	19.14	22.24	+16.19		Deviation MNL17-A20-PHI
MNL17-A20-PHI: the example takes the φ of the product table (0.65), the Table 17.5.3(b) value without supplementary reinforcement, although it states supplementary reinforcement; ILX applies the Table 17.5.3(b) value with it						
cNa (τuncr = 1,990 psi)	in.	10.09	10.09	-0.02		Pass
ANao	in.²	407.0	407.0	+0.01		Pass
ANa	in.²	707.0	707.1	+0.01		Pass
ψec,Na		0.824	0.831	+0.82		Pass
ψed,Na		0.878	0.878	+0.05		Pass
Nba = 1.06 τcr π da hef (τcr = 880 psi)	kips	17.57	17.58	+0.05		Pass
Nag	kips	22.09	22.29	+0.92		Pass
φNag (φ = 0.65)	kips	14.36	16.72	+16.45		Deviation MNL17-A20-PHI
MNL17-A20-PHI: the example takes the φ of the product table (0.65), the Table 17.5.3(b) value without supplementary reinforcement, although it states supplementary reinforcement; ILX applies the Table 17.5.3(b) value with it						

MNL-17 Anch-22: Four 1-1/4 in. adhesive anchors in a 28 in. pedestal, uplift and shear

Source: ACI MNL-17(21), Anchorage Example 22, pp. Vol. 2 pp. 465 to 480. Calculation: Post-installed anchors.

Table E.3, 1-1/4 in., dry concrete, temperature range A: τcr = 700 psi, τuncr = 1,530 psi, Category 2. The factored loads are those the example prints: uplift 0.9(30) - 1.0(35) = -8 kips and shear 22.8 kips (the uplift is printed 135,000 and 315,000 lb in the statement and 35 kips in the calculation). The interaction is not compared: the example adds the uplift and the shear of different combinations and divides by the pryout strength, while its own breakout check needs anchor reinforcement.

MNL-17 Anch-22 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nua,g = 0.9D + 1.0W	kips	8.000	8.000	+0.00		Pass
φNsa	kips	42.15	42.15	+0.00		Pass
hef' = max(ca,max/1.5, s/3)	in.	5.330	5.333	+0.06		Pass
ANc	in.²	784.0	784.0	+0.00		Pass
ANco	in.²	256.0	256.0	+0.00		Pass
ψed,N		0.925	0.925	-0.00		Pass
Nb	kips	14.04	14.05	+0.04		Pass
Ncbg	kips	39.77	39.79	+0.04		Pass
φNcbg (Category 2, supplementary reinforcement, φ = 0.65)	kips	25.85	25.86	+0.04		Pass
cNa	in.	14.74	14.74	+0.01		Pass
ANao	in.²	864.0	869.3	+0.62		Pass
ANa	in.²	784.0	784.0	+0.00		Pass
ψed,Na		0.822	0.822	+0.01		Pass
Nba = τcr π da hef	kips	49.48	49.48	+0.00		Pass
Nag	kips	36.89	36.69	-0.55		Pass
φNag (φ = 0.55)	kips	20.29	23.85	+17.52		Deviation MNL17-A20-PHI
MNL17-A20-PHI: the example takes the φ of the product table (0.55, Category 2), the Table 17.5.3(b) value without supplementary reinforcement; ILX applies 0.65 with it						
Vua,g = 1.2D + 1.6Lr + 0.5W	kips	22.80	22.80	+0.00		Pass
φVsa = 0.65 × 0.8 Vsa (grout pad)	kips	17.54	17.53	-0.00		Pass
Vua per anchor, back row (Case 2)	kips	11.40	11.40	+0.00		Pass
AVc, Case 2 (ca1 = 22 in.)	in.²	924.0	924.0	+0.00		Pass
AVco, Case 2	in.²	2,178	2,178	+0.00		Pass
ψed,V, Case 2		0.755	0.755	-0.06		Pass
Vb, Case 2	kips	62.12	62.30	+0.29		Pass
Vcbg, Case 2	kips	23.86	23.93	+0.29		Pass
φVcbg, Case 2 (governs, φ = 0.75)	kips	17.90	17.95	+0.29		Pass
φVcpg	kips	29.85	51.36	+72.06		Deviation MNL17-A22-PRYOUT
MNL17-A22-PRYOUT: the example takes the breakout of the back row only (ANc = 392 in.²) and φ = 0.75; ACI uses the group (Ncpg of all four anchors) and Table 17.5.3(c) gives 0.70						

TEK-EX: 12 ft wall, 7/16 in. tendons at 48 in., 15 psf

Source: CMHA TEK 14-20A, Post-Tensioned Concrete Masonry Wall Design, Design Example, pp. pp. 4-5. Calculation: Prestressed masonry wall.

TEK-EX · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pd at midheight	lb/ft	234.0	234.0	+0.00		Pass
M	lb-ft/ft	270.0	270.0	+0.00		Pass
0.94 fpy at jacking	ksi	94.00	94.00	+0.00		Pass
Jacking limit, governing	ksi	94.00	94.00	+0.00		Pass
0.82 fpy at transfer	ksi	82.00	82.00	+0.00		Pass
0.78 fpy at service	ksi	78.00	78.00	+0.00		Pass
Ppi	lb/ft	2,850	2,850	+0.00		Pass
Ppf	lb/ft	1,800	1,800	+0.00		Pass
fb	psi	37.00	36.99	-0.04		Pass
fa	psi	49.00	49.01	+0.02		Pass
fai	psi	74.00	74.31	+0.42		Pass
fb − fa, prestress and dead load only	psi	-12.00	-12.03	+0.21		Pass

PB-1: Pretensioned rectangular beam 12 × 28 in., 40 ft, 10 × 0.5 in. strands (default)

Source: Hand calculation (closed form, ACI 318-19 20.3, 22.5.6, 24.5). Calculation: Prestressed concrete beam.

PB-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Top fiber at transfer, midspan	psi	-74.14	-74.14	-0.00		Pass
Bottom fiber at transfer, midspan	psi	1,782	1,782	+0.00		Pass
Bottom fiber at service, total load	psi	-517.1	-517.1	-0.00		Pass
Top fiber at service, total load	psi	1,997	1,997	+0.00		Pass
fps by Eq. 20.3.2.3.1 (γp 0.28, β1 0.75)	ksi	243.7	243.7	+0.00		Pass
Stress block depth a	in.	6.093	6.093	+0.00		Pass
Mn = Aps fps (dp − a/2)	kip-ft	589.0	589.0	+0.00		Pass
Mu = 1.2 (Mg + Msd) + 1.6 ML	kip-ft	460.0	460.0	+0.00		Pass
Mcr = Sb (fr + Pe/A + Pe e/Sb)	kip-ft	338.3	338.3	+0.00		Pass
Vcw at midspan (dp = 0.8h, Vp = 0)	kips	132.5	132.5	+0.00		Pass
Live load deflection 5 wL ℓ⁴ / (384 Ec Ig)	in.	0.475	0.475	+0.00		Pass
Camber at transfer, harped at 0.4ℓ	in.	0.703	0.703	+0.00		Pass

PB-ZIA: Same beam, losses by the Zia et al. expressions (RH 70 %, V/S 3 in.)

Source: Hand calculation of the Zia et al. (1979) expressions as written in calcs/prestress.py. Calculation: Prestressed concrete beam.

fcir = 0.9 (Pi/A + Pi e²/I) − Mg e/I with Pi = Aps fpj; Eps = 28,500 ksi.

PB-ZIA · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Elastic shortening ES	ksi	9.963	9.963	+0.00		Pass
Creep CR	ksi	11.61	11.61	+0.00		Pass
Shrinkage SH	ksi	5.749	5.749	+0.00		Pass
Relaxation RE	ksi	3.712	3.712	-0.01		Pass
Total loss	ksi	31.04	31.04	+0.00		Pass

PB-UNB: Post-tensioned unbonded, ℓ/h = 17 ≤ 35 (Table 20.3.2.4.1)

Source: Hand calculation (closed form, ACI 318-19 20.3, 22.5.6, 24.5). Calculation: Prestressed concrete beam.

PB-UNB · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
fps = fse + 10 + f'c / (100 ρp)	ksi	182.9	182.9	+0.00		Pass
As,min = 0.004 Act (Act = 12 × 14)	in.²	0.672	0.672	+0.00		Pass

MNL-OW-3: Four 20 ft spans, 6 in. slab, unbonded 1/2 in. strand at 29 in. (ACI 318-19)

Source: ACI MNL-17(21), One-way Slab Example 3, pp. pp. 74-79. Calculation: Post-tensioned slab strip.

MNL-OW-3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Aps, in.2/ft	in.²	0.063	0.063	+0.49		Pass
fps, ksi	ksi	202.0	200.8	-0.60		Pass
M2, second support, kip-ft	kip-ft	0.800	0.791	-1.08		Pass
M2, third support, kip-ft	kip-ft	0.500	0.528	+5.52		Pass
Positive Mu with M2, first span, kip-ft		5.900	5.672	-3.87		Pass
Negative Mu with M2 at the second support (centerline), kip-ft		6.400	6.343	-0.89		Pass
Positive Mu with M2, second span, kip-ft		4.300	4.214	-2.00		Pass
Negative Mu with M2 at the middle support (centerline), kip-ft		5.200	5.195	-0.09		Pass

OW-3: Four 20 ft spans, 6 in. slab, unbonded 1/2 in. strand

Source: ACI SP-17(14), One-way Slab Example 3, pp. 65 to 73. Calculation: Post-tensioned slab strip.

OW-3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Aps, in.2/ft	in.²	0.059	0.059	+0.38		Pass
Force per foot, kips 10.36 at 31 in. spacing	kips	10.30	10.36	+0.63		Pass
F over A, psi	psi	143.0	144.0	+0.67		Pass
Balancing load, first span, kip/ft	kip/ft	0.056	0.056	+0.25		Pass
M2, first support, kip-ft	kip-ft	0.000	0.000	+0.00		Pass
M2, second support, kip-ft	kip-ft	0.800	0.740	-7.46		Deviation SP17-OW3-M2
SP17-OW3-M2: the source rounds from a program to 0.8; the balancing method here gives 0.74						
M2, third support, kip-ft	kip-ft	0.500	0.494	-1.29		Pass
fps, ksi	ksi	202.0	201.9	-0.06		Pass
Depth a, tendons and bars, in.	in.	0.410	0.411	+0.22		Pass
Design moment, tendons and bars, kip-ft	kip-ft	7.500	7.536	+0.48		Pass
Positive Mu with M2, first span, kip-ft		5.900	5.649	-4.25		Pass
Negative Mu with M2 at the second support, kip-ft		6.400	5.444	-14.94		Deviation SP17-OW3-MU
SP17-OW3-MU: the source says at the face; its negative moments agree with this type at the centerline, not at the face						
Positive Mu with M2, second span, kip-ft		4.300	4.172	-2.98		Pass
Negative Mu with M2 at the middle support, kip-ft		5.200	4.400	-15.39		Deviation SP17-OW3-MU
SP17-OW3-MU: the source says at the face; its negative moments agree with this type at the centerline, not at the face						
Vc, kips	kips	8.500	8.485	-0.17		Pass

GF-INT: Interior column 16 × 16 in., d = 5.75 in.

Source: StructurePoint DE-GF-ACI, The Role of GammaF in Two-way Slab Punching Shear, pp. pp. 7 to 9 of the PDF. Calculation: Punching shear.

GF-INT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
bo	in.	87.00	87.00	+0.00		Pass
Jc	in.⁴	40,131	40,131	-0.00		Pass
vu	psi	166.7	166.7	+0.02		Pass
φvn	psi	189.7	189.7	+0.02		Pass

GF-EDGE: Edge column flush with the edge, moment at the column centre

Source: StructurePoint DE-GF-ACI, The Role of GammaF in Two-way Slab Punching Shear, pp. pp. 9 to 10. Calculation: Punching shear.

GF-EDGE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
bo	in.	59.50	59.50	+0.00		Pass
Jc	in.⁴	14,110	14,109	-0.00		Pass
Mu at the centroid	kip-ft	54.65	54.65	-0.01		Pass
yv		0.383	0.383	+0.03		Pass
vu	psi	211.9	211.9	+0.01		Pass

GF-EDGE-GF: The same edge column with γf raised to 1.0 (Table 8.4.2.2.4)

Source: StructurePoint DE-GF-ACI, The Role of GammaF in Two-way Slab Punching Shear, pp. pp. 10 to 13. Calculation: Punching shear.

DE-GF uses the εt limit of ACI 318-14 (0.004); ACI 318-19 asks for εty + 0.003 = 0.0051, which εt = 0.0066 also meets.

GF-EDGE-GF · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
vu with γv = 0	psi	105.3	105.3	+0.01		Pass

TW-EDGE: Flat plate, edge column, values at the centroid

Source: StructurePoint DE-TWFP-ACI14, Two-Way Flat Plate, pp. Section 5.2. Calculation: Punching shear.

TW-EDGE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
vu	psi	137.2	137.2	-0.00		Pass
φvc	psi	189.7	189.7	-0.00		Pass

TW-INT: Flat plate, interior column

Source: StructurePoint DE-TWFP-ACI14, Two-Way Flat Plate, pp. Section 5.2. Calculation: Punching shear.

TW-INT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
vu	psi	110.1	110.1	+0.01		Pass

TW-CORNER: Flat plate, corner column

Source: StructurePoint DE-TWFP-ACI14, Two-Way Flat Plate, pp. Section 5.2. Calculation: Punching shear.

TW-CORNER · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
bo	in.	37.75	37.75	+0.00		Pass
vu	psi	108.4	108.4	-0.01		Pass

PSC-M1-EXT: Circular column 34 in., exact circle, moment 219.04 kip-ft

Source: StructurePoint DE-PSC-ACI, Punching Shear for Circular Columns, pp. pp. 9 to 10. Calculation: Punching shear.

DE-PSC has no size effect factor; ACI 318-19 gives λs = 0.993 at d = 10.3 in.

PSC-M1-EXT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
bo	in.	139.2	139.2	-0.01		Pass
Jc/c	in.³	16,240	16,239	-0.01		Pass
Load inside the section	kips	10.55	10.55	+0.03		Pass
vu	psi	234.6	234.7	+0.03		Pass
φvc	psi	212.1	210.6	-0.73		Pass

PSC-M1-INT: Circular column, exact circle, no moment

Source: StructurePoint DE-PSC-ACI, Punching Shear for Circular Columns, pp. p. 10. Calculation: Punching shear.

PSC-M1-INT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
vu	psi	239.6	239.6	+0.01		Pass

PSC-M2: Square of equal perimeter (ACI 352.1R)

Source: StructurePoint DE-PSC-ACI, Punching Shear for Circular Columns, pp. pp. 11 to 13. Calculation: Punching shear.

PSC-M2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
bo	in.	148.0	148.0	+0.00		Pass
Load inside	kips	9.380	9.376	-0.05		Pass
vu	psi	215.4	215.4	+0.00		Pass

PSC-M3: Square of equal area (22.6.4.1.2)

Source: StructurePoint DE-PSC-ACI, Punching Shear for Circular Columns, pp. pp. 14 to 16. Calculation: Punching shear.

DE-PSC adds 145.9 + 46.1 and prints 193.0; the sum is 192.0, which the app gives.

PSC-M3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
bo	in.	161.7	161.7	+0.02		Pass
Load inside	kips	11.19	11.19	+0.03		Pass
vu	psi	193.0	191.9	-0.55		Pass

SSO-NO: Column 12 × 26 in. without an opening

Source: StructurePoint DE-SSO-ACI14, Shear Strength of Slabs with Openings, pp. pp. 6 to 7. Calculation: Punching shear.

SSO-NO · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
bo	in.	95.00	95.00	+0.00		Pass
vu	psi	144.9	144.9	+0.05		Pass
φvc (expression b, β = 2.17)	psi	158.0	158.0	-0.00		Pass

SSO-OPEN: With a 12 × 18 in. opening at (12, 34) in.

Source: StructurePoint DE-SSO-ACI14, Shear Strength of Slabs with Openings, pp. pp. 9 to 10. Calculation: Punching shear.

ACI 318-14 reads an opening within 10h; ACI 318-19 within 4h. The 12 in. gap is inside both. The example's printed denominator 58.03 is a misprint of 85.03.

SSO-OPEN · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
bo	in.	85.03	85.03	-0.00		Pass
vu	psi	161.8	161.9	+0.06		Pass
φvc	psi	158.0	158.0	-0.00		Pass

DL-STUD: Column 12 × 20 in., Vu = 110 kips, Mu = 600 kip-in., headed studs

Source: Dlubal, verification example 009972 (ACI 318-19, ACI 421.1R), dlubal.com, read through a page summary, pp. web page. Calculation: Punching shear.

The page gives 10 studs per line and not how they sit on the faces; 3 rails on each 20 in. face and 2 on each 12 in. face were assumed, 1 in. from the corners. The outer section depends on that layout.

DL-STUD · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
bo	in.	86.50	86.48	-0.02		Pass
Jc	in.⁴	28,000	27,996	-0.01		Pass
vu	psi	294.0	293.6	-0.15		Pass
vc = 3√f'c	psi	190.0	189.7	-0.14		Pass
Av/s	in.²	0.400	0.401	+0.36		Pass
Outer section from the column face	in.	29.80	29.81	+0.03		Pass
vu/φ at the outer section	psi	125.0	125.6	+0.47		Pass
2√f'c at the outer section	psi	126.0	126.5	+0.39		Pass

MNL17-TW1-INT: Interior column 24 × 24 in., 7 in. slab, d = 5.6 in.

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 6, Two-way Slab Example 1, pp. pp. 103–104, 108. Calculation: Punching shear.

Vu = 70 kips and Msc = 20.1 kip-ft (Eq. 8.10.7.2) as the example takes them.

MNL17-TW1-INT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
bo	in.	118.4	118.4	+0.00		Pass
Jc	in.⁴	97,688	97,688	-0.00		Pass
γv		0.400	0.400	-0.00		Pass
c	in.	14.80	14.80	+0.00		Pass
vuv = Vu/(bo d) (0.106 ksi)	psi	106.0	105.6	-0.40		Pass
γv Msc c/Jc (0.015 ksi)	psi	15.00	14.62	-2.55		Pass
vu (0.121 ksi)	psi	121.0	120.2	-0.67		Pass
λs (capped at 1.0)		1.000	1.000	+0.00		Pass
vc = (2 + αs d/bo)λsλ√f'c (governs)	psi	275.0	275.2	+0.07		Pass
φvc	psi	206.0	206.4	+0.19		Pass

MNL17-TW3-EDGE: Post-tensioned roof slab, edge column 24 × 24 in., d = 9 in.

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 6, Two-way Slab Example 3, pp. pp. 134–137. Calculation: Punching shear.

Column face flush with the slab edge; Msc = 10 kip-ft/ft × 14 ft = 140 kip-ft at the centroid of the section; Vu = 57 kips.

MNL17-TW3-EDGE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
bo	in.	90.00	90.00	+0.00		Pass
Jc	in.⁴	76,383	76,382	-0.00		Pass
cAB	in.	9.020	9.025	+0.06		Pass
vuv (0.070 ksi)	psi	70.00	70.37	+0.53		Pass
γv		0.400	0.383	-4.36		Deviation MNL17-P3-GV
MNL17-P3-GV: the example takes γv = 0.4 at the edge column; Eq. 8.4.2.2.2 with b1 = 28.5 in. and b2 = 33 in. gives γf = 0.617, γv = 0.383 (ILX Calcs)						
γv Msc cAB/Jc (0.079 ksi)	psi	79.00	75.94	-3.88		Deviation MNL17-P3-GV
MNL17-P3-GV: the example takes γv = 0.4 at the edge column; Eq. 8.4.2.2.2 with b1 = 28.5 in. and b2 = 33 in. gives γf = 0.617, γv = 0.383 (ILX Calcs)						
vu (0.149 ksi)	psi	149.0	146.3	-1.81		Deviation MNL17-P3-GV
MNL17-P3-GV: the example takes γv = 0.4 at the edge column; Eq. 8.4.2.2.2 with b1 = 28.5 in. and b2 = 33 in. gives γf = 0.617, γv = 0.383 (ILX Calcs)						
vc = 4λsλ√f'c (governs)	psi	283.0	282.8	-0.06		Pass
(2 + αs d/bo)λsλ√f'c (334 psi)	psi	334.0	353.6	+5.85		Deviation MNL17-P3-AS
MNL17-P3-AS: the example's third expression of Table 22.6.5.2 uses αs d/bo = 2.73 at the edge column and 2.5 at the interior column; with αs = 30 and 40, d = 9 in., bo = 90 and 132 in. the terms are 3.0 and 2.73. The expression does not govern						
φvc	psi	212.0	212.1	+0.06		Pass

MNL17-TW3-INT: Post-tensioned roof slab, interior column 24 × 24 in., d = 9 in.

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 6, Two-way Slab Example 3, pp. pp. 134–137. Calculation: Punching shear.

Msc = (24 − 21) kip-ft/ft × 14 ft = 42 kip-ft; Vu = 115 kips.

MNL17-TW3-INT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
bo	in.	132.0	132.0	+0.00		Pass
Jc	in.⁴	219,633	219,632	-0.00		Pass
cAB	in.	16.50	16.50	+0.00		Pass
vuv (0.097 ksi)	psi	97.00	96.80	-0.20		Pass
γv		0.400	0.400	-0.00		Pass
γv Msc cAB/Jc (0.015 ksi)	psi	15.00	15.15	+0.97		Pass
vu (0.112 ksi)	psi	112.0	111.9	-0.05		Pass
λs (capped at 1.0)		1.000	1.000	+0.00		Pass
vc = 4λsλ√f'c (governs)	psi	283.0	282.8	-0.06		Pass
(2 + αs d/bo)λsλ√f'c (318 psi)	psi	318.0	334.3	+5.12		Deviation MNL17-P3-AS
MNL17-P3-AS: the example's third expression of Table 22.6.5.2 uses αs d/bo = 2.73 at the edge column and 2.5 at the interior column; with αs = 30 and 40, d = 9 in., bo = 90 and 132 in. the terms are 3.0 and 2.73. The expression does not govern						
φvc	psi	212.0	212.1	+0.06		Pass

QT-1: W12X26 beams

Source: AISC Shapes Database v16.0 (Manual Table 1-1), pp. 1-22. Calculation: Quantity takeoff.

QT-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Shape weight	lb	5,200	5,200	+0.00		Pass

QT-2: Plate 1/2 × 12 in. × 10 ft

Source: Hand, γ = 490 pcf. Calculation: Quantity takeoff.

QT-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Plate weight	lb	204.2	204.2	-0.00		Pass

QT-3: #5 and #8 bars

Source: ASTM A615/A615M Table 1. Calculation: Quantity takeoff.

QT-3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
#5 bar weight	lb	2,086	2,086	+0.00		Pass

QT-4: #8 bars

Source: ASTM A615/A615M Table 1. Calculation: Quantity takeoff.

QT-4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
#8 bar weight	lb	801.0	801.0	+0.00		Pass

QT-5: Footing 10 × 10 × 2 ft

Source: Hand. Calculation: Quantity takeoff.

QT-5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Concrete volume		7.407	7.407	+0.00		Pass
Formwork area	ft²	80.00	80.00	+0.00		Pass

RN-PONDING: Ponding: W24x76 girders and W18x35 beams, 40 ft spans at 8 ft, D 15 psf, ds + dh 5 in.

Source: ASCE/SEI 7-22 Commentary C8.2, pp. p. 672. Calculation: Rain load.

The example rounds R to 44 psf before factoring; the program carries 44.1 psf.

RN-PONDING · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cp		0.155	0.155	+0.07		Pass
Cs		0.128	0.128	-0.21		Pass
Bp		1.440	1.441	+0.08		Pass
R without ponding + D	psf	41.00	41.00	+0.00		Pass
Total load	psf	59.00	59.09	+0.15		Pass
R	psf	44.00	44.09	+0.20		Pass
1.2D + 1.6R	psf	88.40	88.54	+0.16		Pass

RN-EX1: Example 1: 8 in. outlet, 10 in. x 2 in. dam, Q = 300 gal/min

Source: ASCE/SEI 7-22 Commentary C8.2, pp. p. 670. Calculation: Rain load.

RN-EX1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
dh2	in.	2.400	2.354	-1.94		Pass
Total head	in.	4.400	4.354	-1.06		Pass

RN-EX2: Example 2: 4 in. outlet, bowl 1.5 in., dam 2.5 in. high, Q = 350 gal/min

Source: ASCE/SEI 7-22 Commentary C8.2, pp. p. 670. Calculation: Rain load.

RN-EX2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
dh	in.	4.000	4.000	+0.00		Pass
Total head	in.	6.500	6.500	+0.00		Pass

RN-BETA: 8.3 slope limit next to a free-draining edge: Ls 60 ft, S 5 ft

Source: ASCE/SEI 7-22 Commentary C8.2, pp. p. 674. Calculation: Rain load.

RN-BETA · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
β		0.760	0.757	-0.38		Pass

RN-T1: Table C8.2-1 cell: 12.75 in. dam, 6 in. outlet, 400 gal/min

Source: ASCE/SEI 7-22 Table C8.2-1, pp. p. 668. Calculation: Rain load.

RN-T1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
dh	in.	3.000	3.000	+0.00		Pass

RN-T2: Table C8.2-1, interpolated: 8 in. dam, 4 in. outlet, 125 gal/min (note 3)

Source: ASCE/SEI 7-22 Table C8.2-1, pp. p. 668. Calculation: Rain load.

RN-T2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
dh between 1.0 and 1.5 in.	in.	1.250	1.250	+0.00		Pass

RN-T3: Table C8.2-3: 24 in. channel scupper, 560 gal/min

Source: ASCE/SEI 7-22 Table C8.2-3, pp. p. 670. Calculation: Rain load.

RN-T3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
dh	in.	4.000	4.000	+0.00		Pass

RN-T4: Table C8.2-3: 6 in. wide, 4 in. high closed scupper, 231 gal/min

Source: ASCE/SEI 7-22 Table C8.2-3, pp. p. 670. Calculation: Rain load.

RN-T4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
dh	in.	7.000	7.000	-0.00		Pass

RN-T5: Table C8.2-5: 10 in. circular scupper, 190 gal/min

Source: ASCE/SEI 7-22 Table C8.2-5, pp. p. 671. Calculation: Rain load.

RN-T5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
dh	in.	5.000	5.000	+0.00		Pass

RN-H1: R from entered heads: 2 + 2 + 1 in.

Source: Hand calculation, ASCE/SEI 7-22 Eq. 8.2-1, C8.2-1. Calculation: Rain load.

RN-H1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R = 5.2 × 5	psf	26.00	26.00	+0.00		Pass
1.2D + 1.6R	psf	65.60	65.60	+0.00		Pass
D + R	psf	46.00	46.00	+0.00		Pass

RN-H2: Flow: A 10,000 ft², i 7 in./h

Source: Hand calculation, ASCE/SEI 7-22 Eq. 8.2-1, C8.2-1. Calculation: Rain load.

RN-H2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Q = 0.0104 A i		728.0	728.0	+0.00		Pass

RN-H3: Secondary members on walls: Cp = 0, Bp = 1/(1 − Cs)

Source: Hand calculation, ASCE/SEI 7-22 Eq. 8.2-1, C8.2-1. Calculation: Rain load.

RN-H3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bp		1.146	1.146	+0.00		Pass

MNL-C2: Ordinary moment frame, first floor interior joint (ACI 318-19)

Source: ACI MNL-17(21), Columns Example 2, pp. pp. 409-410. Calculation: Beam-column joint.

MNL-C2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
T2, seven No. 7 at fy	kips	252.0	252.0	+0.00		Pass
C1, two No. 7	kips	72.00	72.00	+0.00		Pass
Column shear from the moments and shears	kips	51.00	50.78	-0.43		Pass
Vj	kips	273.0	273.2	+0.08		Pass
Aj	in.²	576.0	576.0	+0.00		Pass
Vn = 20 λ √f'c Aj	kips	814.0	814.6	+0.07		Pass
φVn, φ = 0.75	kips	610.0	610.9	+0.15		Pass

MNL-C3: Intermediate moment frame, first floor interior joint (ACI 318-19)

Source: ACI MNL-17(21), Columns Example 3, pp. pp. 416-417. Calculation: Beam-column joint.

MNL-C3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
T2, bars at fy	kips	252.0	252.0	+0.00		Pass
C1	kips	108.0	108.0	+0.00		Pass
Vj with the printed column shear	kips	308.0	308.0	+0.00		Pass
Aj	in.²	576.0	576.0	+0.00		Pass
Vn = 20 λ √f'c Aj	kips	814.0	814.6	+0.07		Pass
φVn, φ = 0.75	kips	610.0	610.9	+0.15		Pass

MNL-C3-M: The same, column shear from the printed moments (ACI 318-19)

Source: ACI MNL-17(21), Columns Example 3, pp. p. 416. Calculation: Beam-column joint.

MNL-C3-M · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Column shear	kips	52.00	56.06	+7.81		Deviation SP17-E3-VCOL

SP17-E3-VCOL: the printed formula on the printed moments and shears gives 56 kips; the 2021 handbook prints 52 again

MNL-C4: Special moment frame, first floor interior joint (ACI 318-19)

Source: ACI MNL-17(21), Columns Example 4, pp. pp. 425-426. Calculation: Beam-column joint.

MNL-C4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
T2, seven No. 7 at 1.25 fy	kips	315.0	315.0	+0.00		Pass
C1, four No. 7 at 1.25 fy	kips	180.0	180.0	+0.00		Pass
Vj	kips	424.0	424.0	+0.00		Pass
Aj	in.²	576.0	576.0	+0.00		Pass
Vn	kips	814.0	610.9	-24.95		Deviation MNL17-C4-VN
MNL17-C4-VN: the 2021 handbook takes the Table 15.4.2.3 coefficient 20 for a special moment frame joint; Table 18.8.4.3 gives 15 for a continuous, unconfined joint						
φVn, φ = 0.85	kips	610.0	519.3	-14.87		Deviation MNL17-C4-VN
MNL17-C4-VN: the 2021 handbook takes the Table 15.4.2.3 coefficient 20 for a special moment frame joint; Table 18.8.4.3 gives 15 for a continuous, unconfined joint						

C-3 · Beam-column joint: Intermediate moment frame, first floor interior joint

Source: ACI SP-17(14), Column Example 3 (intermediate moment frame), pp. 380. Calculation: Beam-column joint.

C-3 · Beam-column joint · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
T2, bars at fy	kips	252.0	252.0	+0.00		Pass
C1	kips	108.0	108.0	+0.00		Pass
Vj	kips	308.0	308.0	+0.00		Pass
Aj	in.²	576.0	576.0	+0.00		Pass
Vn at 15 root f'c Aj, as in 318-14	kips	611.0	814.6	+33.32		Deviation SP17-E3-VN

SP17-E3-VN: ACI 318-19 Table 15.4.2.3 gives 20 for this joint where 318-14 gave 15

C-3-M: The same, column shear from the printed moments

Source: ACI SP-17(14), Column Example 3 (intermediate moment frame), pp. 380. Calculation: Beam-column joint.

C-3-M · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Column shear	kips	52.00	56.06	+7.81		Deviation SP17-E3-VCOL
SP17-E3-VCOL: statics on the printed moments and shears gives 56 kips where the source prints 52						

C-4 · Beam-column joint: Special moment frame, first floor interior joint

Source: ACI SP-17(14), Column Example 4 (special moment frame), pp. 392. Calculation: Beam-column joint.

C-4 · Beam-column joint · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
T2, bars at 1.25 fy	kips	315.0	315.0	+0.00		Pass
C1	kips	180.0	180.0	+0.00		Pass
Vj	kips	424.0	424.0	+0.00		Pass
Aj	in.²	576.0	576.0	+0.00		Pass
Vn	kips	611.0	610.9	-0.01		Pass

T-15-True-True-True: Table 15.4.2.3, column True, beam True, confined True

Source: Hand calculation from ACI 318-19 Table 15.4.2.3. Calculation: Beam-column joint.

T-15-True-True-True · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vn	kips	874.3	874.3	+0.00		Pass

T-15-True-True-False: Table 15.4.2.3, column True, beam True, confined False

Source: Hand calculation from ACI 318-19 Table 15.4.2.3. Calculation: Beam-column joint.

T-15-True-True-False · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vn	kips	728.6	728.6	+0.00		Pass

T-15-True-False-True: Table 15.4.2.3, column True, beam False, confined True

Source: Hand calculation from ACI 318-19 Table 15.4.2.3. Calculation: Beam-column joint.

T-15-True-False-True · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vn	kips	728.6	728.6	+0.00		Pass

T-15-True-False-False: Table 15.4.2.3, column True, beam False, confined False

Source: Hand calculation from ACI 318-19 Table 15.4.2.3. Calculation: Beam-column joint.

T-15-True-False-False · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vn	kips	546.4	546.4	+0.00		Pass

T-15-False-True-True: Table 15.4.2.3, column False, beam True, confined True

Source: Hand calculation from ACI 318-19 Table 15.4.2.3. Calculation: Beam-column joint.

T-15-False-True-True · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vn	kips	728.6	728.6	+0.00		Pass

T-15-False-True-False: Table 15.4.2.3, column False, beam True, confined False

Source: Hand calculation from ACI 318-19 Table 15.4.2.3. Calculation: Beam-column joint.

T-15-False-True-False · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vn	kips	546.4	546.4	+0.00		Pass

T-15-False-False-True: Table 15.4.2.3, column False, beam False, confined True

Source: Hand calculation from ACI 318-19 Table 15.4.2.3. Calculation: Beam-column joint.

T-15-False-False-True · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vn	kips	546.4	546.4	+0.00		Pass

T-15-False-False-False: Table 15.4.2.3, column False, beam False, confined False

Source: Hand calculation from ACI 318-19 Table 15.4.2.3. Calculation: Beam-column joint.

T-15-False-False-False · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vn	kips	437.2	437.2	+0.00		Pass

T-18-True-True-True: Table 18.8.4.3, column True, beam True, confined True

Source: Hand calculation from ACI 318-19 Table 18.8.4.3. Calculation: Beam-column joint.

T-18-True-True-True · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vn	kips	728.6	728.6	+0.00		Pass

T-18-True-True-False: Table 18.8.4.3, column True, beam True, confined False

Source: Hand calculation from ACI 318-19 Table 18.8.4.3. Calculation: Beam-column joint.

T-18-True-True-False · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vn	kips	546.4	546.4	+0.00		Pass

T-18-True-False-True: Table 18.8.4.3, column True, beam False, confined True

Source: Hand calculation from ACI 318-19 Table 18.8.4.3. Calculation: Beam-column joint.

T-18-True-False-True · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vn	kips	546.4	546.4	+0.00		Pass

T-18-True-False-False: Table 18.8.4.3, column True, beam False, confined False

Source: Hand calculation from ACI 318-19 Table 18.8.4.3. Calculation: Beam-column joint.

T-18-True-False-False · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vn	kips	437.2	437.2	+0.00		Pass

T-18-False-True-True: Table 18.8.4.3, column False, beam True, confined True

Source: Hand calculation from ACI 318-19 Table 18.8.4.3. Calculation: Beam-column joint.

T-18-False-True-True · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vn	kips	546.4	546.4	+0.00		Pass

T-18-False-True-False: Table 18.8.4.3, column False, beam True, confined False

Source: Hand calculation from ACI 318-19 Table 18.8.4.3. Calculation: Beam-column joint.

T-18-False-True-False · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vn	kips	437.2	437.2	+0.00		Pass

T-18-False-False-True: Table 18.8.4.3, column False, beam False, confined True

Source: Hand calculation from ACI 318-19 Table 18.8.4.3. Calculation: Beam-column joint.

T-18-False-False-True · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vn	kips	437.2	437.2	+0.00		Pass

T-18-False-False-False: Table 18.8.4.3, column False, beam False, confined False

Source: Hand calculation from ACI 318-19 Table 18.8.4.3. Calculation: Beam-column joint.

T-18-False-False-False · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vn	kips	291.4	291.4	+0.00		Pass

CRSI-4k-#8-c1.5: Tension development and laps, #8, f'c = 4,000 psi, cover 1.5 in., bottom bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-4k-#8-c1.5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld	in.	36.00	36.00	+0.00		Pass
Class B lap	in.	47.00	47.00	+0.00		Pass

CRSI-4k-#8-c1.5-top: Tension development and laps, #8, f'c = 4,000 psi, cover 1.5 in., top bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-4k-#8-c1.5-top · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld (top)	in.	47.00	47.00	+0.00		Pass
Class B lap (top)	in.	61.00	61.00	+0.00		Pass

CRSI-4k-#8-c0.75: Tension development and laps, #8, f'c = 4,000 psi, cover 0.75 in., bottom bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-4k-#8-c0.75 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld	in.	57.00	57.00	+0.00		Pass
Class B lap	in.	74.00	74.00	+0.00		Pass

CRSI-4k-#8-c0.75-top: Tension development and laps, #8, f'c = 4,000 psi, cover 0.75 in., top bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-4k-#8-c0.75-top · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld (top)	in.	74.00	74.00	+0.00		Pass
Class B lap (top)	in.	97.00	97.00	+0.00		Pass

CRSI-4k-#5-c0.75: Tension development and laps, #5, f'c = 4,000 psi, cover 0.75 in., bottom bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-4k-#5-c0.75 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld	in.	21.00	21.00	+0.00		Pass
Class B lap	in.	28.00	28.00	+0.00		Pass

CRSI-4k-#5-c0.75-top: Tension development and laps, #5, f'c = 4,000 psi, cover 0.75 in., top bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-4k-#5-c0.75-top · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld (top)	in.	28.00	28.00	+0.00		Pass
Class B lap (top)	in.	36.00	36.00	+0.00		Pass

CRSI-4k-#5-c1.5: Tension development and laps, #5, f'c = 4,000 psi, cover 1.5 in., bottom bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-4k-#5-c1.5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld	in.	15.00	15.00	+0.00		Pass
Class B lap	in.	19.00	19.00	+0.00		Pass

CRSI-4k-#5-c1.5-top: Tension development and laps, #5, f'c = 4,000 psi, cover 1.5 in., top bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-4k-#5-c1.5-top · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld (top)	in.	19.00	19.00	+0.00		Pass
Class B lap (top)	in.	25.00	25.00	+0.00		Pass

CRSI-4k-#6-c1: Tension development and laps, #6, f'c = 4,000 psi, cover 1 in., bottom bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-4k-#6-c1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld	in.	24.00	24.00	+0.00		Pass
Class B lap	in.	31.00	31.00	+0.00		Pass

CRSI-4k-#6-c1-top: Tension development and laps, #6, f'c = 4,000 psi, cover 1 in., top bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-4k-#6-c1-top · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld (top)	in.	31.00	31.00	+0.00		Pass
Class B lap (top)	in.	40.00	40.00	+0.00		Pass

CRSI-4k-#11-c2: Tension development and laps, #11, f'c = 4,000 psi, cover 2 in., bottom bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-4k-#11-c2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld	in.	53.00	53.00	+0.00		Pass
Class B lap	in.	68.00	68.00	+0.00		Pass

CRSI-4k-#11-c2-top: Tension development and laps, #11, f'c = 4,000 psi, cover 2 in., top bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-4k-#11-c2-top · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld (top)	in.	68.00	68.00	+0.00		Pass
Class B lap (top)	in.	89.00	89.00	+0.00		Pass

CRSI-4k-#9-c3: Tension development and laps, #9, f'c = 4,000 psi, cover 3 in., bottom bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-4k-#9-c3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld	in.	33.00	33.00	+0.00		Pass
Class B lap	in.	42.00	42.00	+0.00		Pass

CRSI-4k-#9-c3-top: Tension development and laps, #9, f'c = 4,000 psi, cover 3 in., top bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-4k-#9-c3-top · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld (top)	in.	42.00	42.00	+0.00		Pass
Class B lap (top)	in.	55.00	55.00	+0.00		Pass

CRSI-3k-#5-c0.75: Tension development and laps, #5, f'c = 3,000 psi, cover 0.75 in., bottom bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-3k-#5-c0.75 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld	in.	25.00	25.00	+0.00		Pass
Class B lap	in.	32.00	32.00	+0.00		Pass

CRSI-3k-#5-c0.75-top: Tension development and laps, #5, f'c = 3,000 psi, cover 0.75 in., top bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-3k-#5-c0.75-top · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld (top)	in.	32.00	32.00	+0.00		Pass
Class B lap (top)	in.	41.00	41.00	+0.00		Pass

CRSI-3k-#3-c0.75: Tension development and laps, #3, f'c = 3,000 psi, cover 0.75 in., bottom bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-3k-#3-c0.75 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld	in.	12.00	12.00	+0.00		Pass
Class B lap	in.	13.00	13.00	+0.00		Pass

CRSI-3k-#3-c0.75-top: Tension development and laps, #3, f'c = 3,000 psi, cover 0.75 in., top bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-3k-#3-c0.75-top · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld (top)	in.	13.00	13.00	+0.00		Pass
Class B lap (top)	in.	17.00	17.00	+0.00		Pass

CRSI-3k-#8-c0.75: Tension development and laps, #8, f'c = 3,000 psi, cover 0.75 in., bottom bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-3k-#8-c0.75 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld	in.	66.00	66.00	+0.00		Pass
Class B lap	in.	86.00	86.00	+0.00		Pass

CRSI-3k-#8-c1: Tension development and laps, #8, f'c = 3,000 psi, cover 1 in., bottom bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-3k-#8-c1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld	in.	55.00	55.00	+0.00		Pass
Class B lap	in.	72.00	72.00	+0.00		Pass

CRSI-3k-#8-c1.5: Tension development and laps, #8, f'c = 3,000 psi, cover 1.5 in., bottom bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-3k-#8-c1.5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld	in.	42.00	42.00	+0.00		Pass
Class B lap	in.	54.00	54.00	+0.00		Pass

CRSI-3k-#8-c2: Tension development and laps, #8, f'c = 3,000 psi, cover 2 in., bottom bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-3k-#8-c2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld	in.	33.00	33.00	+0.00		Pass
Class B lap	in.	43.00	43.00	+0.00		Pass

CRSI-3k-#10-c1.5: Tension development and laps, #10, f'c = 3,000 psi, cover 1.5 in., bottom bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-3k-#10-c1.5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld	in.	63.00	63.00	+0.00		Pass
Class B lap	in.	81.00	81.00	+0.00		Pass

CRSI-3k-#10-c1.5-top: Tension development and laps, #10, f'c = 3,000 psi, cover 1.5 in., top bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-3k-#10-c1.5-top · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld (top)	in.	81.00	81.00	+0.00		Pass
Class B lap (top)	in.	105.0	105.0	+0.00		Pass

CRSI-5k-#8-c0.75: Tension development and laps, #8, f'c = 5,000 psi, cover 0.75 in., bottom bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-5k-#8-c0.75 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld	in.	51.00	51.00	+0.00		Pass
Class B lap	in.	67.00	67.00	+0.00		Pass

CRSI-5k-#8-c1: Tension development and laps, #8, f'c = 5,000 psi, cover 1 in., bottom bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-5k-#8-c1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld	in.	43.00	43.00	+0.00		Pass
Class B lap	in.	56.00	56.00	+0.00		Pass

CRSI-5k-#8-c1.5: Tension development and laps, #8, f'c = 5,000 psi, cover 1.5 in., bottom bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-5k-#8-c1.5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld	in.	32.00	32.00	+0.00		Pass
Class B lap	in.	42.00	42.00	+0.00		Pass

CRSI-5k-#8-c2: Tension development and laps, #8, f'c = 5,000 psi, cover 2 in., bottom bar

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-5k-#8-c2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Class A lap = ld	in.	26.00	26.00	+0.00		Pass
Class B lap	in.	34.00	34.00	+0.00		Pass

CRSI-C1-#5-3k: Standard hook, #5, f'c = 3,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#5-3k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	16.00	16.00	+0.00		Pass

CRSI-C1-#5-4k: Standard hook, #5, f'c = 4,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#5-4k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	15.00	15.00	+0.00		Pass

CRSI-C1-#5-5k: Standard hook, #5, f'c = 5,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#5-5k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	15.00	15.00	+0.00		Pass

CRSI-C1-#5-6k: Standard hook, #5, f'c = 6,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#5-6k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	14.00	14.00	+0.00		Pass

CRSI-C1-#5-7k: Standard hook, #5, f'c = 7,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#5-7k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	13.00	13.00	+0.00		Pass

CRSI-C1-#5-8k: Standard hook, #5, f'c = 8,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#5-8k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	13.00	13.00	+0.00		Pass

CRSI-C1-#5-9k: Standard hook, #5, f'c = 9,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#5-9k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	12.00	12.00	+0.00		Pass

CRSI-C1-#5-10k: Standard hook, #5, f'c = 10,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#5-10k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	11.00	11.00	+0.00		Pass

CRSI-C1-#8-3k: Standard hook, #8, f'c = 3,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#8-3k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	32.00	32.00	+0.00		Pass

CRSI-C1-#8-4k: Standard hook, #8, f'c = 4,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#8-4k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	30.00	30.00	+0.00		Pass

CRSI-C1-#8-5k: Standard hook, #8, f'c = 5,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#8-5k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	29.00	29.00	+0.00		Pass

CRSI-C1-#8-6k: Standard hook, #8, f'c = 6,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#8-6k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	29.00	29.00	+0.00		Pass

CRSI-C1-#8-7k: Standard hook, #8, f'c = 7,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#8-7k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	27.00	27.00	+0.00		Pass

CRSI-C1-#8-8k: Standard hook, #8, f'c = 8,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#8-8k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	25.00	25.00	+0.00		Pass

CRSI-C1-#8-9k: Standard hook, #8, f'c = 9,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#8-9k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	23.00	23.00	+0.00		Pass

CRSI-C1-#8-10k: Standard hook, #8, f'c = 10,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#8-10k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	22.00	22.00	+0.00		Pass

CRSI-C1-#11-3k: Standard hook, #11, f'c = 3,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#11-3k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	54.00	54.00	+0.00		Pass

CRSI-C1-#11-4k: Standard hook, #11, f'c = 4,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#11-4k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	51.00	51.00	+0.00		Pass

CRSI-C1-#11-5k: Standard hook, #11, f'c = 5,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#11-5k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	49.00	49.00	+0.00		Pass

CRSI-C1-#11-6k: Standard hook, #11, f'c = 6,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#11-6k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	48.00	48.00	+0.00		Pass

CRSI-C1-#11-7k: Standard hook, #11, f'c = 7,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#11-7k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	44.00	44.00	+0.00		Pass

CRSI-C1-#11-8k: Standard hook, #11, f'c = 8,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#11-8k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	41.00	41.00	+0.00		Pass

CRSI-C1-#11-9k: Standard hook, #11, f'c = 9,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#11-9k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	39.00	39.00	+0.00		Pass

CRSI-C1-#11-10k: Standard hook, #11, f'c = 10,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#11-10k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	37.00	37.00	+0.00		Pass

CRSI-C1-#18-3k: Standard hook, #18, f'c = 3,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#18-3k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	109.0	109.0	+0.00		Pass

CRSI-C1-#18-4k: Standard hook, #18, f'c = 4,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart). Calculation: Rebar development and splices.

CRSI-C1-#18-4k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	102.0	102.0	+0.00		Pass

CRSI-C1-#18-5k: Standard hook, #18, f'c = 5,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#18-5k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	98.00	98.00	+0.00		Pass

CRSI-C1-#18-6k: Standard hook, #18, f'c = 6,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#18-6k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	96.00	96.00	+0.00		Pass

CRSI-C1-#18-7k: Standard hook, #18, f'c = 7,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#18-7k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	89.00	89.00	+0.00		Pass

CRSI-C1-#18-8k: Standard hook, #18, f'c = 8,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#18-8k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	83.00	83.00	+0.00		Pass

CRSI-C1-#18-9k: Standard hook, #18, f'c = 9,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#18-9k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	78.00	78.00	+0.00		Pass

CRSI-C1-#18-10k: Standard hook, #18, f'c = 10,000 psi (psi_r = 1.6, psi_o = 1.25)

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-C1-#18-10k · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	74.00	74.00	+0.00		Pass

CRSI-4k-#14-c2: Tension development, #14, f'c = 4,000 psi, cover 2 in.

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-4k-#14-c2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ld (bottom)	in.	72.00	72.00	+0.00		Pass

CRSI-4k-#18-c3-top: Tension development, #18 top bar, f'c = 4,000 psi, cover 3 in.

Source: CRSI, Development and lap splice lengths to ACI 318-19 (CRSI product catalog 2025, tables A1 to A3, C1), pp. PDF p. 18 (wall chart).
Calculation: Rebar development and splices.

CRSI-4k-#18-c3-top · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ld (top)	in.	115.0	115.0	+0.00		Pass

SST-1: Footing dowel lap, Class B (Eq. 25.4.2.4a)

Source: Simpson Strong-Tie SE Blog (2020), Development length of post-installed rebar, example 1, pp. web page. Calculation: Rebar development and splices.

SST-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
(cb + Ktr)/db (capped)		2.500	2.500	+0.00		Pass
ld = 16.4 in.	in.	16.40	16.43	+0.19		Pass
Class B lap 1.3 ld = 21.3 in.	in.	21.30	21.36	+0.29		Pass

VCM-LD: Simplified method, other cases: lightweight epoxy-coated top bar

Source: VCmaster US template catalog, development length of deformed bars in tension (ACI 318-11), pp. pp. 50–51. Calculation: Rebar development and splices.

VCM-LD · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
psi_t psi_e (capped at 1.7)		1.700	1.700	+0.00		Pass
ld = 142 in. The template takes db = 0.88 in. for #7 (0.875 in. nominal): 0.6 % lower	in.	142.0	141.1	-0.62		Pass
Class B lap 1.3 ld = 184 in.	in.	184.0	183.5	-0.30		Pass

HC-HEAD-1: Headed bar outside a joint (25.4.4.2, 25.4.4.5)

Source: Hand calculation (closed form). Calculation: Rebar development and splices.

HC-HEAD-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
psi_c = f'c/15,000 + 0.6		0.933	0.933	+0.00		Pass
ldt	in.	13.20	13.20	+0.00		Pass

HC-HEAD-2: Headed bars in a beam-column joint with parallel ties (25.4.4.4)

Source: Hand calculation (closed form). Calculation: Rebar development and splices.

HC-HEAD-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldt (all factors 1.0)	in.	10.33	10.33	+0.00		Pass

HC-COMP-1: Compression development with confining ties (25.4.9)

Source: Hand calculation (closed form). Calculation: Rebar development and splices.

HC-COMP-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldc	in.	16.05	16.05	+0.00		Pass

HC-LAPC-60: Compression lap, Grade 60 (25.5.5.1(a))

Source: Hand calculation (closed form). Calculation: Rebar development and splices.

HC-LAPC-60 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
lsc = 0.0005 fy db	in.	30.00	30.00	+0.00		Pass

HC-LAPC-80: Compression lap, Grade 80, f'c below 3,000 psi (25.5.5.1(b))

Source: Hand calculation (closed form). Calculation: Rebar development and splices.

HC-LAPC-80 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
lsc = (0.0009 fy − 24) db x 4/3	in.	64.00	64.00	+0.00		Pass

HC-KTR: General equation with transverse reinforcement Ktr (Eq. 25.4.2.4b)

Source: Hand calculation (closed form). Calculation: Rebar development and splices.

HC-KTR · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ktr	in.	0.889	0.889	+0.00		Pass
ld	in.	28.46	28.46	+0.00		Pass

HC-G80 · Rebar development and splices: Grade 80 bar (psi_g = 1.15)

Source: Hand calculation (closed form). Calculation: Rebar development and splices.

HC-G80 · Rebar development and splices · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ld	in.	26.18	26.18	+0.00		Pass

HC-G100: Grade 100 bar (psi_g = 1.3)

Source: Hand calculation (closed form). Calculation: Rebar development and splices.

HC-G100 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ld	in.	37.00	37.00	+0.00		Pass

HC-EXCESS: Reduction for excess reinforcement (25.4.10.1)

Source: Hand calculation (closed form). Calculation: Rebar development and splices.

HC-EXCESS · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ld x As,req/As,prov	in.	21.35	21.35	+0.00		Pass

HC-HOOK-CONF: Hook with confining ties and large side cover (psi_r = psi_o = 1.0)

Source: Hand calculation (closed form). Calculation: Rebar development and splices.

HC-HOOK-CONF · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ldh	in.	9.710	9.710	+0.00		Pass

MNL17-LD-OW1: One-way slab, No. 5 at 12 in., cover 0.75 in.: ℓd and Class B lap

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 6, One-way Slab Example 1, pp. pp. 55–56.
Calculation: Rebar development and splices.

MNL17-LD-OW1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
cb = 0.75 + 0.625/2	in.	1.060	1.062	+0.24		Pass
(cb + Ktr)/db		1.700	1.700	+0.00		Pass
ℓd (Eq. 25.4.2.4a, ψs = 0.8)	in.	19.00	18.72	-1.49		Deviation MNL17-LD-O1
MNL17-LD-O1: the example prints ℓd = 19 in. for 18.7 in. (rounded up) and laps 1.3 × 19 = 24.7 in. (ours 24.3 in.)						
Class B lap 1.3ℓd	in.	24.70	24.33	-1.49		Deviation MNL17-LD-O1
MNL17-LD-O1: the example prints ℓd = 19 in. for 18.7 in. (rounded up) and laps 1.3 × 19 = 24.7 in. (ours 24.3 in.)						

MNL17-LDH-OW1: One-way slab, No. 5 standard hook at the exterior support

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 6, One-way Slab Example 1, pp. p. 69.
Calculation: Rebar development and splices.

Side cover entered as 6db = 3.75 in.; the example states only that it exceeds 6db.

MNL17-LDH-OW1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ψr (spacing ≥ 6db)		1.000	1.000	+0.00		Pass
ψo (side cover ≥ 6db)		1.000	1.000	+0.00		Pass
ψc = f'c/15,000 + 0.6		0.933	0.933	+0.04		Pass
ℓdh	in.	7.100	7.115	+0.21		Pass

MNL17-LD-TW1: Two-way slab, No. 5, simplified method: ℓd and Class B lap

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 6, Two-way Slab Example 1, pp. p. 110 (also Example 3, p. 138). Calculation: Rebar development and splices.

MNL17-LD-TW1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ℓd = fy ψt ψe ψg/(25λ√f'c) db	in.	21.20	21.21	+0.06		Pass
Class B lap 1.3ℓd	in.	27.50	27.58	+0.28		Pass

MNL17-LDH-B4: Edge beam, No. 6 standard hook in the column (ψr = 1.6, ψo = 1.25)

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 7, Beam Example 4, pp. p. 222. Calculation: Rebar development and splices.

Bar spacing and side cover entered below the 6db limits, as the example states.

MNL17-LDH-B4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ψr (neither confinement nor spacing)		1.600	1.600	+0.00		Pass
ψo (side cover not met)		1.250	1.250	+0.00		Pass
ℓdh	in.	18.70	18.71	+0.03		Pass

MNL17-LD-C2: Column, No. 8 with ties (Ktr): Class B and compression laps

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 9, Columns Example 2, pp. p. 411. Calculation: Rebar development and splices.

Clear cover to the bars 1.5 in. + No. 4 tie; bars 9.5 in. on center.

MNL17-LD-C2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
cb	in.	2.500	2.500	+0.00		Pass
Ktr = 40Atr/(sn)	in.	0.670	0.667	-0.50		Pass
(cb + Ktr)/db (3.17, capped)		2.500	2.500	+0.00		Pass
ℓd	in.	25.40	25.46	+0.22		Pass
Class B lap 1.3ℓd	in.	33.00	33.09	+0.28		Pass
Compression lap 0.0005fy db	in.	30.00	30.00	+0.00		Pass

MNL17-LD-C4: Special moment frame column, No. 7 with hoops (Ktr): laps

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 9, Columns Example 4, pp. pp. 424–425.
Calculation: Rebar development and splices.

The example prints cb = 2.44 in. and then uses 1.94 in. in (cb + Ktr)/db; both exceed the 2.5 cap. Bars 6.375 in. on center (four per 24 in. face).

MNL17-LD-C4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
cb = 1.5 + 0.5 + 0.875/2	in.	2.440	2.438	-0.10		Pass
Ktr = 40Atr/(sn)	in.	1.780	1.778	-0.12		Pass
(cb + Ktr)/db (capped)		2.500	2.500	+0.00		Pass
ℓd	in.	22.30	22.27	-0.12		Pass
Class B lap 1.3ℓd	in.	29.00	28.96	-0.15		Pass
Compression lap 30db	in.	26.25	26.25	+0.00		Pass

MNL17-LD-C5: Column, No. 8, simplified method (Table 25.4.2.3)

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 9, Columns Example 5, pp. p. 429. Calculation: Rebar development and splices.

MNL17-LD-C5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ℓd (63.6 in.)	in.	63.60	42.43	-33.29		Deviation MNL17-LD-C5

MNL17-LD-C5: the example states clear spacing ≥ 2db and cover ≥ db, the first row of Table 25.4.2.3 (fy ψ/(20λ√f'c) db = 42.4 in.), then applies the 'other cases' coefficient 3/40

MNL17-LDH-W2: Special wall, No. 6 horizontal bar hooked in the boundary element

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 10, Shear Wall Example 2, pp. p. 463.
Calculation: Rebar development and splices.

Side cover entered as 6db = 4.5 in.; the example states only that it exceeds 6db.

MNL17-LDH-W2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ψr (spacing ≥ 6db)		1.000	1.000	+0.00		Pass
ψo (side cover ≥ 6db)		1.000	1.000	+0.00		Pass
ψc		0.933	0.933	+0.04		Pass
ℓdh (7.1 in.)	in.	7.100	9.353	+31.73		Deviation MNL17-LDH-W2

MNL17-LDH-W2: the example checks a No. 6 bar with the No. 5 diameter (0.625 in.); with db = 0.75 in. ℓdh = 9.4 in. (26.5 in. available)

MNL17-LDC-F1: Footing dowels, No. 6 in compression (25.4.9)

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 13, Foundation Example 1, pp. p. 485.
Calculation: Rebar development and splices.

Foundation Example 4 (p. 516) prints 14.2 in. for the same bar.

MNL17-LDC-F1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
fy ψr db/(50λ√f'c)	in.	14.30	14.23	-0.49		Pass
0.0003 fy ψr db	in.	13.50	13.50	+0.00		Pass
ℓdc	in.	14.30	14.23	-0.49		Pass

MNL17-LD-F1: Footing, No. 8 bottom bars, 3 in. cover (general equation)

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 13, Foundation Example 1, pp. p. 486.
Calculation: Rebar development and splices.

cb = 3 + 0.5 = 3.5 in. as the example takes it; bar spacing entered as 12 in. (not limiting).

MNL17-LD-F1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
(cb + Ktr)/db (3.5, capped)		2.500	2.500	+0.00		Pass
ℓd = 28.5db	in.	28.50	28.46	-0.14		Pass

MNL17-LD-F5-TOP: Combined footing, No. 9 top bars, simplified method (ψt = 1.3)

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 13, Foundation Example 5, pp. p. 535.
Calculation: Rebar development and splices.

MNL17-LD-F5-TOP · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ℓd = 61.7db	in.	69.60	69.56	-0.06		Pass

MNL17-LD-F5-BOT: Combined footing, No. 9 bottom bars, simplified method

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 13, Foundation Example 5, pp. p. 537.
Calculation: Rebar development and splices.

MNL17-LD-F5-BOT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ℓd	in.	53.50	53.51	+0.01		Pass

MNL17-LDH-F5: Combined footing, No. 9 top bars hooked at the exterior column

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 13, Foundation Example 5, pp. p. 536.
Calculation: Rebar development and splices.

Side cover entered as 3 in., below 6db as the example states.

MNL17-LDH-F5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ψr (spacing ≥ 6db)		1.000	1.000	+0.00		Pass
ψo (side cover not met)		1.250	1.250	+0.00		Pass
ψc = 4,000/15,000 + 0.6		0.867	0.867	-0.04		Pass
ℓdh	in.	22.40	22.39	-0.06		Pass

MNL17-LDC-F5: Combined footing, No. 7 dowels in compression

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 1, Chapter 13, Foundation Example 5, pp. p. 538.
Calculation: Rebar development and splices.

MNL17-LDC-F5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
fy ψr db/(50λ√f'c)	in.	16.60	16.60	+0.01		Pass
0.0003 fy ψr db	in.	15.75	15.75	+0.00		Pass

RT-A1: #5 at 12 in.

Source: CRSI Manual of Standard Practice, area per foot (ASTM A615 Table 1 areas). Calculation: Rebar tables.

RT-A1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Area per foot		0.310	0.310	+0.00		Pass

RT-A2: #4 at 6 in.

Source: CRSI Manual of Standard Practice, area per foot. Calculation: Rebar tables.

RT-A2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Area per foot		0.400	0.400	+0.00		Pass

RT-D1: #5, condition met

Source: ACI 318-19 Table 25.4.2.3 (by hand). Calculation: Rebar tables.

RT-D1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Development length	in.	23.72	23.72	-0.01		Pass
Class B lap	in.	30.84	30.83	-0.03		Pass

RT-D2: #8, condition met

Source: ACI 318-19 Table 25.4.2.3 (by hand). Calculation: Rebar tables.

RT-D2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Development length	in.	47.43	47.43	+0.01		Pass

RT-D3: #8, other cases

Source: ACI 318-19 Table 25.4.2.3 (by hand). Calculation: Rebar tables.

RT-D3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Development length	in.	71.15	71.15	+0.00		Pass

RT-D4: #6 top bar, condition met

Source: ACI 318-19 Table 25.4.2.3 (by hand). Calculation: Rebar tables.

RT-D4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Development length	in.	37.00	37.00	-0.00		Pass

RT-D5: #5, Eq. 25.4.2.4a, confinement term 2.5

Source: ACI 318-19 Eq. 25.4.2.4a (by hand). Calculation: Rebar tables.

RT-D5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Development length	in.	14.23	14.23	+0.00		Pass

RT-H1: #5 standard hook

Source: ACI 318-19 25.4.3.1 (by hand). Calculation: Rebar tables.

RT-H1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Hook development length	in.	14.77	14.77	+0.02		Pass

SP-RW: Tapered cantilever wall with a key (Darwin Ex. 16.8)

Source: StructurePoint, Reinforced Concrete Cantilever Retaining Wall Analysis and Design (ACI 318-19), after Darwin, Dolan and Nilson, Design of Concrete Structures, 16th Ed., Example 16.8, pp. pp. 3-15. Calculation: Retaining wall.

SP-RW · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Horizontal earth + surcharge thrust on the heel plane, ½Ka γ H'(H' + 2h')	kips	6.490	6.500	+0.15		Pass
Overturning moment about the toe	kip-ft	37.46	37.50	+0.11		Pass
Stem Mu at the base, 1.6 × 5.44 kips × 5.25 ft	kip-ft	45.70	45.68	-0.04		Pass
As,min toe = 0.0018 × 12 × 18	in.²	0.390	0.389	-0.31		Pass
As,min heel = 0.0018 × 12 × 18	in.²	0.390	0.389	-0.31		Pass
Stem φVc, 8λs ρw^(1/3) √f'c + Nu/(6Ag), λs = 0.92	kips	10.98	10.67	-2.80		Deviation RW-NU
RW-NU: the program neglects the axial compression term Nu/(6Ag) of the stem's own weight (conservative)						

RW-1: Cantilever wall with a key (the default design)

Source: Hand calculation (closed form). Calculation: Retaining wall.

RW-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Earth pressure resultant ½ Ka γ H'²	kip/ft	3.645	3.645	+0.00		Pass
Overturning ratio Mo FS / Mr		0.427	0.427	+0.00		Pass
Sliding ratio ΣH FS / (μN + Pp)		0.812	0.812	+0.00		Pass
Toe pressure N/B (1 + 6e/B)	ksf	1.748	1.748	-0.00		Pass
Stem Mu at the base	kip-ft	28.03	28.03	+0.00		Pass
Stem Vu at the base	kips	6.208	6.208	+0.00		Pass

MNL17-RW2: Cantilever wall, level backfill (final design, 24 in. footing)

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 2, Chapter 12, Retaining Walls Example 2, pp. Vol. 2 pp. 32-58 (PDF 603-629). Calculation: Retaining wall.

MNL17-RW2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vertical load ΣP (stem, footing, soil over the heel) p. 49	kips	15.45	15.46	+0.03		Pass
Resisting moment about the toe p. 49	kip-ft	85.13	85.13	+0.00		Pass
Overturning moment H h/3 p. 49	kip-ft	28.97	28.97	+0.00		Pass
FS against overturning p. 49		2.940	2.938	-0.06		Pass
Horizontal force H = Ca γ h²/2 p. 49	kips	4.829	4.829	+0.00		Pass
Friction resistance μ ΣP p. 49	kips	7.730	7.728	-0.03		Pass
FS against sliding p. 49		1.600	1.600	+0.01		Pass
Maximum base pressure p. 49	ksf	2.746	2.745	-0.02		Pass
Minimum base pressure p. 49	ksf	0.596	0.596	+0.04		Pass
Stem Mu at the base p. 49	kip-ft	32.56	32.56	-0.00		Pass
Stem φMn, No. 7 at 9 in. p. 42	kip-ft	43.34	43.34	+0.01		Pass
Stem εt, No. 7 at 9 in. p. 39		0.026	0.027	+0.88		Pass
Stem As,min = 0.0018 × 12 × 15 p. 38	in.²	0.324	0.324	+0.00		Pass
Stem Vu at the base p. 49	kips	6.105	6.105	-0.00		Pass
Stem λs p. 46		0.942	0.942	-0.05		Pass
Stem Vc, λs = 0.942, Nu = 0 p. 46	kips	13.29	13.29	-0.03		Pass
Stem φVc p. 46 (0.75 × 13.2 printed)	kips	9.900	9.964	+0.65		Pass
Stem φVn in the revised summary p. 49	kips	17.50	9.964	-43.06		Deviation MNL17-RW2-SUMV
MNL17-RW2-SUMV: the summary of the revised design prints φVn = 17,500 lb for the stem; the stem and its bars did not change and p. 46 gives 9.90 kip (misprint)						
Stem horizontal shrinkage steel 0.0018 × 12 × 15 p. 40	in.²	0.324	0.324	+0.00		Pass
Stem hook ℓdh, No. 7 end bars, 2 in. side cover (ψo = 1.25) p. 56	in.	15.00	14.97	-0.17		Pass
Heel Mu at the back face of the stem p. 49	kip-ft	48.00	26.25	-45.32		Deviation MNL17-RW-HEEL
MNL17-RW-HEEL: the handbook loads the heel with the soil (factored 1.6) and its own weight and neglects the base pressure under it; the program takes the factored base pressure of each ASCE 7 combination up and the soil weight as dead load						
Heel Vu at the back face of the stem p. 48	kips	17.47	7.680	-56.04		Deviation MNL17-RW-HEEL
MNL17-RW-HEEL: the handbook loads the heel with the soil (factored 1.6) and its own weight and neglects the base pressure under it; the program takes the factored base pressure of each ASCE 7 combination up and the soil weight as dead load						
Heel φVc, No. 7 at 4.5 in., d = 21.56 in., λs neglected p. 48	kips	19.10	19.12	+0.08		Pass
Heel Vc p. 48	kips	25.48	25.49	+0.03		Pass

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Heel As,min = 0.0018 × 12 × 24 p. 50	in.²	0.518	0.518	+0.08		Pass
Heel top bar ℓd, No. 7, ψt = 1.3 p. 51	in.	30.50	30.52	+0.07		Pass
Toe Mu at the front face of the stem p. 53	kip-ft	11.93	10.89	-8.70		Deviation MNL17-RW-TOE
MNL17-RW-TOE: the handbook factors the service base pressure by 1.6; the program finds the base pressure from the factored loads of each ASCE 7 combination (0.9D + 1.6H governs)						
Toe Vu at d from the stem p. 53	kips	3.148	2.938	-6.67		Deviation MNL17-RW-TOE
MNL17-RW-TOE: the handbook factors the service base pressure by 1.6; the program finds the base pressure from the factored loads of each ASCE 7 combination (0.9D + 1.6H governs)						
Toe Vc, No. 7 at 9 in., d = 20.56 in. p. 52	kips	19.59	19.60	+0.05		Pass
Toe φVc p. 52 (0.75 × 19.5 printed)	kips	14.60	14.70	+0.68		Pass
Toe As,min = 0.0018 × 12 × 24 p. 54	in.²	0.518	0.518	+0.08		Pass
Toe bottom bar ℓd, No. 7 p. 55	in.	23.50	23.48	-0.09		Pass

MNL17-RW3: Cantilever wall, 10° sloped backfill

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 2, Chapter 12, Retaining Walls Example 3, pp. Vol. 2 pp. 59-78 (PDF 630-649). Calculation: Retaining wall.

MNL17-RW3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vertical load ΣP (with the slope wedge and the vertical earth component) p. 61	kips	13.48	13.52	+0.26		Pass
Resisting moment about the toe p. 62	kip-ft	70.15	70.43	+0.41		Pass
Horizontal force H cos 10° p. 62	kips	4.440	4.643	+4.57		Deviation MNL17-RW3-KA
MNL17-RW3-KA: the handbook uses the level-backfill Rankine coefficient (1 − sin φ)/(1 + sin φ) = 0.282 for the 10° slope; Rankine for a sloped backfill gives cos β (cos β − √(cos²β − cos²φ))/(cos β + √(cos²β − cos²φ)) = 0.294						
Overturning moment p. 62	kip-ft	24.20	25.28	+4.46		Deviation MNL17-RW3-KA
MNL17-RW3-KA: Ca = 0.282 (level backfill) in the handbook, 0.294 (Rankine, 10° slope) in the program						
FS against overturning p. 63		2.900	2.786	-3.94		Deviation MNL17-RW3-KA
MNL17-RW3-KA: Ca = 0.282 in the handbook, 0.294 in the program						
FS against sliding p. 63		1.520	1.456	-4.22		Deviation MNL17-RW3-KA
MNL17-RW3-KA: Ca = 0.282 in the handbook, 0.294 in the program						
Maximum base pressure p. 62	ksf	2.488	2.574	+3.48		Deviation MNL17-RW3-KA
MNL17-RW3-KA: Ca = 0.282 in the handbook, 0.294 in the program						
Stem Mu at the base p. 64	kip-ft	29.01	25.46	-12.24		Deviation MNL17-RW3-STEM
MNL17-RW3-STEM: the handbook applies Ca = 0.282 over 14.84 ft (the height of the plane through the heel less the footing) to the 14 ft stem; the program applies the sloped-backfill Rankine pressure from the top of the stem						
Stem As,min = 0.0018 × 12 × 15 p. 66	in.²	0.324	0.324	+0.00		Pass
Stem λs p. 70		0.942	0.942	-0.05		Pass
Stem Vc, No. 7 at 12 in., λs = 0.942, Nu = 0 p. 70	kips	12.07	12.07	+0.01		Pass
Stem φVc p. 70 (0.75 × 12.0 printed)	kips	9.000	9.053	+0.59		Pass
Heel Mu at the back face of the stem p. 72	kip-ft	34.28	23.50	-31.44		Deviation MNL17-RW-HEEL
MNL17-RW-HEEL: the handbook loads the heel with the soil (factored 1.6) and its own weight and neglects the base pressure under it; the program takes the factored base pressure of each ASCE 7 combination up and the soil weight as dead load						
Heel Vu at the back face of the stem p. 72	kips	14.43	6.941	-51.90		Deviation MNL17-RW-HEEL
MNL17-RW-HEEL: the handbook loads the heel with the soil (factored 1.6) and its own weight and neglects the base pressure under it; the program takes the factored base pressure of each ASCE 7 combination up and the soil weight as dead load						
Heel Vc, No. 8 at 6 in., d = 15.5 in., λs neglected p. 71	kips	20.37	20.37	-0.02		Pass
Heel φVc pp. 71-72	kips	15.28	15.28	-0.03		Pass
Heel As,min = 0.0018 × 12 × 18 p. 73	in.²	0.389	0.389	-0.05		Pass
Heel top bar ℓd, No. 8, ψt = 1.3 p. 74	in.	34.90	34.88	-0.05		Pass
Toe Vc, No. 7 at 12 in., d = 14.56 in. p. 75	kips	14.14	14.15	+0.06		Pass
Toe φVc p. 75	kips	10.60	10.61	+0.10		Pass

MNL17-RW4: Cantilever wall with a 360 psf surcharge

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 2, Chapter 12, Retaining Walls Example 4, pp. Vol. 2 pp. 79-103 (PDF 650-674). Calculation: Retaining wall.

MNL17-RW4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vertical load ΣP (surcharge over the heel included) p. 81	kips	9.257	9.257	-0.00		Pass
Resisting moment about the toe p. 81	kip-ft	42.55	42.55	+0.00		Pass
Horizontal force H1 + H2 (earth + surcharge) p. 81	kips	3.272	3.272	+0.01		Pass
Overturning moment p. 81	kip-ft	14.69	14.69	+0.01		Pass
FS against overturning p. 82		2.900	2.896	-0.15		Pass
FS against sliding p. 82		1.560	1.556	-0.26		Pass
Maximum base pressure p. 82	ksf	1.932	1.928	-0.21		Pass
Minimum base pressure p. 82	ksf	0.622	0.626	+0.59		Pass
Stem Mu at the base p. 83	kip-ft	17.57	17.54	-0.18		Pass
Stem Vu at the base p. 93	kips	4.331	4.333	+0.05		Pass
Stem Vc, No. 7 at 12 in., d = 9.56 in., λs = 1.0 p. 93	kips	10.69	10.69	-0.01		Pass
Stem As,min = 0.0018 × 12 × 12 p. 85	in.²	0.259	0.259	+0.08		Pass
Stem hook ℓdh, No. 7, ψo = 1.0 p. 100	in.	12.00	11.98	-0.17		Pass
Heel Mu at the back face of the stem p. 95	kip-ft	22.15	12.15	-45.15		Deviation MNL17-RW-HEEL
MNL17-RW-HEEL: the handbook loads the heel with the soil (factored 1.6) and its own weight and neglects the base pressure under it; the program takes the factored base pressure of each ASCE 7 combination up and the soil weight as dead load						
Heel Vu at the back face of the stem p. 94	kips	11.08	5.136	-53.65		Deviation MNL17-RW-HEEL
MNL17-RW-HEEL: the handbook loads the heel with the soil (factored 1.6) and its own weight and neglects the base pressure under it; the program takes the factored base pressure of each ASCE 7 combination up and the soil weight as dead load						
Heel φVc, No. 7 at 6 in., d = 12.56 in., λs neglected p. 94	kips	12.10	12.11	+0.12		Pass
Heel top bar ℓd, No. 7, ψt = 1.3 p. 96	in.	30.50	30.52	+0.07		Pass
Toe Mu at the front face of the stem p. 98	kip-ft	6.848	6.380	-6.83		Deviation MNL17-RW-TOE
MNL17-RW-TOE: the handbook factors the service base pressure by 1.6; the program finds the base pressure from the factored loads of each ASCE 7 combination (0.9D + 1.6H governs)						
Toe Vc, No. 7 at 12 in., d = 11.56 in. p. 97	kips	12.13	12.13	+0.01		Pass
Toe φVc p. 97	kips	9.100	9.098	-0.02		Pass
Toe bottom bar ℓd, No. 7 p. 101	in.	23.50	23.48	-0.09		Pass

MNL17-RW5: Cantilever wall with a 330 psf surcharge (check before the shear key)

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 2, Chapter 12, Retaining Walls Example 5, pp. Vol. 2 pp. 104-129 (PDF 675-700). Calculation: Retaining wall.

MNL17-RW5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vertical load ΣP (surcharge over the heel included) p. 106	kips	12.07	12.07	+0.01		Pass
Resisting moment about the toe p. 106	kip-ft	59.50	59.51	+0.02		Pass
Overturning moment p. 107	kip-ft	24.55	24.55	-0.01		Pass
FS against overturning p. 108		2.420	2.424	+0.18		Pass
FS against sliding, no key (below 1.5) p. 108		1.090	1.090	-0.01		Pass
Maximum base pressure p. 107	ksf	2.755	2.758	+0.10		Pass
Minimum base pressure p. 107	ksf	0.265	0.260	-1.83		Pass
Stem Mu at the base p. 112	kip-ft	30.64	30.55	-0.30		Pass
Stem Vu at the base p. 112	kips	6.031	6.018	-0.21		Pass
Stem Vc, No. 7 at 12 in., λs = 0.942 p. 118	kips	12.07	12.07	+0.01		Pass
Heel Mu at the back face of the stem p. 119	kip-ft	31.24	20.62	-33.99		Deviation MNL17-RW-HEEL
MNL17-RW-HEEL: the handbook loads the heel with the soil (factored 1.6) and its own weight and neglects the base pressure under it; the program takes the factored base pressure of each ASCE 7 combination up and the soil weight as dead load						
Heel Vu at the back face of the stem p. 118	kips	13.89	7.874	-43.31		Deviation MNL17-RW-HEEL
MNL17-RW-HEEL: the handbook loads the heel with the soil (factored 1.6) and its own weight and neglects the base pressure under it; the program takes the factored base pressure of each ASCE 7 combination up and the soil weight as dead load						
Heel Vc, No. 9 at 6 in., d = 13.44 in., λs neglected p. 119	kips	20.03	20.03	-0.00		Pass
Heel φVc p. 119	kips	15.02	15.02	+0.01		Pass

MNL17-RW6: Cantilever wall at a property line (no toe)

Source: ACI MNL-17(21), Reinforced Concrete Design Handbook (ACI 318-19), Vol. 2, Chapter 12, Retaining Walls Example 6, pp. Vol. 2 pp. 130 ff. (PDF 701 ff.). Calculation: Retaining wall.

MNL17-RW6 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vertical load ΣP p. 132	kips	7.587	7.584	-0.04		Pass
Resisting moment about the toe p. 132	kip-ft	20.98	20.93	-0.24		Pass
Horizontal force H p. 132	kips	1.793	1.793	-0.02		Pass
Overturning moment p. 132	kip-ft	6.276	6.274	-0.03		Pass
FS against overturning p. 133		3.300	3.336	+1.08		Pass
FS against sliding p. 133		1.690	1.692	+0.13		Pass
Maximum base pressure p. 133	ksf	2.612	2.615	+0.12		Pass
Minimum base pressure p. 133	ksf	0.064	0.062	-3.81		Pass
Stem Mu at the base p. 134	kip-ft	6.860	6.863	+0.05		Pass
Stem εt, No. 5 at 12 in. p. 137		0.044	0.044	-0.11		Pass
Stem As,min = 0.0018 × 12 × 10 p. 136	in.²	0.216	0.216	+0.00		Pass
Stem Vu at the base p. 140	kips	2.225	2.226	+0.04		Pass
Stem Vc, No. 5 at 12 in., d = 7.68 in., λs = 1.0 p. 140	kips	7.410	7.415	+0.07		Pass
Stem φVc p. 140	kips	5.560	5.561	+0.03		Pass
Heel Mu at the back face of the stem p. 142 (2634 + 20,802 ft-lb printed as 23,347; the sum is 23,436)	kip-ft	23.35	9.519	-59.23		Deviation MNL17-RW-HEEL
MNL17-RW-HEEL: the handbook loads the heel with the soil (factored 1.6) and its own weight and neglects the base pressure under it; the program takes the factored base pressure of each ASCE 7 combination up and the soil weight as dead load						
Heel Vu at the back face of the stem p. 141	kips	9.690	1.444	-85.10		Deviation MNL17-RW-HEEL
MNL17-RW-HEEL: the handbook loads the heel with the soil (factored 1.6) and its own weight and neglects the base pressure under it; the program takes the factored base pressure of each ASCE 7 combination up and the soil weight as dead load						
Heel Vc, No. 6 at 6 in. p. 141 (d = 12.69 in. with the No. 5 diameter; 12.63 in. for the No. 6 bars provided)	kips	14.67	14.62	-0.37		Pass
Heel φVc p. 141	kips	11.00	10.96	-0.35		Pass
Heel As,min = 0.0018 × 12 × 15 p. 143	in.²	0.324	0.324	+0.00		Pass

WW-T36: Overturning and chord tension, Tables 3.6, 3.10

Source: WoodWorks DE-2025, Five-Story Light-Frame Wood Over Podium, 2nd Ed., pp. pp. 31, 36. Calculation: Continuous rod tie-down.

WW-T36 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Overturning moment, Roof	kip-ft	94.00	93.97	-0.03		Pass
Overturning moment, 6th	kip-ft	279.2	279.2	+0.01		Pass
Overturning moment, 5th	kip-ft	533.0	533.0	-0.01		Pass
Overturning moment, 4th	kip-ft	832.3	832.3	+0.00		Pass
Overturning moment, 3rd	kip-ft	1,154	1,155	+0.00		Pass
Lateral T-C couple, Roof	kips	3.390	3.386	-0.11		Pass
Lateral T-C couple, 6th	kips	10.10	10.10	-0.01		Pass
Lateral T-C couple, 5th	kips	19.45	19.45	+0.01		Pass
Lateral T-C couple, 4th	kips	30.63	30.62	-0.02		Pass
Lateral T-C couple, 3rd	kips	42.81	42.81	-0.01		Pass
Resisting moment, Roof	kip-ft	65.60	65.60	-0.00		Pass
Resisting moment, 6th	kip-ft	271.6	271.6	+0.02		Pass
Resisting moment, 5th	kip-ft	477.7	477.7	-0.00		Pass
Resisting moment, 4th	kip-ft	683.7	683.7	+0.00		Pass
Resisting moment, 3rd	kip-ft	889.8	889.8	-0.00		Pass
Tension 0.43D + 0.7E, Roof	kips	1.351	1.351	+0.01		Pass
Tension 0.43D + 0.7E, 6th	kips	2.833	2.833	+0.01		Pass
Tension 0.43D + 0.7E, 5th	kips	6.099	6.099	-0.00		Pass
Tension 0.43D + 0.7E, 4th	kips	10.59	10.59	-0.01		Pass
Tension 0.43D + 0.7E, 3rd	kips	15.74	15.74	-0.01		Pass
Differential load, Roof	kips	1.350	1.351	+0.09		Pass
Differential load, 6th	kips	1.480	1.482	+0.14		Pass
Differential load, 5th	kips	3.260	3.266	+0.18		Pass
Differential load, 4th	kips	4.490	4.491	+0.02		Pass
Differential load, 3rd	kips	5.150	5.151	+0.02		Pass

WW-T311: Rod capacity, Table 3.11

Source: WoodWorks DE-2025, Five-Story Light-Frame Wood Over Podium, 2nd Ed., pp. p. 37. Calculation: Continuous rod tie-down.

WW-T311 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rod capacity, Roof	kips	6.670	6.673	+0.04		Pass
Rod capacity, 6th	kips	6.670	6.673	+0.04		Pass
Rod capacity, 5th	kips	9.610	9.609	-0.01		Pass
Rod capacity, 4th	kips	17.08	17.08	+0.01		Pass
Rod capacity, 3rd	kips	21.62	21.62	-0.00		Pass

WW-T312: Bearing plates, Table 3.12 and the Level 3 plate

Source: WoodWorks DE-2025, Five-Story Light-Frame Wood Over Podium, 2nd Ed., pp. p. 38. Calculation: Continuous rod tie-down.

WW-T312 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Net bearing area, Roof	in.²	8.480	8.482	+0.02		Pass
Net bearing area, 6th	in.²	8.480	8.482	+0.02		Pass
Net bearing area, 5th	in.²	9.810	9.810	-0.00		Pass
Net bearing area, 4th	in.²	10.89	10.89	+0.02		Pass
Net bearing area, 3rd	in.²	10.65	10.65	-0.03		Pass
Bearing factor Cb, Roof		1.130	1.125	-0.44		Pass
Bearing factor Cb, 6th		1.130	1.125	-0.44		Pass
Bearing factor Cb, 5th		1.110	1.107	-0.26		Pass
Bearing factor Cb, 4th		1.090	1.094	+0.34		Pass
Bearing factor Cb, 3rd		1.090	1.094	+0.34		Pass
Bearing capacity, Roof	kips	5.964	5.964	-0.01		Pass
Bearing capacity, 6th	kips	5.964	5.964	-0.01		Pass
Bearing capacity, 5th	kips	6.788	6.788	-0.00		Pass
Bearing capacity, 4th	kips	7.446	7.446	+0.00		Pass
Bearing capacity, 3rd	kips	7.278	7.278	+0.00		Pass
Stress on the plate, 3rd	psi	484.0	483.8	-0.04		Pass
Plate moment, 3rd	kip-ft	2.903	2.903	-0.01		Pass
Plate Z, 3rd	in.³	0.177	0.177	+0.00		Pass
Allowable plate moment, 3rd	kip-ft	3.816	3.816	-0.01		Pass

WW-T39: Compression posts, Tables 3.8, 3.9

Source: WoodWorks DE-2025, Five-Story Light-Frame Wood Over Podium, 2nd Ed., pp. pp. 33-35. Calculation: Continuous rod tie-down.

WW-T39 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Dead load on the chord, Roof	kips	0.200	0.195	-2.50		Pass
Dead load on the chord, 6th	kips	0.890	0.888	-0.20		Pass
Dead load on the chord, 5th	kips	1.990	1.988	-0.10		Pass
Dead load on the chord, 4th	kips	3.460	3.455	-0.14		Pass
Dead load on the chord, 3rd	kips	5.290	5.290	+0.00		Pass
Live load on the chord, Roof	kips	0.000	0.000	+0.00		Pass
Live load on the chord, 6th	kips	0.720	0.715	-0.69		Pass
Live load on the chord, 5th	kips	1.820	1.820	+0.00		Pass
Live load on the chord, 4th	kips	3.320	3.315	-0.15		Pass
Live load on the chord, 3rd	kips	5.200	5.200	+0.00		Pass
Compression demand 1.17D + 0.7E, Roof	kips	2.600	2.598	-0.06		Pass
Compression demand 1.17D + 0.7E, 6th	kips	8.110	8.107	-0.03		Pass
Compression demand 1.17D + 0.7E, 5th	kips	15.94	15.94	-0.00		Pass
Compression demand 1.17D + 0.7E, 4th	kips	25.48	25.47	-0.02		Pass
Compression demand 1.17D + 0.7E, 3rd	kips	36.15	36.15	-0.00		Pass
Fc' with CP	psi	450.0	450.4	+0.09		Pass
Fc perpendicular	psi	625.0	625.0	+0.00		Pass
Allowable compression, Roof	kips	14.19	14.19	-0.01		Pass
Allowable compression, 6th	kips	16.55	16.55	+0.02		Pass
Allowable compression, 5th	kips	23.65	23.65	-0.01		Pass
Allowable compression, 4th	kips	30.74	30.74	+0.00		Pass
Allowable compression, 3rd	kips	37.84	37.84	-0.01		Pass

WW-T213: Shrinkage and gaps, p. 14 and Table 2.1

Source: WoodWorks DE-2025, Five-Story Light-Frame Wood Over Podium, 2nd Ed., pp. pp. 14-15. Calculation: Continuous rod tie-down.

WW-T213 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vertical displacement per level, Roof	in.	0.190	0.190	+0.00		Pass
Vertical displacement per level, 6th	in.	0.190	0.190	+0.00		Pass
Vertical displacement per level, 5th	in.	0.190	0.190	+0.00		Pass
Vertical displacement per level, 4th	in.	0.190	0.190	+0.00		Pass
Vertical displacement per level, 3rd	in.	0.190	0.190	+0.00		Pass
Accumulated, Roof	in.	0.950	0.950	+0.00		Pass
Accumulated, 6th	in.	0.760	0.760	+0.00		Pass
Accumulated, 5th	in.	0.570	0.570	+0.00		Pass
Accumulated, 4th	in.	0.380	0.380	+0.00		Pass
Accumulated, 3rd	in.	0.190	0.190	+0.00		Pass

WW-PLATFORM: Platform framing, p. 14: shrinkage only

Source: WoodWorks DE-2025, Five-Story Light-Frame Wood Over Podium, 2nd Ed., pp. p. 14. Calculation: Continuous rod tie-down.

WW-PLATFORM · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Double 2x4 plate, 2x12 joists, 2x4 plate	in.	0.315	0.315	+0.00		Pass

WW-T313: Forces for deformation, Tables 3.13A, B, C

Source: WoodWorks DE-2025, Five-Story Light-Frame Wood Over Podium, 2nd Ed., pp. pp. 40-41. Calculation: Continuous rod tie-down.

WW-T313 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Compression for drift, Roof	kips	3.390	3.386	-0.11		Pass
Compression for drift, 6th	kips	10.10	10.10	-0.01		Pass
Compression for drift, 5th	kips	19.45	19.45	+0.01		Pass
Compression for drift, 4th	kips	30.63	30.62	-0.02		Pass
Compression for drift, 3rd	kips	42.81	42.81	-0.01		Pass
Tension for drift, Roof	kips	1.829	1.829	-0.00		Pass
Tension for drift, 6th	kips	3.627	3.626	-0.01		Pass
Tension for drift, 5th	kips	7.966	7.966	-0.00		Pass
Tension for drift, 4th	kips	14.05	14.05	-0.01		Pass
Tension for drift, 3rd	kips	21.07	21.07	-0.01		Pass
Differential tension, Roof	kips	1.829	1.829	-0.00		Pass
Differential tension, 6th	kips	1.797	1.797	+0.03		Pass
Differential tension, 5th	kips	4.339	4.339	+0.00		Pass
Differential tension, 4th	kips	6.086	6.085	-0.02		Pass
Differential tension, 3rd	kips	7.023	7.023	-0.01		Pass
Unit shear, Roof	plf	324.0	324.0	+0.01		Pass
Unit shear, 6th	plf	639.0	638.8	-0.03		Pass
Unit shear, 5th	plf	875.0	874.9	-0.01		Pass
Unit shear, 4th	plf	1,032	1,032	+0.03		Pass
Unit shear, 3rd	plf	1,111	1,111	+0.00		Pass

WW-T314: Crushing and rod elongation, Tables 3.14 to 3.16

Source: WoodWorks DE-2025, Five-Story Light-Frame Wood Over Podium, 2nd Ed., pp. pp. 45-47. Calculation: Continuous rod tie-down.

WW-T314 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Posts on the bottom plate, factored, Roof	in.	0.008	0.008	+3.08		Pass
Posts on the bottom plate, factored, 6th	in.	0.021	0.021	+0.38		Pass
Posts on the bottom plate, factored, 5th	in.	0.028	0.028	+1.51		Pass
Posts on the bottom plate, factored, 4th	in.	0.034	0.034	+1.23		Pass
Posts on the bottom plate, factored, 3rd	in.	0.046	0.046	+0.15		Pass
Sheathing, Roof	in.	0.006	0.006	+2.38		Pass
Sheathing, 6th	in.	0.017	0.017	-2.03		Pass
Sheathing, 5th	in.	0.027	0.027	+1.06		Pass
Sheathing, 4th	in.	0.038	0.038	-0.66		Pass
Sheathing, 3rd	in.	0.000	0.000	+0.00		Pass
Top plate, factored, Roof	in.	0.007	0.007	+0.98		Pass
Top plate, factored, 6th	in.	0.015	0.015	-1.63		Pass
Top plate, factored, 5th	in.	0.022	0.022	-0.62		Pass
Top plate, factored, 4th	in.	0.028	0.028	-0.12		Pass
Top plate, factored, 3rd	in.	0.000	0.000	+0.00		Pass
Total crushing, Roof	in.	0.021	0.021	+2.18		Pass
Total crushing, 6th	in.	0.052	0.052	+0.94		Pass
Total crushing, 5th	in.	0.078	0.078	-0.55		Pass
Total crushing, 4th	in.	0.100	0.100	+0.13		Pass
Total crushing, 3rd	in.	0.046	0.046	+0.15		Pass
Rod elongation, Roof	in.	0.033	0.033	+1.48		Pass
Rod elongation, 6th	in.	0.066	0.066	+0.60		Pass
Rod elongation, 5th	in.	0.099	0.099	-0.45		Pass
Rod elongation, 4th	in.	0.096	0.096	-0.02		Pass
Rod elongation, 3rd	in.	0.114	0.114	+0.21		Pass
Plate stress, Roof	psi	216.0	215.6	-0.17		Pass
Plate stress, 6th	psi	212.0	211.9	-0.03		Pass
Plate stress, 5th	psi	442.0	442.3	+0.08		Pass
Plate stress, 4th	psi	559.0	558.6	-0.07		Pass
Plate stress, 3rd	psi	660.0	659.6	-0.06		Pass
Plate crushing, Roof	in.	0.009	0.009	+5.03		Pass
Plate crushing, 6th	in.	0.009	0.009	+3.22		Pass
Plate crushing, 5th	in.	0.019	0.019	+2.05		Pass
Plate crushing, 4th	in.	0.032	0.032	+0.41		Pass
Plate crushing, 3rd	in.	0.047	0.047	+0.03		Pass

WW-T317A: Chord deformation with take-up devices, Table 3.17A

Source: WoodWorks DE-2025, Five-Story Light-Frame Wood Over Podium, 2nd Ed., pp. p. 47. Calculation: Continuous rod tie-down.

WW-T317A · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vertical chord deformation, Roof	in.	0.131	0.131	+0.24		Pass
Vertical chord deformation, 6th	in.	0.199	0.199	-0.16		Pass
Vertical chord deformation, 5th	in.	0.272	0.272	-0.09		Pass
Vertical chord deformation, 4th	in.	0.309	0.309	-0.04		Pass
Vertical chord deformation, 3rd	in.	0.289	0.289	-0.07		Pass

WW-T317B: Chord deformation without devices, Table 3.17B

Source: WoodWorks DE-2025, Five-Story Light-Frame Wood Over Podium, 2nd Ed., pp. p. 48. Calculation: Continuous rod tie-down.

WW-T317B · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
At each level, Roof	in.	0.266	0.266	-0.05		Pass
At each level, 6th	in.	0.334	0.334	-0.09		Pass
At each level, 5th	in.	0.408	0.408	+0.01		Pass
At each level, 4th	in.	0.466	0.446	-4.24		Deviation WW-T317B-4TH
WW-T317B-4TH: Table 3.17B prints 0.466 in. at the 4th level; its own columns add to 0.418 in., times b/d = 1.067 gives 0.446 in., and its printed accumulated values follow 0.446						
At each level, 3rd	in.	0.427	0.427	+0.05		Pass
Accumulated, Roof	in.	1.880	1.881	+0.06		Pass
Accumulated, 6th	in.	1.620	1.615	-0.30		Pass
Accumulated, 5th	in.	1.280	1.282	+0.12		Pass
Accumulated, 4th	in.	0.870	0.873	+0.40		Pass
Accumulated, 3rd	in.	0.430	0.427	-0.64		Pass

WW-T318: Shear wall deflection and drift, Tables 3.18, 3.19

Source: WoodWorks DE-2025, Five-Story Light-Frame Wood Over Podium, 2nd Ed., pp. pp. 48, 50. Calculation: Continuous rod tie-down.

WW-T318 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bending term, Roof	in.	0.002	0.002	-16.54		Pass
Bending term, 6th	in.	0.003	0.003	-5.97		Pass
Bending term, 5th	in.	0.003	0.003	-9.86		Pass
Bending term, 4th	in.	0.002	0.002	+22.72		Pass
Bending term, 3rd	in.	0.002	0.002	+7.31		Pass
Shear and nail slip term, Roof	in.	0.147	0.147	+0.20		Pass
Shear and nail slip term, 6th	in.	0.213	0.213	-0.03		Pass
Shear and nail slip term, 5th	in.	0.168	0.168	+0.15		Pass
Shear and nail slip term, 4th	in.	0.199	0.199	-0.24		Pass
Shear and nail slip term, 3rd	in.	0.185	0.185	+0.09		Pass
Chord deformation term, Roof	in.	0.045	0.045	+0.62		Pass
Chord deformation term, 6th	in.	0.069	0.069	-0.71		Pass
Chord deformation term, 5th	in.	0.094	0.094	-0.31		Pass
Chord deformation term, 4th	in.	0.107	0.107	-0.46		Pass
Chord deformation term, 3rd	in.	0.100	0.100	-0.42		Pass
Deflection, Roof	in.	0.194	0.194	+0.12		Pass
Deflection, 6th	in.	0.284	0.284	+0.10		Pass
Deflection, 5th	in.	0.265	0.265	-0.13		Pass
Deflection, 4th	in.	0.307	0.307	+0.16		Pass
Deflection, 3rd	in.	0.287	0.287	-0.04		Pass
Design story drift, Roof	in.	0.780	0.777	-0.39		Pass
Design story drift, 6th	in.	1.140	1.137	-0.26		Pass
Design story drift, 5th	in.	1.060	1.059	-0.13		Pass
Design story drift, 4th	in.	1.230	1.230	-0.00		Pass
Design story drift, 3rd	in.	1.150	1.148	-0.21		Pass
Allowable story drift, Roof	in.	2.400	2.400	+0.00		Pass
Allowable story drift, 6th	in.	2.400	2.400	+0.00		Pass
Allowable story drift, 5th	in.	2.400	2.400	+0.00		Pass
Allowable story drift, 4th	in.	2.400	2.400	+0.00		Pass
Allowable story drift, 3rd	in.	2.400	2.400	+0.00		Pass

HC-LRFD: Strength design of the top story, by hand

Source: Hand calculation (closed form). Calculation: Continuous rod tie-down.

HC-LRFD · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
T: (1.0 x 93.97 − 0.7 x 65.60) / 27.75	kips	1.732	1.732	-0.02		Pass
Rod: 0.75 x 0.75 x 58 x 0.3068	kips	10.01	10.01	-0.01		Pass
Plate bearing: 625 x 1.67 x 0.9 x 1.125 x 8.482	kips	8.960	8.963	+0.04		Pass

HC-WIND · Continuous rod tie-down: Wind, by hand

Source: Hand calculation (closed form). Calculation: Continuous rod tie-down.

HC-WIND · Continuous rod tie-down · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
T: (0.6 x 50 − 0.6 x 40) / 19	kips	0.316	0.316	-0.00		Pass

HIP-6: Hip roof 40 ft × 30 ft at 6:12

Source: Hand calculation (right-triangle trigonometry); framing-square rafter table (to confirm). Calculation: Roof geometry.

HIP-6 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Angle (26.565°)		26.57	26.57	+0.00		Pass
Common rafter per foot of run (13.42 in.)	in.	13.42	13.42	+0.00		Pass
Hip per foot of common run (18.00 in.)	in.	18.00	18.00	+0.00		Pass
Common rafter length	ft	16.77	16.77	+0.00		Pass
Hip length	ft	22.50	22.50	+0.00		Pass
Hip slope angle		19.47	19.47	+0.00		Pass
Ridge length	ft	10.00	10.00	+0.00		Pass
Ridge above the plate	ft	7.500	7.500	+0.00		Pass
Roof surface area	ft²	1,342	1,342	+0.00		Pass
Difference in length of jacks at 16 in. (17 7/8 in.)	in.	17.89	17.89	+0.00		Pass
Jack side cut		41.81	41.81	+0.00		Pass
Hip side cut		43.31	43.31	+0.00		Pass

SQUARE-12: Rafter table at 12:12

Source: Hand calculation (right-triangle trigonometry); framing-square rafter table (to confirm). Calculation: Roof geometry.

SQUARE-12 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Common rafter per foot of run (16.97 in.)	in.	16.97	16.97	+0.00		Pass
Hip per foot of common run (20.78 in.)	in.	20.78	20.78	+0.00		Pass

UNEQUAL: Hip roof with steeper ends (8:12 sides, 12:12 ends)

Source: Hand calculation (right-triangle trigonometry). Calculation: Roof geometry.

UNEQUAL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
End run	ft	8.000	8.000	+0.00		Pass
Ridge length	ft	24.00	24.00	+0.00		Pass
Hip length	ft	16.49	16.49	+0.00		Pass
Roof surface area	ft²	1,195	1,195	+0.00		Pass

OVERHANG: Hip roof 40 ft × 30 ft at 6:12, 2 ft overhang

Source: Hand calculation (right-triangle trigonometry). Calculation: Roof geometry.

OVERHANG · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Roof surface area	ft²	1,673	1,673	+0.00		Pass
Common rafter, ridge to eave	ft	19.01	19.01	+0.00		Pass
Hip, ridge to eave	ft	25.50	25.50	+0.00		Pass

GABLE: Gable roof 40 ft × 30 ft at 6:12 with eaves and rakes

Source: Hand calculation (right-triangle trigonometry). Calculation: Roof geometry.

GABLE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Roof surface area	ft²	1,550	1,550	+0.00		Pass
Ridge length	ft	42.00	42.00	+0.00		Pass
Plan area	ft²	1,386	1,386	+0.00		Pass

VALLEY: Valleys of a 20 ft wing at 6:12

Source: Hand calculation (right-triangle trigonometry); framing-square rafter table (to confirm). Calculation: Roof geometry.

VALLEY · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Valley length	ft	15.00	15.00	+0.00		Pass

METRIC: Gable 10 m wide at 30° (metric)

Source: Hand calculation (right-triangle trigonometry). Calculation: Roof geometry.

METRIC · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rise (2.887 m)	ft	9.471	9.471	-0.00		Pass
Common rafter (5.774 m)	ft	18.94	18.94	-0.00		Pass

SDOF: Mass on a spring, harmonic force

Source: Chopra, Dynamics of Structures, 5th Ed., Eqs. 2.1.4, 3.2.11, 3.2.12; hand calculation. Calculation: Natural frequency and dynamic response.

SDOF · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Natural frequency	Hz	6.993	6.993	+0.00		Pass
Natural period		0.143	0.143	+0.00		Pass
Dynamic amplification		1.225	1.225	+0.00		Pass
Phase lag		1.205	1.205	+0.00		Pass
Transmissibility		1.225	1.225	+0.00		Pass
Largest displacement		0.025	0.025	+0.00		Pass

BEAM-SS: Simply supported beam, first three modes

Source: Blevins, Formulas for Natural Frequency and Mode Shape, Table 8-1; AISC Design Guide 11 (2016) Eq. 3-3. Calculation: Natural frequency and dynamic response.

BEAM-SS · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
First mode, Blevins	Hz	9.996	9.996	+0.00		Pass
First mode, DG11 Eq. 3-3	Hz	10.04	9.996	-0.42		Pass
Second mode	Hz	39.98	39.98	+0.00		Pass
Third mode	Hz	89.96	89.96	+0.00		Pass
Stiffness at midspan	kip/in.	100.7	100.7	+0.00		Pass

BEAM-CANT: Cantilever, first mode

Source: Blevins, Formulas for Natural Frequency and Mode Shape, Table 8-1. Calculation: Natural frequency and dynamic response.

BEAM-CANT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
First mode	Hz	3.561	3.561	+0.00		Pass
Stiffness at the tip		6.293	6.293	+0.00		Pass

BEAM-FF: Fixed-fixed beam, first mode

Source: Blevins, Formulas for Natural Frequency and Mode Shape, Table 8-1. Calculation: Natural frequency and dynamic response.

BEAM-FF · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
First mode	Hz	22.66	22.66	+0.00		Pass

BEAM-FP: Fixed-pinned beam, first mode

Source: Blevins, Formulas for Natural Frequency and Mode Shape, Table 8-1. Calculation: Natural frequency and dynamic response.

BEAM-FP · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
First mode	Hz	15.62	15.62	+0.00		Pass
Stiffness at midspan		230.2	230.2	+0.00		Pass

PULSE-RECT: Rectangular pulse, td = Tn / 4

Source: Chopra, Dynamics of Structures, 5th Ed., 4.7. Calculation: Natural frequency and dynamic response.

PULSE-RECT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Dynamic amplification		1.414	1.414	+0.00		Pass

PULSE-SINE: Half-cycle sine pulse, td = Tn / 4

Source: Chopra, Dynamics of Structures, 5th Ed., 4.8. Calculation: Natural frequency and dynamic response.

PULSE-SINE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Dynamic amplification		0.943	0.943	+0.00		Pass

PULSE-SINE-1: Half-cycle sine pulse, td = Tn

Source: Chopra, Dynamics of Structures, 5th Ed., 4.8. Calculation: Natural frequency and dynamic response.

PULSE-SINE-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Dynamic amplification		1.732	1.732	-0.00		Pass

SP-1: Solid rectangle 4 × 12 in

Source: Hand calculation (closed form). Calculation: Section properties.

SP-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A	in.²	48.00	48.00	+0.00		Pass
Ix	in.⁴	576.0	576.0	+0.00		Pass
Iy	in.⁴	64.00	64.00	+0.00		Pass
Sx	in.³	96.00	96.00	+0.00		Pass
Zx	in.³	144.0	144.0	+0.00		Pass
J (Roark)	in.⁴	202.3	202.2	-0.03		Pass

SP-2: Solid circle D = 10 in

Source: Hand calculation (closed form). Calculation: Section properties.

SP-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A	in.²	78.54	78.54	-0.00		Pass
I	in.⁴	490.9	490.9	+0.00		Pass
S	in.³	98.17	98.17	-0.00		Pass
Z	in.³	166.7	166.7	-0.00		Pass
J	in.⁴	981.8	981.7	-0.00		Pass

SP-3: Tube D = 10 in, t = 0.5 in

Source: Hand calculation (closed form). Calculation: Section properties.

SP-3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
I	in.⁴	168.8	168.8	+0.00		Pass
Z	in.³	45.17	45.17	-0.00		Pass

SP-4: I-shape from plates (W14X90 dimensions, no fillets)

Source: Hand calculation (closed form). Calculation: Section properties.

SP-4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A	in.²	26.12	26.13	+0.00		Pass
Ix	in.⁴	983.0	983.0	+0.00		Pass
Zx	in.³	154.2	154.2	-0.00		Pass

SP-5: T-shape 6 × 8 in

Source: Hand calculation (closed form). Calculation: Section properties.

SP-5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ȳ from the bottom	in.	5.750	5.750	+0.00		Pass
Ix	in.⁴	38.12	38.12	-0.00		Pass
Zx	in.³	12.00	12.00	-0.00		Pass

SP-6: Equal-leg angle 4 × 4 × 1/2 in (no fillet)

Source: Hand calculation (closed form). Calculation: Section properties.

SP-6 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A	in.²	3.750	3.750	+0.00		Pass
ȳ	in.	1.183	1.183	+0.00		Pass
Ix	in.⁴	5.562	5.561	-0.00		Pass
Ixy	in.⁴	-3.267	-3.267	-0.00		Pass
I2 (minor principal)	in.⁴	2.295	2.295	-0.00		Pass

SP-7: W14X90 from plates with fillets

Source: AISC Shapes Database v16.0, W14X90. Calculation: Section properties.

Fillet radius kdes − tf; the database values include the rolled flange-tip rounding.

SP-7 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A	in.²	26.50	26.43	-0.25		Pass
Ix	in.⁴	999.0	994.8	-0.43		Pass
Iy	in.⁴	362.0	360.9	-0.31		Pass
Sx	in.³	143.0	142.1	-0.62		Pass
Zx	in.³	157.0	156.1	-0.55		Pass
Zy	in.³	75.60	75.36	-0.32		Pass

SP-8: HSS8X4X1/2 from its walls

Source: AISC Shapes Database v16.0, HSS8X4X1/2. Calculation: Section properties.

Design wall thickness tdes = 0.465 in, outside corner radius 2 tdes (AISC Manual Part 1). AISC tabulates J by Bredt's thin-walled formula; the finite element J of the solid wall is 61.9 in.⁴, also shown in the result.

SP-8 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A	in.²	9.740	9.738	-0.02		Pass
Ix	in.⁴	71.80	71.74	-0.08		Pass
Iy	in.⁴	23.60	23.59	-0.03		Pass
Sx	in.³	17.90	17.94	+0.20		Pass
Zx	in.³	23.50	23.46	-0.18		Pass
J (AISC basis, Bredt)	in.⁴	61.10	61.05	-0.08		Pass

SP-9: W24X68 from its tabulated dimensions

Source: AISC Shapes Database v16.0, W24X68, pp. row W24X68. Calculation: Section properties.

SP-9 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A	in.²	20.10	20.06	-0.18		Pass
Ix	in.⁴	1,830	1,825	-0.28		Pass
Iy	in.⁴	70.40	70.53	+0.18		Pass
Sx	in.³	154.0	154.0	-0.00		Pass
Zx	in.³	177.0	176.4	-0.34		Pass
Zy	in.³	24.50	24.57	+0.31		Pass
J	in.⁴	1.870	1.875	+0.27		Pass

SP-10: W8X31 from its tabulated dimensions

Source: AISC Shapes Database v16.0, W8X31, pp. row W8X31. Calculation: Section properties.

SP-10 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A	in.²	9.130	9.125	-0.05		Pass
Ix	in.⁴	110.0	109.9	-0.08		Pass
Iy	in.⁴	37.10	37.14	+0.11		Pass
Sx	in.³	27.50	27.48	-0.08		Pass
Zx	in.³	30.40	30.41	+0.04		Pass
Zy	in.³	14.10	14.10	-0.03		Pass

SP-11: W36X150 from its tabulated dimensions

Source: AISC Shapes Database v16.0, W36X150, pp. row W36X150. Calculation: Section properties.

SP-11 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A	in.²	44.30	44.31	+0.01		Pass
Ix	in.⁴	9,040	9,083	+0.47		Pass
Iy	in.⁴	270.0	271.5	+0.57		Pass
Sx	in.³	504.0	506.0	+0.40		Pass
Zx	in.³	581.0	583.3	+0.40		Pass
Zy	in.³	70.90	71.23	+0.47		Pass

SP-12: HSS6X6X3/8 from its tabulated dimensions

Source: AISC Shapes Database v16.0, HSS6X6X3/8, pp. row HSS6X6X3/8. Calculation: Section properties.

SP-12 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A	in.²	7.580	7.575	-0.06		Pass
Ix	in.⁴	39.50	39.45	-0.13		Pass
Sx	in.³	13.20	13.15	-0.38		Pass
Zx	in.³	15.80	15.82	+0.11		Pass
J (AISC basis, Bredt)	in.⁴	64.60	64.62	+0.04		Pass

SP-13: HSS12X8X5/8 from its tabulated dimensions

Source: AISC Shapes Database v16.0, HSS12X8X5/8, pp. row HSS12X8X5/8. Calculation: Section properties.

SP-13 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A	in.²	21.00	21.02	+0.10		Pass
Ix	in.⁴	397.0	396.4	-0.14		Pass
Iy	in.⁴	210.0	210.1	+0.05		Pass
Sx	in.³	66.10	66.07	-0.04		Pass
Zx	in.³	82.10	82.08	-0.03		Pass
J (AISC basis, Bredt)	in.⁴	454.0	453.9	-0.01		Pass

SP-14: HSS10.000X0.500 from its tabulated dimensions

Source: AISC Shapes Database v16.0, HSS10.000X0.500, pp. row HSS10.000X0.500. Calculation: Section properties.

SP-14 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A	in.²	13.90	13.93	+0.21		Pass
I	in.⁴	159.0	158.7	-0.20		Pass
S	in.³	31.70	31.73	+0.11		Pass
Z	in.³	42.30	42.31	+0.02		Pass
J	in.⁴	317.0	317.3	+0.11		Pass

SP-15: HSS6.625X0.280 from its tabulated dimensions

Source: AISC Shapes Database v16.0, HSS6.625X0.280, pp. row HSS6.625X0.280. Calculation: Section properties.

SP-15 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A	in.²	5.200	5.199	-0.02		Pass
I	in.⁴	26.40	26.37	-0.10		Pass
S	in.³	7.960	7.962	+0.02		Pass
Z	in.³	10.50	10.54	+0.37		Pass
J	in.⁴	52.70	52.75	+0.09		Pass

SP-16: WT7X45 from its tabulated dimensions

Source: AISC Shapes Database v16.0, WT7X45, pp. row WT7X45. Calculation: Section properties.

SP-16 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A	in.²	13.20	13.22	+0.16		Pass
Ix	in.⁴	36.50	36.44	-0.16		Pass
Iy	in.⁴	181.0	180.4	-0.31		Pass
Zx	in.³	11.50	11.47	-0.25		Pass
ȳ from the stem tip = d − y = 7.01 − 1.09	in.	5.920	5.914	-0.09		Pass

SP-17: C10X20 from its tabulated dimensions

Source: AISC Shapes Database v16.0, C10X20, pp. row C10X20. Calculation: Section properties.

Sloped flanges of 1:6 with tf at mid-outstand, r from kdes, toe radius r / 2: the database row's geometry.

SP-17 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A	in.²	5.870	5.870	-0.00		Pass
Ix	in.⁴	78.90	78.78	-0.15		Pass
Iy	in.⁴	2.800	2.804	+0.13		Pass
Sx	in.³	15.80	15.76	-0.28		Pass
Zx	in.³	19.40	19.38	-0.12		Pass
Zy	in.³	2.700	2.695	-0.18		Pass
J	in.⁴	0.368	0.368	+0.08		Pass
ho	in.	9.560	9.564	+0.04		Pass
x̄	in.	0.606	0.606	-0.01		Pass
rts	in.	0.894	0.895	+0.06		Pass
Wno	in.²	8.250	8.245	-0.06		Pass
eo	in.	0.636	0.637	+0.13		Pass
Qf	in.³	4.920	4.923	+0.05		Pass
Qw	in.³	9.660	9.651	-0.09		Pass
Sw1	in.⁴	3.100	3.099	-0.03		Pass

SP-18: L4X4X1/2 from its tabulated dimensions

Source: AISC Shapes Database v16.0, L4X4X1/2, pp. row L4X4X1/2. Calculation: Section properties.

SP-18 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A	in.²	3.750	3.765	+0.40		Pass
Ix	in.⁴	5.520	5.510	-0.18		Pass
y	in.	1.180	1.174	-0.47		Pass
J	in.⁴	0.322	0.321	-0.27		Pass
Cw (AISC basis)	in.⁶	0.366	0.366	+0.06		Pass
Iz (minor principal)	in.⁴	2.250	2.284	+1.52		Deviation AISC-L-TOES
AISC-L-TOES: 2.28 in.⁴ with the assumed toe radius r / 2						

SP-19: W14X90 from its tabulated dimensions

Source: AISC Shapes Database v16.0, W14X90, pp. row W14X90. Calculation: Section properties.

The database row's dimensions: d, bf, tw, tf, r = kdes − tf. The finite element Cw on the true outline is 15,830 in.⁶, also shown.

SP-19 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A	in.²	26.50	26.43	-0.25		Pass
Ix	in.⁴	999.0	994.8	-0.43		Pass
Iy	in.⁴	362.0	360.9	-0.31		Pass
Sx	in.³	143.0	142.1	-0.62		Pass
Zx	in.³	157.0	156.1	-0.55		Pass
Zy	in.³	75.60	75.36	-0.32		Pass
J	in.⁴	4.060	4.061	+0.03		Pass
Cw (AISC basis, Iy ho² / 4)	in.⁶	16,000	15,935	-0.40		Pass
ho	in.	13.30	13.29	-0.08		Pass
rts	in.	4.100	4.108	+0.19		Pass
Wno	in.²	48.20	48.18	-0.05		Pass
Sw1	in.⁴	124.0	124.0	-0.01		Pass
Qf	in.³	33.20	33.17	-0.10		Pass
Qw	in.³	77.10	77.11	+0.02		Pass

SP-20: Square bar 4 × 4 in: J by the series

Source: Hand calculation (closed form). Calculation: Section properties.

SP-20 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
J = 0.1406 a^4	$in.^4$	35.99	35.99	+0.00		Pass

SP-21: Rectangle 4 × 8 in: J by the series

Source: Hand calculation (closed form). Calculation: Section properties.

SP-21 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
J = 0.2287 a b³	in.⁴	117.1	117.1	-0.01		Pass

SP-22: Rectangle 1 × 10 in: J by the series

Source: Hand calculation (closed form). Calculation: Section properties.

SP-22 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
J = 0.3123 a b³	in.⁴	3.123	3.123	+0.01		Pass

SP-23: Circle D = 10 in: shear area at a Poisson's ratio of 0.3

Source: Hand calculation (closed form). Calculation: Section properties.

The energy value $6(1+\nu)^2/(7+14\nu+8\nu^2)$ A, not Cowper's 0.886 A.

SP-23 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
$J = \pi D^4 / 32$	$in.^4$	981.7	981.7	-0.00		Pass
$Asy = 0.851 A$	$in.^2$	66.81	66.81	-0.00		Pass
xo	in.	0.000	0.000	+0.00		Pass

SP-24: Ring D = 10 in, t = 1 in

Source: Hand calculation (closed form). Calculation: Section properties.

SP-24 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A = π (D² − Di²) / 4	in.²	28.27	28.27	+0.00		Pass
I = π (D⁴ − Di⁴) / 64	in.⁴	289.8	289.8	+0.00		Pass
Z = (D³ − Di³) / 6	in.³	81.33	81.33	+0.00		Pass
J = π (D⁴ − Di⁴) / 32	in.⁴	579.6	579.6	-0.00		Pass

SP-25: Channel, thin-walled closed forms, d = 10, bf = 4, tf = tw = 0.25 in

Source: Hand calculation (closed form). Calculation: Section properties.

SP-25 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
J = (2 b tf³ + h tw³) / 3	in.⁴	0.091	0.091	+0.00		Pass
Cw, Vlasov	in.⁶	108.7	108.7	-0.00		Pass
e from the web centre line	in.	1.365	1.365	+0.00		Pass

SP-26: UPE 400 from its dimensions: catalog plastic modulus

Source: ArcelorMittal catalog (published), hand calculation, pp. row UPE 400. Calculation: Section properties.

SP-26 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Iy	in.⁴	25.11	25.10	-0.03		Pass
Zy (catalog)	in.³	11.66	13.48	+15.62		Deviation SECT-UPE-ZY
SECT-UPE-ZY: 220.8 cm³ from the geometry; 220 cm³ by hand						

SP-27: HP12X53: published value against the geometry

Source: AISC Shapes Database v16.0, HP12X53, pp. row. Calculation: Section properties.

SP-27 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
PA (shape perimeter minus one flange)	in.	3.290	57.54	+1648.84		Deviation SECT-HP-PA
SECT-HP-PA: 57.5 in. from the geometry						

SP-28: M3X2.9: published value against the geometry

Source: AISC Shapes Database v16.0, M3X2.9, pp. row. Calculation: Section properties.

SP-28 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A	in.²	0.914	0.852	-6.76		Deviation SECT-M-WEIGHT
SECT-M-WEIGHT: 0.852 in.², the nominal weight's area						

SP-29: MC10X6.5: published value against the geometry

Source: AISC Shapes Database v16.0, MC10X6.5, pp. row. Calculation: Section properties.

SP-29 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Iy	in.⁴	0.133	0.122	-8.41		Deviation SECT-MC-SLOPE
SECT-MC-SLOPE: with the stated slope rule						

SP-30: Pipe20XS: published value against the geometry

Source: AISC Shapes Database v16.0, Pipe20XS, pp. row. Calculation: Section properties.

SP-30 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
A	in.²	27.60	28.54	+3.40		Deviation SECT-PIPE-AREA
SECT-PIPE-AREA: 28.5 in.² from the row's diameter and design wall						

SP-31: 1000T250-54: published value against the geometry

Source: SSMA 2022 Product Technical Guide, 1000T250-54, pp. row. Calculation: Section properties.

SP-31 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
rx	in.	3.577	3.757	+5.02		Deviation SECT-SSMA-RX
SECT-SSMA-RX: 3.757 in. from the guide's own Ix and A						

SP-32: HEAA 800: published value against the geometry

Source: ArcelorMittal catalog, HEAA 800, pp. row. Calculation: Section properties.

SP-32 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
J	in.⁴	6.170	5.750	-6.80		Deviation SECT-J-SOURCES
SECT-J-SOURCES: 239 cm⁴ on the true outline						

SP-33: C10X20 on the true outline: published value against the geometry

Source: AISC Shapes Database v16.0, C10X20, pp. row. Calculation: Section properties.

SP-33 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cw on the true outline	in.⁶	56.90	44.15	-22.41		Deviation SECT-TW-BASIS
SECT-TW-BASIS: 44.7 in.⁶ on the true outline; the thin-walled basis matches, see the C10X20 example						

SRW-HC1: Three-course conventional wall

Source: Hand calculation (closed form). Calculation: Segmental retaining wall.

SRW-HC1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Batter ω = atan(setback / unit height)		7.125	7.125	+0.00		Pass
Coulomb Ka on the battered back		0.243	0.243	+0.00		Pass
Sliding force Pa cos(δ − ω')	kip/ft	0.056	0.056	+0.00		Pass
Sliding resistance μN ÷ 1.5	kip/ft	0.157	0.157	+0.00		Pass
Overturning moment	kip-ft	0.037	0.037	+0.00		Pass
Resisting moment ÷ 2.0	kip-ft	0.169	0.169	-0.00		Pass
Interface shear capacity at the first joint ÷ 1.5	kip/ft	0.766	0.766	+0.00		Pass

EQ-1: Four-story steel SCBF, short period (Cs by Eq. 12.8-3)

Source: Hand calculation (closed form). Calculation: Seismic base shear (ELF).

Σ wx hx = 1,000(15 + 28 + 41) + 800(54) = 127,200 kip-ft; R = 6, Cd = 5 (Table 12.2-1 B.2).

EQ-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ta = 0.02 (54)^0.75	s	0.398	0.398	+0.00		Pass
Cs = SDS/(R/Ie) = 1.0/6		0.167	0.167	-0.00		Pass
V = Cs W = 0.16667 × 3,800	kips	633.3	633.3	+0.00		Pass
F4 = V × 800(54) / 127,200 (k = 1)	kips	215.1	215.1	+0.00		Pass
F1 = V × 1,000(15) / 127,200	kips	74.69	74.69	-0.01		Pass
Base overturning Σ Fx hx = V × 5,022,800 / 127,200	kip-ft	25,009	25,009	+0.00		Pass
Story 2 drift Δ = 5 (0.60 − 0.30) / 1.0	in.	1.500	1.500	+0.00		Pass
Allowable Δa = 0.020 × 13 ft × 12	in.	3.120	3.120	+0.00		Pass

EQ-2: Ten-story steel SMF, analytical period capped at Cu Ta, Cs by Eq. 12.8-6

Source: Hand calculation (closed form). Calculation: Seismic base shear (ELF).

Cs,max = 0.3 / (1.8056 × 8) = 0.0208 (Eq. 12.8-4) < Cs,min = 0.0352, so Eq. 12.8-6 governs.

EQ-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ta = 0.028 (120)^0.8	s	1.290	1.290	+0.00		Pass
T = Cu Ta = 1.4 × 1.2897 (< 2.2 s analytical)	s	1.806	1.806	+0.00		Pass
k = 1 + (1.8056 − 0.5)/2		1.653	1.653	+0.00		Pass
Cs = 0.044 SDS Ie = 0.044 × 0.8		0.035	0.035	+0.00		Pass
V = 0.0352 × 5,000	kips	176.0	176.0	+0.00		Pass
F10 = V × 500 (120)^k / Σ wi hi^k	kips	41.09	41.09	+0.01		Pass
Base overturning	kip-ft	16,074	16,074	+0.00		Pass

EQ-3: Twenty-story steel SMF, S1 ≥ 0.6 g (Cs by Eq. 12.8-7)

Source: Hand calculation (closed form). Calculation: Seismic base shear (ELF).

Cs,max = 0.8 / (2.2456 × 8) = 0.0445 (Eq. 12.8-4) and Cs,min = 0.044 (Eq. 12.8-6); Eq. 12.8-7 (0.050) governs. SDC E (S1 ≥ 0.75 g).

EQ-3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ta = 0.028 (240)^0.8	s	2.246	2.246	-0.00		Pass
Cs = 0.5 S1/(R/Ie) = 0.5 × 0.8 / 8		0.050	0.050	+0.00		Pass
V = 0.05 × 20,000	kips	1,000	1,000	+0.00		Pass

T12.2-1 B.1: Table 12.2-1 line B.1: R, Ω0, Cd

Source: ASCE/SEI 7-22, Table 12.2-1, pp. PDF p. 173. Calculation: Seismic base shear (ELF).

T12.2-1 B.1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (B.1)		8.000	8.000	+0.00		Pass
Ω0 (B.1)		2.000	2.000	+0.00		Pass
Cd (B.1)		4.000	4.000	+0.00		Pass

T12.2-1 B.2: Table 12.2-1 line B.2: R, Ω0, Cd

Source: ASCE/SEI 7-22, Table 12.2-1, pp. PDF p. 173. Calculation: Seismic base shear (ELF).

T12.2-1 B.2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (B.2)		6.000	6.000	+0.00		Pass
Ω0 (B.2)		2.000	2.000	+0.00		Pass
Cd (B.2)		5.000	5.000	+0.00		Pass

T12.2-1 B.3: Table 12.2-1 line B.3: R, Ω0, Cd

Source: ASCE/SEI 7-22, Table 12.2-1, pp. PDF p. 173. Calculation: Seismic base shear (ELF).

T12.2-1 B.3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (B.3)		3.250	3.250	+0.00		Pass
Ω0 (B.3)		2.000	2.000	+0.00		Pass
Cd (B.3)		3.250	3.250	+0.00		Pass

T12.2-1 B.4: Table 12.2-1 line B.4: R, Ω0, Cd

Source: ASCE/SEI 7-22, Table 12.2-1, pp. PDF p. 173. Calculation: Seismic base shear (ELF).

T12.2-1 B.4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (B.4)		6.000	6.000	+0.00		Pass
Ω0 (B.4)		2.500	2.500	+0.00		Pass
Cd (B.4)		5.000	5.000	+0.00		Pass

T12.2-1 A.1: Table 12.2-1 line A.1: R, Ω0, Cd

Source: ASCE/SEI 7-22, Table 12.2-1, pp. PDF p. 173. Calculation: Seismic base shear (ELF).

T12.2-1 A.1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (A.1)		5.000	5.000	+0.00		Pass
Ω0 (A.1)		2.500	2.500	+0.00		Pass
Cd (A.1)		5.000	5.000	+0.00		Pass

T12.2-1 A.8: Table 12.2-1 line A.8: R, Ω0, Cd

Source: ASCE/SEI 7-22, Table 12.2-1, pp. PDF p. 173. Calculation: Seismic base shear (ELF).

T12.2-1 A.8 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (A.8)		5.000	5.000	+0.00		Pass
Ω0 (A.8)		2.500	2.500	+0.00		Pass
Cd (A.8)		3.500	3.500	+0.00		Pass

T12.2-1 A.10: Table 12.2-1 line A.10: R, Ω0, Cd

Source: ASCE/SEI 7-22, Table 12.2-1, pp. PDF p. 173. Calculation: Seismic base shear (ELF).

T12.2-1 A.10 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (A.10)		2.000	2.000	+0.00		Pass
Ω0 (A.10)		2.500	2.500	+0.00		Pass
Cd (A.10)		1.750	1.750	+0.00		Pass

T12.2-1 A.16: Table 12.2-1 line A.16: R, Ω0, Cd

Source: ASCE/SEI 7-22, Table 12.2-1, pp. PDF p. 173. Calculation: Seismic base shear (ELF).

T12.2-1 A.16 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (A.16)		6.500	6.500	+0.00		Pass
Ω0 (A.16)		3.000	3.000	+0.00		Pass
Cd (A.16)		4.000	4.000	+0.00		Pass

T12.2-1 A.17: Table 12.2-1 line A.17: R, Ω0, Cd

Source: ASCE/SEI 7-22, Table 12.2-1, pp. PDF p. 173. Calculation: Seismic base shear (ELF).

T12.2-1 A.17 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (A.17)		6.500	6.500	+0.00		Pass
Ω0 (A.17)		3.000	3.000	+0.00		Pass
Cd (A.17)		4.000	4.000	+0.00		Pass

T12.2-1 B.26: Table 12.2-1 line B.26: R, Ω0, Cd

Source: ASCE/SEI 7-22, Table 12.2-1, pp. PDF p. 174. Calculation: Seismic base shear (ELF).

T12.2-1 B.26 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (B.26)		8.000	8.000	+0.00		Pass
Ω0 (B.26)		2.500	2.500	+0.00		Pass
Cd (B.26)		5.000	5.000	+0.00		Pass

T12.2-1 C.1: Table 12.2-1 line C.1: R, Ω0, Cd

Source: ASCE/SEI 7-22, Table 12.2-1, pp. PDF p. 174. Calculation: Seismic base shear (ELF).

T12.2-1 C.1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (C.1)		8.000	8.000	+0.00		Pass
Ω0 (C.1)		3.000	3.000	+0.00		Pass
Cd (C.1)		5.500	5.500	+0.00		Pass

T12.2-1 C.3: Table 12.2-1 line C.3: R, Ω0, Cd

Source: ASCE/SEI 7-22, Table 12.2-1, pp. PDF p. 174. Calculation: Seismic base shear (ELF).

T12.2-1 C.3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (C.3)		4.500	4.500	+0.00		Pass
Ω0 (C.3)		3.000	3.000	+0.00		Pass
Cd (C.3)		4.000	4.000	+0.00		Pass

T12.2-1 C.4: Table 12.2-1 line C.4: R, Ω0, Cd

Source: ASCE/SEI 7-22, Table 12.2-1, pp. PDF p. 174. Calculation: Seismic base shear (ELF).

T12.2-1 C.4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (C.4)		3.500	3.500	+0.00		Pass
Ω0 (C.4)		3.000	3.000	+0.00		Pass
Cd (C.4)		3.000	3.000	+0.00		Pass

T12.2-1 C.5: Table 12.2-1 line C.5: R, Ω0, Cd

Source: ASCE/SEI 7-22, Table 12.2-1, pp. PDF p. 174. Calculation: Seismic base shear (ELF).

T12.2-1 C.5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (C.5)		8.000	8.000	+0.00		Pass
Ω0 (C.5)		3.000	3.000	+0.00		Pass
Cd (C.5)		5.500	5.500	+0.00		Pass

T12.2-1 H: Table 12.2-1 line H: R, Ω0, Cd

Source: ASCE/SEI 7-22, Table 12.2-1, pp. PDF p. 175. Calculation: Seismic base shear (ELF).

T12.2-1 H · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (H)		3.000	3.000	+0.00		Pass
Ω0 (H)		3.000	3.000	+0.00		Pass
Cd (H)		3.000	3.000	+0.00		Pass

T12.8-1 SD1=0.4: Table 12.8-1: Cu at SD1 = 0.4

Source: ASCE/SEI 7-22, Table 12.8-1, pp. PDF p. 186. Calculation: Seismic base shear (ELF).

T12.8-1 SD1=0.4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cu (SD1 = 0.4)		1.400	1.400	+0.00		Pass

T12.8-1 SD1=0.3: Table 12.8-1: Cu at SD1 = 0.3

Source: ASCE/SEI 7-22, Table 12.8-1, pp. PDF p. 186. Calculation: Seismic base shear (ELF).

T12.8-1 SD1=0.3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cu (SD1 = 0.3)		1.400	1.400	+0.00		Pass

T12.8-1 SD1=0.2: Table 12.8-1: Cu at SD1 = 0.2

Source: ASCE/SEI 7-22, Table 12.8-1, pp. PDF p. 186. Calculation: Seismic base shear (ELF).

T12.8-1 SD1=0.2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cu (SD1 = 0.2)		1.500	1.500	+0.00		Pass

T12.8-1 SD1=0.15: Table 12.8-1: Cu at SD1 = 0.15

Source: ASCE/SEI 7-22, Table 12.8-1, pp. PDF p. 186. Calculation: Seismic base shear (ELF).

T12.8-1 SD1=0.15 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cu (SD1 = 0.15)		1.600	1.600	+0.00		Pass

T12.8-1 SD1=0.1: Table 12.8-1: Cu at SD1 = 0.1

Source: ASCE/SEI 7-22, Table 12.8-1, pp. PDF p. 186. Calculation: Seismic base shear (ELF).

T12.8-1 SD1=0.1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cu (SD1 = 0.1)		1.700	1.700	+0.00		Pass

T12.8-2 steel_mf: Table 12.8-2: Ct, x (steel_mf)

Source: ASCE/SEI 7-22, Table 12.8-2, pp. PDF p. 186. Calculation: Seismic base shear (ELF).

T12.8-2 steel_mf · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ct		0.028	0.028	+0.00		Pass
x		0.800	0.800	+0.00		Pass

T12.8-2 conc_mf: Table 12.8-2: Ct, x (conc_mf)

Source: ASCE/SEI 7-22, Table 12.8-2, pp. PDF p. 186. Calculation: Seismic base shear (ELF).

T12.8-2 conc_mf · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ct		0.016	0.016	+0.00		Pass
x		0.900	0.900	+0.00		Pass

T12.8-2 ebf: Table 12.8-2: Ct, x (ebf)

Source: ASCE/SEI 7-22, Table 12.8-2, pp. PDF p. 186. Calculation: Seismic base shear (ELF).

T12.8-2 ebf · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ct		0.030	0.030	+0.00		Pass
x		0.750	0.750	+0.00		Pass

T12.8-2 other: Table 12.8-2: Ct, x (other)

Source: ASCE/SEI 7-22, Table 12.8-2, pp. PDF p. 186. Calculation: Seismic base shear (ELF).

T12.8-2 other · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ct		0.020	0.020	+0.00		Pass
x		0.750	0.750	+0.00		Pass

T1.5-2 I: Table 1.5-2: Ie, risk category I

Source: ASCE/SEI 7-22, Table 1.5-2, pp. PDF p. 66. Calculation: Seismic base shear (ELF).

T1.5-2 I · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ie (risk category I)		1.000	1.000	+0.00		Pass

T1.5-2 II: Table 1.5-2: Ie, risk category II

Source: ASCE/SEI 7-22, Table 1.5-2, pp. PDF p. 66. Calculation: Seismic base shear (ELF).

T1.5-2 II · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ie (risk category II)		1.000	1.000	+0.00		Pass

T1.5-2 III: Table 1.5-2: Ie, risk category III

Source: ASCE/SEI 7-22, Table 1.5-2, pp. PDF p. 66. Calculation: Seismic base shear (ELF).

T1.5-2 III · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ie (risk category III)		1.250	1.250	+0.00		Pass

T1.5-2 IV: Table 1.5-2: Ie, risk category IV

Source: ASCE/SEI 7-22, Table 1.5-2, pp. PDF p. 66. Calculation: Seismic base shear (ELF).

T1.5-2 IV · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ie (risk category IV)		1.500	1.500	+0.00		Pass

AISC-III-seismic: Four-story steel office building, SDC B, steel system not detailed (Table III-8)

Source: AISC Design Examples v16.0 (Companion to the Manual, Vol. 1), Part III building design example: seismic load determination, pp. pp. III-64 to III-69 (PDF pp. 1004 to 1009). Calculation: Seismic base shear (ELF).

SDS = 0.129 g, SD1 = 0.096 g (default site), Ie = 1.0, R = 3, TL = 12 s; S1 is not stated in the example (any value below 0.6 g gives the same result). The example's base-shear row of Table III-8 lists ΣFx = 355 kips (rounded story forces); SDC B in the program as in the example (Table 11.6-2).

AISC-III-seismic · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ta = 0.02 (55)^0.75	s	0.404	0.404	-0.02		Pass
Cs = SDS/(R/Ie) = 0.129/3		0.043	0.043	+0.00		Pass
Cs,max = SD1/(T R/Ie) (Eq. 12.8-4)		0.079	0.079	+0.03		Pass
V = 0.0430 × 8,280	kips	356.0	356.0	+0.01		Pass
F roof	kips	64.80	64.89	+0.14		Pass
F 4th	kips	146.0	146.3	+0.18		Pass
F 3rd	kips	97.20	97.50	+0.31		Pass
F 2nd	kips	47.30	47.39	+0.20		Pass
V 3rd story	kips	308.0	308.6	+0.21		Pass
V 4th story	kips	211.0	211.1	+0.07		Pass
M at the 4th floor	kip-ft	940.0	940.9	+0.09		Pass
M at the 3rd floor	kip-ft	3,790	3,791	+0.03		Pass
M at the 2nd floor	kip-ft	7,940	7,958	+0.23		Pass
Overturning moment at the base	kip-ft	12,700	12,765	+0.51		Pass
Ev = 0.2 SDS = 0.0258 (× D)		0.026	0.026	+0.00		Pass
Ω0 (Table 12.2-1 H)		3.000	3.000	+0.00		Pass

P2192-4.5: 23-story ductile coupled concrete wall building: period cap, Cs, V and story drift

Source: FEMA P-2192-V1 (2020 NEHRP Recommended Seismic Provisions: Design Examples), Section 4.5.1.7 and Table 4-7, pp. pp. 147 to 151. Calculation: Seismic base shear (ELF).

Risk Category II, Site Class D, SDC D, R = 8, Cd = 8, Ω0 = 2.5 (ductile coupled walls, entered as a custom system), TL = 8 s. Only W (43,099 kips) is given; it is spread evenly over the 22 levels (V and the drifts do not depend on the distribution). The elastic displacements entered are δx/Cd from the δx column of Table 4-7 (MRSA, X direction); the published relative drifts are compared. The example's equation numbers follow ASCE 7-16.

P2192-4.5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ta = 0.02 (234.25)^0.75	s	1.200	1.198	-0.21		Pass
T = Cu Ta = 1.4 × 1.2 (ETABS 2.58 s capped)	s	1.680	1.677	-0.21		Pass
Cs = SDS/(R/Ie) = 1.10/8		0.138	0.138	-0.36		Pass
Cs,max = SD1/(T R/Ie)		0.049	0.048	-0.08		Pass
Cs,min = 0.5 S1/(R/Ie) (S1 ≥ 0.6 g)		0.041	0.041	-0.91		Pass
Cs,min = 0.044 SDS Ie		0.029	0.048	+66.90		Deviation FEMA-P2192-4.5-CSMIN
FEMA-P2192-4.5-CSMIN: the example evaluates 0.044 SDS Ie with 0.65 (SD1) in place of SDS = 1.10; the program computes 0.044 × 1.10 = 0.0484						
Governing Cs		0.048	0.048	+0.96		Pass
V = Cs W (W = 43,099 kips)	kips	2,090	2,089	-0.06		Pass
Story L02 drift (16.25 ft)		0.280	0.282	+0.73		Pass
Story L04 drift (13 ft)		0.800	0.801	+0.16		Pass
Story L07 drift		1.000	0.992	-0.83		Pass
Story L14 drift (largest, 1.11 %)		1.110	1.108	-0.15		Pass
Story L23 drift		1.000	0.992	-0.83		Pass
Allowable drift 0.020 hsx at a 10 ft story	in.	2.400	2.400	+0.00		Pass

P2192-5.5: 18-story coupled composite plate shear wall building: k, Cvx, Fx, overturning

Source: FEMA P-2192-V1 (2020 NEHRP Recommended Seismic Provisions: Design Examples), Section 5.5.3.6 and Table 5-4, pp. pp. 191 to 193. Calculation: Seismic base shear (ELF).

SDS = 1.101 g, SD1 = S1 = 0.650 g, Ie = 1.0, R = 8, Cd = 5.5, Ω0 = 2.5 (coupled C-PSW/CF, custom system). The example's equation numbers follow ASCE 7-16; the period caps and Cvx agree.

P2192-5.5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ta = 0.02 (238)^0.75	s	1.210	1.212	+0.16		Pass
T = Cu Ta = 1.4 × 1.21 (ETABS 1.87 s capped)	s	1.700	1.697	-0.20		Pass
Cs = SDS/(R/Ie) = 1.101/8		0.138	0.138	-0.27		Pass
Cs,max = SD1/(T R/Ie)		0.048	0.048	-0.23		Pass
Cs,min = 0.044 SDS Ie		0.048	0.048	+0.93		Pass
Cs,min = 0.5 S1/(R/Ie)		0.041	0.041	-0.91		Pass
Governing Cs		0.048	0.048	+0.93		Pass
k (12.8.3, interpolated)		1.600	1.598	-0.10		Pass
Cvx roof		0.118	0.118	+0.04		Pass
Cvx level 18		0.123	0.123	+0.03		Pass
Cvx level 10		0.046	0.046	-0.76		Pass
V = Cs W	kips	1,238	1,253	+1.18		Deviation FEMA-P2192-5.5-V
FEMA-P2192-5.5-V: the example multiplies the rounded Cs = 0.048 by W = 25,844 kips (Table 5-4 sums 25,855); the program keeps Cs = 0.044 SDS = 0.04844, 1.2 % higher						
F roof	kips	146.2	147.9	+1.14		Deviation FEMA-P2192-5.5-V
FEMA-P2192-5.5-V: the example multiplies the rounded Cs = 0.048 by W = 25,844 kips (Table 5-4 sums 25,855); the program keeps Cs = 0.044 SDS = 0.04844, 1.2 % higher						
Overturning moment Σ Fi hi	kip-ft	217,217	219,762	+1.17		Deviation FEMA-P2192-5.5-V
FEMA-P2192-5.5-V: the example multiplies the rounded Cs = 0.048 by W = 25,844 kips (Table 5-4 sums 25,855); the program keeps Cs = 0.044 SDS = 0.04844, 1.2 % higher						

P2192-6.4: Three-story cross-laminated timber shear wall building: Cs

Source: FEMA P-2192-V1 (2020 NEHRP Recommended Seismic Provisions: Design Examples), Section 6.4, pp. p. 229. Calculation: Seismic base shear (ELF).

CLT shear walls (R = 3, Ω0 = 3, Cd = 3, Table 6-3 of the example); the example gives SDS = 1.0 and V = 0.333 W only. SD1, S1 and the levels entered are placeholders that do not change Cs (short-period plateau).

P2192-6.4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cs = SDS/(R/Ie) = 1.0/3		0.333	0.333	+0.10		Pass

P2192-7.4: One-story wood assembly hall, Risk Category III

Source: FEMA P-2192-V1 (2020 NEHRP Recommended Seismic Provisions: Design Examples), Section 7.4.1, Steps 1 and 2, pp. pp. 267 to 268. Calculation: Seismic base shear (ELF).

Wood structural panel shear walls R = 6.5, Ω0 = 3, Cd = 4; mean roof height 25 ft. S1 is not stated (any value below 0.6 g gives the same Cs).

P2192-7.4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ta = 0.02 (25)^0.75 published to two decimals (0.224)		0.220	0.224	+1.64		Pass
Ie (Risk Category III)		1.250	1.250	+0.00		Pass
Cs = 1.0/(6.5/1.25)		0.192	0.192	+0.16		Pass
Cs,max = 0.60/(0.22 × 6.5/1.25) the example uses Ta rounded to 0.22 s; with 0.224 s the limit is 0.516		0.524	0.516	-1.52		Pass
V = 0.192 × 86,288 lb	kips	16.57	16.59	+0.16		Pass

P2192-7.5: Six-story steel SCBF building with steel deck diaphragms (Table 7-6)

Source: FEMA P-2192-V1 (2020 NEHRP Recommended Seismic Provisions: Design Examples), Section 7.5.1, Steps 1 to 3, pp. pp. 273 to 275. Calculation: Seismic base shear (ELF).

R = 6 (B.2); S1 is not stated (any value below 0.6 g gives the same Cs).

P2192-7.5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ta = 0.02 (72)^0.75 published to two decimals (0.494)		0.490	0.494	+0.89		Pass
Cs = 1.20/6		0.200	0.200	-0.00		Pass
Cs,max = 0.70/(0.49 × 6)		0.238	0.236	-0.84		Pass
V = 0.20 × 8,678	kips	1,736	1,736	-0.02		Pass
k (T ≤ 0.5 s)		1.000	1.000	+0.00		Pass
F roof	kips	302.0	302.4	+0.12		Pass
F 6	kips	478.0	477.7	-0.05		Pass
F 5	kips	382.0	382.2	+0.05		Pass
F 4	kips	287.0	286.6	-0.12		Pass
F 3	kips	191.0	191.1	+0.05		Pass
F 2	kips	96.00	95.55	-0.47		Pass

P2192-7.6: One-story tilt-up building with a bare steel deck diaphragm

Source: FEMA P-2192-V1 (2020 NEHRP Recommended Seismic Provisions: Design Examples), Section 7.6.1, Steps 1 and 2, pp. pp. 286 to 287. Calculation: Seismic base shear (ELF).

Intermediate precast concrete shear walls R = 4, Ω0 = 2.5, Cd = 4 (custom system); S1 not stated.

P2192-7.6 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ta = 0.02 (30)^0.75		0.260	0.256	-1.40		Pass
Cs = 1.0/4		0.250	0.250	+0.00		Pass
Cs,max = 0.50/(0.26 × 4) the example uses Ta rounded to 0.26 s (0.256 s gives 0.488)		0.481	0.488	+1.37		Pass
V = 0.250 × 8,362	kips	2,090	2,090	+0.02		Pass

WW-seismic: Five-story wood-frame upper portion over a podium: Cs, Fx, story drift

Source: WoodWorks, Five-Story Light-Frame Wood Structure Over Podium, design example, 2nd ed. (Nov. 2025), Sections 3.1 and 3.4.5 (Tables 3.1, 3.19), pp. pp. 17, 19 to 20, 49 to 50 (PDF pp. 23, 25 to 26, 55 to 56). Calculation: Seismic base shear (ELF).

Two-stage analysis: the base is the top of the podium (12.2.3.2), five 10 ft wood stories; SDS = 1.206 g, SD1 = S1 = 0.692 g, Ie = 1.0, wood structural panel shear walls R = 6.5, Cd = 4. The elastic displacements entered are the running sums of the shear-wall deflections of Table 3.18 (the example treats them as the elastic story drifts).

WW-seismic · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ta = 0.02 (50)^0.75		0.380	0.376	-1.04		Pass
Cs = 1.206/6.5		0.186	0.186	-0.25		Pass
V = 0.186 × 2,460	kips	458.0	456.4	-0.34		Pass
F roof	kips	133.5	133.1	-0.28		Pass
F 6th	kips	129.6	129.3	-0.22		Pass
F 5th	kips	97.20	96.99	-0.22		Pass
F 4th	kips	64.80	64.66	-0.22		Pass
F 3rd	kips	32.40	32.33	-0.22		Pass
Design story drift, 3rd floor (4 × 0.287)	in.	1.150	1.148	-0.17		Pass
Design story drift, 4th floor (governing, 4 × 0.307)	in.	1.230	1.228	-0.16		Pass
Design story drift, roof (4 × 0.194)	in.	0.780	0.776	-0.51		Pass
Allowable story drift 0.020 × 10 ft	in.	2.400	2.400	+0.00		Pass

MRSA-2DOF-CQC: Two equal masses and stiffnesses, two-period spectrum, CQC

Source: Hand calculation (closed form: shear-building modes; ASCE/SEI 7-22 12.8, 12.9.1). Calculation: Modal response spectrum.

MRSA-2DOF-CQC · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
T1 = 2π / √(0.382 k/m)	s	1.017	1.017	-0.00		Pass
T2 = 2π / √(2.618 k/m)	s	0.388	0.388	+0.00		Pass
Mode 1 effective mass ratio 2.618 / 2.764		0.947	0.947	-0.00		Pass
Mode 2 effective mass ratio		0.053	0.053	+0.00		Pass
Γ1 = 1.618 / 1.382 (roof = 1)		1.171	1.171	+0.00		Pass
ρ12 at r = 0.382, ζ = 0.05		0.009	0.009	+0.00		Pass
Vt by CQC = √(53.959² + 5.095² + 2 ρ12 53.959 × 5.095)	kips	54.24	54.24	-0.00		Pass
ELF V = 0.125 × 772.18 (T = Cu Ta = 0.2648 s)	kips	96.52	96.52	+0.00		Pass
Force scale V / Vt		1.779	1.779	-0.00		Pass
No drift scaling (S1 < 0.6 g)		1.000	1.000	+0.00		Pass

MRSA-2DOF-SRSS: The same, SRSS

Source: Hand calculation (closed form: shear-building modes; ASCE/SEI 7-22 12.8, 12.9.1). Calculation: Modal response spectrum.

MRSA-2DOF-SRSS · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vt by SRSS = √(53.959² + 5.095²)	kips	54.20	54.20	-0.00		Pass
Mode 1 base shear Sa W* / (R/Ie)	kips	53.96	53.96	-0.00		Pass
Sa at T1 = SD1 / T1	g	0.590	0.590	-0.00		Pass
Sa at T2 = SDS (plateau)	g	1.000	1.000	+0.00		Pass

MRSA-UNIFORM-5: Uniform five-story shear building: ωj = 20 sin((2j − 1)π/22)

Source: Hand calculation (closed form: shear-building modes; ASCE/SEI 7-22 12.8, 12.9.1). Calculation: Modal response spectrum.

MRSA-UNIFORM-5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
T1 = 2π / (20 sin(π/22))	s	2.207	2.207	+0.00		Pass
T2 = 2π / (20 sin(3π/22))	s	0.756	0.756	+0.00		Pass
T3 = 2π / (20 sin(5π/22))	s	0.480	0.480	+0.00		Pass
Sum of the effective mass ratios (all modes)		1.000	1.000	-0.00		Pass

MRSA-SDOF: One story in the plateau: Vt = W SDS / R, δ = Cd Sa g / (R ω²)

Source: Hand calculation (closed form: shear-building modes; ASCE/SEI 7-22 12.8, 12.9.1). Calculation: Modal response spectrum.

MRSA-SDOF · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
T = 2π / √1000	s	0.199	0.199	-0.00		Pass
Vt = 386.09 × 1.0 / 8	kips	48.26	48.26	-0.00		Pass
Design displacement Cd Sa g / (R ω²)	in.	0.265	0.265	-0.00		Pass
ELF V = 0.125 W (T = Cu Ta = 0.1575 s): no scaling		1.000	1.000	+0.00		Pass

MRSA-EQ12.8-7: S1 = 0.8 g: Cs by Eq. 12.8-7, drifts scaled by Cs W / Vt

Source: Hand calculation (closed form: shear-building modes; ASCE/SEI 7-22 12.8, 12.9.1). Calculation: Modal response spectrum.

MRSA-EQ12.8-7 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Sa = SDS (0.4 + 0.6 T/T0), T0 = 0.4 s	g	0.209	0.209	-0.00		Pass
Cs = 0.5 S1 / (R/Ie)		0.050	0.050	+0.00		Pass
Drift scale Cs W / Vt = 19.304 / 10.107		1.910	1.910	+0.00		Pass
Force scale V / Vt		1.910	1.910	+0.00		Pass

P1051-17.2-T: Pipe rack, transverse: steel ordinary moment frame (Table 15.4-1)

Source: FEMA P-1051 (2015 NEHRP Provisions: Design Examples), Chapter 17, pp. PDF pp. 883 to 885 (printed 17-7 to 17-9). Calculation: Nonbuilding structures (seismic).

Tier heights are not given by the example (V does not depend on them); W = 36 kips in two tiers.

P1051-17.2-T · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cs = 0.40 / (3.5 / 1.5)		0.171	0.171	+0.25		Pass
Cs,max = 0.18 / (0.42 × 3.5 / 1.5)		0.184	0.184	-0.18		Pass
Cs,min = 0.044 × 1.5 × 0.40 (pipe rack OMF)		0.026	0.026	+0.00		Pass
V = 0.171 × 36 kips	kips	6.200	6.171	-0.46		Pass
Ie (risk category IV)		1.500	1.500	+0.00		Pass

P1051-17.2-L: Pipe rack, longitudinal: steel ordinary braced frame

Source: FEMA P-1051 (2015 NEHRP Provisions: Design Examples), Chapter 17, pp. PDF pp. 886 to 888 (printed 17-10 to 17-12). Calculation: Nonbuilding structures (seismic).

P1051-17.2-L · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cs = 0.40 / (3.25 / 1.5)		0.185	0.185	-0.21		Pass
Cs,max = 0.18 / (0.24 × 3.25 / 1.5)		0.346	0.346	+0.04		Pass
V = 0.185 × 432 kips	kips	79.90	79.75	-0.18		Pass

P1051-17.4: Boiler building: steel OCBF with unlimited height, R = 1.5

Source: FEMA P-1051 (2015 NEHRP Provisions: Design Examples), Chapter 17, pp. PDF pp. 894 to 895 (printed 17-18 to 17-19). Calculation: Nonbuilding structures (seismic).

One level carries the whole weight (the example gives V only); the structure height is not used.

P1051-17.4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cs = 0.327 / (1.90 × 1.5 / 1.25)		0.143	0.143	+0.29		Pass
Cs,min = 0.044 × 1.25 × 0.665 (boiler)		0.037	0.037	-0.07		Pass
V = 0.143 × 48,300	kips	6,907	6,927	+0.29		Pass

P1051-17.7: Skirt-supported vertical vessel, Table 15.4-2 (R = 3)

Source: FEMA P-1051 (2015 NEHRP Provisions: Design Examples), Chapter 17, pp. PDF pp. 908 to 911 (printed 17-32 to 17-35). Calculation: Nonbuilding structures (seismic).

S1 is not given (SD1 = 0.79 g); Eq. 15.4-2 would govern only above S1 = 1.29 g, so S1 = 0.5 g is entered. The row's R, Ω0, Cd are read from the example; the ASCE 7-22 text copy loses them [verify].

P1051-17.7 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cs = 0.79 / (0.762 × 3 / 1.5)		0.518	0.518	+0.07		Pass
Cs,min = 0.044 × 1.5 × 1.86 ≥ 0.03 (Eq. 15.4-1)		0.123	0.123	-0.20		Pass
V = 0.518 × 300 kips	kips	155.4	155.5	+0.07		Pass
k = 1 + (0.762 − 0.5)/2		1.131	1.131	+0.00		Pass
Overturning M = V × 68.1 ft	kip-ft	10,583	10,583	+0.00		Pass

NB-RIGID: Rigid structure T = 0.05 s: V = 0.30 SDS W Ie (Eq. 15.4-5)

Source: Hand calculation (closed form, ASCE/SEI 7-22 15.4). Calculation: Nonbuilding structures (seismic).

NB-RIGID · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
V = 0.30 × 1.0 × 100 × 1.0	kips	30.00	30.00	+0.00		Pass

NB-15.4-2: Steel stack, S1 = 0.75 g: Eq. 15.4-2 governs

Source: Hand calculation (closed form, ASCE/SEI 7-22 15.4). Calculation: Nonbuilding structures (seismic).

NB-15.4-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cs = 0.8 × 0.75 / (2 / 1.0)		0.300	0.300	+0.00		Pass
Cs,max = 0.6 / (2.0 × 2)		0.150	0.150	+0.00		Pass

NB-15.4-4: Steel stack to its reference document: Eq. 15.4-4

Source: Hand calculation (closed form, ASCE/SEI 7-22 15.4). Calculation: Nonbuilding structures (seismic).

NB-15.4-4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cs = 0.5 × 0.75 / 2		0.188	0.188	+0.00		Pass

NB-MIN03: Table 15.4-2 minimum 0.03 (Eq. 15.4-1)

Source: Hand calculation (closed form, ASCE/SEI 7-22 15.4). Calculation: Nonbuilding structures (seismic).

SD1 / (T R / Ie) = 0.1 / 9 = 0.011 and 0.044 SDS Ie = 0.0132, both under 0.03.

NB-MIN03 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cs = max(0.044 × 0.3, 0.03)		0.030	0.030	+0.00		Pass

NB-RAYLEIGH: Period by Eq. 15.4-6

Source: Hand calculation (closed form, ASCE/SEI 7-22 15.4). Calculation: Nonbuilding structures (seismic).

NB-RAYLEIGH · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
T = 2π √(125 / (386.09 × 25))	s	0.715	0.715	+0.00		Pass

T15.4-1 rack: Table 15.4-1: Steel storage racks

Source: ASCE/SEI 7-22, Table 15.4-1, pp. PDF p. 230. Calculation: Nonbuilding structures (seismic).

T15.4-1 rack · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (Steel storage racks)		4.000	4.000	+0.00		Pass
Ω0 (Steel storage racks)		2.000	2.000	+0.00		Pass
Cd (Steel storage racks)		3.500	3.500	+0.00		Pass

T15.4-1 ocbf: Table 15.4-1: Steel OCBF

Source: ASCE/SEI 7-22, Table 15.4-1, pp. PDF p. 230. Calculation: Nonbuilding structures (seismic).

T15.4-1 ocbf · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (Steel OCBF)		3.250	3.250	+0.00		Pass
Ω0 (Steel OCBF)		2.000	2.000	+0.00		Pass
Cd (Steel OCBF)		3.250	3.250	+0.00		Pass

T15.4-1 ocbf_inc: Table 15.4-1: Steel OCBF, permitted height increase

Source: ASCE/SEI 7-22, Table 15.4-1, pp. PDF p. 230. Calculation: Nonbuilding structures (seismic).

T15.4-1 ocbf_inc · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (Steel OCBF, permitted height increase)		2.500	2.500	+0.00		Pass
Ω0 (Steel OCBF, permitted height increase)		2.000	2.000	+0.00		Pass
Cd (Steel OCBF, permitted height increase)		2.500	2.500	+0.00		Pass

T15.4-1 omf: Table 15.4-1: Steel OMF

Source: ASCE/SEI 7-22, Table 15.4-1, pp. PDF p. 230. Calculation: Nonbuilding structures (seismic).

T15.4-1 omf · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (Steel OMF)		3.500	3.500	+0.00		Pass
Ω0 (Steel OMF)		3.000	3.000	+0.00		Pass
Cd (Steel OMF)		3.000	3.000	+0.00		Pass

T15.4-1 omf_unl: Table 15.4-1: Steel OMF, unlimited height

Source: ASCE/SEI 7-22, Table 15.4-1, pp. PDF p. 230. Calculation: Nonbuilding structures (seismic).

T15.4-1 omf_unl · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (Steel OMF, unlimited height)		1.000	1.000	+0.00		Pass
Ω0 (Steel OMF, unlimited height)		1.000	1.000	+0.00		Pass
Cd (Steel OMF, unlimited height)		1.000	1.000	+0.00		Pass

T15.4-1 rc_imf_unl: Table 15.4-1: Concrete IMF, unlimited height

Source: ASCE/SEI 7-22, Table 15.4-1, pp. PDF p. 230. Calculation: Nonbuilding structures (seismic).

T15.4-1 rc_imf_unl · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (Concrete IMF, unlimited height)		0.800	0.800	+0.00		Pass
Ω0 (Concrete IMF, unlimited height)		1.000	1.000	+0.00		Pass
Cd (Concrete IMF, unlimited height)		1.000	1.000	+0.00		Pass

T15.4-2 elev_braced: Table 15.4-2: Elevated tank, braced legs

Source: ASCE/SEI 7-22, Table 15.4-2, pp. PDF pp. 231 to 232. Calculation: Nonbuilding structures (seismic).

T15.4-2 elev_braced · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (Elevated tank, braced legs)		3.000	3.000	+0.00		Pass
Ω0 (Elevated tank, braced legs)		2.000	2.000	+0.00		Pass
Cd (Elevated tank, braced legs)		2.500	2.500	+0.00		Pass

T15.4-2 tank_steel_self: Table 15.4-2: Ground tank, steel, self-anchored

Source: ASCE/SEI 7-22, Table 15.4-2, pp. PDF pp. 231 to 232. Calculation: Nonbuilding structures (seismic).

T15.4-2 tank_steel_self · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (Ground tank, steel, self-anchored)		2.500	2.500	+0.00		Pass
Ω0 (Ground tank, steel, self-anchored)		2.000	2.000	+0.00		Pass
Cd (Ground tank, steel, self-anchored)		2.000	2.000	+0.00		Pass

T15.4-2 tank_conc_anchored: Table 15.4-2: Ground tank, concrete, anchored flexible base

Source: ASCE/SEI 7-22, Table 15.4-2, pp. PDF pp. 231 to 232. Calculation: Nonbuilding structures (seismic).

T15.4-2 tank_conc_anchored · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (Ground tank, concrete, anchored flexible base)		3.250	3.250	+0.00		Pass
Ω0 (Ground tank, concrete, anchored flexible base)		2.000	2.000	+0.00		Pass
Cd (Ground tank, concrete, anchored flexible base)		2.000	2.000	+0.00		Pass

T15.4-2 silo_cip: Table 15.4-2: Cast-in-place silo

Source: ASCE/SEI 7-22, Table 15.4-2, pp. PDF pp. 231 to 232. Calculation: Nonbuilding structures (seismic).

T15.4-2 silo_cip · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (Cast-in-place silo)		3.000	3.000	+0.00		Pass
Ω0 (Cast-in-place silo)		1.750	1.750	+0.00		Pass
Cd (Cast-in-place silo)		3.000	3.000	+0.00		Pass

T15.4-2 chimney_conc: Table 15.4-2: Concrete chimney

Source: ASCE/SEI 7-22, Table 15.4-2, pp. PDF pp. 231 to 232. Calculation: Nonbuilding structures (seismic).

T15.4-2 chimney_conc · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (Concrete chimney)		2.000	2.000	+0.00		Pass
Ω0 (Concrete chimney)		1.500	1.500	+0.00		Pass
Cd (Concrete chimney)		2.000	2.000	+0.00		Pass

T15.4-2 tower_trussed: Table 15.4-2: Trussed tower

Source: ASCE/SEI 7-22, Table 15.4-2, pp. PDF pp. 231 to 232. Calculation: Nonbuilding structures (seismic).

T15.4-2 tower_trussed · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (Trussed tower)		3.000	3.000	+0.00		Pass
Ω0 (Trussed tower)		2.000	2.000	+0.00		Pass
Cd (Trussed tower)		2.500	2.500	+0.00		Pass

T15.4-2 sign: Table 15.4-2: Signs and billboards

Source: ASCE/SEI 7-22, Table 15.4-2, pp. PDF pp. 231 to 232. Calculation: Nonbuilding structures (seismic).

T15.4-2 sign · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (Signs and billboards)		3.000	3.000	+0.00		Pass
Ω0 (Signs and billboards)		1.750	1.750	+0.00		Pass
Cd (Signs and billboards)		3.000	3.000	+0.00		Pass

T15.4-2 cantilever_wall: Table 15.4-2: Cantilever wall or fence

Source: ASCE/SEI 7-22, Table 15.4-2, pp. PDF pp. 231 to 232. Calculation: Nonbuilding structures (seismic).

T15.4-2 cantilever_wall · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (Cantilever wall or fence)		1.250	1.250	+0.00		Pass
Ω0 (Cantilever wall or fence)		2.000	2.000	+0.00		Pass
Cd (Cantilever wall or fence)		2.500	2.500	+0.00		Pass

T15.4-2 other: Table 15.4-2: All other

Source: ASCE/SEI 7-22, Table 15.4-2, pp. PDF pp. 231 to 232. Calculation: Nonbuilding structures (seismic).

T15.4-2 other · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (All other)		1.250	1.250	+0.00		Pass
Ω0 (All other)		2.000	2.000	+0.00		Pass
Cd (All other)		2.500	2.500	+0.00		Pass

8.3-PANEL: Precast spandrel panel, wall element (SMF building, z/h = 40.5/67.5)

Source: FEMA P-2192-V1 (2020 NEHRP Provisions Design Examples), Chapter 8, pp. 8.3.3, 8.3.4, pp. 339-349. Calculation: Seismic nonstructural components.

8.3-PANEL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ta = 0.028 (67.5)^0.8	s	0.810	0.814	+0.49		Pass
a1 = 1/Ta		1.230	1.229	-0.12		Pass
a2 = 1 − (0.4/Ta)²		0.760	0.758	-0.20		Pass
Hf (Eq. 13.3-4)		1.740	1.742	+0.10		Pass
Rμ = (1.1 × 8 / (1.0 × 3))^½		1.710	1.713	+0.16		Pass
Eq. 13.3-1 coefficient		0.403	0.403	+0.06		Pass
Fp,max / Wp = 1.6 SDS		2.379	2.379	+0.01		Pass
Fp,min / Wp = 0.3 SDS (governs)		0.446	0.446	+0.02		Pass
Fp = Eh	lb	4,570	4,570	+0.01		Pass
Ev = 0.2 SDS Wp	lb	3,047	3,047	-0.00		Pass

8.3-PANEL-HF5: Precast panel, Hf by Eq. 13.3-5 (period not used)

Source: FEMA P-2192-V1 (2020 NEHRP Provisions Design Examples), Chapter 8, pp. 8.3.3, p. 342. Calculation: Seismic nonstructural components.

8.3-PANEL-HF5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Hf = 1 + 2.5 (z/h)		2.500	2.500	+0.00		Pass

8.3-FASTENERS: Precast panel, fasteners of the connecting system (CAR 2.8, Ω0p 1.0)

Source: FEMA P-2192-V1 (2020 NEHRP Provisions Design Examples), Chapter 8, pp. 8.3.5, p. 350. Calculation: Seismic nonstructural components.

8.3-FASTENERS · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Eq. 13.3-1 coefficient (governs)		1.129	1.129	+0.01		Pass
Fp = Eh	lb	11,568	11,568	-0.00		Pass
Ω0p (Table 13.5-1)		1.000	1.000	+0.00		Pass

8.4-FLIGHT: Egress stair flight (Ip = Ie = 1.5; Ta of the braced frame, Rμ of the moment frame)

Source: FEMA P-2192-V1 (2020 NEHRP Provisions Design Examples), Chapter 8, pp. 8.4.3, pp. 370-374. Calculation: Seismic nonstructural components.

8.4-FLIGHT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ta = 0.02 (70)^0.75	s	0.484	0.484	+0.00		Pass
a1		2.070	2.066	-0.19		Pass
a2		0.320	0.317	-0.93		Pass
Hf (z = 35 ft average)		2.030	2.033	+0.16		Pass
Rμ, steel SMF (N-S, governs)		1.400	1.398	-0.11		Pass
Eq. 13.3-1 coefficient		0.582	0.582	-0.07		Pass
Flight Fp	lb	410.0	410.6	+0.15		Pass
Flight Ev	lb	141.0	141.2	+0.14		Pass
DpI = (42 − 28)(12)(0.010) × 1.5	in.	2.520	2.520	+0.00		Pass

8.4-SCBF: Egress stair: Rμ of the braced frame direction (E-W)

Source: FEMA P-2192-V1 (2020 NEHRP Provisions Design Examples), Chapter 8, pp. 8.4.2, p. 371. Calculation: Seismic nonstructural components.

8.4-SCBF · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rμ, steel SCBF		1.480	1.483	+0.22		Pass

8.4-LANDING: Egress stair landing

Source: FEMA P-2192-V1 (2020 NEHRP Provisions Design Examples), Chapter 8, pp. 8.4.3, p. 375. Calculation: Seismic nonstructural components.

8.4-LANDING · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Landing Fp	lb	298.0	298.4	+0.12		Pass
Landing Ev	lb	103.0	102.6	-0.39		Pass

8.4-FAST-FLIGHT: Egress stair fasteners and attachments, flight

Source: FEMA P-2192-V1 (2020 NEHRP Provisions Design Examples), Chapter 8, pp. 8.4.3, p. 378. Calculation: Seismic nonstructural components.

8.4-FAST-FLIGHT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Eq. 13.3-1 coefficient		1.280	1.280	-0.03		Pass
Flight fastener Fp	lb	903.0	903.4	+0.04		Pass

8.4-FAST-LANDING: Egress stair fasteners and attachments, landing

Source: FEMA P-2192-V1 (2020 NEHRP Provisions Design Examples), Chapter 8, pp. 8.4.3, p. 378. Calculation: Seismic nonstructural components.

8.4-FAST-LANDING · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Landing fastener Fp	lb	657.0	656.4	-0.09		Pass

8.5-FAN: HVAC fan on the roof, directly attached (ordinary reinforced masonry walls)

Source: FEMA P-2192-V1 (2020 NEHRP Provisions Design Examples), Chapter 8, pp. 8.5.3, pp. 383-388. Calculation: Seismic nonstructural components.

8.5-FAN · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ta = 0.02 (36)^0.75	s	0.290	0.294	+1.36		Pass
a1 = 3.45 → 2.5		2.500	2.500	+0.00		Pass
a2 = −0.90 → 0		0.000	0.000	+0.00		Pass
Hf		3.500	3.500	+0.00		Pass
Rμ = 0.94 → 1.3		1.300	1.300	+0.00		Pass
Eq. 13.3-1 coefficient (governs)		0.357	0.357	+0.09		Pass
Fp,max / Wp		0.758	0.758	+0.05		Pass
Fp,min / Wp		0.142	0.142	+0.14		Pass
Fp = Eh	lb	1,072	1,072	-0.00		Pass
Ev	lb	284.0	284.4	+0.14		Pass
Shear per bolt Vu = Eh / 4	lb	268.0	268.0	-0.00		Pass
LC7 bolt force, force across b (−: compression)	lb	-409.0	-409.0	-0.00		Pass

8.5-ISOLATED: HVAC fan on spring isolators (air gap > 0.25 in.: 2Fp)

Source: FEMA P-2192-V1 (2020 NEHRP Provisions Design Examples), Chapter 8, pp. 8.5.4, pp. 390-393. Calculation: Seismic nonstructural components.

8.5-ISOLATED · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Eq. 13.3-1 coefficient		0.864	0.864	-0.02		Pass
Fp = Fp,max (governs)	lb	2,275	2,275	+0.01		Pass
Eh = 2Fp	lb	4,550	4,550	+0.01		Pass
LC7 tension per isolator, diagonal θ = 38.16°	lb	448.0	448.3	+0.06		Pass
LC6 compression per isolator	lb	2,023	2,023	+0.01		Pass
Vu = Eh / 4	lb	1,138	1,138	-0.04		Pass
Tension with Ω0p = 1.75 (LC7)	lb	1,237	1,237	+0.03		Pass
Shear with Ω0p = 1.75	lb	1,991	1,991	-0.01		Pass

8.6-PIPE4: 4 in. threaded pipe (not ASME B31) on a BRBF building roof

Source: FEMA P-2192-V1 (2020 NEHRP Provisions Design Examples), Chapter 8, pp. 8.6.2, 8.6.3, pp. 405-411. Calculation: Seismic nonstructural components.

8.6-PIPE4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ta = 0.03 (30)^0.75	s	0.380	0.385	+1.20		Pass
Hf		3.500	3.500	+0.00		Pass
Rμ = (1.1 × 8 / (1.5 × 2.5))^½		1.530	1.532	+0.12		Pass
Eq. 13.3-1 coefficient (governs)		1.508	1.508	-0.00		Pass
Fp per ft, 16.4 plf pipe	lb	24.70	24.73	+0.12		Pass
Ev per ft	lb	3.280	3.280	+0.00		Pass

8.6-PIPE6: 6 in. threaded pipe

Source: FEMA P-2192-V1 (2020 NEHRP Provisions Design Examples), Chapter 8, pp. 8.6.3, p. 411. Calculation: Seismic nonstructural components.

8.6-PIPE6 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fp per ft, 31.7 plf pipe	lb	47.80	47.80	+0.00		Pass

8.6-SUPPORT: Pipe supports, hot-rolled steel bracing, longitudinal brace of the 6 in. pipe (80 ft tributary)

Source: FEMA P-2192-V1 (2020 NEHRP Provisions Design Examples), Chapter 8, pp. 8.6.4, pp. 413-416. Calculation: Seismic nonstructural components.

8.6-SUPPORT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Eq. 13.3-1 coefficient (governs)		0.914	0.914	-0.01		Pass
PX1B = 0.914 (31.7)(80)	lb	2,318	2,318	-0.01		Pass

8.7-VESSEL: Elevated vessel on a braced platform (CAR raised to the platform's 1.4)

Source: FEMA P-2192-V1 (2020 NEHRP Provisions Design Examples), Chapter 8, pp. 8.7.2, 8.7.3, pp. 432-434. Calculation: Seismic nonstructural components.

8.7-VESSEL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ta = 0.02 (46)^0.75	s	0.353	0.353	+0.07		Pass
Hf		2.520	2.522	+0.07		Pass
Rμ = (1.1 × 5 / (1.0 × 2.5))^½		1.480	1.483	+0.22		Pass
CAR = max(1.0, 1.4)		1.400	1.400	+0.00		Pass
Eq. 13.3-1 coefficient (governs)		0.762	0.762	-0.04		Pass
Fp,ves = Eh	lb	3,808	3,808	+0.01		Pass
Ev	lb	1,200	1,200	+0.00		Pass

8.7-PLATFORM: Vessel support platform (seismic system R > 3)

Source: FEMA P-2192-V1 (2020 NEHRP Provisions Design Examples), Chapter 8, pp. 8.7.4, p. 444. Calculation: Seismic nonstructural components.

8.7-PLATFORM · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fp,sup	lb	762.0	761.7	-0.04		Pass
Ev,sup	lb	240.0	240.0	+0.00		Pass

HC-GRADE: Generator at grade: Hf = Rμ = 1.0, grade CAR

Source: Hand calculation (closed form). Calculation: Seismic nonstructural components.

HC-GRADE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Hf		1.000	1.000	+0.00		Pass
Rμ		1.000	1.000	+0.00		Pass
CAR at or below grade		1.800	1.800	+0.00		Pass
Fp = 0.4 (1.0)(1.0)(10,000)(1/1)(1.8/1.5)	lb	4,800	4,800	+0.00		Pass

HC-UNKNOWN: System not specified (Rμ = 1.3), Eq. 13.3-5, minimum and maximum

Source: Hand calculation (closed form). Calculation: Seismic nonstructural components.

HC-UNKNOWN · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Hf = 1 + 2.5 (0.5)		2.250	2.250	+0.00		Pass
Rμ		1.300	1.300	+0.00		Pass
Fp = 0.4 (0.8)(2000)(2.25/1.3)(1.4/2.0)	lb	775.4	775.4	-0.00		Pass

HC-ASD-ANCHOR: Anchor forces, ASD (0.6 − 0.14 SDS)D + 0.7 Eh, force across b

Source: Hand calculation (closed form). Calculation: Seismic nonstructural components.

HC-ASD-ANCHOR · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fp = 0.3 SDS Wp (minimum governs at z = 0)	lb	1,200	1,200	+0.00		Pass
T = 0.7 (1200)(3) / (2 × 4) − 0.46 (4000) / 4	lb	-145.0	-145.0	-0.00		Pass
V = 0.7 (1200) / 4	lb	210.0	210.0	+0.00		Pass

P1051-14.1: Three-story wood light-frame residential building, SDC D

Source: FEMA P-1051 (2015 NEHRP Provisions: Design Examples), Example 14.1, pp. PDF pp. 726 to 730 (printed 14-6 to 14-10). Calculation: Simplified seismic design.

SDS = 2/3 (1.0)(1.34) = 0.89 as the example rounds it (Fa = 1.0 from Table 11.4-1 of ASCE 7-10); level heights 9 ft per story from Figure 14.1-5.

P1051-14.1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
V = 1.2 × 0.89 × 751 / 6.5	kips	123.4	123.4	+0.02		Pass
F roof = 182.8 / 751 × 123.4	kips	30.00	30.04	+0.12		Pass
F 3rd = 284.2 / 751 × 123.4	kips	46.70	46.70	-0.01		Pass
F 2nd = 284.2 / 751 × 123.4	kips	46.70	46.70	-0.01		Pass
Effective seismic weight W	kips	751.0	751.2	+0.03		Pass
F (three stories)		1.200	1.200	+0.00		Pass
R (A.13 light-frame wood)		6.500	6.500	+0.00		Pass

SS-SOIL: SDS with Fa = 1.4 for a soil site (12.14.8.1)

Source: Hand calculation (closed form, ASCE/SEI 7-22 12.14.8). Calculation: Simplified seismic design.

SS-SOIL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
SDS = 2/3 × 1.4 × 1.34	g	1.251	1.251	-0.00		Pass
V = 1.2 × 1.2507 × 751.2 / 6.5	kips	173.4	173.4	-0.00		Pass

SS-CAP: Rock site, Ss = 2.0 taken as 1.5 (12.14.8.1)

Source: Hand calculation (closed form, ASCE/SEI 7-22 12.14.8). Calculation: Simplified seismic design.

SS-CAP · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
SDS = 2/3 × 1.0 × 1.5	g	1.000	1.000	+0.00		Pass
V = 1.0 × 1.0 × 400 / 6 (one story, SCBF)	kips	66.67	66.67	-0.01		Pass

SS-2STORY: Two stories: F = 1.1, overturning and 1 % drift

Source: Hand calculation (closed form, ASCE/SEI 7-22 12.14.8). Calculation: Simplified seismic design.

SS-2STORY · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
V = 1.1 × 0.6 × 500 / 5	kips	66.00	66.00	+0.00		Pass
F2 = 200 / 500 × 66	kips	26.40	26.40	+0.00		Pass
Base overturning 39.6 × 12 + 26.4 × 24	kip-ft	1,109	1,109	+0.00		Pass
Drift 0.01 × 24 ft	in.	2.880	2.880	+0.00		Pass
Ev = 0.2 SDS (per unit D)		0.120	0.120	+0.00		Pass

T12.14-1 A.1: Table 12.14-1 line A.1: R

Source: ASCE/SEI 7-22, Table 12.14-1, pp. PDF pp. 201 to 202. Calculation: Simplified seismic design.

T12.14-1 A.1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (A.1)		5.000	5.000	+0.00		Pass

T12.14-1 A.2: Table 12.14-1 line A.2: R

Source: ASCE/SEI 7-22, Table 12.14-1, pp. PDF pp. 201 to 202. Calculation: Simplified seismic design.

T12.14-1 A.2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (A.2)		4.000	4.000	+0.00		Pass

T12.14-1 A.5: Table 12.14-1 line A.5: R

Source: ASCE/SEI 7-22, Table 12.14-1, pp. PDF pp. 201 to 202. Calculation: Simplified seismic design.

T12.14-1 A.5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (A.5)		4.000	4.000	+0.00		Pass

T12.14-1 A.8: Table 12.14-1 line A.8: R

Source: ASCE/SEI 7-22, Table 12.14-1, pp. PDF pp. 201 to 202. Calculation: Simplified seismic design.

T12.14-1 A.8 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (A.8)		3.500	3.500	+0.00		Pass

T12.14-1 A.13: Table 12.14-1 line A.13: R

Source: ASCE/SEI 7-22, Table 12.14-1, pp. PDF pp. 201 to 202. Calculation: Simplified seismic design.

T12.14-1 A.13 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (A.13)		6.500	6.500	+0.00		Pass

T12.14-1 A.15: Table 12.14-1 line A.15: R

Source: ASCE/SEI 7-22, Table 12.14-1, pp. PDF pp. 201 to 202. Calculation: Simplified seismic design.

T12.14-1 A.15 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (A.15)		2.000	2.000	+0.00		Pass

T12.14-1 A.16: Table 12.14-1 line A.16: R

Source: ASCE/SEI 7-22, Table 12.14-1, pp. PDF pp. 201 to 202. Calculation: Simplified seismic design.

T12.14-1 A.16 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (A.16)		4.000	4.000	+0.00		Pass

T12.14-1 A.17: Table 12.14-1 line A.17: R

Source: ASCE/SEI 7-22, Table 12.14-1, pp. PDF pp. 201 to 202. Calculation: Simplified seismic design.

T12.14-1 A.17 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (A.17)		3.000	3.000	+0.00		Pass

T12.14-1 B.1: Table 12.14-1 line B.1: R

Source: ASCE/SEI 7-22, Table 12.14-1, pp. PDF pp. 201 to 202. Calculation: Simplified seismic design.

T12.14-1 B.1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (B.1)		8.000	8.000	+0.00		Pass

T12.14-1 B.3: Table 12.14-1 line B.3: R

Source: ASCE/SEI 7-22, Table 12.14-1, pp. PDF pp. 201 to 202. Calculation: Simplified seismic design.

T12.14-1 B.3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (B.3)		3.250	3.250	+0.00		Pass

T12.14-1 B.13: Table 12.14-1 line B.13: R

Source: ASCE/SEI 7-22, Table 12.14-1, pp. PDF pp. 201 to 202. Calculation: Simplified seismic design.

T12.14-1 B.13 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (B.13)		6.500	6.500	+0.00		Pass

T12.14-1 B.16: Table 12.14-1 line B.16: R

Source: ASCE/SEI 7-22, Table 12.14-1, pp. PDF pp. 201 to 202. Calculation: Simplified seismic design.

T12.14-1 B.16 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (B.16)		5.500	5.500	+0.00		Pass

T12.14-1 B.22: Table 12.14-1 line B.22: R

Source: ASCE/SEI 7-22, Table 12.14-1, pp. PDF pp. 201 to 202. Calculation: Simplified seismic design.

T12.14-1 B.22 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (B.22)		7.000	7.000	+0.00		Pass

T12.14-1 B.24: Table 12.14-1 line B.24: R

Source: ASCE/SEI 7-22, Table 12.14-1, pp. PDF pp. 201 to 202. Calculation: Simplified seismic design.

T12.14-1 B.24 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (B.24)		2.500	2.500	+0.00		Pass

T12.14-1 B.25: Table 12.14-1 line B.25: R

Source: ASCE/SEI 7-22, Table 12.14-1, pp. PDF pp. 201 to 202. Calculation: Simplified seismic design.

T12.14-1 B.25 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (B.25)		8.000	8.000	+0.00		Pass

T12.14-1 B.26: Table 12.14-1 line B.26: R

Source: ASCE/SEI 7-22, Table 12.14-1, pp. PDF pp. 201 to 202. Calculation: Simplified seismic design.

T12.14-1 B.26 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R (B.26)		7.000	7.000	+0.00		Pass

SP-3-2: Vertical MCER spectrum, Irvine, California, Site Class D

Source: FEMA P-2192-V1 (2020), Chapter 3, pp. p. 122, Table 3-2. Calculation: Seismic site parameters and spectrum.

SP-3-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
SMS	g	1.630	1.631	+0.05		Pass
Cv		1.426	1.426	+0.01		Pass
SaMv at 0 s	g	0.547	0.547	-0.01		Pass
SaMv at 0.01 s	g	0.550	0.551	+0.14		Pass
SaMv at 0.02 s	g	0.552	0.552	-0.08		Pass
SaMv at 0.025 s	g	0.558	0.558	-0.05		Pass
SaMv at 0.03 s	g	0.632	0.632	+0.07		Pass
SaMv at 0.05 s	g	1.033	1.033	+0.02		Pass
SaMv at 0.075 s	g	1.294	1.294	+0.00		Pass
SaMv at 0.1 s	g	1.544	1.545	+0.06		Pass
SaMv at 0.15 s	g	1.535	1.535	+0.03		Pass
SaMv at 0.2 s	g	1.467	1.467	+0.03		Pass
SaMv at 0.25 s	g	1.383	1.384	+0.06		Pass
SaMv at 0.3 s	g	1.298	1.299	+0.06		Pass
SaMv at 0.4 s	g	1.101	1.101	+0.00		Pass
SaMv at 0.5 s	g	0.932	0.932	-0.01		Pass
SaMv at 0.75 s	g	0.605	0.605	+0.02		Pass
SaMv at 1 s	g	0.425	0.449	+5.69		Deviation P2192-T3-2-FLOOR
P2192-T3-2-FLOOR: the table leaves out the lower limit of Eq. 11.9-4, 0.5 SaM / Fmd, at 1, 1.5 and 2 s						
SaMv at 1.5 s	g	0.242	0.313	+29.30		Deviation P2192-T3-2-FLOOR
P2192-T3-2-FLOOR: the table leaves out the lower limit of Eq. 11.9-4, 0.5 SaM / Fmd, at 1, 1.5 and 2 s						
SaMv at 2 s	g	0.155	0.232	+49.79		Deviation P2192-T3-2-FLOOR
P2192-T3-2-FLOOR: the table leaves out the lower limit of Eq. 11.9-4, 0.5 SaM / Fmd, at 1, 1.5 and 2 s						
SaMv at 3 s	g	0.147	0.147	-0.21		Pass
SaMv at 4 s	g	0.102	0.102	-0.15		Pass
SaMv at 5 s	g	0.076	0.076	-0.20		Pass
SaMv at 7.5 s	g	0.045	0.045	+0.22		Pass
SaMv at 10 s	g	0.030	0.030	+0.00		Pass
Fmd at 0.25 s		1.203	1.203	+0.01		Pass
Fmd at 0.3 s		1.206	1.206	+0.02		Pass
Fmd at 0.4 s		1.213	1.212	-0.04		Pass
Fmd at 0.5 s		1.219	1.219	-0.02		Pass
Fmd at 0.75 s		1.234	1.234	+0.03		Pass
Fmd at 1 s		1.250	1.250	+0.00		Pass
Fmd at 1.5 s		1.253	1.253	-0.02		Pass
Fmd at 2 s		1.256	1.256	-0.04		Pass
Fmd at 3 s		1.261	1.261	+0.01		Pass
Fmd at 4 s		1.267	1.267	-0.03		Pass
Fmd at 5 s		1.272	1.272	+0.02		Pass
Fmd at 7.5 s		1.286	1.286	+0.01		Pass
Fmd at 10 s		1.300	1.300	+0.00		Pass

SP-3-3: Most critical of Site Classes D, CD and DE, velocities estimated

Source: FEMA P-2192-V1 (2020), Chapter 3, pp. p. 124, Table 3-3. Calculation: Seismic site parameters and spectrum.

SP-3-3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
SaM final at 0 s	g	0.718	0.718	+0.00		Pass
SaM final at 0.01 s	g	0.722	0.722	+0.00		Pass
SaM final at 0.02 s	g	0.726	0.726	+0.00		Pass
SaM final at 0.025 s	g	0.744	0.744	+0.00		Pass
SaM final at 0.03 s	g	0.763	0.763	+0.00		Pass
SaM final at 0.05 s	g	0.904	0.904	+0.00		Pass
SaM final at 0.075 s	g	1.142	1.142	+0.00		Pass
SaM final at 0.1 s	g	1.346	1.346	+0.00		Pass
SaM final at 0.15 s	g	1.608	1.608	+0.00		Pass
SaM final at 0.2 s	g	1.736	1.736	+0.00		Pass
SaM final at 0.25 s	g	1.781	1.781	+0.00		Pass
SaM final at 0.3 s	g	1.812	1.812	+0.00		Pass
SaM final at 0.4 s	g	1.810	1.810	+0.00		Pass
SaM final at 0.5 s	g	1.779	1.779	+0.00		Pass
SaM final at 0.75 s	g	1.508	1.508	+0.00		Pass
SaM final at 1 s	g	1.313	1.313	+0.00		Pass
SaM final at 1.5 s	g	1.004	1.004	+0.00		Pass
SaM final at 2 s	g	0.795	0.795	+0.00		Pass
SaM final at 3 s	g	0.517	0.517	+0.00		Pass
SaM final at 4 s	g	0.356	0.356	+0.00		Pass
SaM final at 5 s	g	0.263	0.263	+0.00		Pass
SaM final at 7.5 s	g	0.153	0.153	+0.00		Pass
SaM final at 10 s	g	0.099	0.099	+0.00		Pass
v̄s		850.0	850.0	+0.00		Pass
1.3 v̄s		1,105	1,105	+0.00		Pass
v̄s / 1.3		654.0	653.8	-0.02		Pass

T1-1-W21X50: Properties of a W21X50

Source: AISC Steel Construction Manual, 16th Ed. (AISC Shapes Database v16.0), Table 1-1; Table 3-2, pp. 3-25 (Table 3-2). Calculation: Shape browser and comparison.

T1-1-W21X50 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Area A	$in.^2$	14.70	14.70	+0.00		Pass
Depth d	in.	20.80	20.80	+0.00		Pass
Ix	$in.^4$	984.0	984.0	+0.00		Pass
Sx	$in.^3$	94.50	94.50	+0.00		Pass
Zx	$in.^3$	110.0	110.0	+0.00		Pass
rx	in.	8.180	8.180	+0.00		Pass
Iy	$in.^4$	24.90	24.90	+0.00		Pass
ry	in.	1.300	1.300	+0.00		Pass
J	$in.^4$	1.140	1.140	+0.00		Pass
Cw	$in.^6$	2,570	2,570	+0.00		Pass

T3-2-ZX100: Lightest W-shape with Zx ≥ 100 in³

Source: AISC Steel Construction Manual, 16th Ed. (AISC Shapes Database v16.0), Table 3-2, pp. 3-25. Calculation: Shape browser and comparison.

T3-2-ZX100 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Weight of the lightest (W21X48)		48.00	48.00	+0.00		Pass
Its Zx	in.³	107.0	107.0	+0.00		Pass

T3-2-ZX90: Lightest W-shape with Zx ≥ 90 in³

Source: AISC Steel Construction Manual, 16th Ed. (AISC Shapes Database v16.0), Table 3-2, pp. 3-25. Calculation: Shape browser and comparison.

T3-2-ZX90 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Weight of the lightest (W21X44)		44.00	44.00	+0.00		Pass
Its Zx	in.³	95.40	95.40	+0.00		Pass

T3-3-IX800: Lightest W-shape with Ix ≥ 800 in⁴

Source: AISC Steel Construction Manual, 16th Ed. (AISC Shapes Database v16.0), Table 3-3. Calculation: Shape browser and comparison.

T3-3-IX800 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Weight of the lightest (W21X44)		44.00	44.00	+0.00		Pass
Its Ix	in.⁴	843.0	843.0	+0.00		Pass

DEPTH-18: Zx ≥ 100 in³ within 18 in. of depth

Source: AISC Steel Construction Manual, 16th Ed. (AISC Shapes Database v16.0), Table 3-2, pp. 3-25. Calculation: Shape browser and comparison.

DEPTH-18 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Weight of the lightest (W18X50)		50.00	50.00	+0.00		Pass
Its Zx	in.³	101.0	101.0	+0.00		Pass

HSS-8X8X1/2: Properties of an HSS8X8X1/2

Source: AISC Steel Construction Manual, 16th Ed. (AISC Shapes Database v16.0), Table 1-12. Calculation: Shape browser and comparison.

HSS-8X8X1/2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Weight		48.85	48.85	+0.00		Pass
Area A	in.²	13.50	13.50	+0.00		Pass
Ix	in.⁴	125.0	125.0	+0.00		Pass
J	in.⁴	204.0	204.0	+0.00		Pass

P1051-J1: Precast plank diaphragm, Joint 1, with the amplification of 1.4

Source: FEMA P-1051 (2015), Chapter 11, pp. p. 526. Calculation: Shear friction.

P1051-J1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Avf	in.²	2.920	2.924	+0.15		Pass

P1051-J4: Joint 4

Source: FEMA P-1051 (2015), Chapter 11, pp. p. 530. Calculation: Shear friction.

P1051-J4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Avf	in.²	0.640	0.641	+0.14		Pass

P1051-J5: Joint 5, μ with λ = 0.85

Source: FEMA P-1051 (2015), Chapter 11, pp. p. 531. Calculation: Shear friction.

P1051-J5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Avf	in.²	1.410	1.409	-0.06		Pass

P1051-T4: Topped plank, Joint 4, amplification of 2.0, λ = 0.85

Source: FEMA P-1051 (2015), Chapter 11, pp. p. 540. Calculation: Shear friction.

P1051-T4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Avf	in.²	2.150	2.154	+0.20		Pass

P1051-T5: Topped plank, Joint 5

Source: FEMA P-1051 (2015), Chapter 11, pp. p. 540. Calculation: Shear friction.

P1051-T5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Avf	in.²	4.030	4.026	-0.10		Pass

P1051-COLL: Collector bars across the joint: 4 #8, φ Vn with μ = 1.0λ, λ = 0.85

Source: FEMA P-1051 (2015), Chapter 11, pp. p. 539. Calculation: Shear friction.

P1051-COLL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φVn	kips	120.0	120.9	+0.72		Pass

VC-65: Column base on a footing: horizontal force, μ = 0.6, the limits

Source: VCmaster US catalog (ACI 318-11), pp. pp. 65 to 66. Calculation: Shear friction.

VC-65 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Avf	in.²	3.110	3.111	+0.04		Pass
φ times the limit, the lesser of 0.2f'c Ac and 800 Ac	kips	86.40	86.40	+0.00		Pass

VC-73: Plate on all-lightweight concrete, μ = 0.7λ

Source: VCmaster US catalog (ACI 318-11), pp. pp. 73 to 74. Calculation: Shear friction.

VC-73 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Avf	in.²	0.151	0.151	+0.07		Pass

VC-90: Composite slab on a precast beam, above the limit of 500 psi

Source: VCmaster US catalog (ACI 318-11), pp. pp. 90 to 91. Calculation: Shear friction.

VC-90 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φ 500 bv d	kips	71.30	71.25	-0.07		Pass
Ties, in.² per foot	in.²	1.090	1.086	-0.34		Pass

HC-DEFAULT · Shear friction: The default plane

Source: Hand calculation (closed form, ACI 318-19), pp. Eq. 22.9.4.2, Table 22.9.4.4. Calculation: Shear friction.

HC-DEFAULT · Shear friction · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vu	kips	48.00	48.00	+0.00		Pass
Avf	in.²	1.067	1.067	+0.00		Pass
Vn	kips	111.6	111.6	+0.00		Pass
Limit	kips	230.4	230.4	+0.00		Pass

HC-INCLINED: Inclined bars, 60 degrees, monolithic

Source: Hand calculation (closed form, ACI 318-19), pp. Eq. 22.9.4.3. Calculation: Shear friction.

HC-INCLINED · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
μ sin α + cos α		1.712	1.712	+0.00		Pass
Avf	in.²	1.298	1.298	-0.00		Pass

HC-TENSION · Shear friction: Net tension adds steel

Source: Hand calculation (closed form, ACI 318-19), pp. 22.9.4.6. Calculation: Shear friction.

HC-TENSION · Shear friction · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
An	in.²	0.556	0.556	+0.00		Pass
Area required	in.²	1.889	1.889	+0.00		Pass

HC-COMP: Permanent compression, as entered

Source: Hand calculation (closed form, ACI 318-19), pp. 22.9.4.5. Calculation: Shear friction.

HC-COMP · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Area required	in.²	1.000	1.000	+0.00		Pass

HC-G80 · Shear friction: Grade 80 bars count as 60 ksi

Source: Hand calculation (closed form, ACI 318-19), pp. Table 20.2.2.4(a). Calculation: Shear friction.

HC-G80 · Shear friction · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
fy	ksi	60.00	60.00	+0.00		Pass
Avf	in.²	1.333	1.333	+0.00		Pass

HC-LESSER: The limit takes the lesser f'c

Source: Hand calculation (closed form, ACI 318-19), pp. 22.9.4.4. Calculation: Shear friction.

HC-LESSER · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Limit	kips	172.8	172.8	+0.00		Pass

HC-LW: Density gives λ = 0.975; μ takes at most 0.85

Source: Hand calculation (closed form, ACI 318-19), pp. Table 22.9.4.2 note. Calculation: Shear friction.

HC-LW · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
μ		1.190	1.190	+0.00		Pass
Limit, other cases	kips	230.4	230.4	+0.00		Pass

HC-H-A: Composite, Table 16.4.4.2 (a)

Source: Hand calculation (closed form, ACI 318-19), pp. Table 16.4.4.2. Calculation: Shear friction.

HC-H-A · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vnh	kips	86.40	86.40	+0.00		Pass
Av,min	in.²	0.120	0.120	+0.00		Pass

HC-H-B: Composite, the limit (b)

Source: Hand calculation (closed form, ACI 318-19), pp. Table 16.4.4.2. Calculation: Shear friction.

HC-H-B · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vnh	kips	120.0	120.0	+0.00		Pass

HC-H-D: Composite, roughened without ties, (d)

Source: Hand calculation (closed form, ACI 318-19), pp. Table 16.4.4.2. Calculation: Shear friction.

HC-H-D · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vnh	kips	19.20	19.20	+0.00		Pass

HC-H-ALT: 16.4.5: the contact area over a segment, above the limit

Source: Hand calculation (closed form, ACI 318-19), pp. 16.4.5.1, 22.9. Calculation: Shear friction.

HC-H-ALT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Contact area	in.²	720.0	720.0	+0.00		Pass
Vnh = μ Av fy × 60 / 6	kips	372.0	372.0	+0.00		Pass

B-2 · Sheet pile wall: Anchored bulkhead in sand, 24 ft, tierod 5 ft down

Source: UFS 3-220-20 (2026), Appendix B-2, pp. 606 to 614. Calculation: Sheet pile wall.

B-2 · Sheet pile wall · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Embedment D, ft	ft	14.45	14.45	+0.00		Pass
Design embedment, ft	ft	18.00	18.00	+0.00		Pass
Tierod force T, lb/ft	lb/ft	9,568	9,568	-0.00		Pass
For connections, lb/ft, rounded by the source	lb/ft	11,400	11,481	+0.71		Pass
Zero shear above the dredge line, ft	ft	4.570	4.546	-0.52		Pass
Maximum moment, ft-lb/ft	lb-ft/ft	63,400	63,469	+0.11		Pass
Flexibility number		18.520	18.518	-0.01		Pass
Rowe factor		0.620	0.620	-0.08		Pass
Design moment, ft-lb/ft	lb-ft/ft	39,300	39,319	+0.05		Pass
S required, in.3/ft	in.³/ft	12.25	12.26	+0.04		Pass

F4-43: Cantilever in sand, 15 ft, water 5 ft down

Source: UFS 3-220-20 (2026), Figure 4-43, pp. 245. Calculation: Sheet pile wall.

F4-43 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
D read off the chart, ft		14.25	13.82	-3.02		Pass
Moment from the chart, ft-lb/ft		31,590	29,192	-7.59		Deviation UFS-F443-M
UFS-F443-M: the chart ratio is printed as 0.6, on 62.4 pcf; equilibrium on the stated soil gives 29,190 lb-ft/ft						

F4-45: Cantilever, sand over clay, 20 ft

Source: UFS 3-220-20 (2026), Figure 4-45, pp. 247. Calculation: Sheet pile wall.

F4-45 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
D read off the chart, ft		17.20	16.96	-1.38		Pass
Moment from the chart, ft-lb/ft		51,840	52,315	+0.92		Pass

W26-h6-k100-a2: Westergaard 1926 tables, h = 6 in, k = 100 pci, a = 2 in

Source: Westergaard (1926), Computation of Stresses in Concrete Roads, HRB Proc. 5, pp. pp. 95, 99, 100 (Tables II-IV). Calculation: Slab on grade point loads.

W26-h6-k100-a2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Corner σc (Table II), a = 2 in	psi	619.0	619.3	+0.05		Pass
Interior σi (Table III), a = 2 in	psi	461.0	460.7	-0.06		Pass
Edge σe (Table IV), a = 2 in	psi	721.0	720.8	-0.03		Pass

W26-h6-k100-a4: Westergaard 1926 tables, h = 6 in, k = 100 pci, a = 4 in

Source: Westergaard (1926), Computation of Stresses in Concrete Roads, HRB Proc. 5, pp. pp. 95, 99, 100 (Tables II-IV). Calculation: Slab on grade point loads.

W26-h6-k100-a4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Corner σc (Table II), a = 4 in	psi	509.0	509.0	-0.00		Pass
Interior σi (Table III), a = 4 in	psi	395.0	394.5	-0.11		Pass
Edge σe (Table IV), a = 4 in	psi	601.0	601.0	+0.01		Pass

W26-h6-k100-a6: Westergaard 1926 tables, h = 6 in, k = 100 pci, a = 6 in

Source: Westergaard (1926), Computation of Stresses in Concrete Roads, HRB Proc. 5, pp. pp. 95, 99, 100 (Tables II-IV). Calculation: Slab on grade point loads.

W26-h6-k100-a6 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Corner σc (Table II), a = 6 in	psi	420.0	419.6	-0.09		Pass
Interior σi (Table III), a = 6 in	psi	335.0	334.7	-0.10		Pass
Edge σe (Table IV), a = 6 in	psi	493.0	492.7	-0.06		Pass

W26-h10-k100-a2: Westergaard 1926 tables, h = 10 in, k = 100 pci, a = 2 in

Source: Westergaard (1926), Computation of Stresses in Concrete Roads, HRB Proc. 5, pp. pp. 95, 99, 100 (Tables II-IV). Calculation: Slab on grade point loads.

W26-h10-k100-a2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Corner σc (Table II), a = 2 in	psi	239.0	238.8	-0.09		Pass
Edge σe (Table IV), a = 2 in	psi	261.0	260.8	-0.10		Pass

W26-h10-k100-a6: Westergaard 1926 tables, h = 10 in, k = 100 pci, a = 6 in

Source: Westergaard (1926), Computation of Stresses in Concrete Roads, HRB Proc. 5, pp. pp. 95, 99, 100 (Tables II-IV). Calculation: Slab on grade point loads.

W26-h10-k100-a6 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Corner σc (Table II), a = 6 in	psi	182.0	181.7	-0.19		Pass
Edge σe (Table IV), a = 6 in	psi	212.0	212.3	+0.15		Pass

W26-SUPER: Two and four wheels 66 in apart (superposition)

Source: Westergaard (1926), Computation of Stresses in Concrete Roads, HRB Proc. 5, pp. pp. 104-106. Calculation: Slab on grade point loads.

W26-SUPER · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Interior stress of one wheel (a = 6 in)	psi	279.0	278.8	-0.09		Pass
Two wheels: larger stress, across the line of the loads	psi	301.0	300.9	-0.02		Pass

W26-SUPER4: Four wheels at the corners of a 66 in square

Source: Westergaard (1926), Computation of Stresses in Concrete Roads, HRB Proc. 5, pp. pp. 104-106. Calculation: Slab on grade point loads.

W26-SUPER4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Four wheels: stress under wheel 1	psi	282.0	282.0	-0.00		Pass

HUANG-1-3: Single wheel, interior and corner (Westergaard 1926)

Source: Huang, Pavement Analysis and Design, 2nd Ed., Ch. 4, as reproduced in Mustansiriyah University, Rigid Pavement Stresses (lecture), pp. pp. 5-7 (Huang Ex. 4.1, 4.2). Calculation: Slab on grade point loads.

HUANG-1-3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Radius of relative stiffness ℓ	in.	42.97	42.97	+0.01		Pass
Equivalent radius b	in.	5.804	5.804	-0.00		Pass
Interior stress σi	psi	143.7	143.7	+0.03		Pass
Corner stress σc (Westergaard 1926)	psi	186.6	186.7	+0.03		Pass

HUANG-3: Single wheel at an edge (Westergaard 1948, circular load)

Source: Huang, Pavement Analysis and Design, 2nd Ed., Ch. 4, as reproduced in Mustansiriyah University, Rigid Pavement Stresses (lecture), pp. pp. 8-9 (Huang Ex. 4.3). Calculation: Slab on grade point loads.

HUANG-3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Edge stress σe (circle)	psi	279.4	279.3	-0.04		Pass

HUANG-4: Dual tires 14 in apart, 5,000 lb each

Source: Huang, Pavement Analysis and Design, 2nd Ed., Ch. 4, as reproduced in Mustansiriyah University, Rigid Pavement Stresses (lecture), pp. pp. 10-11 (Huang Ex. 4.4). Calculation: Slab on grade point loads.

HUANG-4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Equivalent contact radius a	in.	7.850	7.854	+0.05		Pass
Corner stress σc	psi	166.8	166.8	-0.01		Pass
Interior stress σi	psi	130.8	130.8	+0.01		Pass

HUANG-4E: Dual tires at an edge (Westergaard 1948)

Source: Huang, Pavement Analysis and Design, 2nd Ed., Ch. 4, as reproduced in Mustansiriyah University, Rigid Pavement Stresses (lecture), pp. p. 11 (Huang Ex. 4.4). Calculation: Slab on grade point loads.

HUANG-4E · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Edge stress σe	psi	244.2	244.1	-0.06		Pass

PI-9: 9,000 lb wheel on a 9 in slab

Source: Pavement Interactive, Rigid Pavement Response (Westergaard calculation example), pp. p. 1. Calculation: Slab on grade point loads.

PI-9 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ℓ	in.	35.30	35.31	+0.02		Pass
Interior stress	psi	150.0	149.7	-0.18		Pass
Edge stress (1926)	psi	226.0	225.8	-0.10		Pass
Corner stress (1926)	psi	193.0	193.1	+0.03		Pass

IO84-C001: Corner load, finite elements run C001 (h = 9 in, k = 200 pci, 2.5 in square load)

Source: Ioannides, Thompson and Barenberg (1984), AFOSR-TR-85-0083, Table 5.13 and Eq. 5-17, pp. p. 170 (Table 5.13). Calculation: Slab on grade point loads.

IO84-C001 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Corner stress σc (finite elements)	psi	307.5	310.0	+0.82		Pass

IO84-C002: Corner load, finite elements run C002 (h = 9 in, k = 200 pci, 5.0 in square load)

Source: Ioannides, Thompson and Barenberg (1984), AFOSR-TR-85-0083, Table 5.13 and Eq. 5-17, pp. p. 170 (Table 5.13). Calculation: Slab on grade point loads.

IO84-C002 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Corner stress σc (finite elements)	psi	270.9	271.0	+0.03		Pass

IO84-C003: Corner load, finite elements run C003 (h = 9 in, k = 200 pci, 7.5 in square load)

Source: Ioannides, Thompson and Barenberg (1984), AFOSR-TR-85-0083, Table 5.13 and Eq. 5-17, pp. p. 170 (Table 5.13). Calculation: Slab on grade point loads.

IO84-C003 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Corner stress σc (finite elements)	psi	242.7	237.3	-2.24		Deviation SOG-IOANNIDES-FIT
SOG-IOANNIDES-FIT: the corner formula fits the finite-element results within about 2 %; this run is 2.2 % below them						

IO84-C004: Corner load, finite elements run C004 (h = 9 in, k = 100 pci, 5.0 in square load)

Source: Ioannides, Thompson and Barenberg (1984), AFOSR-TR-85-0083, Table 5.13 and Eq. 5-17, pp. p. 170 (Table 5.13). Calculation: Slab on grade point loads.

IO84-C004 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Corner stress σc (finite elements)	psi	282.1	282.6	+0.19		Pass

IO84-C005: Corner load, finite elements run C005 (h = 9 in, k = 400 pci, 5.0 in square load)

Source: Ioannides, Thompson and Barenberg (1984), AFOSR-TR-85-0083, Table 5.13 and Eq. 5-17, pp. p. 170 (Table 5.13). Calculation: Slab on grade point loads.

IO84-C005 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Corner stress σc (finite elements)	psi	259.9	257.8	-0.82		Pass

IO84-C006: Corner load, finite elements run C006 (h = 6 in, k = 200 pci, 5.0 in square load)

Source: Ioannides, Thompson and Barenberg (1984), AFOSR-TR-85-0083, Table 5.13 and Eq. 5-17, pp. p. 170 (Table 5.13). Calculation: Slab on grade point loads.

IO84-C006 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Corner stress σc (finite elements)	psi	563.6	554.9	-1.54		Deviation SOG-IOANNIDES-FIT
SOG-IOANNIDES-FIT: the corner formula fits the finite-element results within about 2 %; this run is 1.5 % below them						

IO84-C007: Corner load, finite elements run C007 (h = 12 in, k = 200 pci, 5.0 in square load)

Source: Ioannides, Thompson and Barenberg (1984), AFOSR-TR-85-0083, Table 5.13 and Eq. 5-17, pp. p. 170 (Table 5.13). Calculation: Slab on grade point loads.

IO84-C007 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Corner stress σc (finite elements)	psi	159.9	160.5	+0.35		Pass

UFC-T5-3: Allowable uniform load, critical aisle (Table 5-3, k = 100 pci)

Source: UFC 3-320-06 (2025), Design: Concrete Floor Slabs on Ground, pp. p. 68 (Table 5-3), Eq. 5-4. Calculation: Slab on grade point loads.

UFC-T5-3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
h = 7 in, MR = 650 psi, FS = 2	psf	1,109	1,109	-0.03		Pass

UFC-T5-3b: Allowable uniform load, h = 6 in, MR = 550 psi

Source: UFC 3-320-06 (2025), Design: Concrete Floor Slabs on Ground, pp. p. 68 (Table 5-3). Calculation: Slab on grade point loads.

UFC-T5-3b · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable load	psf	868.0	868.5	+0.06		Pass

UFC-T5-3c: Allowable uniform load, h = 20 in, MR = 700 psi

Source: UFC 3-320-06 (2025), Design: Concrete Floor Slabs on Ground, pp. p. 68 (Table 5-3). Calculation: Slab on grade point loads.

UFC-T5-3c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable load	psf	2,018	2,018	+0.01		Pass

UFC-B-1.1: Uniform storage load, k = 150 pci (Example B-1.1)

Source: UFC 3-320-06 (2025), Design: Concrete Floor Slabs on Ground, pp. pp. 161-162 (Example B-1.1). Calculation: Slab on grade point loads.

UFC-B-1.1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable uniform load	psf	1,358	1,358	-0.01		Pass

PCA-T5-5a: Critical aisle, k = 100 pci, h = 6 in, working stress 300 psi

Source: UFC 3-320-06 (2025), Design: Concrete Floor Slabs on Ground, pp. p. 71 (Table 5-5, PCA). Calculation: Slab on grade point loads.

PCA-T5-5a · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Critical aisle width	ft	5.400	5.392	-0.14		Pass
Allowable load at the critical aisle	psf	950.0	947.5	-0.26		Pass

PCA-T5-5b: Critical aisle, k = 50 pci, h = 5 in, working stress 300 psi

Source: UFC 3-320-06 (2025), Design: Concrete Floor Slabs on Ground, pp. p. 71 (Table 5-5, PCA). Calculation: Slab on grade point loads.

PCA-T5-5b · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Critical aisle width	ft	5.600	5.593	-0.12		Pass
Allowable load at the critical aisle	psf	610.0	611.6	+0.26		Pass

PCA-T5-5c: Critical aisle, k = 200 pci, h = 8 in, working stress 400 psi

Source: UFC 3-320-06 (2025), Design: Concrete Floor Slabs on Ground, pp. p. 71 (Table 5-5, PCA). Calculation: Slab on grade point loads.

PCA-T5-5c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Critical aisle width	ft	5.600	5.626	+0.47		Pass
Allowable load at the critical aisle	psf	2,065	2,063	-0.10		Pass

SOG-1: Rack post defaults: shear and bearing under the base plate

Source: Hand calculation (closed form). Calculation: Slab on grade point loads.

SOG-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Two-way shear φVn, edge perimeter, h − 2 in (14.5.5.1, 14.5.1.7)	kips	18.17	18.17	+0.00		Pass
Factored post load 1.6 P	kips	8.000	8.000	+0.00		Pass
Bearing φBn = 0.6 × 0.85 f'c A1 × 2 (14.5.6.1)	kips	146.9	146.9	+0.00		Pass

SOG-2: Uniform load beside a fixed 4 ft aisle (Hetényi)

Source: Hand calculation (closed form). Calculation: Slab on grade point loads.

SOG-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable uniform load, aisle 4 ft	psf	1,247	1,247	+0.00		Pass

SL-DM71-7.4: Bishop simplified on a published slice table

Source: UFS 3-220-10 (DM7.1, 2026), Figure 7-4, pp. pp. 353-354. Calculation: Slope stability.

SL-DM71-7.4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
F = 1.3 (Bishop simplified)		1.300	1.301	+0.08		Pass
ΣW·sinα = 12.3 kips	kips	12.30	12.28	-0.17		Pass

SL-DM71-OMS: Ordinary method of slices on the same table (hand)

Source: Hand calculation from UFS 3-220-10 Figure 7-4 data. Calculation: Slope stability.

SL-DM71-OMS · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
F (ordinary method) = 1.174		1.174	1.174	+0.03		Pass

AISC-III-ROOF: Flat roof snow load, minimum load, rain-on-snow, density

Source: AISC Design Examples v16.0, Part III, pp. III-5, III-6. Calculation: Snow loads.

AISC-III-ROOF · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Thermal factor Ct (Rroof = 40, pg = 30)		1.170	1.170	+0.00		Pass
Flat roof snow load pf	psf	24.60	24.57	-0.12		Pass
Minimum snow load pm	psf	30.00	30.00	+0.00		Pass
Snow plus rain-on-snow	psf	32.60	32.57	-0.09		Pass
Snow density γ	pcf	17.90	17.90	+0.00		Pass
Balanced snow height hb	ft	1.370	1.373	+0.19		Pass

AISC-III-1-SIDE: Drift at the side parapet (lu = 121 ft, 2 ft parapet)

Source: AISC Design Examples v16.0, Part III, pp. III-7 Table III-1. Calculation: Snow loads.

AISC-III-1-SIDE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Drift height hd	ft	0.630	0.627	-0.42		Pass
Maximum drift load	psf	11.20	11.23	+0.27		Pass
Maximum drift width w	ft	5.020	5.019	-0.02		Pass

AISC-III-1-END: Drift at the end parapet (lu = 211 ft, 2 ft parapet)

Source: AISC Design Examples v16.0, Part III, pp. III-7 Table III-1. Calculation: Snow loads.

AISC-III-1-END · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Drift height hd	ft	0.630	0.627	-0.42		Pass
Maximum drift load	psf	11.20	11.23	+0.27		Pass
Maximum drift width w	ft	5.020	5.019	-0.02		Pass

AISC-III-1-SCREEN: Drift at the 6 ft screen wall (lu = 60.5 ft)

Source: AISC Design Examples v16.0, Part III, pp. III-7 Table III-1. Calculation: Snow loads.

AISC-III-1-SCREEN · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Drift height hd	ft	2.370	2.367	-0.13		Pass
Maximum drift load	psf	42.40	42.37	-0.08		Pass
Maximum drift width w	ft	18.90	18.94	+0.19		Pass

C7-EX1: Gable roof 6 on 12, balanced and unbalanced loads

Source: ASCE/SEI 7-22 Commentary C7, pp. p. 661 (Example 1). Calculation: Snow loads.

C7-EX1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ct (Rroof = 30, pg = 30)		1.140	1.140	+0.00		Pass
Flat roof snow load pf	psf	23.90	23.94	+0.17		Pass
Sloped roof snow load ps (Cs = 1.0, Fig. 7.4-1b)	psf	23.90	23.94	+0.17		Pass
Snow density γ	pcf	17.90	17.90	+0.00		Pass
Gable drift height hd (lu = W = 30 ft)	ft	2.460	2.469	+0.36		Pass
Surcharge hd γ / √S	psf	31.10	31.25	+0.48		Pass
Surcharge extent 8 hd √S / 3	ft	9.300	9.311	+0.12		Pass

C7-EX2: Exposed roof, Rroof = 20, slope 41° at the eaves: pf and Cs

Source: ASCE/SEI 7-22 Commentary C7, pp. pp. 661 to 662 (Example 2). Calculation: Snow loads.

C7-EX2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ct (interpolated, Rroof = 20, pg = 27.5)		1.070	1.065	-0.47		Pass
Flat roof snow load pf	psf	18.50	18.45	-0.26		Pass
Cs at 41° (Fig. 7.4-1a)		0.720	0.725	+0.69		Pass
ps at the eaves	psf	13.30	13.38	+0.58		Pass

C7-ROS: Rain-on-snow surcharge on a 1/4 on 12 monoslope roof, risk category IV

Source: ASCE/SEI 7-22 Commentary C7, pp. p. 659 (C7.10). Calculation: Snow loads.

C7-ROS · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Sloped roof snow load ps	psf	24.60	24.64	+0.16		Pass
ps + 8 psf rain-on-snow	psf	32.60	32.64	+0.12		Pass
Minimum load pm	psf	32.00	32.00	+0.00		Pass

C7-EX3-HIGH: Upper roof: fully exposed, heated, Rroof = 30, pg = 40

Source: ASCE/SEI 7-22 Commentary C7, pp. p. 662 (Example 3). Calculation: Snow loads.

C7-EX3-HIGH · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ct (Rroof = 30, pg = 40)		1.130	1.130	+0.00		Pass
Flat roof snow load pf	psf	28.50	28.48	-0.08		Pass
Minimum load pm (pg > pm,max = 30)	psf	30.00	30.00	+0.00		Pass

C7-EX3-LOW: Lower unheated roof with a 10 ft step: leeward and windward drifts

Source: ASCE/SEI 7-22 Commentary C7, pp. pp. 662 to 663 (Example 3). Calculation: Snow loads.

C7-EX3-LOW · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Flat roof snow load pf	psf	27.00	26.88	-0.44		Pass
Minimum load pm (pm,max = 25)	psf	25.00	25.00	+0.00		Pass
hb	ft	1.400	1.480	+5.73		Deviation ASCE7-C7-EX3-GAMMA
ASCE7-C7-EX3-GAMMA: the example divides by γ = 19 pcf of the upper roof's pg						
hc	ft	8.600	8.520	-0.93		Pass
Windward drift height 0.75 hd (governs)	ft	3.410	3.595	+5.43		Deviation ASCE7-C7-EX3-GAMMA
ASCE7-C7-EX3-GAMMA: hd = 4.55 ft printed; Eq. 7.6-1 gives 4.79 ft with γ = 18.2						
Windward drift width 8 × 0.75 hd	ft	27.30	28.76	+5.35		Deviation ASCE7-C7-EX3-GAMMA
ASCE7-C7-EX3-GAMMA: follows the windward height						
Drift surcharge pd	psf	64.80	65.29	+0.75		Pass
Peak load at the step	psf	92.00	92.17	+0.18		Pass
Leeward drift height (lu = 100 ft)	ft	3.400	3.528	+3.77		Deviation ASCE7-C7-EX3-GAMMA
ASCE7-C7-EX3-GAMMA: the example uses γ = 19 pcf (3.45 ft); γ = 18.2 gives 3.53 ft						

H1: Sliding snow from a 30° slippery upper roof

Source: Hand calculation (closed form). Calculation: Snow loads.

H1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Upper roof pf	psf	30.80	30.80	+0.00		Pass
Sliding load 0.4 pf W	plf	246.4	246.4	+0.00		Pass
Sliding surcharge over 15 ft	psf	16.43	16.43	-0.02		Pass
Total ps + sliding	psf	50.03	50.03	-0.01		Pass

H2: Adjacent higher structure 6 ft away (7.7.2)

Source: Hand calculation (closed form). Calculation: Snow loads.

H2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Leeward drift height	ft	5.829	5.829	+0.01		Pass
Leeward drift width min(6hd, 6h − s)	ft	34.98	34.98	-0.01		Pass
pd	psf	119.5	119.5	+0.00		Pass
Windward drift height, truncated in the gap	ft	2.680	2.680	+0.01		Pass

H3: Short simple rafters: unbalanced load pg on the leeward side

Source: Hand calculation (closed form). Calculation: Snow loads.

H3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Leeward unbalanced load	psf	30.00	30.00	+0.00		Pass
Windward unbalanced load	psf	0.000	0.000	+0.00		Pass

H4: Ct interpolated in Table 7.3-3, slippery roof of Fig. 7.4-1(b)

Source: Hand calculation (closed form). Calculation: Snow loads.

H4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ct		1.188	1.188	+0.00		Pass
Cs		0.667	0.667	-0.01		Pass
pf	psf	20.78	20.78	+0.01		Pass
ps	psf	13.85	13.85	+0.03		Pass

H5: Leeward drift truncated at hc and tapered on a short lower roof

Source: Hand calculation (closed form). Calculation: Snow loads.

H5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
hc	ft	1.663	1.663	-0.03		Pass
Drift height (hc)	ft	1.663	1.663	-0.03		Pass
Drift width (tapered to the roof length)	ft	10.00	10.00	+0.00		Pass
pd	psf	29.76	29.76	-0.00		Pass

CT-7-1B: Cantilevered soldier pile wall, simplified method

Source: Caltrans Trenching and Shoring Manual (2025), Example 7-1B, cantilevered soldier pile wall, simplified method, pp. pp. 7-26 to 7-32.
Calculation: Soldier pile wall.

CT-7-1B · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Arching capability factor f = 0.08 φ		2.800	2.800	+0.00		Pass
D0 from moments about O	ft	12.27	12.27	-0.05		Pass
Embedment D = 1.2 D0	ft	14.73	14.72	-0.08		Pass
Depth of zero shear below the excavation Y	ft	5.997	5.996	-0.01		Pass
Maximum moment	kip-ft	379.7	379.7	+0.01		Pass
Maximum shear (at O)	kips	137.7	137.6	-0.08		Pass

CT-6-5: Timber lagging, 4x12 DF-L No. 2

Source: Caltrans Trenching and Shoring Manual (2025), 6-5.01 Example lagging calculations (NDS 2018 values), pp. pp. 6-8 to 6-11.
Calculation: Soldier pile wall.

CT-6-5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Adjusted F'b = Fb CD CF Cfu	psi	1,252	1,252	+0.03		Pass
Bending stress fb	psi	1,283	1,286	+0.25		Pass
Adjusted F'v = Fv CD CM	psi	201.0	200.8	-0.10		Pass
Shear stress fv = 3V / 2A	psi	50.00	49.71	-0.57		Pass
Adjusted F'c⊥ = Fc⊥ CM	psi	419.0	418.8	-0.06		Pass
Bearing stress fc⊥	psi	39.00	38.67	-0.85		Pass

SP-HC1: Driven pile, moment balance about O

Source: Hand calculation (closed form). Calculation: Soldier pile wall.

SP-HC1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
D0 (closed-form moment balance)	ft	14.80	14.86	+0.38		Pass
Zero shear below the excavation: f b Kp y y² / 2 = s Ka y H² / 2 + b Ka y (H y + y² / 2)	ft	7.857	7.888	+0.40		Pass

MNL-F1: Square spread footing, 24 in. column (ACI 318-19)

Source: ACI MNL-17(21), Foundation Example 1, pp. pp. 475-487. Calculation: Spread footing.

MNL-F1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
One-way Vu at d = 31.5 in. from the face p. 480	kips	191.0	189.9	-0.57		Pass
φVc one-way with ρw = 0.0018 p. 480	kips	208.0	226.0	+8.67		Deviation MNL17-F1-RHO
MNL17-F1-RHO: the handbook estimates ρw as 0.0018; ILX Calcs uses the 13 No. 8 bars provided						
φvc punching = 0.75 × 4√f'c (vc = 253 psi) p. 482	psi	189.8	189.7	-0.01		Pass
Factored moment at the column face p. 483	kip-ft	1,005	999.6	-0.54		Pass
As,min = 0.0018 b h p. 483	in.²	9.400	9.331	-0.73		Pass
φBn on the footing (√(A2/A1) ≤ 2) p. 485	kips	2,546	2,546	-0.00		Pass
ℓd of No. 8 p. 486	in.	28.50	28.46	-0.14		Pass
Bar length available beyond the column face p. 486	in.	57.00	57.00	+0.00		Pass

SP-SF: Square spread footing, 18 in column (Wight Ex. 15-2)

Source: StructurePoint, Reinforced Concrete Spread Footing (Isolated Footing) Analysis and Design (ACI 318-14), after Wight, Reinforced Concrete Mechanics and Design, 7th Ed., Example 15-2, pp. pp. 4-11. Calculation: Spread footing.

SP-SF · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Factored moment at the column face 7310 psf × 11.17 ft × (58/12 ft)²/2	kip-ft	954.0	954.0	-0.00		Pass
Punching vu at d/2 (d = 28 in average)	psi	156.0	156.2	+0.10		Pass
φvc = 0.75 × 4√f'c	psi	164.0	164.3	+0.19		Pass
As,min = 0.0018 b h	in.²	7.720	7.718	-0.02		Pass
Bar length available beyond the column face	in.	55.00	55.00	+0.00		Pass
φBn on the footing (√(A2/A1) ≤ 2)	kips	1,070	1,074	+0.38		Pass
φBn on the column base (f'c,col = 5000 psi)	kips	895.0	895.0	+0.01		Pass
One-way shear Vu at d from the face	kips	204.0	200.8	-1.58		Deviation SF-DAVG-ONEWAY
SF-DAVG-ONEWAY: the publication uses the average d = 28 in of both layers; the program uses the d of the bars in the direction checked (28.5 in)						
φVc one-way (ACI 318-14: 2√f'c bw d)	kips	308.0	165.1	-46.40		Deviation SF-ACI19-ONEWAY
SF-ACI19-ONEWAY: ACI 318-19 Table 22.5.5.1(c) replaces 2√f'c bw d of ACI 318-14 for members without stirrups						
ℓd of #8 (simplified Table 25.4.2.2 of ACI 318-14)	in.	54.80	32.86	-40.03		Deviation SF-LD-SIMPLIFIED
SF-LD-SIMPLIFIED: the publication uses the simplified table; the program uses the general Eq. 25.4.2.4(a) with (cb + Ktr)/db = 2.5, both permitted						

SP-STF: Wall (strip) footing, 12 in wall, 10 ft length (Wight Ex. 15-1)

Source: StructurePoint, Reinforced Concrete Shear Wall Foundation (Strip Footing) Analysis and Design (ACI 318-14), after Wight, Reinforced Concrete Mechanics and Design, 7th Ed., Example 15-1, pp. pp. 2-6. Calculation: Spread footing.

SP-STF · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Factored moment at the wall face (13.4 kip-ft/ft × 10 ft)	kip-ft	134.0	134.4	+0.30		Pass
One-way shear Vu at d = 9.75 in (7.87 kips/ft × 10 ft)	kips	78.70	78.71	+0.01		Pass
As,min = 0.0018 b h (0.281 in²/ft × 10 ft)	in.²	2.810	2.808	-0.07		Pass
Bar length available beyond the wall face	in.	22.00	22.00	+0.00		Pass
Shrinkage and temperature steel along the wall, 0.0018 × 62 in × 13 in	in.²	1.450	1.451	+0.06		Pass
Spacing of 5 #5 along the wall	in.	13.84	13.84	+0.03		Pass
φVc one-way (ACI 318-14: 9.61 kips/ft × 10 ft)	kips	96.10	54.87	-42.90		Deviation SF-ACI19-ONEWAY
SF-ACI19-ONEWAY: ACI 318-19 Table 22.5.5.1(c) replaces 2√f'c bw d of ACI 318-14 for members without stirrups						

SF-1: Square footing, concentric load (the default design)

Source: Hand calculation (closed form). Calculation: Spread footing.

SF-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Service soil pressure (D + L) (P + Wf + Ws) / (L B)	ksf	3.503	3.503	+0.00		Pass
Factored moment at the column face qu,net B ℓ²/2 with qu,net = Pu / (L B)	kip-ft	265.6	265.6	+0.00		Pass
φMn, 11 #6 along L	kip-ft	440.6	440.6	-0.00		Pass
One-way shear Vu at d	kips	76.74	76.74	+0.00		Pass
φVc (Table 22.5.5.1(c), λs = 1)	kips	109.5	109.5	+0.00		Pass
Punching shear stress vu	psi	95.97	95.97	+0.00		Pass
φvc = 0.75 × 4√f'c	psi	189.7	189.7	+0.00		Pass
Bearing φBn on the footing	kips	1,432	1,432	+0.00		Pass
Development length ℓd of #6	in.	17.08	17.08	+0.00		Pass

SF-2: Uniaxial moment outside the kern (partial contact)

Source: Hand calculation (closed form). Calculation: Spread footing.

SF-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
q max = 2P / (3B (L/2 − e))	ksf	5.645	5.645	+0.00		Pass
Overturning ratio M·FS / (P L/2)		0.656	0.656	+0.00		Pass

SF-3: Biaxial moments inside the kern

Source: Hand calculation (closed form). Calculation: Spread footing.

SF-3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Corner pressure P/A (1 + 6ex/L + 6ey/B)	ksf	3.625	3.625	+0.00		Pass

A-6.1: Point bracing of a W12X72 column, 12 ft unbraced

Source: AISC Design Examples v16.0, Example A-6.1, pp. A6-3 to A6-4. Calculation: Member stability bracing.

A-6.1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required strength	kips	6.300	6.300	+0.00		Pass
Required stiffness		46.70	46.67	-0.07		Pass

A-6.1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required strength	kips	4.200	4.200	+0.00		Pass
Required stiffness		46.70	46.67	-0.07		Pass

A-6.1 Lc: The same column, Lbr at the 19.0 ft the required strength allows

Source: AISC Design Examples v16.0, Example A-6.1, pp. A6-5. Calculation: Member stability bracing.

A-6.1 Lc · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required stiffness		29.50	29.47	-0.09		Pass

A-6.2: Point bracing of a WT7X34 column, 7.5 ft unbraced

Source: AISC Design Examples v16.0, Example A-6.2, pp. A6-7. Calculation: Member stability bracing.

A-6.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required strength	kips	1.500	1.500	+0.00		Pass
Required stiffness		17.80	17.78	-0.12		Pass

A-6.2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required strength	kips	1.000	1.000	+0.00		Pass
Required stiffness		17.80	17.78	-0.12		Pass

A-6.2 n: The same column, 18.6 ft and the reduction for three braces

Source: AISC Design Examples v16.0, Example A-6.2, pp. A6-8 to A6-9. Calculation: Member stability bracing.

A-6.2 n · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required stiffness		5.970	5.974	+0.06		Pass

A-6.3: Two walkway beams braced by two diagonal angles

Source: AISC Design Examples v16.0, Example A-6.3, pp. A6-11 to A6-13. Calculation: Member stability bracing.

A-6.3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required strength, one beam	kips	0.514	0.514	+0.06		Pass
Required strength, two beams	kips	1.030	1.029	-0.14		Pass
Force in one brace	kips	1.530	1.533	+0.17		Pass
Required stiffness, one beam		2.040	2.041	+0.04		Pass
Required stiffness, two beams		4.080	4.082	+0.04		Pass
Provided stiffness, two braces		112.0	112.1	+0.13		Pass

A-6.3 ASD: Two walkway beams braced by two diagonal angles, ASD

Source: AISC Design Examples v16.0, Example A-6.3, pp. A6-11 to A6-13. Calculation: Member stability bracing.

A-6.3 ASD · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required strength, one beam	kips	0.347	0.347	-0.03		Pass
Required strength, two beams	kips	0.694	0.694	-0.03		Pass
Force in one brace	kips	1.030	1.034	+0.36		Pass
Required stiffness, one beam		2.060	2.065	+0.23		Pass
Required stiffness, two beams		4.120	4.130	+0.23		Pass

A-6.4: Two walkway beams braced to a column: double angle and column in series

Source: AISC Design Examples v16.0, Example A-6.4, pp. A6-15 to A6-17. Calculation: Member stability bracing.

A-6.4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required stiffness		4.080	4.082	+0.04		Pass
Provided stiffness in series		4.120	4.108	-0.30		Pass

A-6.5: W21X50 girder in reverse curvature, the brace nearest the inflection point

Source: AISC Design Examples v16.0, Example A-6.5, pp. A6-20 to A6-22. Calculation: Member stability bracing.

A-6.5 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required strength	kips	6.670	6.668	-0.03		Pass
Required stiffness		16.70	16.69	-0.08		Pass
Force in the brace	kips	7.230	7.224	-0.09		Pass

A-6.5 ASD: W21X50 girder in reverse curvature, ASD

Source: AISC Design Examples v16.0, Example A-6.5, pp. A6-20 to A6-22. Calculation: Member stability bracing.

A-6.5 ASD · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required strength	kips	4.870	4.871	+0.02		Pass
Required stiffness		19.50	19.51	+0.08		Pass
Force in the brace	kips	5.280	5.277	-0.06		Pass

A-6.6: W30X90 girders braced torsionally by W12X40 beams

Source: AISC Design Examples v16.0, Example A-6.6, pp. A6-24 to A6-27. Calculation: Member stability bracing.

A-6.6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required brace moment	kip-ft	11.70	11.70	+0.00		Pass
Required stiffness of the system		4,640	4,643	+0.06		Pass
Web distortional stiffness alone		1,240	1,242	+0.16		Pass
Beam stiffness		148,000	148,383	+0.26		Pass
Web stiffness needed		4,790	4,793	+0.05		Pass
Stiffener width needed	in.	3.250	3.249	-0.02		Pass

A-6.6 ASD: W30X90 girders braced torsionally by W12X40 beams, ASD

Source: AISC Design Examples v16.0, Example A-6.6, pp. A6-24 to A6-27. Calculation: Member stability bracing.

A-6.6 ASD · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required brace moment	kip-ft	8.640	8.640	+0.00		Pass
Required stiffness of the system		5,700	5,696	-0.06		Pass
Web stiffness needed		5,930	5,924	-0.10		Pass

J.6 · Column base plate: W12×96 base plate bearing on a concrete pedestal

Source: AISC Design Examples v16.0, Example J.6, pp. J-20 to J-23. Calculation: Column base plate.

J.6 · Column base plate · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available bearing strength φcPp	kips	875.0	875.2	+0.02		Pass
Required plate thickness tmin	in.	1.540	1.541	+0.03		Pass

J.6 · Column base plate · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available bearing strength Pp/Ωc	kips	583.0	582.9	-0.02		Pass
Required plate thickness tmin	in.	1.540	1.542	+0.13		Pass

K.9: HSS6×6×½ column base plate on a footing

Source: AISC Design Examples v16.0, Example K.9, pp. K-42 to K-44. Calculation: Column base plate.

K.9 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Nominal bearing strength Pp	kips	862.0	861.9	-0.01		Pass
Available bearing strength φcPp	kips	560.0	560.2	+0.04		Pass
m = (N − 0.95 B)/2	in.	3.650	3.650	+0.00		Pass
Required plate thickness tmin	in.	0.917	0.917	-0.00		Pass

K.9 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available bearing strength Pp/Ωc	kips	373.0	373.1	+0.03		Pass
Required plate thickness tmin	in.	0.918	0.918	-0.01		Pass

DG1 4.7-1: Concentric axial compression, A2 = A1 (LRFD)

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-1, pp. 64 to 67. Calculation: Column base plate.

The example takes A2 = A1 (confinement ignored): a 22 × 20 in. support. Rod pattern 16 × 14 in. assumed.

DG1 4.7-1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Concrete bearing φcPp (Eq. J8-1)	kips	729.0	729.3	+0.04		Pass
m (Eq. 4-10)	in.	4.970	4.968	-0.05		Pass
n (Eq. 4-11)	in.	5.120	5.120	+0.00		Pass
X (Eq. 4-14)		0.960	0.959	-0.06		Pass
λn' (Eq. 4-12)	in.	3.110	3.112	+0.06		Pass
tmin (Eq. 4-15)	in.	1.360	1.361	+0.11		Pass

DG1 4.7-1 ASD: Concentric axial compression, A2 = A1 (ASD)

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-1, pp. 64 to 67. Calculation: Column base plate.

DG1 4.7-1 ASD · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Concrete bearing Pp/Ωc	kips	486.0	485.7	-0.06		Pass
X (Eq. 4-14)		0.958	0.959	+0.11		Pass
tmin (Eq. 4-15)	in.	1.360	1.362	+0.14		Pass

DG1 4.7-2: Concentric axial compression with confinement (LRFD)

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-2, pp. 67 to 70. Calculation: Column base plate.

DG1 4.7-2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Concrete bearing φcPp (Eq. J8-2) ILX takes A2 geometrically similar to the plate (J8), 518 in.²; DG1 528 in.²	kips	723.0	716.0	-0.96		Pass
l = max(m, n, λn')	in.	4.120	4.120	+0.00		Pass
tmin (Eq. 4-15)	in.	1.210	1.211	+0.10		Pass

DG1 4.7-2 ASD: Concentric axial compression with confinement (ASD)

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-2, pp. 67 to 70. Calculation: Column base plate.

DG1 4.7-2 ASD · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Concrete bearing Pp/Ωc	kips	481.0	476.9	-0.86		Pass
tmin (Eq. 4-15)	in.	1.210	1.212	+0.12		Pass

DG1 4.7-3 · Column base plate: Axial uplift, rods between the flanges (LRFD)

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-3, pp. 70 to 76. Calculation: Column base plate.

Plate plan size not given: 14 × 14 in. used; large spread footing (no edges).

DG1 4.7-3 · Column base plate · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tension per rod ru	kips	17.50	17.50	+0.00		Pass
Rod tension φRn = 0.75 Fu Ase	kips	20.10	20.09	-0.07		Pass
ACI φNsa	kips	20.10	20.09	-0.07		Pass
Required plate thickness (beff = 2a)	in.	0.882	0.882	-0.01		Pass
Pullout φNpn (heavy hex)	kips	26.70	26.62	-0.31		Pass
Nb = 16 λa √f'c hef^5/3	kips	92.30	92.32	+0.02		Pass
φNcbg	kips	76.30	76.62	+0.43		Pass

DG1 4.7-3 ASD: Axial uplift, rods between the flanges (ASD)

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-3, pp. 70 to 76. Calculation: Column base plate.

DG1 4.7-3 ASD · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tension per rod ra	kips	11.30	11.25	-0.44		Pass
Rod tension Rn/Ω	kips	13.40	13.39	-0.07		Pass
Required plate thickness	in.	0.869	0.867	-0.24		Pass

DG1 4.7-5: Shear lug (LRFD)

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-5, pp. 80 to 91. Calculation: Column base plate.

The 30 in. wall (length not given) is a 30 × 120 × 60 in. support.

DG1 4.7-5 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Lug moment Mu = V (G + hef,sl/2)	kip-ft	75.00	75.00	+0.00		Pass
fp(max) (A2/A1 = 4)	ksi	4.420	4.420	+0.00		Pass
Bearing length Y (Eq. 4-32)	in.	0.097	0.097	-0.03		Pass
Rod tension T = qmax Y	kips	6.410	6.409	-0.01		Pass
Tension per rod	kips	3.210	3.205	-0.17		Pass
Pullout φNpn (¾ in. heavy hex)	kips	20.40	20.41	+0.07		Pass
φNcbg (two rods, one edge)	kips	38.60	38.67	+0.18		Pass
Lug bearing φVbrg,sl	kips	70.90	70.72	-0.25		Pass
Lug breakout φVcb,sl	kips	26.10	26.06	-0.14		Pass
Lug shear yielding φRn (Eq. J4-3)	kips	240.0	240.0	+0.00		Pass
Lug flexural yielding φMn	kip-ft	90.00	90.00	+0.00		Pass
Lug weld resultant ru	kip/in.	7.910	7.914	+0.06		Pass
Lug weld φRn (5/16 in., kds = 1.5)	kip/in.	10.40	10.44	+0.38		Pass

DG1 4.7-5 ASD: Shear lug (ASD)

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-5, pp. 80 to 91. Calculation: Column base plate.

DG1 4.7-5 ASD · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Lug moment Ma	kip-ft	48.00	48.00	+0.00		Pass
fp(max)	ksi	2.940	2.944	+0.13		Pass
Bearing length Y	in.	0.093	0.093	-0.13		Pass
Rod tension T	kips	4.100	4.101	+0.03		Pass
Lug shear yielding Rn/Ω	kips	160.0	160.0	+0.00		Pass
Lug flexural yielding Mn/Ω	kip-ft	59.90	59.88	-0.03		Pass
Lug weld resultant ra	kip/in.	5.060	5.065	+0.10		Pass
Lug weld Rn/Ω	kip/in.	6.950	6.960	+0.14		Pass

DG1 4.7-6: Rods in tension, shear and bending, 1⅛ in. trial (LRFD)

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-6, pp. 91 to 94. Calculation: Column base plate.

Plate size and rod pattern not given: 18 × 18 in. plate, 14 × 14 in. rods; only the AISC rod rows.

DG1 4.7-6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Shear stress frv	ksi	9.560	9.557	-0.03		Pass
Rod moment Ml	kip-ft	5.640	5.641	+0.01		Pass
Bending stress ftb	ksi	23.80	23.77	-0.13		Pass
Axial stress fta	ksi	18.40	18.41	+0.05		Pass
Total tensile stress ft	ksi	42.20	42.18	-0.05		Pass
φF'nt (Eq. J3-3a)	ksi	26.50	26.48	-0.06		Pass

DG1 4.7-6 ASD: Rods in tension, shear and bending, 1⅛ in. trial (ASD)

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-6, pp. 91 to 94. Calculation: Column base plate.

DG1 4.7-6 ASD · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Shear stress frv	ksi	5.730	5.734	+0.07		Pass
Total tensile stress ft	ksi	25.00	24.98	-0.10		Pass
F'nt/Ω (Eq. J3-3b)	ksi	18.70	18.72	+0.10		Pass

DG1 4.7-6b: Rods in tension, shear and bending, 1½ in. rods (LRFD)

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-6, pp. 94 to 96. Calculation: Column base plate.

DG1 4.7-6b · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bending stress ftb	ksi	10.00	10.03	+0.28		Pass
Total tensile stress ft	ksi	20.30	20.38	+0.41		Pass
φF'nt	ksi	32.60	32.62	+0.08		Pass

DG1 4.7-8: Compression and shear by friction (LRFD)

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-8, pp. 104 to 109. Calculation: Column base plate.

Rods not dimensioned: four ¾ in. rods 6 × 6 in. assumed.

DG1 4.7-8 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Friction φVn (Eq. 4-30, μ = 0.4)	kips	129.0	129.0	-0.03		Pass

DG1 4.7-8 bearing: Compression with A2 ≥ 4A1, Pu = 619 kips (LRFD)

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-8, pp. 104 to 109. Calculation: Column base plate.

DG1 4.7-8 bearing · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pp = 1.7 f'c A1	kips	2,210	2,210	+0.00		Pass
Concrete bearing φcPp	kips	1,440	1,436	-0.24		Pass
X (Eq. 4-14)		0.390	0.390	+0.13		Pass
λ (Eq. 4-13)		0.701	0.702	+0.12		Pass
l = max(m, n, λn')	in.	3.080	3.082	+0.06		Pass
tmin	in.	0.896	0.897	+0.07		Pass

DG1 4.7-8 bearing ASD: Compression with A2 ≥ 4A1, Pa = 486 kips (ASD)

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-8, pp. 104 to 109. Calculation: Column base plate.

DG1 4.7-8 bearing ASD · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Concrete bearing Pp/Ωc	kips	957.0	956.7	-0.03		Pass
λ (Eq. 4-13)		0.782	0.782	+0.04		Pass
tmin	in.	1.080	1.086	+0.52		Pass

DG1 4.7-9 · Column base plate: Bending without axial load, rods in tension (LRFD)

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-9, pp. 109 to 115. Calculation: Column base plate.

DG1 4.7-9 · Column base plate · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
fp(max) = φc 1.7 f'c	ksi	4.420	4.420	+0.00		Pass
Bearing length Y (Eq. 4-32)	in.	0.886	0.885	-0.09		Pass
Rod tension T = qmax Y (Eq. 4-31)	kips	47.00	46.95	-0.10		Pass
Tension per rod	kips	23.50	23.48	-0.10		Pass
φNsa (1 in. F1554 Gr. 36)	kips	26.30	26.35	+0.19		Pass
φNcbg (two rods, s = 6 in.)	kips	51.70	51.98	+0.54		Pass
φNpn (heavy hex)	kips	33.60	33.63	+0.10		Pass
x = f − d/2 + tf/2 (Eq. 4-61)	in.	3.240	3.240	+0.00		Pass
tp,req tension interface (Eq. 4-62)	in.	1.060	1.062	+0.15		Pass
m (Eq. 4-10)	in.	5.360	5.355	-0.09		Pass
tp,req bearing interface, Y < m (Eq. 4-52)	in.	1.310	1.307	-0.22		Pass

DG1 4.7-9 ASD: Bending without axial load, rods in tension (ASD)

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-9, pp. 109 to 115. Calculation: Column base plate.

DG1 4.7-9 ASD · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
fp(max) = 1.7 f'c/Ωc	ksi	2.940	2.944	+0.13		Pass
Bearing length Y	in.	0.905	0.904	-0.09		Pass
Rod tension T	kips	31.90	31.94	+0.13		Pass
Tension per rod	kips	16.00	15.97	-0.19		Pass
tp,req tension interface	in.	1.070	1.073	+0.32		Pass
tp,req bearing interface	in.	1.320	1.320	+0.03		Pass

DG1 4.7-10: Bending without anchor rod tension (low moment)

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-10, pp. 115 to 118. Calculation: Column base plate.

Rod pattern not dimensioned: 15 × 15 in. assumed (no rod tension).

DG1 4.7-10 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
e = M/P (Eq. 4-39)	in.	2.500	2.500	+0.00		Pass
fp(max) = φc 0.85 f'c	ksi	2.210	2.210	+0.00		Pass
ecrit (Eq. 4-40)	in.	5.020	5.023	+0.05		Pass
Y = N − 2e (Eq. 4-42)	in.	14.00	14.00	+0.00		Pass
fp = P/(B Y) (Eq. 4-44)	ksi	1.410	1.414	+0.25		Pass
tp,req (n governs)	in.	1.160	1.158	-0.17		Pass

DG1 4.7-10 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
e = M/P	in.	2.500	2.500	+0.00		Pass
fp(max) = 0.85 f'c/Ωc	ksi	1.470	1.472	+0.13		Pass
ecrit	in.	4.840	4.851	+0.24		Pass
fp = P/(B Y)	ksi	0.977	0.977	+0.05		Pass
tp,req (n governs)	in.	1.180	1.181	+0.04		Pass

DG1 4.7-11: Bending with anchor rod tension (large moment)

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-11, pp. 118 to 122. Calculation: Column base plate.

A2 = A1 (24 × 22 in. support); four 1 in. rods 12 in. apart at f = 9.25 in.

DG1 4.7-11 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
fp(max)	ksi	2.210	2.210	+0.00		Pass
e = M/P	in.	9.570	9.574	+0.05		Pass
ecrit (Eq. 4-40)	in.	8.130	8.133	+0.04		Pass
Bearing length Y (Eq. 4-58)	in.	8.600	8.585	-0.18		Pass
tp,req bearing interface, n governs (Eq. 4-51)	in.	1.920	1.918	-0.10		Pass
x = f − d/2 + tf/2 (Eq. 4-61)	in.	3.350	3.350	+0.00		Pass
tp,req tension interface (Eq. 4-62)	in.	0.755	0.749	-0.86		Pass

DG1 4.7-11 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
e = M/P	in.	9.620	9.615	-0.05		Pass
ecrit	in.	7.980	7.985	+0.07		Pass
Bearing length Y	in.	9.100	9.060	-0.44		Pass
tp,req bearing interface	in.	1.920	1.919	-0.05		Pass
tp,req tension interface	in.	0.829	0.824	-0.63		Pass

DG1 4.7-12: Uplift with a large moment: bearing length and rod tension (LRFD)

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-12, pp. 125 to 127. Calculation: Column base plate.

DG1 4.7-12 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
qmax = fp(max) B	kip/in.	42.00	41.99	-0.02		Pass
Bearing length Y (Eq. 4-65)	in.	0.300	0.274	-8.56		Deviation DG1-4712-ROUND
DG1-4712-ROUND: the Example writes Y = 17.5 in. − 17.2 in. = 0.300 in., the difference of two rounded numbers; Eq. 4-65 with unrounded terms gives Y = 0.274 in. and T = 111.5 kips						
Rod tension Tu = qmax Y + Pu (Eq. 4-63)	kips	113.0	111.5	-1.31		Deviation DG1-4712-ROUND
DG1-4712-ROUND: the Example writes Y = 17.5 in. − 17.2 in. = 0.300 in., the difference of two rounded numbers; Eq. 4-65 with unrounded terms gives Y = 0.274 in. and T = 111.5 kips						

DG1 4.7-12 ASD: Uplift with a large moment: bearing length and rod tension (ASD)

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-12, pp. 125 to 127. Calculation: Column base plate.

DG1 4.7-12 ASD · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
qmax = fp(max) B	kip/in.	27.90	27.97	+0.23		Pass
Bearing length Y (Eq. 4-65)	in.	0.300	0.247	-17.69		Deviation DG1-4712-ROUND
DG1-4712-ROUND: the Example writes Y = 17.5 in. − 17.2 in. = 0.300 in., the difference of two rounded numbers; Eq. 4-65 with unrounded terms gives Y = 0.247 in. and T = 66.9 kips						
Rod tension Ta = qmax Y + Pa (Eq. 4-63)	kips	68.40	66.91	-2.18		Deviation DG1-4712-ROUND
DG1-4712-ROUND: the Example writes Y = 17.5 in. − 17.2 in. = 0.300 in., the difference of two rounded numbers; Eq. 4-65 with unrounded terms gives Y = 0.247 in. and T = 66.9 kips						

DG1 4.7-13: Uplift with a low moment: all rods in tension (LRFD)

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-13, pp. 127 to 129. Calculation: Column base plate.

DG1 4.7-13 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Largest rod tension P/n + P e y/Ix (Eq. 4-67)	kips	28.10	28.12	+0.09		Pass

DG1 4.7-13 ASD: Uplift with a low moment: all rods in tension (ASD)

Source: AISC Design Guide 1, 3rd Ed. (2024), Example 4.7-13, pp. 127 to 129. Calculation: Column base plate.

DG1 4.7-13 ASD · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Largest rod tension P/n + P e y/Ix (Eq. 4-67)	kips	16.90	16.88	-0.15		Pass

MNL-17 Anch-21 lug: Shear lug under a column base plate, uplift and shear (LRFD)

Source: ACI MNL-17(21), Anchorage Example 21, pp. Vol. 2 pp. 458 to 461. Calculation: Column base plate.

The lug is centered on the pedestal: ca1 = (32 − 1.5)/2 and ca2 = (32 − 7.5)/2 = 12.25 in., as the example. Only the lug checks are compared; the example's rods are in the concrete anchor file.

MNL-17 Anch-21 lug · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ψbrg,sl = 1 + Pu/(n Nsa)		0.601	0.601	+0.00		Pass
Vbrg,sl = 1.7 f'c Aef,sl ψbrg,sl (Aef,sl = 22.5 in.²)	kips	103.0	103.4	+0.44		Pass
φVbrg,sl (φ = 0.65)	kips	67.00	67.24	+0.36		Pass
AVc of the lug, less its own area	in.²	805.0	805.5	+0.06		Pass
AVco = 4.5 ca1² (ca1 = 15.25 in.)	in.²	1,047	1,047	-0.04		Pass
Vb = 9 λa √f'c ca1^1.5	kips	36.00	35.95	-0.13		Pass
Vcb,sl	kips	28.60	28.58	-0.07		Pass
φVcb,sl (φ = 0.65)	kips	18.60	18.58	-0.12		Pass

F.1-1A · Steel beam: W-shape in major-axis bending, continuously braced

Source: AISC Design Examples v16.0, Example F.1-1A, pp. F-3 to F-5. Calculation: Steel beam.

F.1-1A · Steel beam · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	266.0	266.4	+0.16		Pass
Available flexural strength	kip-ft	379.0	378.8	-0.07		Pass
Mn	kip-ft	421.0	420.8	-0.04		Pass
Live load deflection 5wL⁴/384EI with Ix = 800 in.⁴ (the Example sizes Ix ≥ 746 in.⁴ for the 1.17 in. limit)	in.	1.090	1.092	+0.14		Pass
Live load deflection limit L/360	in.	1.170	1.167	-0.28		Pass

F.1-1A · Steel beam · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	184.0	183.8	-0.14		Pass
Available flexural strength	kip-ft	252.0	252.0	-0.00		Pass
Mn	kip-ft	421.0	420.8	-0.04		Pass

F.1-2B: W-shape in major-axis bending, braced at the third points

Source: AISC Design Examples v16.0, Example F.1-2B, pp. F-7 to F-9. Calculation: Steel beam.

F.1-2B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	266.0	266.4	+0.16		Pass
Available flexural strength	kip-ft	304.0	306.5	+0.82		Pass
Mn	kip-ft	338.0	340.5	+0.75		Pass
Cb (Eq. F1-1)		1.010	1.014	+0.35		Pass

F.1-2B · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	184.0	183.8	-0.14		Pass
Available flexural strength	kip-ft	202.0	203.9	+0.95		Pass
Mn	kip-ft	338.0	340.5	+0.75		Pass

F.1-3B: W-shape in major-axis bending, braced at midspan

Source: AISC Design Examples v16.0, Example F.1-3B, pp. F-12 to F-14. Calculation: Steel beam.

F.1-3B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	266.0	266.4	+0.16		Pass
Available flexural strength	kip-ft	288.0	287.6	-0.14		Pass
Mn	kip-ft	320.0	319.6	-0.14		Pass
Cb (Eq. F1-1)		1.300	1.299	-0.08		Pass

F.1-3B · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	184.0	183.8	-0.14		Pass
Available flexural strength	kip-ft	192.0	191.4	-0.34		Pass
Mn	kip-ft	320.0	319.6	-0.14		Pass

F.3B: W-shape with noncompact flanges, continuously braced

Source: AISC Design Examples v16.0, Example F.3B, pp. F-21 to F-22. Calculation: Steel beam.

F.3B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	396.0	396.0	-0.00		Pass
Available flexural strength	kip-ft	398.0	397.9	-0.03		Pass
Mn	kip-ft	442.0	445.8	+0.87		Pass

F.3B · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	250.0	250.0	-0.00		Pass
Available flexural strength	kip-ft	265.0	264.7	-0.10		Pass
Mn	kip-ft	442.0	445.8	+0.87		Pass

G.1B · Steel beam: W-shape in major-axis shear

Source: AISC Design Examples v16.0, Example G.1B, pp. G-3 to G-4. Calculation: Steel beam.

End shears of 48 kips (D) and 145 kips (L) are produced by uniform loads on a 20 ft simple span.

G.1B · Steel beam · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required shear strength	kips	290.0	289.6	-0.14		Pass
Available shear strength	kips	306.0	305.7	-0.09		Pass

G.1B · Steel beam · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required shear strength	kips	193.0	193.0	+0.00		Pass
Available shear strength	kips	204.0	203.8	-0.09		Pass

T3-2 W21X55: W21X55, continuously braced

Source: AISC Steel Construction Manual, 16th Ed., Table 3-2, pp. 3-25. Calculation: Steel beam.

T3-2 W21X55 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φbMpx (Table 3-2)	kip-ft	473.0	472.5	-0.11		Pass
φvVnx (Table 3-2)	kips	234.0	234.0	+0.00		Pass
Lp (Table 3-2)	ft	6.110	6.111	+0.01		Pass
Lr (Table 3-2)	ft	17.40	17.38	-0.12		Pass

T3-2 W21X55 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mpx/Ωb (Table 3-2)	kip-ft	314.0	314.4	+0.12		Pass
Vnx/Ωv (Table 3-2)	kips	156.0	156.0	+0.00		Pass

T3-2 W21X55 Lr: W21X55, Lb = Lr = 17.4 ft, Cb = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 3-2, pp. 3-25. Calculation: Steel beam.

Lb = Lr (tabulated, rounded to 0.1 ft): Eq. F2-2 gives Mn = 0.7 Fy Sx.

T3-2 W21X55 Lr · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φbMrx (Table 3-2)	kip-ft	289.0	287.8	-0.43		Pass

T3-2 W21X55 Lr · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mrx/Ωb (Table 3-2)	kip-ft	192.0	191.5	-0.28		Pass

T3-2 W18X40: W18X40, continuously braced

Source: AISC Steel Construction Manual, 16th Ed., Table 3-2, pp. 3-25. Calculation: Steel beam.

T3-2 W18X40 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φbMpx (Table 3-2)	kip-ft	294.0	294.0	+0.00		Pass
φvVnx (Table 3-2)	kips	169.0	169.2	+0.09		Pass
Lp (Table 3-2)	ft	4.490	4.486	-0.09		Pass
Lr (Table 3-2)	ft	13.10	13.10	+0.02		Pass

T3-2 W18X40 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mpx/Ωb (Table 3-2)	kip-ft	196.0	195.6	-0.20		Pass
Vnx/Ωv (Table 3-2)	kips	113.0	112.8	-0.20		Pass

T3-2 W18X40 Lr: W18X40, Lb = Lr = 13.1 ft, Cb = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 3-2, pp. 3-25. Calculation: Steel beam.

Lb = Lr (tabulated, rounded to 0.1 ft): Eq. F2-2 gives Mn = 0.7 Fy Sx.

T3-2 W18X40 Lr · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φbMrx (Table 3-2)	kip-ft	180.0	179.6	-0.23		Pass

T3-2 W18X40 Lr · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mrx/Ωb (Table 3-2)	kip-ft	119.0	119.5	+0.41		Pass

T3-2 W16X40: W16X40, continuously braced

Source: AISC Steel Construction Manual, 16th Ed., Table 3-2, pp. 3-25. Calculation: Steel beam.

T3-2 W16X40 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φbMpx (Table 3-2)	kip-ft	274.0	273.8	-0.09		Pass
φvVnx (Table 3-2)	kips	146.0	146.4	+0.27		Pass
Lp (Table 3-2)	ft	5.550	5.546	-0.08		Pass
Lr (Table 3-2)	ft	15.90	15.89	-0.04		Pass

T3-2 W16X40 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mpx/Ωb (Table 3-2)	kip-ft	182.0	182.1	+0.07		Pass
Vnx/Ωv (Table 3-2)	kips	97.60	97.60	+0.00		Pass

T3-2 W16X40 Lr: W16X40, Lb = Lr = 15.9 ft, Cb = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 3-2, pp. 3-25. Calculation: Steel beam.

Lb = Lr (tabulated, rounded to 0.1 ft): Eq. F2-2 gives Mn = 0.7 Fy Sx.

T3-2 W16X40 Lr · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φbMrx (Table 3-2)	kip-ft	170.0	169.5	-0.27		Pass

T3-2 W16X40 Lr · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mrx/Ωb (Table 3-2)	kip-ft	113.0	112.8	-0.18		Pass

T3-2 W14X43: W14X43, continuously braced

Source: AISC Steel Construction Manual, 16th Ed., Table 3-2, pp. 3-25. Calculation: Steel beam.

T3-2 W14X43 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φbMpx (Table 3-2)	kip-ft	261.0	261.0	-0.00		Pass
φvVnx (Table 3-2)	kips	125.0	125.4	+0.28		Pass
Lp (Table 3-2)	ft	6.680	6.676	-0.06		Pass
Lr (Table 3-2)	ft	20.00	20.03	+0.14		Pass

T3-2 W14X43 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mpx/Ωb (Table 3-2)	kip-ft	174.0	173.7	-0.20		Pass
Vnx/Ωv (Table 3-2)	kips	83.60	83.57	-0.04		Pass

T3-2 W14X43 Lr: W14X43, Lb = Lr = 20.0 ft, Cb = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 3-2, pp. 3-25. Calculation: Steel beam.

Lb = Lr (tabulated, rounded to 0.1 ft): Eq. F2-2 gives Mn = 0.7 Fy Sx.

T3-2 W14X43 Lr · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φbMrx (Table 3-2)	kip-ft	164.0	164.5	+0.32		Pass

T3-2 W14X43 Lr · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mrx/Ωb (Table 3-2)	kip-ft	109.0	109.5	+0.43		Pass

T3-2 W12X65: W12X65, continuously braced (noncompact flange: F3 governs)

Source: AISC Steel Construction Manual, 16th Ed., Table 3-2, pp. 3-25. Calculation: Steel beam.

For a noncompact-flange shape the Manual tabulates Lp′ (the length where lateral-torsional buckling reaches the flange local buckling strength, Manual Eq. 3-2, Fig. 3-1), not Eq. F2-5; ILX reports Eq. F2-5, so Lp is not compared.

T3-2 W12X65 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φbMpx (Table 3-2)	kip-ft	356.0	356.2	+0.05		Pass
φvVnx (Table 3-2)	kips	142.0	141.6	-0.30		Pass
Lr (Table 3-2)	ft	35.10	35.15	+0.13		Pass

T3-2 W12X65 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mpx/Ωb (Table 3-2)	kip-ft	237.0	237.0	-0.00		Pass
Vnx/Ωv (Table 3-2)	kips	94.40	94.38	-0.02		Pass

T3-2 W12X65 Lr: W12X65, Lb = Lr = 35.1 ft, Cb = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 3-2, pp. 3-25. Calculation: Steel beam.

Lb = Lr (tabulated, rounded to 0.1 ft): Eq. F2-2 gives Mn = 0.7 Fy Sx.

T3-2 W12X65 Lr · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φbMrx (Table 3-2)	kip-ft	231.0	231.0	-0.01		Pass

T3-2 W12X65 Lr · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mrx/Ωb (Table 3-2)	kip-ft	154.0	153.7	-0.21		Pass

F.2-1B: Compact channel, continuously braced

Source: AISC Design Examples v16.0, Example F.2-1B, pp. F-18. Calculation: Steel beam.

F.2-1B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	108.0	107.8	-0.17		Pass
Available flexural strength	kip-ft	191.0	190.5	-0.26		Pass

F.2-1B · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	71.90	71.88	-0.03		Pass
Available flexural strength	kip-ft	127.0	126.7	-0.20		Pass

F.2-2B: Compact channel, braced at 5 ft, Cb = 1.0

Source: AISC Design Examples v16.0, Example F.2-2B, pp. F-20 to F-21. Calculation: Steel beam.

F.2-2B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	108.0	107.8	-0.17		Pass
Available flexural strength	kip-ft	173.0	172.3	-0.39		Pass

F.2-2B · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	71.90	71.88	-0.03		Pass
Available flexural strength	kip-ft	115.0	114.7	-0.30		Pass

F.5 · Steel beam: W-shape in minor-axis bending

Source: AISC Design Examples v16.0, Example F.5, pp. F-28 to F-29. Calculation: Steel beam.

F.5 · Steel beam · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	113.0	112.5	-0.43		Pass
Available flexural strength	kip-ft	122.0	121.9	-0.10		Pass

F.5 · Steel beam · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	75.10	75.01	-0.12		Pass
Available flexural strength	kip-ft	81.40	81.09	-0.38		Pass

F.6 · Steel beam: Square HSS, compact flange (the Example reads a Manual table)

Source: AISC Design Examples v16.0, Example F.6, pp. F-30 to F-31. Calculation: Steel beam.

F.6 · Steel beam · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	6.120	6.117	-0.05		Pass
Available flexural strength	kip-ft	7.200	7.203	+0.05		Pass

F.6 · Steel beam · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	4.080	4.078	-0.05		Pass
Available flexural strength	kip-ft	4.790	4.793	+0.06		Pass

F.7B · Steel beam: Rectangular HSS, noncompact flange

Source: AISC Design Examples v16.0, Example F.7B, pp. F-34 to F-36. Calculation: Steel beam.

F.7B · Steel beam · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	45.20	45.20	+0.01		Pass
Available flexural strength	kip-ft	59.70	59.70	-0.01		Pass

F.7B · Steel beam · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	30.20	30.32	+0.39		Pass
Available flexural strength	kip-ft	39.70	39.72	+0.05		Pass

F.8B: Square HSS, slender flange

Source: AISC Design Examples v16.0, Example F.8B, pp. F-39 to F-41. Calculation: Steel beam.

F.8B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	41.30	41.34	+0.11		Pass
Effective width be	in.	6.330	6.333	+0.05		Pass
Available flexural strength	kip-ft	45.40	46.27	+1.92		Deviation F.8B-Se
F.8B-Se: Example F.8B takes the simpler, conservative section with the ineffective width removed from both flanges (Se = 12.1 in.3); ILX removes it from the compression flange and shifts the neutral axis, as F7.2(c) says (Se = 12.3 in.3)						

F.8B · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	27.60	27.56	-0.14		Pass
Available flexural strength	kip-ft	30.20	30.79	+1.94		Deviation F.8B-Se
F.8B-Se: Example F.8B takes the simpler, conservative section with the ineffective width removed from both flanges (Se = 12.1 in.3); ILX removes it from the compression flange and shifts the neutral axis, as F7.2(c) says (Se = 12.3 in.3)						

F.9B · Steel beam: Pipe

Source: AISC Design Examples v16.0, Example F.9B, pp. F-43 to F-44. Calculation: Steel beam.

F.9B · Steel beam · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	61.40	61.44	+0.07		Pass
Available flexural strength	kip-ft	81.40	81.38	-0.03		Pass

F.9B · Steel beam · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	41.00	40.96	-0.10		Pass
Available flexural strength	kip-ft	54.10	54.14	+0.08		Pass

F.10 · Steel beam: WT, stem in tension, continuously braced

Source: AISC Design Examples v16.0, Example F.10, pp. F-45 to F-47. Calculation: Steel beam.

F.10 · Steel beam · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	2.160	2.160	-0.00		Pass
Available flexural strength	kip-ft	7.320	7.320	+0.00		Pass

F.10 · Steel beam · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	1.440	1.440	-0.00		Pass
Available flexural strength	kip-ft	4.870	4.870	+0.01		Pass

F.11A · Steel beam: Equal-leg angle, geometric axis, toe in compression, no restraint

Source: AISC Design Examples v16.0, Example F.11A, pp. F-48 to F-50. Calculation: Steel beam.

F.11A · Steel beam · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	1.350	1.350	+0.00		Pass
Available flexural strength	kip-ft	3.690	3.690	+0.01		Pass

F.11A · Steel beam · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	0.900	0.900	+0.00		Pass
Available flexural strength	kip-ft	2.460	2.455	-0.19		Pass

F.11B · Steel beam: Equal-leg angle, restraint at midspan

Source: AISC Design Examples v16.0, Example F.11B, pp. F-51 to F-53. Calculation: Steel beam.

F.11B · Steel beam · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	1.350	1.350	+0.00		Pass
Lateral-torsional buckling Mn	kip-ft	5.530	5.526	-0.08		Pass
Available flexural strength	kip-ft	3.980	4.972	+24.93		Deviation F.11B-LLB

F.11B-LLB: Example F.11B reuses the leg local buckling of F.11A with 0.80 Sc and says it is conservative; F10.3 applies 0.80 only without lateral-torsional restraint, so ILX gives the lateral-torsional buckling limit, 5.53 kip-ft

F.11B · Steel beam · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available flexural strength	kip-ft	2.650	3.308	+24.84		Deviation F.11B-LLB

F.11B-LLB: Example F.11B reuses the leg local buckling of F.11A with 0.80 Sc and says it is conservative; F10.3 applies 0.80 only without lateral-torsional restraint, so ILX gives the lateral-torsional buckling limit, 5.53 kip-ft

F.11C z: Equal-leg angle, minor principal axis, toes in compression

Source: AISC Design Examples v16.0, Example F.11C, pp. F-54 to F-59. Calculation: Steel beam.

The strengths of the principal axes; the Example's combined stress ratio by H2 is outside this type (it is the steel column's).

F.11C z · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available strength about z	kip-ft	4.130	4.132	+0.05		Pass

F.11C z · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available strength about z	kip-ft	2.750	2.749	-0.03		Pass

F.11C w: Equal-leg angle, major principal axis

Source: AISC Design Examples v16.0, Example F.11C, pp. F-54 to F-59. Calculation: Steel beam.

F.11C w · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available strength about w	kip-ft	7.490	7.478	-0.16		Pass

F.11C w · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available strength about w	kip-ft	4.980	4.976	-0.09		Pass

F.12: Rectangular bar, braced at midspan, Cb = 1.0

Source: AISC Design Examples v16.0, Example F.12, pp. F-61 to F-62. Calculation: Steel beam.

F.12 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	47.50	47.52	+0.04		Pass
Available flexural strength	kip-ft	70.40	70.31	-0.12		Pass

F.12 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	31.70	31.68	-0.06		Pass
Available flexural strength	kip-ft	46.80	46.78	-0.04		Pass

F.14 · Steel beam: Plate girder, noncompact web, braced at the quarter points

Source: AISC Design Examples v16.0, Example F.14, pp. F-65 to F-73. Calculation: Steel beam.

Self-weight 0.296 kip/ft is the girder's own, from its plates. The deflection limit of 1 in. is entered as span / 600.

F.14 · Steel beam · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	6,910	6,911	+0.01		Pass
Available flexural strength	kip-ft	7,880	7,896	+0.20		Pass
Rpc		1.030	1.033	+0.24		Pass
Lp (98.3 in.)	ft	8.192	8.198	+0.07		Pass
Lr (369 in.)	ft	30.75	30.76	+0.03		Pass
Required shear strength	kips	281.0	280.9	-0.04		Pass
Available shear strength	kips	440.0	439.9	-0.03		Pass
Total deflection	in.	0.944	0.944	-0.03		Pass

F.14 · Steel beam · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required flexural strength	kip-ft	5,090	5,093	+0.05		Pass
Available flexural strength	kip-ft	5,250	5,253	+0.06		Pass
Required shear strength	kips	207.0	207.4	+0.19		Pass
Available shear strength	kips	293.0	292.7	-0.11		Pass

G.2B: Channel in major-axis shear

Source: AISC Design Examples v16.0, Example G.2B, pp. G-6. Calculation: Steel beam.

The Example's end shears are made by a uniform load on a 10 ft simple span.

G.2B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required shear strength	kips	150.0	150.0	+0.00		Pass
Available shear strength	kips	162.0	162.0	+0.00		Pass

G.2B · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required shear strength	kips	100.0	100.0	+0.00		Pass
Available shear strength	kips	108.0	107.8	-0.20		Pass

G.3: Angle in shear, long leg vertical

Source: AISC Design Examples v16.0, Example G.3, pp. G-7 to G-8. Calculation: Steel beam.

G.3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required shear strength	kips	30.00	30.00	+0.00		Pass
Available shear strength	kips	33.80	33.75	-0.15		Pass

G.3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required shear strength	kips	20.00	20.00	+0.00		Pass
Available shear strength	kips	22.50	22.46	-0.20		Pass

G.4 · Steel beam: Rectangular HSS in shear

Source: AISC Design Examples v16.0, Example G.4, pp. G-9 to G-10. Calculation: Steel beam.

G.4 · Steel beam · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required shear strength	kips	66.00	66.00	-0.00		Pass
Available shear strength	kips	93.60	93.29	-0.33		Pass

G.4 · Steel beam · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required shear strength	kips	44.00	44.00	-0.00		Pass
Available shear strength	kips	62.30	62.07	-0.37		Pass

G.5 · Steel beam: Round HSS in shear, Lv = half the span

Source: AISC Design Examples v16.0, Example G.5, pp. G-11 to G-12. Calculation: Steel beam.

G.5 · Steel beam · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required shear strength	kips	180.0	180.0	-0.00		Pass
Available shear strength	kips	232.0	232.2	+0.09		Pass

G.5 · Steel beam · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required shear strength	kips	120.0	120.0	-0.00		Pass
Available shear strength	kips	155.0	154.5	-0.33		Pass

G.6 · Steel beam: W-shape in minor-axis shear

Source: AISC Design Examples v16.0, Example G.6, pp. G-13 to G-14. Calculation: Steel beam.

G.6 · Steel beam · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required shear strength	kips	120.0	120.0	+0.00		Pass
Available shear strength	kips	189.0	189.0	+0.01		Pass

G.6 · Steel beam · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required shear strength	kips	80.00	80.00	+0.00		Pass
Available shear strength	kips	126.0	125.8	-0.19		Pass

G.7: Channel in minor-axis shear

Source: AISC Design Examples v16.0, Example G.7, pp. G-15 to G-16. Calculation: Steel beam.

G.7 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required shear strength	kips	45.00	45.00	+0.00		Pass
Available shear strength	kips	59.10	59.10	+0.00		Pass

G.7 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required shear strength	kips	30.00	30.00	+0.00		Pass
Available shear strength	kips	39.30	39.32	+0.05		Pass

G.8A: Built-up girder without stiffeners

Source: AISC Design Examples v16.0, Example G.8A, pp. G-17 to G-18. Calculation: Steel beam.

G.8A · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required shear strength	kips	210.0	210.0	+0.00		Pass
Available shear strength	kips	176.0	176.1	+0.05		Pass

G.8A · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required shear strength	kips	140.0	140.0	+0.00		Pass
Available shear strength	kips	117.0	117.2	+0.13		Pass

G.8B · Steel beam: Built-up girder: end panel a = 42 in., second panel a = 90 in. with tension field

Source: AISC Design Examples v16.0, Example G.8B, pp. G-22 to G-24. Calculation: Steel beam.

The Example designs the end of the girder; the same stiffeners are entered at the far end. Stiffener a: the spacing, as the Example takes it.

G.8B · Steel beam · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
End panel required	kips	210.0	210.0	+0.00		Pass
End panel available	kips	217.0	216.7	-0.14		Pass
Second panel required	kips	184.0	183.8	-0.14		Pass
Second panel available	kips	185.0	185.7	+0.40		Pass

G.8B · Steel beam · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
End panel required	kips	140.0	140.0	+0.00		Pass
End panel available	kips	144.0	144.2	+0.12		Pass
Second panel required	kips	123.0	122.5	-0.41		Pass
Second panel available	kips	123.0	123.6	+0.47		Pass

E.1C: W14×132, pinned, Lc = 30 ft both axes

Source: AISC Design Examples v16.0, Example E.1C, pp. E-8 to E-9. Calculation: Steel column.

The Example interpolates Fn from Manual Table 4-14 (φcFn = 23.0 ksi); ILX computes Eq. E3-2.

E.1C · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	892.0	893.2	+0.13		Pass

E.1C · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	598.0	594.3	-0.62		Pass

E.1D: W14×90, Lcx = 30 ft, Lcy = Lcz = 15 ft

Source: AISC Design Examples v16.0, Example E.1D, pp. E-10 to E-12. Calculation: Steel column.

E.1D · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	927.0	927.5	+0.05		Pass
Fe (x-axis, Eq. E3-4)	ksi	83.30	83.26	-0.05		Pass

E.1D · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	617.0	617.1	+0.01		Pass

E.1E-a: W16×31 with a slender web, Lc = 5 ft

Source: AISC Design Examples v16.0, Example E.1E, pp. E-13 to E-16. Calculation: Steel column.

E.1E-a · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	314.0	313.2	-0.26		Pass
Effective area Ae (E7)	in.²	8.440	8.435	-0.06		Pass

E.1E-a · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	209.0	208.4	-0.30		Pass

E.1E-b: W16×31, Lc = 10 ft (web fully effective)

Source: AISC Design Examples v16.0, Example E.1E, pp. E-16 to E-17. Calculation: Steel column.

E.1E-b · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	189.0	190.4	+0.74		Pass

E.1E-b · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	126.0	126.7	+0.53		Pass

E.1E-c: W16×31, Lc = 15 ft (Eq. E3-3)

Source: AISC Design Examples v16.0, Example E.1E, pp. E-17 to E-18. Calculation: Steel column.

E.1E-c · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	87.10	87.14	+0.05		Pass

E.1E-c · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	58.00	57.98	-0.03		Pass

E.9: HSS12×10×3/8, fixed-pinned, K = 0.8, L = 20 ft

Source: AISC Design Examples v16.0, Example E.9, pp. E-59 to E-61. Calculation: Steel column.

E.9 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	556.0	555.6	-0.07		Pass

E.9 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	370.0	369.7	-0.09		Pass

E.10: HSS12×8×3/16 with slender walls, Lc = 24 ft

Source: AISC Design Examples v16.0, Example E.10, pp. E-62 to E-65. Calculation: Steel column.

E.10 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	151.0	151.3	+0.22		Pass
Effective area Ae (E7)	in.²	5.770	5.773	+0.05		Pass

E.10 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	101.0	100.7	-0.31		Pass

E.10-18: HSS12×8×3/16, Lc = 18 ft (both walls reduced)

Source: AISC Design Examples v16.0, Example E.10, Table E.10-1, pp. E-66. Calculation: Steel column.

E.10-18 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	177.0	177.8	+0.46		Pass
Effective area Ae (E7)	in.²	5.350	5.355	+0.09		Pass

E.10-18 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	118.0	118.3	+0.26		Pass

E.10-40: HSS12×8×3/16, Lc = 40 ft (no local buckling)

Source: AISC Design Examples v16.0, Example E.10, Table E.10-1, pp. E-66. Calculation: Steel column.

E.10-40 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	74.80	74.39	-0.55		Pass

E.10-40 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	49.80	49.49	-0.62		Pass

E.11: Pipe 10 Std., Lx = 30 ft, Ly = 15 ft

Source: AISC Design Examples v16.0, Example E.11, pp. E-67 to E-69. Calculation: Steel column.

E.11 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	221.0	222.0	+0.44		Pass

E.11 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	147.0	147.7	+0.46		Pass

D.1 · Steel column: W8×21 tension member, bolted flanges

Source: AISC Design Examples v16.0, Example D.1, pp. D-2 to D-4. Calculation: Steel column.

D.1 · Steel column · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tensile yielding φtPn	kips	277.0	277.2	+0.07		Pass
Tensile rupture φtPn	kips	211.0	210.7	-0.14		Pass

D.1 · Steel column · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tensile yielding Pn/Ωt	kips	184.0	184.4	+0.23		Pass
Tensile rupture Pn/Ωt	kips	141.0	140.5	-0.38		Pass

F.5 · Steel column: W12×58 in minor-axis bending (F6)

Source: AISC Design Examples v16.0, Example F.5, pp. F-28 to F-29. Calculation: Steel column.

F.5 · Steel column · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available flexural strength	kip-ft	122.0	121.9	-0.10		Pass

F.5 · Steel column · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available flexural strength	kip-ft	81.40	81.09	-0.38		Pass

F.7B · Steel column: HSS10×6×3/16, noncompact flange, Lb = 21 ft

Source: AISC Design Examples v16.0, Example F.7B, pp. F-34 to F-36. Calculation: Steel column.

F.7B · Steel column · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available flexural strength	kip-ft	59.70	59.70	-0.01		Pass
Cb (Eq. F1-1, uniform load)		1.140	1.136	-0.32		Pass

F.7B · Steel column · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available flexural strength	kip-ft	39.70	39.72	+0.05		Pass

F.8A: HSS8×8×3/16 with slender flanges (Manual Table 3-13)

Source: AISC Design Examples v16.0, Example F.8A, pp. F-37. Calculation: Steel column.

ILX computes Se with the compression flange reduced and the neutral axis shifted (F7.2(c)); the Manual table value is compared. Example F.8B removes the ineffective width from both flanges (conservative) and obtains 45.4 / 30.2 kip-ft.

F.8A · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available flexural strength	kip-ft	46.30	46.27	-0.07		Pass

F.8A · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available flexural strength	kip-ft	30.80	30.79	-0.05		Pass

F.9B · Steel column: Pipe 8 x-Strong in flexure (F8)

Source: AISC Design Examples v16.0, Example F.9B, pp. F-43 to F-44. Calculation: Steel column.

F.9B · Steel column · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available flexural strength	kip-ft	81.40	81.38	-0.03		Pass

F.9B · Steel column · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available flexural strength	kip-ft	54.10	54.14	+0.08		Pass

G.1B · Steel column: W24×62 major-axis shear

Source: AISC Design Examples v16.0, Example G.1B, pp. G-3 to G-4. Calculation: Steel column.

G.1B · Steel column · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available shear strength	kips	306.0	305.7	-0.09		Pass

G.1B · Steel column · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available shear strength	kips	204.0	203.8	-0.09		Pass

G.4 · Steel column: HSS6×4×3/8 shear (G4)

Source: AISC Design Examples v16.0, Example G.4, pp. G-9 to G-10. Calculation: Steel column.

G.4 · Steel column · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available shear strength	kips	93.60	93.29	-0.33		Pass

G.4 · Steel column · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available shear strength	kips	62.30	62.07	-0.37		Pass

G.5 · Steel column: HSS16.000×0.375 shear (G5), 32 ft span

Source: AISC Design Examples v16.0, Example G.5, pp. G-11 to G-12. Calculation: Steel column.

Uniform load on a 32 ft span: Lv = half the span (192 in.).

G.5 · Steel column · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available shear strength	kips	232.0	232.2	+0.09		Pass

G.5 · Steel column · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available shear strength	kips	155.0	154.5	-0.33		Pass

G.6 · Steel column: W21×48 minor-axis shear (G6)

Source: AISC Design Examples v16.0, Example G.6, pp. G-13 to G-14. Calculation: Steel column.

G.6 · Steel column · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available shear strength	kips	189.0	189.0	+0.01		Pass

G.6 · Steel column · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available shear strength	kips	126.0	125.8	-0.19		Pass

H.1B: W14×99 in compression and biaxial bending (second-order moments given)

Source: AISC Design Examples v16.0, Example H.1B, pp. H-4 to H-5. Calculation: Steel column.

H.1B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	1,130	1,127	-0.25		Pass
Available major-axis flexural strength	kip-ft	642.0	642.2	+0.03		Pass
Available minor-axis flexural strength	kip-ft	311.0	311.4	+0.12		Pass
Interaction (Eq. H1-1a)		0.929	0.929	+0.03		Pass

H.1B-ASD: W14×99, ASD required strengths

Source: AISC Design Examples v16.0, Example H.1B, pp. H-4 to H-5. Calculation: Steel column.

H.1B-ASD · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	750.0	750.0	-0.01		Pass
Available major-axis flexural strength	kip-ft	427.0	427.3	+0.06		Pass
Available minor-axis flexural strength	kip-ft	207.0	207.2	+0.08		Pass
Interaction (Eq. H1-1a)		0.933	0.932	-0.09		Pass

H.3: W14×82 in axial tension and biaxial bending (Cb increased by H1.2)

Source: AISC Design Examples v16.0, Example H.3, pp. H-8 to H-11. Calculation: Steel column.

Cb = 1.14 (Manual Table 3-1) × √(1 + αPr/Pey) = 1.41; ILX computes Cb = 1.136 by Eq. F1-1.

H.3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required tension Pu	kips	174.0	174.0	+0.00		Pass
Available tensile strength	kips	1,080	1,080	+0.00		Pass
Available major-axis flexural strength	kip-ft	492.0	490.4	-0.33		Pass
Available minor-axis flexural strength	kip-ft	168.0	168.0	+0.00		Pass
Interaction (Eq. H1-1b)		0.873	0.875	+0.20		Pass

H.3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required tension Pa	kips	116.0	116.0	+0.00		Pass
Available tensile strength	kips	719.0	718.6	-0.06		Pass
Available major-axis flexural strength	kip-ft	328.0	330.0	+0.62		Pass
Available minor-axis flexural strength	kip-ft	112.0	111.8	-0.20		Pass
Interaction (Eq. H1-1b)		0.874	0.872	-0.22		Pass

H.4: W10×33 in compression and biaxial bending, B1 by Appendix 8

Source: AISC Design Examples v16.0, Example H.4, pp. H-12 to H-15. Calculation: Steel column.

Pe1 with EI (effective length method), Cm = 1.0 for transverse loading; Cb = 1.14 (Manual Table 3-1).

H.4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	253.0	252.5	-0.19		Pass
B1x (Eq. A-8-3)		1.020	1.018	-0.23		Pass
Mux = B1 Mnt	kip-ft	91.80	91.58	-0.23		Pass
B1y (Eq. A-8-3)		1.090	1.088	-0.19		Pass
Muy = B1 Mnt	kip-ft	13.10	13.06	-0.34		Pass
Available major-axis flexural strength	kip-ft	137.0	136.2	-0.62		Pass
Available minor-axis flexural strength	kip-ft	52.50	52.50	+0.00		Pass
Interaction (Eq. H1-1b)		0.979	0.981	+0.18		Pass

H.4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	168.0	168.0	+0.01		Pass
Max = B1 Mnt	kip-ft	61.20	61.13	-0.12		Pass
May = B1 Mnt	kip-ft	8.720	8.755	+0.40		Pass
Available major-axis flexural strength	kip-ft	91.00	90.59	-0.45		Pass
Available minor-axis flexural strength	kip-ft	34.90	34.93	+0.09		Pass
Interaction (Eq. H1-1b)		0.982	0.985	+0.30		Pass

D.4 · Steel column: HSS6×4×3/8 tension member, welded single gusset (U = 0.919)

Source: AISC Design Examples v16.0, Example D.4, pp. D-11 to D-13. Calculation: Steel column.

An = Ag − 2(t + 1/16 in.) t = 5.79 in.² for the gusset slots, U = 1 − x̄/l (Table D3.1).

D.4 · Steel column · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tensile yielding φtPn	kips	278.0	278.1	+0.04		Pass
Tensile rupture φtPn	kips	248.0	247.4	-0.23		Pass

D.4 · Steel column · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tensile yielding Pn/Ωt	kips	185.0	185.0	+0.02		Pass
Tensile rupture Pn/Ωt	kips	165.0	165.0	-0.03		Pass

D.5 · Steel column: HSS6.000×0.500 tension member, welded single gusset (U = 0.991)

Source: AISC Design Examples v16.0, Example D.5, pp. D-14 to D-16. Calculation: Steel column.

D.5 · Steel column · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tensile yielding φtPn	kips	364.0	364.1	+0.01		Pass
Tensile rupture φtPn	kips	349.0	348.8	-0.05		Pass

D.5 · Steel column · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tensile yielding Pn/Ωt	kips	242.0	242.2	+0.09		Pass
Tensile rupture Pn/Ωt	kips	233.0	232.6	-0.19		Pass

E.1B: W14×90, Lc = 19 ft (Manual Table 4-1a entry used by the Example)

Source: AISC Design Examples v16.0, Example E.1B, pp. E-6 to E-7. Calculation: Steel column.

The Example takes the Table 4-1a strength at Lc = 19 ft (conservative for the 18.1 ft equivalent length); ILX is run at Lc = 19 ft on both axes.

E.1B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	903.0	903.4	+0.04		Pass

E.1B · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	601.0	601.1	+0.01		Pass

E.4B · Steel column: W14×82 in a moment frame, Kx = 2.0 (alignment chart), L = 14 ft

Source: AISC Design Examples v16.0, Example E.4B, pp. E-34 to E-35. Calculation: Steel column.

Weak axis continuously braced (entered as Ly = Lz = 1 ft); Lcx = 28 ft. The Example interpolates Table 4-1a at Lcx/(rx/ry) = 11.5 ft.

E.4B · Steel column · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	861.0	861.9	+0.11		Pass

E.4B · Steel column · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	573.0	573.5	+0.08		Pass

F.6 · Steel column: HSS3½×3½×1/8 with compact flanges in flexure

Source: AISC Design Examples v16.0, Example F.6, pp. F-30 to F-31. Calculation: Steel column.

F.6 · Steel column · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available flexural strength	kip-ft	7.200	7.203	+0.05		Pass

F.6 · Steel column · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available flexural strength	kip-ft	4.790	4.793	+0.06		Pass

T4-1a W14X145 20: W14X145, Lc = 20 ft

Source: AISC Steel Construction Manual, 16th Ed., Table 4-1a, pp. 4-16. Calculation: Steel column.

T4-1a W14X145 20 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	1,470	1,473	+0.20		Pass

T4-1a W14X145 20 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	980.0	980.0	-0.00		Pass

T4-1a W14X145 40: W14X145, Lc = 40 ft

Source: AISC Steel Construction Manual, 16th Ed., Table 4-1a, pp. 4-16. Calculation: Steel column.

T4-1a W14X145 40 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	663.0	663.2	+0.03		Pass

T4-1a W14X145 40 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	441.0	441.3	+0.06		Pass

T4-1a W14X120 10: W14X120, Lc = 10 ft

Source: AISC Steel Construction Manual, 16th Ed., Table 4-1a, pp. 4-16. Calculation: Steel column.

T4-1a W14X120 10 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	1,470	1,473	+0.23		Pass

T4-1a W14X120 10 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	980.0	980.3	+0.03		Pass

T4-1a W14X120 30: W14X120, Lc = 30 ft

Source: AISC Steel Construction Manual, 16th Ed., Table 4-1a, pp. 4-16. Calculation: Steel column.

T4-1a W14X120 30 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	807.0	806.8	-0.02		Pass

T4-1a W14X120 30 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	537.0	536.8	-0.04		Pass

T4-1a W14X109 16: W14X109, Lc = 16 ft

Source: AISC Steel Construction Manual, 16th Ed., Table 4-1a, pp. 4-16. Calculation: Steel column.

T4-1a W14X109 16 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	1,190	1,186	-0.30		Pass

T4-1a W14X109 16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	789.0	789.3	+0.04		Pass

T4-1a W14X99 26: W14X99, Lc = 26 ft

Source: AISC Steel Construction Manual, 16th Ed., Table 4-1a, pp. 4-16. Calculation: Steel column.

T4-1a W14X99 26 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	781.0	780.8	-0.03		Pass

T4-1a W14X99 26 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	519.0	519.5	+0.09		Pass

T4-4 HSS8X8X1/4 12: HSS8X8X1/4, Lc = 12 ft

Source: AISC Steel Construction Manual, 16th Ed., Table 4-4, pp. 4-73. Calculation: Steel column.

T4-4 HSS8X8X1/4 12 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	274.0	274.2	+0.08		Pass

T4-4 HSS8X8X1/4 12 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	182.0	182.5	+0.25		Pass

T4-4 HSS8X8X3/16 10: HSS8X8X3/16, Lc = 10 ft (slender walls)

Source: AISC Steel Construction Manual, 16th Ed., Table 4-4, pp. 4-73. Calculation: Steel column.

T4-4 HSS8X8X3/16 10 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	193.0	192.4	-0.30		Pass

T4-4 HSS8X8X3/16 10 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	128.0	128.0	+0.02		Pass

T4-4 HSS8X8X3/16 20: HSS8X8X3/16, Lc = 20 ft (slender walls)

Source: AISC Steel Construction Manual, 16th Ed., Table 4-4, pp. 4-73. Calculation: Steel column.

T4-4 HSS8X8X3/16 20 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	156.0	155.8	-0.10		Pass

T4-4 HSS8X8X3/16 20 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	104.0	103.7	-0.30		Pass

T4-4 HSS8X8X1/8 15: HSS8X8X1/8, Lc = 15 ft (slender walls)

Source: AISC Steel Construction Manual, 16th Ed., Table 4-4, pp. 4-73. Calculation: Steel column.

T4-4 HSS8X8X1/8 15 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	87.20	86.99	-0.25		Pass

T4-4 HSS8X8X1/8 15 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	58.00	57.88	-0.22		Pass

T4-4 HSS7X7X1/2 16: HSS7X7X1/2, Lc = 16 ft

Source: AISC Steel Construction Manual, 16th Ed., Table 4-4, pp. 4-73. Calculation: Steel column.

T4-4 HSS7X7X1/2 16 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	354.0	353.5	-0.13		Pass

T4-4 HSS7X7X1/2 16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	235.0	235.2	+0.09		Pass

T4-4 HSS7X7X1/2 30: HSS7X7X1/2, Lc = 30 ft

Source: AISC Steel Construction Manual, 16th Ed., Table 4-4, pp. 4-73. Calculation: Steel column.

T4-4 HSS7X7X1/2 30 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	140.0	139.9	-0.10		Pass

T4-4 HSS7X7X1/2 30 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	93.10	93.06	-0.05		Pass

T4-6 PIPE12STD 20: PIPE12STD, Lc = 20 ft

Source: AISC Steel Construction Manual, 16th Ed., Table 4-6, pp. 4-100. Calculation: Steel column.

T4-6 PIPE12STD 20 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	370.0	370.3	+0.09		Pass

T4-6 PIPE12STD 20 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	246.0	246.4	+0.16		Pass

T4-6 PIPE10XS 14: PIPE10XS, Lc = 14 ft

Source: AISC Steel Construction Manual, 16th Ed., Table 4-6, pp. 4-100. Calculation: Steel column.

T4-6 PIPE10XS 14 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	427.0	426.5	-0.11		Pass

T4-6 PIPE10XS 14 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	284.0	283.8	-0.08		Pass

T4-6 PIPE8XS 30: PIPE8XS, Lc = 30 ft

Source: AISC Steel Construction Manual, 16th Ed., Table 4-6, pp. 4-100. Calculation: Steel column.

T4-6 PIPE8XS 30 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	169.0	169.4	+0.24		Pass

T4-6 PIPE8XS 30 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	113.0	112.7	-0.25		Pass

D.2 · Steel column: L4×4×1/2 tension member, one line of four 3/4 in. bolts (U = 0.869)

Source: AISC Design Examples v16.0, Example D.2, pp. D-5 to D-7. Calculation: Steel column.

U from Table D3.1 Case 2 is an input; An from the path through one hole.

D.2 · Steel column · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tensile yielding φtPn	kips	169.0	168.8	-0.15		Pass
Tensile rupture φtPn	kips	140.0	140.3	+0.24		Pass
Net area An (B4.3b)	in.²	3.310	3.312	+0.08		Pass

D.2 · Steel column · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tensile yielding Pn/Ωt	kips	113.0	112.3	-0.64		Pass
Tensile rupture Pn/Ωt	kips	93.50	93.55	+0.06		Pass

D.3 · Steel column: WT6×20 tension member, welded flange (U = 0.860)

Source: AISC Design Examples v16.0, Example D.3, pp. D-8 to D-10. Calculation: Steel column.

U from Table D3.1 Case 4 is an input; the yielding values are the Example's from Manual Table 5-3.

D.3 · Steel column · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tensile yielding φtPn	kips	263.0	262.8	-0.08		Pass
Tensile rupture φtPn	kips	245.0	244.8	-0.06		Pass

D.3 · Steel column · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tensile yielding Pn/Ωt	kips	175.0	174.9	-0.09		Pass
Tensile rupture Pn/Ωt	kips	163.0	163.2	+0.14		Pass

D.6 · Steel column: 2L4×4×1/2 (3/8 in. separation) tension member, one line of eight bolts (U = 0.944)

Source: AISC Design Examples v16.0, Example D.6, pp. D-17 to D-19. Calculation: Steel column.

D.6 · Steel column · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tensile yielding φtPn	kips	338.0	337.5	-0.15		Pass
Tensile rupture φtPn	kips	305.0	304.9	-0.04		Pass
Net area An (B4.3b)	in.²	6.630	6.625	-0.08		Pass

D.6 · Steel column · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tensile yielding Pn/Ωt	kips	225.0	224.6	-0.20		Pass
Tensile rupture Pn/Ωt	kips	204.0	203.3	-0.37		Pass

D.7: Pin-connected plate 4 1/4 × 1/2, pin 1 in.

Source: AISC Design Examples v16.0, Example D.7, pp. D-20 to D-23. Calculation: Steel column.

D.7 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
pin_rupture	kips	78.80	78.49	-0.40		Pass
pin_shear	kips	80.30	80.44	+0.17		Pass
pin_bearing	kips	33.80	33.75	-0.15		Pass
tension_yield	kips	96.30	95.62	-0.70		Pass

D.7 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
pin_rupture	kips	52.50	52.33	-0.33		Pass
pin_shear	kips	53.50	53.62	+0.23		Pass
pin_bearing	kips	22.50	22.50	+0.00		Pass
tension_yield	kips	64.10	63.62	-0.74		Pass

D.8: Eyebar 3 × 5/8, pin 3 in.

Source: AISC Design Examples v16.0, Example D.8, pp. D-24 to D-26. Calculation: Steel column.

D.8 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
tension_yield	kips	84.60	84.38	-0.27		Pass

D.8 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
tension_yield	kips	56.30	56.14	-0.29		Pass

D.9 · Steel column: Plate 14 × 1/2 with staggered bolts: the worst of four paths

Source: AISC Design Examples v16.0, Example D.9, pp. D-27 to D-28. Calculation: Steel column.

Pitch s = 2 1/2 in., gages 3 and 7 in., as in Figure D.9-1; the Example rounds each path's width to 0.1 in.

D.9 · Steel column · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Net area An	in.²	5.750	5.771	+0.36		Pass
Effective net area Ae	in.²	5.750	5.771	+0.36		Pass

E.2: Built-up I, 8 × 1 flanges, 15 × 1/4 slender web

Source: AISC Design Examples v16.0, Example E.2, pp. E-20 to E-24. Calculation: Steel column.

E.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	500.0	498.0	-0.39		Pass
Effective area Ae (E7)	in.²	19.20	19.15	-0.27		Pass
Fe,z (Eq. E4-2)	ksi	91.90	92.16	+0.28		Pass

E.2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	332.0	331.4	-0.19		Pass

E.3: Built-up I, 10 1/2 × 3/8 flanges, 7 1/4 × 1/4 web

Source: AISC Design Examples v16.0, Example E.3, pp. E-25 to E-29. Calculation: Steel column.

E.3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	318.0	317.5	-0.17		Pass
Fe,z (Eq. E4-2)	ksi	71.20	71.06	-0.20		Pass

E.3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	211.0	211.2	+0.10		Pass

E.5 · Steel column: 2L4×3 1/2×3/8 LLBB, 3/4 in. separation, two connectors

Source: AISC Design Examples v16.0, Example E.5, pp. E-36 to E-41. Calculation: Steel column.

E.5 · Steel column · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	157.0	156.7	-0.19		Pass
Fex (Eq. E4-5)	ksi	48.50	48.53	+0.05		Pass
Fey with (Lc/r)m (Eq. E4-6)	ksi	76.90	76.90	-0.00		Pass
Fez (Eq. E4-7)	ksi	102.0	101.9	-0.10		Pass
Fe (Eq. E4-3)	ksi	60.50	60.43	-0.11		Pass

E.5 · Steel column · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	104.0	104.3	+0.25		Pass

E.6 · Steel column: 2L5×3×1/4 LLBB, 3/4 in. separation, slender legs

Source: AISC Design Examples v16.0, Example E.6, pp. E-42 to E-48. Calculation: Steel column.

E.6 · Steel column · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	73.80	73.83	+0.04		Pass
Effective area Ae (E7)	in.²	3.580	3.579	-0.02		Pass
Fez (Eq. E4-7)	ksi	37.80	37.84	+0.11		Pass
Fe (Eq. E4-3)	ksi	26.80	26.83	+0.10		Pass

E.6 · Steel column · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	49.10	49.12	+0.04		Pass

E.7 · Steel column: WT7×34, no slender elements, L = 20 ft

Source: AISC Design Examples v16.0, Example E.7, pp. E-49 to E-53. Calculation: Steel column.

E.7 · Steel column · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	128.0	128.5	+0.38		Pass
Fex (Eq. E4-5)	ksi	16.20	16.28	+0.49		Pass
Fez (Eq. E4-7)	ksi	165.0	165.2	+0.15		Pass
Fe (Eq. E4-3)	ksi	29.50	29.53	+0.11		Pass

E.7 · Steel column · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	85.00	85.49	+0.58		Pass

E.8: WT7×15 with a slender stem, L = 20 ft

Source: AISC Design Examples v16.0, Example E.8, pp. E-54 to E-58. Calculation: Steel column.

E.8 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	36.60	36.61	+0.04		Pass
Fez (Eq. E4-7)	ksi	57.00	57.29	+0.50		Pass
Fe (Eq. E4-3)	ksi	10.50	10.50	-0.05		Pass

E.8 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	24.40	24.36	-0.16		Pass

E.12: Built-up I with different flanges: 8 × 3/4 and 5 × 3/4, web 10 1/2 × 3/8

Source: AISC Design Examples v16.0, Example E.12, pp. E-70 to E-75. Calculation: Steel column.

The Example rounds ho to 11.3 in. and carries the rounded centroid; ILX keeps ho = 11.25 in.

E.12 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	280.0	278.3	-0.60		Pass
Fez (Eq. E4-7)	ksi	66.20	66.75	+0.83		Pass
Fe (Eq. E4-3)	ksi	26.40	26.34	-0.21		Pass

E.12 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	186.0	185.2	-0.45		Pass

E.13: Two WT9×20, flange to flange, 1/2 in. apart, one connector

Source: AISC Design Examples v16.0, Example E.13, pp. E-76 to E-82. Calculation: Steel column.

E.13 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	297.0	297.7	+0.23		Pass
Modified slenderness (Lc/r)m (Eq. E6-2b)		46.60	46.54	-0.13		Pass
Fe,z = G J/(Ix + Iy)	ksi	49.20	49.03	-0.34		Pass
Effective area Ae (E7)	in.²	11.20	11.18	-0.14		Pass

E.13 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	198.0	198.1	+0.03		Pass

E.14A: L5×3×1/2 through the long leg, L = 5 ft (E5)

Source: AISC Design Examples v16.0, Example E.14A, pp. E-83 to E-85. Calculation: Steel column.

E.14A · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	52.30	52.85	+1.05		Deviation AISC-E14A-ROUND
AISC-E14A-ROUND: the Example rounds Lc/r up to 127						
Lc/r (Eq. E5-1)		127.0	126.6	-0.31		Pass

E.14A · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	34.80	35.16	+1.04		Pass

E.14B: L8×4×1/2 with an eccentric load, at the strength of the Example (H2)

Source: AISC Design Examples v16.0, Example E.14B, pp. E-87 to E-98. Calculation: Steel column.

Pu = 85.9 kips is the Example's governing result at point B: the interaction there reads 1.00.

E.14B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	168.0	168.8	+0.47		Pass
Effective area Ae (E7)	in.²	5.340	5.341	+0.02		Pass
Available flexural strength about w	kip-ft	31.25	31.25	+0.00		Pass
Available flexural strength about z	kip-ft	10.25	10.24	-0.12		Pass
Interaction at Pu = 85.9 kips (Eq. H2-1)		1.000	0.999	-0.09		Pass

E.14B-ASD: L8×4×1/2 with an eccentric load, ASD

Source: AISC Design Examples v16.0, Example E.14B, pp. E-87 to E-98. Calculation: Steel column.

E.14B-ASD · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	112.0	112.3	+0.27		Pass
Available flexural strength about w	kip-ft	20.83	20.79	-0.20		Pass
Available flexural strength about z	kip-ft	6.833	6.811	-0.32		Pass
Interaction at Pa = 56.4 kips (Eq. H2-1)		1.000	0.999	-0.05		Pass

T4-11 L12X12X1-1/4 10: L12X12X1-1/4, Lc = 10 ft about z

Source: AISC Steel Construction Manual, 16th Ed., Table 4-11, pp. 4-179. Calculation: Steel column.

T4-11 L12X12X1-1/4 10 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	1,050	1,049	-0.08		Pass

T4-11 L12X12X1-1/4 10 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	698.0	698.0	+0.01		Pass

T4-11 L12X12X1-1/4 20: L12X12X1-1/4, Lc = 20 ft about z

Source: AISC Steel Construction Manual, 16th Ed., Table 4-11, pp. 4-179. Calculation: Steel column.

T4-11 L12X12X1-1/4 20 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	580.0	580.4	+0.08		Pass

T4-11 L12X12X1-1/4 20 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	386.0	386.2	+0.05		Pass

T4-11 L12X12X1 10: L12X12X1, Lc = 10 ft about z (slender legs)

Source: AISC Steel Construction Manual, 16th Ed., Table 4-11, pp. 4-179. Calculation: Steel column.

T4-11 L12X12X1 10 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	851.0	852.7	+0.20		Pass

T4-11 L12X12X1 10 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	566.0	567.3	+0.24		Pass

T4-11 L12X12X1 20: L12X12X1, Lc = 20 ft about z (slender legs)

Source: AISC Steel Construction Manual, 16th Ed., Table 4-11, pp. 4-179. Calculation: Steel column.

T4-11 L12X12X1 20 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	480.0	479.6	-0.08		Pass

T4-11 L12X12X1 20 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	319.0	319.1	+0.04		Pass

T4-11 L6X6X9/16 10: L6X6X9/16, Lc = 10 ft about z

Source: AISC Steel Construction Manual, 16th Ed., Table 4-11, pp. 4-186. Calculation: Steel column.

T4-11 L6X6X9/16 10 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	136.0	136.3	+0.19		Pass

T4-11 L6X6X9/16 10 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	90.70	90.66	-0.04		Pass

T4-11 L6X6X5/16 1: L6X6X5/16, Lc = 1 ft about z (slender legs)

Source: AISC Steel Construction Manual, 16th Ed., Table 4-11, pp. 4-186. Calculation: Steel column.

T4-11 L6X6X5/16 1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	86.90	87.15	+0.29		Pass

T4-11 L6X6X5/16 1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	57.80	57.98	+0.32		Pass

T4-11 L6X6X5/16 3: L6X6X5/16, Lc = 3 ft about z (slender legs)

Source: AISC Steel Construction Manual, 16th Ed., Table 4-11, pp. 4-186. Calculation: Steel column.

T4-11 L6X6X5/16 3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	78.10	78.31	+0.27		Pass

T4-11 L6X6X5/16 3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	51.90	52.10	+0.39		Pass

T4-11 L6X6X5/16 5: L6X6X5/16, Lc = 5 ft about z (slender legs)

Source: AISC Steel Construction Manual, 16th Ed., Table 4-11, pp. 4-186. Calculation: Steel column.

T4-11 L6X6X5/16 5 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	76.50	76.77	+0.36		Pass

T4-11 L6X6X5/16 5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	50.90	51.08	+0.35		Pass

T4-11 L6X6X5/16 8: L6X6X5/16, Lc = 8 ft about z (slender legs)

Source: AISC Steel Construction Manual, 16th Ed., Table 4-11, pp. 4-186. Calculation: Steel column.

T4-11 L6X6X5/16 8 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	74.60	74.85	+0.34		Pass

T4-11 L6X6X5/16 8 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	49.60	49.80	+0.40		Pass

T4-11 L6X6X5/16 10: L6X6X5/16, Lc = 10 ft about z (slender legs)

Source: AISC Steel Construction Manual, 16th Ed., Table 4-11, pp. 4-186. Calculation: Steel column.

T4-11 L6X6X5/16 10 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	69.70	69.95	+0.35		Pass

T4-11 L6X6X5/16 10 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	46.40	46.54	+0.30		Pass

T4-11 L6X6X5/16 15: L6X6X5/16, Lc = 15 ft about z (slender legs)

Source: AISC Steel Construction Manual, 16th Ed., Table 4-11, pp. 4-186. Calculation: Steel column.

T4-11 L6X6X5/16 15 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	36.20	36.24	+0.10		Pass

T4-11 L6X6X5/16 15 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	24.10	24.11	+0.04		Pass

VUL-EX: 1.5PLB22, three 5 ft spans, 30 psf

Source: Vulcraft PunchLok II Roof Deck Design Guide and Catalog (Dec. 2016), Design Example, pp. pp. 13-14, 20, 22. Calculation: Steel deck (gravity).

VUL-EX · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable load, stress	psf	177.0	176.6	-0.20		Pass
End reaction	lb/ft	60.00	60.00	+0.00		Pass
Interior reaction	lb/ft	165.0	165.0	+0.00		Pass
Shear at the interior support	lb/ft	90.00	90.00	+0.00		Pass
Allowable end reaction, 2 in.	lb/ft	897.0	911.8	+1.65		Deviation VUL-WC
VUL-WC: the catalog prints no radius or web angle; those of another maker's similar deck						
Allowable interior reaction, 2 in.	lb/ft	1,325	1,344	+1.40		Deviation VUL-WC
VUL-WC: the catalog prints no radius or web angle; those of another maker's similar deck						
Allowable web shear	lb/ft	2,825	2,651	-6.15		Deviation VUL-V
VUL-V: the catalog's web geometry is not printed, and it does not print how its value is reached						

VUL-T1: 1.5PLB22, single 5 ft span

Source: Vulcraft PunchLok II Roof Deck Design Guide and Catalog (Dec. 2016), Gravity Load Tables, pp. p. 21. Calculation: Steel deck (gravity).

VUL-T1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable load, stress	psf	134.0	133.3	-0.50		Pass
Load at span / 360	psf	53.00	53.14	+0.27		Pass
Load at span / 240	psf	80.00	79.72	-0.36		Pass

VUL-T2: 1.5PLB22, single 4 ft span

Source: Vulcraft PunchLok II Roof Deck Design Guide and Catalog (Dec. 2016), Gravity Load Tables, pp. p. 21. Calculation: Steel deck (gravity).

VUL-T2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable load, stress	psf	209.0	208.3	-0.32		Pass
Load at span / 360	psf	104.0	103.8	-0.20		Pass
Load at span / 180	psf	208.0	207.6	-0.20		Pass

VUL-T3: 1.5PLB22, two 5 ft spans

Source: Vulcraft PunchLok II Roof Deck Design Guide and Catalog (Dec. 2016), Gravity Load Tables, pp. p. 21. Calculation: Steel deck (gravity).

VUL-T3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable load, stress	psf	142.0	141.3	-0.48		Pass

VUL-T4: 1.5PLB22, three 6 ft spans

Source: Vulcraft PunchLok II Roof Deck Design Guide and Catalog (Dec. 2016), Gravity Load Tables, pp. p. 21. Calculation: Steel deck (gravity).

VUL-T4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable load, stress	psf	123.0	122.7	-0.27		Pass
Load at span / 360	psf	67.00	67.03	+0.04		Pass
Load at span / 240	psf	100.0	100.5	+0.54		Pass

LEC-EX: 1.5B, three 6 ft spans, 2 psf dead, 60 psf live on the adverse spans

Source: Nucor / Vulcraft lecture, Roof Design with Steel Deck, Example, pp. slide 24. Calculation: Steel deck (gravity).

LEC-EX · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Exterior reaction	lb/ft	166.8	166.8	-0.00		Pass
Interior reaction	lb/ft	445.2	445.2	+0.00		Pass

VER-22: PLB-36, 22 gage

Source: IAPMO UES ER-2018, Verco Decking (rev. May 2024), Table, pp. p. 25. Calculation: Steel deck (gravity).

VER-22 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mn+	lb-ft/ft	733.0	733.3	+0.05		Pass
Mn-	lb-ft/ft	783.0	783.3	+0.04		Pass
Vn	lb/ft	4,300	4,300	-0.01		Pass

VER-20: PLB-36, 20 gage

Source: IAPMO UES ER-2018, Verco Decking (rev. May 2024), Table, pp. p. 25. Calculation: Steel deck (gravity).

VER-20 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mn+	lb-ft/ft	958.0	958.3	+0.03		Pass
Mn-	lb-ft/ft	988.0	987.5	-0.05		Pass
Vn	lb/ft	5,152	5,152	-0.01		Pass

VER-18: PLB-36, 18 gage

Source: IAPMO UES ER-2018, Verco Decking (rev. May 2024), Table, pp. p. 25. Calculation: Steel deck (gravity).

VER-18 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mn+	lb-ft/ft	1,308	1,308	+0.03		Pass
Mn-	lb-ft/ft	1,379	1,379	+0.01		Pass
Vn	lb/ft	6,822	6,822	-0.00		Pass

VER-16: PLB-36, 16 gage

Source: IAPMO UES ER-2018, Verco Decking (rev. May 2024), Table, pp. p. 25. Calculation: Steel deck (gravity).

VER-16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mn+	lb-ft/ft	1,663	1,662	-0.03		Pass
Mn-	lb-ft/ft	1,708	1,708	+0.02		Pass
Vn	lb/ft	8,483	8,483	+0.00		Pass

INT-S22: 1.5WR22, single, the printed 8 ft 4 in. span

Source: Intsel Steel, 1.5 in. Roof Deck Specs and Spans, Table 3.1, pp. p. 1. Calculation: Steel deck (gravity).

INT-S22 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Strength ratio at the printed span		1.000	1.000	-0.00		Pass

INT-S20: 1.5WR20, single, the printed 11 ft 1 in. span

Source: Intsel Steel, 1.5 in. Roof Deck Specs and Spans, Table 3.1, pp. p. 1. Calculation: Steel deck (gravity).

INT-S20 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Strength ratio at the printed span		1.000	1.000	+0.05		Pass

INT-S18: 1.5WR18, single, the printed 15 ft 3 in. span

Source: Intsel Steel, 1.5 in. Roof Deck Specs and Spans, Table 3.1, pp. p. 1. Calculation: Steel deck (gravity).

INT-S18 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Strength ratio at the printed span		1.000	1.002	+0.20		Pass

INT-D22: 1.5WR22, double, the printed 10 ft 3 in. span

Source: Intsel Steel, 1.5 in. Roof Deck Specs and Spans, Table 3.1, pp. p. 1. Calculation: Steel deck (gravity).

INT-D22 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Strength ratio at the printed span		1.000	0.999	-0.06		Pass

INT-D20: 1.5WR20, double, the printed 13 ft 8 in. span

Source: Intsel Steel, 1.5 in. Roof Deck Specs and Spans, Table 3.1, pp. p. 1. Calculation: Steel deck (gravity).

INT-D20 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Strength ratio at the printed span		1.000	1.002	+0.24		Pass

INT-D18: 1.5WR18, double, the printed 18 ft 9 in. span

Source: Intsel Steel, 1.5 in. Roof Deck Specs and Spans, Table 3.1, pp. p. 1. Calculation: Steel deck (gravity).

INT-D18 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Strength ratio at the printed span		1.000	1.001	+0.10		Pass

INT-D16: 1.5WR16, double, the printed 24 ft 1 in. span

Source: Intsel Steel, 1.5 in. Roof Deck Specs and Spans, Table 3.1, pp. p. 1. Calculation: Steel deck (gravity).

INT-D16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Strength ratio at the printed span		1.000	1.000	+0.03		Pass

HAND-FIRE-BEAM: W14X22 beam at 1,000 °F, braced continuously

Source: Hand calculation (closed form). Calculation: Steel fire resistance.

Hand calculation; the default design.

HAND-FIRE-BEAM · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φMn(T) = 0.9 Fy(T) Zx (Lb = 0)	kip-ft	986.0	986.0	+0.00		Pass
φVn(T) = 0.6 Fy(T) Aw	kips	62.39	62.39	+0.00		Pass
ky at 1,000 °F		0.660	0.660	+0.00		Pass

HAND-FIRE-K900: Table A-4.2.1 interpolated at 900 °F

Source: Hand calculation (closed form). Calculation: Steel fire resistance.

HAND-FIRE-K900 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
kE at 900 °F		0.580	0.580	+0.00		Pass
kp at 900 °F		0.345	0.345	+0.00		Pass
ky at 900 °F		0.800	0.800	+0.00		Pass

HAND-FIRE-LTB: W14X22 beam at 1,000 °F, Lb = 10 ft

Source: Hand calculation (closed form). Calculation: Steel fire resistance.

HAND-FIRE-LTB · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φMn(T), Eq. A-4-13	kip-ft	331.7	331.7	+0.00		Pass

HAND-FIRE-COL: W12X50 column at 1,000 °F, Lc = 12 ft

Source: Hand calculation (closed form). Calculation: Steel fire resistance.

HAND-FIRE-COL · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φPn(T), Eq. A-4-9	kips	163.1	163.1	+0.00		Pass

HAND-FIRE-COOL: The same column between cooler columns (Eq. A-4-10, n = 1)

Source: Hand calculation (closed form). Calculation: Steel fire resistance.

HAND-FIRE-COOL · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φPn(T) with Lc/r(T)	kips	240.5	240.5	+0.00		Pass

VI-2: W12X87 column in 1-1/2 in. Type X gypsum board

Source: AISC Design Guide 19 (2003), Example VI-2, pp. 25. Calculation: Steel fire resistance.

VI-2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R of 1-1/2 in. of board (minutes)		195.0	195.0	-0.01		Pass
Heated perimeter D = 2(bf + d)	in.	49.20	49.20	+0.00		Pass

VI-3: W14X109 column, sprayed material, 2 hours (C1 = 1.05, C2 = 0.61)

Source: AISC Design Guide 19 (2003), Example VI-3, pp. 27. Calculation: Steel fire resistance.

VI-3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
h = R/(C1 W/D + C2)	in.	1.020	1.029	+0.89		Pass

VII-1: W14X22 beam from the W8X28 of UL D902 (3/8 in.)

Source: AISC Design Guide 19 (2003), Example VII-1, pp. 44. Calculation: Steel fire resistance.

VII-1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
h1, Eq. A-4-32	in.	0.470	0.471	+0.26		Pass

VII-2a: W14X22 beam from the W10X25 of UL D858 (1/2 in.)

Source: AISC Design Guide 19 (2003), Example VII-2, pp. 45. Calculation: Steel fire resistance.

VII-2a · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
h1 of the W14X22	in.	0.570	0.571	+0.14		Pass

VII-2b: W18X55 beam from the W10X25 of UL D858 (1/2 in.)

Source: AISC Design Guide 19 (2003), Example VII-2, pp. 45. Calculation: Steel fire resistance.

VII-2b · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
h1 of the W18X55	in.	0.410	0.413	+0.84		Pass

COSP-O4-1: KCS joist, uniform load and one point load (22KCS3)

Source: SJI Code of Standard Practice for Steel Joists and Joist Girders (COSP 2020), 2.4(a) Option 4, ASD Example 1, pp. 181. Calculation: Steel joist.

COSP-O4-1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Maximum moment M	kip-in.	625.0	625.0	-0.01		Pass
End reaction RL	lb	5,600	5,600	-0.00		Pass
End reaction RR	lb	5,000	5,000	-0.00		Pass
22KCS3 moment capacity	kip-in.	658.0	658.0	+0.00		Pass
22KCS3 shear capacity	lb	6,600	6,600	+0.00		Pass
Rows of bridging, 22K9 at 40 ft (Table 5.5-1) The example names bridging section 9; the row count is read from SJI 100 Table 5.5-1.		3.000	3.000	+0.00		Pass

COSP-O4-2: KCS joist, partial triangular load and three point loads (22KCS2)

Source: SJI Code of Standard Practice for Steel Joists and Joist Girders (COSP 2020), 2.4(a) Option 4, ASD Example 2, pp. 182. Calculation: Steel joist.

COSP-O4-2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Maximum moment M	kip-in.	443.0	442.8	-0.04		Pass
End reaction RL	lb	5,000	5,000	-0.00		Pass
End reaction RR	lb	5,340	5,340	+0.00		Pass
Maximum uniform load (270 + 160 plf)	plf	430.0	430.0	+0.00		Pass

COSP-O4-3: Heavy loads beyond the largest KCS joist (30KCS5)

Source: SJI Code of Standard Practice for Steel Joists and Joist Girders (COSP 2020), 2.4(a) Option 4, ASD Example 3, pp. 183. Calculation: Steel joist.

The example concludes the loads exceed the 30KCS5 capacity and the 550 plf KCS uniform load; ILX reports the moment, shear and uniform load checks as not satisfied (test_steel_joist.py).

COSP-O4-3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Maximum moment M	kip-in.	2,910	2,909	-0.03		Pass
End reaction RL = RR	lb	14,000	14,000	-0.00		Pass
Maximum uniform load (300 + 500 plf, over 550 plf)	plf	800.0	800.0	+0.00		Pass

COSP-O4-3A: Option A: two joists, each half the load (28KCS5)

Source: SJI Code of Standard Practice for Steel Joists and Joist Girders (COSP 2020), 2.4(a) Option 4, ASD Example 3, Option A, pp. 183.
Calculation: Steel joist.

COSP-O4-3A · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Moment per joist	kip-in.	1,455	1,455	-0.03		Pass
Shear per joist	lb	7,000	7,000	+0.00		Pass
Uniform load per joist	plf	400.0	400.0	+0.00		Pass
28KCS5 moment capacity	kip-in.	1,704	1,704	+0.00		Pass

SJI-OPT1: Standard designation from the area loads (Option 1)

Source: SJI webinar Properly Specifying Steel Joists (2019), slide 53 (Option 1, standard designation), pp. 53. Calculation: Steel joist.

The slide's 250/150 plf: (20 + 30 psf) × 5 ft and 30 psf × 5 ft; 18K5 at 25 ft (ASD table 400 / 281 plf) carries it.

SJI-OPT1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Total uniform load (D + L)	plf	250.0	250.0	+0.00		Pass
Live load	plf	150.0	150.0	+0.00		Pass

SJI-DLH: 96DLH21 spanning 116 ft: live load deflection against the red figure

Source: SJI webinar Properly Specifying Steel Joists (2019), slides 72 and 73 (special deflection limits), pp. 72-73. Calculation: Steel joist.

L/360 = 3.86 in. is the design length (115.67 ft) / 360, which ILX uses for the limit.

SJI-DLH · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
L/360 deflection	in.	3.860	3.856	-0.12		Pass
Deflection under 200 plf live load (200/877 × 3.86 in.)	in.	0.750	0.879	+17.23		Deviation SJI-WEB-DEFL
SJI-WEB-DEFL: the slide prints 3/4 in. for 200/877 × 3.86 in. = 0.88 in.						
Rows of bridging, DLH21 at 116 ft (Table 5.5-1)		3.000	3.000	+0.00		Pass
Bearing seat depth, DLH18-25 (Table 5.4-3)	in.	7.500	7.500	+0.00		Pass

SJI-TBL: 18K5 at 30 ft: the load-table note and the SJI 100 tables

Source: SJI 100-2020 Standard Specification: Tables 4.6-1, 5.4-1, 5.4-3, 5.5-1; K-series load table notes, pp. 44, 47-48, 52, 144. Calculation: Steel joist.

Default calculation (18K5, 30 ft span, LRFD 414 / red 161 plf from the K-series table).

SJI-TBL · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rows of bridging, 18K5 at 30 ft (Table 5.5-1)		2.000	2.000	+0.00		Pass
Minimum bearing on steel, K1-12 (Table 5.4-1)	in.	2.500	2.500	+0.00		Pass
Standard seat depth, K1-12 (Table 5.4-3)	in.	2.500	2.500	+0.00		Pass
Camber at 30 ft (Table 4.6-1)	in.	0.375	0.375	+0.00		Pass
Gross moment of inertia $26.767\ W\ L^3\ 10^{-6}$ (W = 161 plf, L = 29.67 ft)	$in.^4$	112.6	112.6	-0.04		Pass

F.11A · Steel lintel: L4X4X1/4, 6 ft, braced at the ends, toe in compression

Source: AISC Design Examples v16.0, Example F.11A, pp. F-49 to F-50. Calculation: Steel lintel.

F.11A · Steel lintel · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required moment	kip-ft	1.350	1.350	+0.00		Pass
Available moment	kip-ft	3.690	3.690	+0.01		Pass

F.11A · Steel lintel · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required moment	kip-ft	0.900	0.900	+0.00		Pass
Available moment	kip-ft	2.460	2.455	-0.19		Pass

F.11B · Steel lintel: L4X4X1/4, 6 ft, braced at the ends and midspan

Source: AISC Design Examples v16.0, Example F.11B, pp. F-52 to F-53. Calculation: Steel lintel.

F.11B · Steel lintel · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available moment	kip-ft	3.980	3.978	-0.06		Pass

F.11B · Steel lintel · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available moment	kip-ft	2.650	2.647	-0.13		Pass

F.1-1A · Steel lintel: W18X50, 35 ft, continuously braced

Source: AISC Design Examples v16.0, Example F.1-1A, pp. F-3 to F-5. Calculation: Steel lintel.

F.1-1A · Steel lintel · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required moment	kip-ft	266.0	266.4	+0.16		Pass
Available moment	kip-ft	379.0	378.8	-0.07		Pass

F.1-1A · Steel lintel · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required moment	kip-ft	184.0	183.8	-0.14		Pass
Available moment	kip-ft	252.0	252.0	-0.00		Pass

TN31B-T1-A: L5X3-1/2X5/16, 8 ft, 324 plf: L/600 governs the table

Source: BIA Technical Note 31B (1987), pp. Table 1, p. 6. Calculation: Steel lintel.

TN31B-T1-A · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Deflection at the table's load (span / 600)	in.	0.160	0.161	+0.43		Pass

TN31B-T1-B: L5X3-1/2X3/8, 8 ft, 381 plf: L/600 governs the table

Source: BIA Technical Note 31B (1987), pp. Table 1, p. 6. Calculation: Steel lintel.

TN31B-T1-B · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Deflection at the table's load (span / 600)	in.	0.160	0.160	+0.31		Pass

TN31B-T1-C: L4X3-1/2X1/4, 7 ft, 212 plf: L/600 governs the table

Source: BIA Technical Note 31B (1987), pp. Table 1, p. 6. Calculation: Steel lintel.

TN31B-T1-C · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Deflection at the table's load (span / 600)	in.	0.140	0.141	+0.46		Pass

TN31B-T1-D: L3-1/2X3-1/2X1/4, 6 ft, 234 plf: L/600 governs the table

Source: BIA Technical Note 31B (1987), pp. Table 1, p. 6. Calculation: Steel lintel.

TN31B-T1-D · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Deflection at the table's load (span / 600)	in.	0.120	0.121	+0.47		Pass

TN31B-T1-E: L5X3-1/2X5/16, 3 ft, 3153 plf: moment governs the table

Source: BIA Technical Note 31B (1987), pp. Table 1, p. 6. Calculation: Steel lintel.

TN31B-T1-E · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required moment at the table's load (the printed resisting moment)	kip-ft	3.557	3.557	-0.00		Pass

TN31B-T1-F: L6X3-1/2X3/8, 3 ft, 5268 plf: moment governs the table

Source: BIA Technical Note 31B (1987), pp. Table 1, p. 6. Calculation: Steel lintel.

TN31B-T1-F · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required moment at the table's load (the printed resisting moment)	kip-ft	5.940	5.940	-0.01		Pass

TN31B-T3: Bearing: 3-1/2 in. horizontal leg, 4 in. of bearing, fm = 250 psi

Source: BIA Technical Note 31B (1987), pp. Table 3, p. 7. Calculation: Steel lintel.

TN31B-T3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable end reaction	kips	3.500	3.500	-0.00		Pass

TN31B-TRI: Triangular wall load: Mmax = W L / 6

Source: BIA Technical Note 31B (1987), p. 3, equation evaluated by hand, pp. p. 3. Calculation: Steel lintel.

TN31B-TRI · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required moment, W = 640 lb on 8 ft	kip-ft	0.853	0.853	+0.04		Pass
End reaction, W / 2	kips	0.320	0.320	+0.00		Pass

HC-2L: 2L5X3-1/2X5/16LLBB in A36, restrained: 1.5 My and the web leg local buckling of F10.3

Source: Hand calculation from the cited equations (no published example). Calculation: Steel lintel.

HC-2L · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mn / Ω, F10-6 on Sx	kip-ft	10.07	10.08	+0.10		Pass

HC-PLATE · Steel lintel: W8X18 with PL 7-1/2 × 3/8 in A992: elastic strength of the built-up section

Source: Hand calculation from the cited equations (no published example). Calculation: Steel lintel.

HC-PLATE · Steel lintel · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mn / Ω, top fiber	kip-ft	42.70	42.75	+0.12		Pass

HAND-POND-1: W24X55 girders, W16X26 beams at 6 ft, 30 ft by 30 ft bay

Source: Hand calculation (closed form). Calculation: Roof ponding.

Hand calculation; the default design.

HAND-POND-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cp (Eq. A-2-3)		0.058	0.058	+0.00		Pass
Cs (Eq. A-2-4)		0.052	0.052	+0.00		Pass
Up (Eq. A-2-5)		1.815	1.815	+0.00		Pass
Us (Eq. A-2-6)		3.741	3.741	+0.00		Pass
Δw/Δo (Eq. C-A-2-1)		0.109	0.109	+0.00		Pass
δw/δo (Eq. C-A-2-2)		0.138	0.138	+0.00		Pass

HAND-POND-SIMPLE: The same bay by the simplified method

Source: Hand calculation (closed form). Calculation: Roof ponding.

HAND-POND-SIMPLE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
(Cp + 0.9 Cs)/0.25 (Eq. A-2-1)		0.416	0.416	+0.00		Pass

HAND-POND-WALL: Wall-bearing W16X26 beams (Cp = 0)

Source: Hand calculation (closed form). Calculation: Roof ponding.

HAND-POND-WALL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
δw/δo = αs		0.054	0.054	+0.00		Pass

HAND-SM-COL: W14X159 SMF column, W21X44 beams both sides

Source: Hand calculation (closed form). Calculation: Seismic member checks.

Hand calculation; the default design.

HAND-SM-COL · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
λhd of the flange, 0.30 √(E/(Ry Fy))		6.889	6.889	+0.00		Pass
Ca = Pr/(Ry Fy Ag)		0.304	0.304	+0.00		Pass
λhd of the web, 2.5 (1 − Ca)^2.3 √(E/(Ry Fy))		24.97	24.97	+0.00		Pass
Pr with Ω0 QE (ASCE 7-22 2.3.6)	kips	780.0	780.0	+0.00		Pass
ΣM*pc/ΣM*be (Eq. E3-1)		1.467	1.467	+0.00		Pass

HAND-SM-COL-MD: The same column, moderately ductile

Source: Hand calculation (closed form). Calculation: Seismic member checks.

HAND-SM-COL-MD · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
λmd of the flange, 0.38 √(E/(Ry Fy))		8.726	8.726	+0.00		Pass
λmd of the web, 5.4 (1 − Ca)^2.3 √(E/(Ry Fy))		53.94	53.94	+0.00		Pass

HAND-SM-BEAM: W21X44 SMF beam, bracing

Source: Hand calculation (closed form). Calculation: Seismic member checks.

HAND-SM-BEAM · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Lb max, 0.086 ry E/(Ry Fy) (D1.2b)	in.	57.14	57.14	-0.00		Pass
Pr at hinges, 0.06 Ry Fy Z/ho (Eq. D1-4)	kips	15.51	15.51	+0.00		Pass

F.1-1A · Steel section selection: Lightest W-shape beam, nominal depth ≤ 18 in., live load deflection L/360

Source: AISC Design Examples v16.0, Example F.1-1A, pp. F-6 to F-7. Calculation: Steel section selection.

F.1-1A · Steel section selection · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Selected W18×50 (plf)		50.00	50.00	+0.00		Pass
Available flexural strength φMp	kip-ft	379.0	378.8	-0.07		Pass

F.1-1A · Steel section selection · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Selected W18×50 (plf)		50.00	50.00	+0.00		Pass
Available flexural strength Mp/Ω	kip-ft	252.0	252.0	-0.00		Pass

F.4: Lightest W-shape for a 1.00 in. live load deflection limit (L/360)

Source: AISC Design Examples v16.0, Example F.4, pp. F-26 to F-27. Calculation: Steel section selection.

F.4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Selected W24×55 (plf)		55.00	55.00	+0.00		Pass
Available flexural strength φMp	kip-ft	503.0	502.5	-0.10		Pass

F.4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Selected W24×55 (plf)		55.00	55.00	+0.00		Pass
Available flexural strength Mp/Ω	kip-ft	334.0	334.3	+0.10		Pass

E.1A · Steel section selection: Lightest W14 column, pinned, 30 ft

Source: AISC Design Examples v16.0, Example E.1A, pp. E-4 to E-5. Calculation: Steel section selection.

The Example reads Manual Table 4-1a (893 / 594 kips); ILX computes Eq. E3-2.

E.1A · Steel section selection · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Selected W14×132 (plf)		132.0	132.0	+0.00		Pass
Available compressive strength	kips	893.0	893.2	+0.02		Pass

E.1A · Steel section selection · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Selected W14×132 (plf)		132.0	132.0	+0.00		Pass
Available compressive strength	kips	594.0	594.3	+0.05		Pass

T3-2 select: Lightest W-shape, continuously braced, Mu = 405 / Ma = 270 kip-ft

Source: AISC Steel Construction Manual, 16th Ed., Table 3-2, pp. 3-25. Calculation: Steel section selection.

Table 3-2: W21×48 (φbMpx = 398, Mpx/Ωb = 265 kip-ft) is the next lighter shape and is not enough.

T3-2 select · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Selected W21×50 (plf)		50.00	50.00	+0.00		Pass
φbMpx (Table 3-2)	kip-ft	413.0	412.5	-0.12		Pass

T3-2 select · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Selected W21×50 (plf)		50.00	50.00	+0.00		Pass
Mpx/Ωb (Table 3-2)	kip-ft	274.0	274.5	+0.16		Pass

T4-1a select 20: Lightest W14 column, Lc = 20 ft, Pu = 1400 / Pa = 938 kips

Source: AISC Steel Construction Manual, 16th Ed., Table 4-1a, pp. 4-16. Calculation: Steel section selection.

Table 4-1a at Lc = 20 ft: W14×132 has 1300 / 862 kips.

T4-1a select 20 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Selected W14×145 (plf)		145.0	145.0	+0.00		Pass
φcPn (Table 4-1a)	kips	1,470	1,473	+0.20		Pass

T4-1a select 20 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Selected W14×145 (plf)		145.0	145.0	+0.00		Pass
Pn/Ωc (Table 4-1a)	kips	980.0	980.0	-0.00		Pass

T4-1a select 16: Lightest W14 column, Lc = 16 ft, Pu = 1000 / Pa = 675 kips

Source: AISC Steel Construction Manual, 16th Ed., Table 4-1a, pp. 4-16. Calculation: Steel section selection.

Table 4-1a at Lc = 16 ft: W14×90 has 979 / 652 kips.

T4-1a select 16 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Selected W14×99 (plf)		99.00	99.00	+0.00		Pass
φcPn (Table 4-1a)	kips	1,080	1,077	-0.31		Pass

T4-1a select 16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Selected W14×99 (plf)		99.00	99.00	+0.00		Pass
Pn/Ωc (Table 4-1a)	kips	716.0	716.3	+0.04		Pass

DG34-4.1: Horizontal plane method, service loads

Source: AISC Design Guide 34 (2018), Example 4.1(b), pp. PDF p. 39. Calculation: Steel stair.

DG34-4.1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Shear V	kips	1.820	1.822	+0.11		Pass
Moment M 20 lb/ft self-weight × 14.2/12 entered as a line load; riser 7.594 in. and tread 12 in. give the guide's 14.2 ft on 12 ft.	kip-ft	5.470	5.466	-0.07		Pass

DG34-10.1.2: Commercial stair stringer, C12X20.7

Source: AISC Design Guide 34 (2018), Example 10.1.2, pp. PDF pp. 73-75. Calculation: Steel stair.

DG34-10.1.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Line load wu	kip/ft	0.424	0.424	-0.05		Pass
Required moment Mu	kip-ft	4.960	4.949	-0.23		Pass
Available moment	kip-ft	69.10	69.12	+0.03		Pass
Required shear Vu	kips	2.050	2.048	-0.09		Pass
Available shear	kips	65.80	65.78	-0.02		Pass
Live load deflection limit	in.	0.322	0.322	+0.07		Pass
Total load deflection limit	in.	0.484	0.483	-0.14		Pass

DG34-10.1.2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Line load wa	kip/ft	0.292	0.292	+0.01		Pass
Required moment Ma	kip-ft	3.410	3.410	+0.01		Pass
Available moment	kip-ft	46.00	45.99	-0.03		Pass
Required shear Va	kips	1.410	1.412	+0.11		Pass
Available shear	kips	43.80	43.77	-0.07		Pass
Deflection factor Eq. 4-1 gives 1.405; the guide prints 1.40.		1.400	1.405	+0.35		Pass
Live load deflection The guide's own product 1.40 × 0.00962 in. is 0.0135 in., which the program gives; both are inside the tolerance on a length this small.	in.	0.014	0.014	-3.41		Pass
Total load deflection	in.	0.021	0.022	+0.66		Pass

DG34-10.1.3: Flight header beam, C10X15.3

Source: AISC Design Guide 34 (2018), Example 10.1.3, pp. PDF pp. 76-77. Calculation: Steel stair.

DG34-10.1.3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Line load wu	kip/ft	0.393	0.393	+0.02		Pass
End reaction Ru	kips	5.900	5.898	-0.03		Pass
Required moment Mu	kip-ft	13.40	13.34	-0.41		Pass
Available moment	kip-ft	42.90	42.93	+0.07		Pass
Available shear	kips	46.70	46.66	-0.09		Pass

DG34-10.1.3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Line load wa	kip/ft	0.267	0.266	-0.20		Pass
End reaction Ra	kips	4.050	4.044	-0.14		Pass
Required moment Ma	kip-ft	9.170	9.150	-0.22		Pass
Available moment	kip-ft	28.60	28.56	-0.13		Pass
Available shear	kips	31.00	31.04	+0.14		Pass
Total load deflection limit	in.	0.459	0.458	-0.15		Pass

DG34-10.1.4: Platform rear beam, C10X15.3

Source: AISC Design Guide 34 (2018), Example 10.1.4, pp. PDF pp. 77-79. Calculation: Steel stair.

DG34-10.1.4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
End reaction Ru	kips	1.800	1.802	+0.09		Pass
Required moment Mu	kip-ft	4.130	4.128	-0.05		Pass
Available moment	kip-ft	42.90	42.93	+0.07		Pass

DG34-10.1.4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
End reaction Ra	kips	1.220	1.221	+0.11		Pass
Required moment Ma	kip-ft	2.810	2.798	-0.42		Pass
Available moment	kip-ft	28.60	28.56	-0.13		Pass

DG34-10.1.5: Landing post, HSS3X3X3/16

Source: AISC Design Guide 34 (2018), Example 10.1.5, pp. PDF p. 79. Calculation: Steel stair.

DG34-10.1.5 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compression	kips	60.40	60.40	-0.00		Pass
Required compression Pu	kips	5.820	5.898	+1.34		Deviation DG34-FIG-SELFWEIGHT
DG34-FIG-SELFWEIGHT: Figures 10-5 and 10-6 leave the beam self-weight out of the reactions the post and hanger take						

DG34-10.1.5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compression	kips	40.20	40.18	-0.04		Pass
Required compression Pa	kips	3.980	4.044	+1.62		Deviation DG34-FIG-SELFWEIGHT
DG34-FIG-SELFWEIGHT: Figures 10-5 and 10-6 leave the beam self-weight out of the reactions the post and hanger take						

DG34-10.1.6: Landing hanger, L3X3X3/16

Source: AISC Design Guide 34 (2018), Example 10.1.6, pp. PDF pp. 79-80. Calculation: Steel stair.

DG34-10.1.6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tensile yielding	kips	35.30	35.32	+0.05		Pass
Tensile rupture	kips	35.60	35.56	-0.11		Pass
Required tension Pu	kips	1.710	1.802	+5.36		Deviation DG34-FIG-SELFWEIGHT
DG34-FIG-SELFWEIGHT: Figures 10-5 and 10-6 leave the beam self-weight out of the reactions the post and hanger take						

DG34-10.1.6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tensile yielding	kips	23.50	23.50	-0.01		Pass
Tensile rupture	kips	23.70	23.71	+0.03		Pass
Required tension Pa	kips	1.150	1.221	+6.20		Deviation DG34-FIG-SELFWEIGHT
DG34-FIG-SELFWEIGHT: Figures 10-5 and 10-6 leave the beam self-weight out of the reactions the post and hanger take						

DG34-10.1.7 · Steel stair: Guard assembly: top rail, handrail, post, infill

Source: AISC Design Guide 34 (2018), Example 10.1.7, pp. PDF pp. 80-89. Calculation: Steel stair.

DG34-10.1.7 · Steel stair · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Top rail required moment	kip-ft	0.327	0.327	-0.14		Pass
Top rail required shear	kips	0.327	0.327	-0.14		Pass
Top rail required compression	kips	0.320	0.320	+0.00		Pass
Top rail available moment	kip-ft	1.450	1.452	+0.17		Pass
Top rail available shear	kips	9.270	9.303	+0.35		Pass
Top rail available compression	kips	20.90	20.88	-0.10		Pass
Handrail available moment	kip-ft	1.050	1.052	+0.21		Pass
Handrail available shear	kips	7.770	7.763	-0.10		Pass
Handrail available compression	kips	15.30	15.30	-0.02		Pass
Post required moment	kip-ft	1.120	1.120	+0.00		Pass
Post required compression	kips	0.338	0.338	-0.01		Pass
Post required shear	kips	0.320	0.320	+0.00		Pass
Post available compression, K = 2	kips	9.360	9.397	+0.40		Pass
Infill required moment	kip-ft	0.060	0.060	+0.00		Pass
Infill available moment The guide compares Eq. F11-2 in kip-in. (1.14) with Mp in kip-ft and so stops at Mp; in one unit F11-2 gives 0.0933 kip-ft, below Mp = 0.0939. Inside the tolerance.	kip-ft	0.085	0.084	-0.45		Pass
Infill available shear	kips	4.860	4.860	-0.00		Pass

DG34-10.1.7 · Steel stair · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Top rail required moment	kip-ft	0.205	0.205	+0.21		Pass
Top rail available moment	kip-ft	0.966	0.966	+0.04		Pass
Top rail available shear	kips	6.170	6.189	+0.31		Pass
Top rail available compression	kips	13.90	13.89	-0.06		Pass
Handrail available moment	kip-ft	0.700	0.700	+0.01		Pass
Handrail available shear	kips	5.170	5.165	-0.10		Pass
Handrail available compression	kips	10.20	10.18	-0.22		Pass
Post required moment	kip-ft	0.700	0.700	+0.00		Pass
Post required compression	kips	0.215	0.215	-0.02		Pass
Post available compression, K = 2	kips	6.220	6.252	+0.52		Pass
Infill required moment	kip-ft	0.037	0.037	+0.00		Pass
Infill available moment	kip-ft	0.056	0.056	-0.41		Pass
Infill available shear	kips	3.230	3.234	+0.11		Pass

DG34-10.2.2: Checkered plate tread, bent plate

Source: AISC Design Guide 34 (2018), Example 10.2.2, pp. PDF pp. 97-99. Calculation: Steel stair.

Fy = 26.7 ksi is the guide's reading of the bending stresses of AISC Manual Table 3-18. Section values come from the plate with square corners; the guide used software (0.711 and 0.426, against 0.715 and 0.427).

DG34-10.2.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Uniform case Vu	kips	0.162	0.162	+0.00		Pass
Uniform case Mu	kip-ft	0.122	0.121	-0.41		Pass
Concentrated case Vu	kips	1.620	1.618	-0.12		Pass
Concentrated case Mu	kip-ft	1.210	1.214	+0.29		Pass
Available shear	kips	10.80	10.81	+0.12		Pass
Available moment	kip-ft	1.360	1.368	+0.56		Pass
Moment of inertia	in.⁴	0.711	0.715	+0.52		Pass
Elastic section modulus	in.³	0.426	0.427	+0.20		Pass

DG34-10.2.2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Uniform case Va	kips	0.105	0.105	-0.00		Pass
Uniform case Ma	kip-ft	0.079	0.079	-0.06		Pass
Concentrated case Va	kips	1.020	1.015	-0.49		Pass
Concentrated case Ma	kip-ft	0.761	0.761	+0.03		Pass
Available shear	kips	7.200	7.195	-0.07		Pass
Available moment	kip-ft	0.909	0.910	+0.10		Pass

DG34-10.2.3: Industrial stringer with seismic, HSS12X2X1/4

Source: AISC Design Guide 34 (2018), Example 10.2.3, pp. PDF pp. 100-105. Calculation: Steel stair.

DG34-10.2.3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Uniform case wu On 14.67 ft, the guide's 14'-8"; it computes with 14.7 ft.	kip/ft	0.218	0.218	-0.05		Pass
Point case Mu	kip-ft	7.880	7.853	-0.34		Pass
Point case Vu, load at a support	kips	2.140	2.142	+0.09		Pass
Available moment	kip-ft	75.40	75.38	-0.03		Pass
Available shear	kips	142.0	142.2	+0.12		Pass
Seismic Mu, major axis	kip-ft	5.890	5.872	-0.31		Pass
Available moment, minor axis	kip-ft	13.30	13.33	+0.26		Pass
Available shear, minor axis	kips	16.40	16.36	-0.26		Pass
Seismic Mu, minor axis	kip-ft	0.540	0.622	+15.21		Deviation DG34-SEISMIC-SPAN
DG34-SEISMIC-SPAN: the guide takes the lateral moment on the span on plan; the member spans its sloped length, which the program uses						
Interaction		0.119	0.125	+4.67		Deviation DG34-SEISMIC-SPAN
DG34-SEISMIC-SPAN: the guide takes the lateral moment on the span on plan; the member spans its sloped length, which the program uses						

DG34-10.2.3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Uniform case wa	kip/ft	0.152	0.152	-0.28		Pass
Point case Ma	kip-ft	5.340	5.322	-0.33		Pass
Point case Va, load at a support	kips	1.450	1.452	+0.11		Pass
Available moment	kip-ft	50.10	50.15	+0.10		Pass
Available shear	kips	94.60	94.60	-0.01		Pass
Seismic Ma, major axis	kip-ft	4.540	4.520	-0.43		Pass
Available moment, minor axis	kip-ft	8.870	8.872	+0.02		Pass
Available shear, minor axis	kips	10.90	10.88	-0.16		Pass
Seismic Ma, minor axis	kip-ft	0.284	0.327	+15.00		Deviation DG34-SEISMIC-SPAN
DG34-SEISMIC-SPAN: the guide takes the lateral moment on the span on plan; the member spans its sloped length, which the program uses						
Interaction		0.123	0.127	+3.21		Pass

D.1 · Steel tension member / brace: W8X21 tension member, flanges bolted

Source: AISC Design Examples v16.0, Example D.1, pp. D-2 to D-4. Calculation: Steel tension member / brace.

D.1 · Steel tension member / brace · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φt Pn, yielding	kips	277.0	277.2	+0.07		Pass
φt Pn, rupture	kips	211.0	210.7	-0.15		Pass
U (Case 2 governs Case 7)		0.908	0.908	-0.00		Pass
L/r		238.000	238.095	+0.04		Pass

D.1 · Steel tension member / brace · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pn/Ωt, yielding	kips	184.0	184.4	+0.23		Pass
Pn/Ωt, rupture	kips	141.0	140.5	-0.38		Pass

D.2 · Steel tension member / brace: L4X4X1/2, one line of four 3/4 in. bolts

Source: AISC Design Examples v16.0, Example D.2, pp. D-5 to D-7. Calculation: Steel tension member / brace.

D.2 · Steel tension member / brace · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φt Pn, yielding	kips	169.0	168.8	-0.15		Pass
φt Pn, rupture	kips	140.0	140.3	+0.22		Pass
U (Case 2 governs Case 8)		0.869	0.869	-0.01		Pass
Lmax at L/r = 300	ft	19.40	19.40	+0.00		Pass

D.2 · Steel tension member / brace · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pn/Ωt, yielding	kips	113.0	112.3	-0.64		Pass
Pn/Ωt, rupture	kips	93.50	93.54	+0.04		Pass

D.3 · Steel tension member / brace: WT6X20, flange welded with longitudinal welds

Source: AISC Design Examples v16.0, Example D.3, pp. D-8 to D-10. Calculation: Steel tension member / brace.

D.3 · Steel tension member / brace · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φt Pn, yielding	kips	263.0	262.8	-0.08		Pass
φt Pn, rupture	kips	245.0	244.8	-0.06		Pass
U (Case 4)		0.860	0.860	+0.00		Pass
L/r		229.000	229.299	+0.13		Pass

D.3 · Steel tension member / brace · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pn/Ωt, yielding	kips	175.0	174.9	-0.09		Pass
Pn/Ωt, rupture	kips	163.0	163.2	+0.14		Pass

D.4 · Steel tension member / brace: HSS6X4X3/8, slotted concentric gusset

Source: AISC Design Examples v16.0, Example D.4, pp. D-11 to D-13. Calculation: Steel tension member / brace.

D.4 · Steel tension member / brace · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φt Pn, yielding	kips	278.0	278.1	+0.04		Pass
φt Pn, rupture	kips	248.0	247.3	-0.28		Pass
U (Case 5, rectangular)		0.919	0.919	-0.01		Pass
An through the slots	in.²	5.790	5.787	-0.05		Pass
L/r		232.000	232.258	+0.11		Pass

D.4 · Steel tension member / brace · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pn/Ωt, yielding	kips	185.0	185.0	+0.02		Pass
Pn/Ωt, rupture	kips	165.0	164.9	-0.08		Pass

D.5 · Steel tension member / brace: HSS6.000X0.500, slotted concentric gusset

Source: AISC Design Examples v16.0, Example D.5, pp. D-14 to D-16. Calculation: Steel tension member / brace.

D.5 · Steel tension member / brace · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φt Pn, yielding	kips	364.0	364.1	+0.01		Pass
φt Pn, rupture	kips	349.0	348.9	-0.04		Pass
U (Case 5, round)		0.991	0.991	+0.05		Pass
An through the slots	in.²	7.570	7.567	-0.04		Pass

D.5 · Steel tension member / brace · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pn/Ωt, yielding	kips	242.0	242.2	+0.09		Pass
Pn/Ωt, rupture	kips	233.0	232.6	-0.18		Pass

D.6 · Steel tension member / brace: 2L4X4X1/2 (3/8 in. separation), one line of eight bolts

Source: AISC Design Examples v16.0, Example D.6, pp. D-17 to D-19. Calculation: Steel tension member / brace.

D.6 · Steel tension member / brace · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φt Pn, yielding	kips	338.0	337.5	-0.15		Pass
φt Pn, rupture	kips	305.0	304.8	-0.06		Pass
U (Case 2 governs Case 8)		0.944	0.944	-0.02		Pass
An, two holes	in.²	6.630	6.625	-0.08		Pass
L/rx		248.000	247.934	-0.03		Pass

D.6 · Steel tension member / brace · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pn/Ωt, yielding	kips	225.0	224.6	-0.20		Pass
Pn/Ωt, rupture	kips	204.0	203.2	-0.39		Pass

D.9 · Steel tension member / brace: 14 × 1/2 in. plate with staggered holes

Source: AISC Design Examples v16.0, Example D.9, pp. D-27, D-28. Calculation: Steel tension member / brace.

The Example rounds the net width to 11.5 in.; the App keeps 11.54 in.

D.9 · Steel tension member / brace · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
An of the governing path A-B-C-D-E-F	in.²	5.750	5.771	+0.36		Pass
U (Case 1)		1.000	1.000	+0.00		Pass

HAND-TM-BLOCK: The default: block shear and bearing of the L4X4X1/2 at its bolts

Source: Hand calculation (closed form). Calculation: Steel tension member / brace.

Hand calculation; the default design.

HAND-TM-BLOCK · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φ Rn, block shear (J4.3)	kips	134.7	134.7	+0.00		Pass
φ Rn, bearing and tearout (J3.11a)	kips	163.6	163.6	+0.00		Pass

HAND-TM-BLOCK · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rn/Ω, block shear	kips	89.78	89.78	+0.00		Pass
Rn/Ω, bearing and tearout	kips	109.1	109.1	+0.00		Pass

HAND-TM-ROD: 1 in. ASTM F1554 Gr. 36 threaded rod

Source: Hand calculation (closed form). Calculation: Steel tension member / brace.

Hand calculation.

HAND-TM-ROD · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φ Rn, threaded part (J3.7, Fnt = 0.75 Fu)	kips	25.62	25.62	+0.00		Pass
φ Pn, body yielding (D2)	kips	25.45	25.45	+0.00		Pass

HAND-TM-ROD · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rn/Ω, threaded part	kips	17.08	17.08	+0.00		Pass

HAND-TM-CASE6: HSS6X4X3/8 with two side gussets, l = 8 in.

Source: Hand calculation (closed form). Calculation: Steel tension member / brace.

Hand calculation of the 2022 Case 6 equation.

HAND-TM-CASE6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
U (Table D3.1 Case 6)		0.874	0.874	+0.00		Pass

DG9-5.1: W10X49, 15 ft, torsionally pinned, eccentric load at midspan

Source: AISC Design Guide 9, Torsional Analysis of Structural Steel Members (1997), Example 5.1, pp. 19 to 21. Calculation: Steel beam with torsion.

DG9-5.1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Moment Mu at midspan	kip-ft	56.25	56.25	+0.00		Pass
Shear Vu	kips	7.500	7.500	+0.00		Pass
Bending stress σb at midspan	ksi	12.40	12.36	-0.30		Pass
Warping normal stress σw at midspan	ksi	28.00	28.53	+1.90		Pass
Largest normal stress f_un	ksi	40.40	40.89	+1.22		Pass
τt in the flange at the support	ksi	10.20	10.06	-1.34		Pass
τt in the web at the support	ksi	6.160	6.110	-0.82		Pass
τw in the flange at the support	ksi	0.560	0.570	+1.78		Pass
τw in the flange at midspan	ksi	1.280	1.281	+0.08		Pass
f_uv in the flange at midspan	ksi	1.920	1.911	-0.45		Pass
τb in the web Qw = 29.8 in.³ (v16.0 database) against 30.2 in DG9	ksi	2.450	2.417	-1.36		Pass
τb in the flange	ksi	0.640	0.630	-1.52		Pass
f_uv in the flange at the support	ksi	11.40	11.26	-1.20		Pass
f_uv in the web at the support	ksi	8.610	8.527	-0.97		Pass
Largest shear stress f_uv	ksi	11.40	11.26	-1.20		Pass
Rotation at midspan under service loads	rad	0.062	0.066	+6.88		Deviation DG9-CHART
DG9-CHART: the guide reads the rotation functions from the Appendix B charts to two digits (0.09 for the exact 0.0955)						

DG9-5.2: HSS10X6X1/2 in place of the W10X49 of Example 5.1

Source: AISC Design Guide 9, Torsional Analysis of Structural Steel Members (1997), Example 5.2, pp. 21 to 22. Calculation: Steel beam with torsion.

DG9-5.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Moment Mu at midspan	kip-ft	56.25	56.25	+0.00		Pass
Shear Vu	kips	7.500	7.500	+0.00		Pass
Torsional shear stress τt	ksi	1.720	0.924	-46.28		Deviation DG9-5.2-TAU
DG9-5.2-TAU: the guide divides the whole 90 kip-in. torque by 2 t Ao of the 1997 TS10x6x1/2; each support takes half of it, and T/C uses C = 48.7 in.³						
Rotation at midspan under service loads	rad	0.001	0.001	+5.36		Deviation DG9-5.2-J
DG9-5.2-J: J = 187 in.⁴ of the 1997 TS10x6x1/2 against 176 in.⁴ in the v16.0 database						

DG9-5.4: Welded plate girder, 25 ft, two eccentric concentrated loads

Source: AISC Design Guide 9, Torsional Analysis of Structural Steel Members (1997), Example 5.4, pp. 24 to 26. Calculation: Steel beam with torsion.

DG9-5.4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ix	in.⁴	23,600	23,563	-0.16		Pass
Sx	in.³	1,310	1,309	-0.07		Pass
Iy	in.⁴	1,950	1,947	-0.17		Pass
J (Eq. 3.4)	in.⁴	107.0	106.7	-0.31		Pass
Cw (Eq. 3.5)		564,000	562,587	-0.25		Pass
a (Eq. 3.6)	in.	117.0	116.9	-0.12		Pass
Wno (Eq. 3.7)	in.²	153.0	153.0	+0.00		Pass
Sw1 (Eq. 3.8)		1,380	1,377	-0.22		Pass
Qf (Eq. 3.9)	in.³	289.0	289.0	+0.00		Pass
Qw (Eq. 3.10)	in.³	740.0	740.0	+0.00		Pass
Moment Mu at D	kip-ft	2,902	2,902	+0.00		Pass
Bending stress σb at D	ksi	26.60	26.61	+0.03		Pass
Warping normal stress σw at D	ksi	18.40	18.68	+1.50		Pass
Largest normal stress f_un	ksi	45.00	45.28	+0.63		Pass
Rotation at D (factored loads)	rad	0.029	0.030	+1.98		Pass
τt in the flange at D	ksi	4.470	4.740	+6.03		Deviation DG9-CHART
DG9-CHART: the guide reads the rotation functions from the Appendix B charts to two digits (θ' = −0.12 and −0.10 for the exact −0.128 and −0.106)						
τt in the web at D	ksi	2.240	2.370	+5.79		Deviation DG9-CHART
DG9-CHART: the guide reads the rotation functions from the Appendix B charts to two digits (θ' = −0.12 and −0.10 for the exact −0.128 and −0.106)						
τw in the flange at D	ksi	1.110	1.111	+0.13		Pass
f_uv in the flange at D	ksi	7.950	8.224	+3.45		Deviation DG9-CHART
DG9-CHART: the guide reads the rotation functions from the Appendix B charts to two digits (θ' = −0.12 and −0.10 for the exact −0.128 and −0.106)						
f_uv in the web at D	ksi	14.30	14.52	+1.56		Pass
τt in the flange at E	ksi	8.750	8.784	+0.39		Pass
τt in the web at E	ksi	4.370	4.392	+0.51		Pass
τw in the flange at E	ksi	0.870	0.847	-2.59		Pass
τb in the web	ksi	12.10	12.15	+0.45		Pass
τb in the flange	ksi	2.370	2.373	+0.14		Pass
f_uv in the flange at E	ksi	12.00	12.01	+0.04		Pass
Largest shear stress f_uv (web at E)	ksi	16.50	16.55	+0.28		Pass
Largest rotation under service loads	rad	0.023	0.024	+5.37		Deviation DG9-CHART
DG9-CHART: the guide reads the rotation functions from the Appendix B charts to two digits (0.055 and 0.065 at an estimated 14.5 ft)						

DG9-5.5: MC18X42.7, 12 ft, fixed ends, uniform load through the centroid

Source: AISC Design Guide 9, Torsional Analysis of Structural Steel Members (1997), Example 5.5, pp. 26 to 29. Calculation: Steel beam with torsion.

DG9-5.5 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bending stress σb at the support	ksi	8.410	8.429	+0.23		Pass
τb in the web at the support	ksi	3.280	3.223	-1.73		Pass
τb in the flange at the support Qf = 19.0 in.³ (v16.0 database) against 19.7 in DG9	ksi	1.230	1.185	-3.64		Pass
Normal stress at point 0 at the support (σw0 + σb)	ksi	11.70	12.57	+7.45		Deviation DG9-CHART
DG9-CHART: the guide reads the rotation functions from the Appendix B charts to two digits (θ" 0.46 for the exact 0.481)						
Normal stress at point 2 at the support (σw2 + σb)	ksi	17.90	18.34	+2.44		Pass
Largest normal stress f_un	ksi	17.90	18.34	+2.44		Pass
Point of the largest normal stress (2 = flange-web junction)		2.000	2.000	+0.00		Pass
Warping normal stress σw0 at the support	ksi	20.10	21.00	+4.48		Deviation DG9-CHART
DG9-CHART: the guide reads the rotation functions from the Appendix B charts to two digits (θ" 0.46 for the exact 0.481)						
Warping normal stress σw2 at the support	ksi	9.490	9.907	+4.39		Deviation DG9-CHART
DG9-CHART: the guide reads the rotation functions from the Appendix B charts to two digits (θ" 0.46 for the exact 0.481)						
Bending stress σb at midspan	ksi	4.200	4.215	+0.35		Pass
Warping normal stress σw0 at midspan	ksi	8.730	9.183	+5.19		Deviation DG9-CHART
DG9-CHART: the guide reads the rotation functions from the Appendix B charts to two digits (θ" −0.20 for the exact −0.210)						
Warping normal stress σw2 at midspan	ksi	4.130	4.332	+4.89		Deviation DG9-CHART
DG9-CHART: the guide reads the rotation functions from the Appendix B charts to two digits (θ" −0.20 for the exact −0.210)						
Normal stress at point 0 at midspan	ksi	4.530	4.968	+9.68		Deviation DG9-CHART
DG9-CHART: the guide reads the rotation functions from the Appendix B charts to two digits (θ" −0.20 for the exact −0.210)						
Normal stress at point 2 at midspan	ksi	8.330	8.547	+2.60		Pass
τt in the web at z/l = 0.2	ksi	2.050	2.106	+2.73		Pass
τt in the flange at z/l = 0.2	ksi	2.840	2.925	+2.99		Pass
τw at point 1 at the support	ksi	1.300	1.306	+0.44		Pass
τw at point 2 at the support	ksi	1.010	1.013	+0.30		Pass
τw at point 3 at the support	ksi	0.702	0.712	+1.40		Pass
Shear stress f_uv at point 3 at the support	ksi	3.980	3.935	-1.13		Pass
τw at point 1 at z/l = 0.2	ksi	0.599	0.595	-0.61		Pass
τw at point 2 at z/l = 0.2	ksi	0.465	0.462	-0.67		Pass
τw at point 3 at z/l = 0.2	ksi	0.323	0.325	+0.49		Pass
τb in the web at z/l = 0.2	ksi	1.980	1.934	-2.33		Pass
τb in the flange at z/l = 0.2 Qf = 19.0 in.³ (v16.0 database) against 19.7 in DG9	ksi	0.740	0.711	-3.90		Pass
Shear stress f_uv at point 1, z/l = 0.2	ksi	3.440	4.004	+16.38		Deviation DG9-5.5-SIGNS
DG9-5.5-SIGNS: at the flange points of a channel the guide adds the shear stresses with their signs and takes no flexural shear at point 1; the module adds absolute values and the flexural shear at point 1 (conservative)						
Shear stress f_uv at point 2, z/l = 0.2	ksi	3.120	4.098	+31.35		Deviation DG9-5.5-SIGNS
DG9-5.5-SIGNS: at the flange points of a channel the guide adds the shear stresses with their signs and takes no flexural shear at point 1; the module adds absolute values and the flexural shear at point 1 (conservative)						
Shear stress f_uv at point 3, z/l = 0.2	ksi	4.350	4.364	+0.33		Pass
Largest shear stress f_uv along the span	ksi	4.350	4.717	+8.43		Deviation DG9-5.5-STATIONS
DG9-5.5-STATIONS: the guide checks z/l = 0, 0.2 and 0.5 only; the module's envelope finds 4.72 ksi at 1.4 ft (z/l = 0.12)						
Rotation at midspan under service loads	rad	0.012	0.013	+8.48		Deviation DG9-CHART
DG9-CHART: the guide reads the rotation functions from the Appendix B charts to two digits (0.15 for the exact 0.159)						

H.5A: Rectangular HSS torsional strength, HSS6X4X1/4

Source: AISC Design Examples v16.0, Example H.5A, pp. H-16 to H-17. Calculation: Steel beam with torsion.

H.5A · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available torsional strength φT Tn	kip-in.	273.0	272.7	-0.11		Pass

H.5A · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available torsional strength Tn/ΩT	kip-in.	181.0	181.4	+0.24		Pass

H.5B: Round HSS torsional strength, HSS5.000X0.250, 14 ft

Source: AISC Design Examples v16.0, Example H.5B, pp. H-18 to H-19. Calculation: Steel beam with torsion.

H.5B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available torsional strength φT Tn	kip-in.	215.0	214.7	-0.16		Pass

H.5B · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available torsional strength Tn/ΩT	kip-in.	143.0	142.8	-0.13		Pass

H.5C: HSS6X4X1/4, 8 ft, uniform load at 6 in., torsionally fixed ends

Source: AISC Design Examples v16.0, Example H.5C, pp. H-20 to H-24. Calculation: Steel beam with torsion.

H.5C · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required shear Vr	kips	11.00	11.04	+0.36		Pass
Available shear strength	kips	66.70	66.68	-0.02		Pass
Required torsional strength Tr (support)	kip-in.	66.20	66.24	+0.06		Pass
Available flexural strength	kip-ft	32.00	31.99	-0.04		Pass
H3-6 at Tr = 0.2 Tc (governing)		0.333	0.335	+0.68		Pass

H.5C · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required shear Vr	kips	7.360	7.360	+0.00		Pass
Available shear strength	kips	44.40	44.37	-0.07		Pass
Required torsional strength Tr (support)	kip-in.	44.20	44.16	-0.09		Pass
Available flexural strength	kip-ft	21.33	21.28	-0.24		Pass
H3-6 at Tr = 0.2 Tc (governing)		0.340	0.338	-0.72		Pass

H.6: W10X49 torsional strength (AISC 360-22 H3.3), the DG9 Example 5.1 beam

Source: AISC Design Examples v16.0, Example H.6, pp. H-25 to H-32. Calculation: Steel beam with torsion.

H.6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bending stress σb at midspan	ksi	12.40	12.36	-0.30		Pass
τb in the web	ksi	2.420	2.417	-0.13		Pass
τb in the flange	ksi	0.630	0.630	+0.04		Pass
Warping normal stress σw at midspan	ksi	28.00	28.53	+1.90		Pass
Largest normal stress f_un	ksi	40.40	40.89	+1.22		Pass
τt in the flange at the support	ksi	10.20	10.06	-1.34		Pass
τt in the web at the support	ksi	6.160	6.110	-0.82		Pass
τw in the flange at the support	ksi	0.563	0.570	+1.24		Pass
τw in the flange at midspan	ksi	1.280	1.281	+0.08		Pass
Largest shear stress f_uv (flange at the support)	ksi	11.40	11.26	-1.20		Pass
f_uv in the web at the support	ksi	8.580	8.527	-0.62		Pass
Cb (Manual Table 3-1)		1.320	1.316	-0.32		Pass
φT Fy (normal stress yielding)	ksi	45.00	45.00	+0.00		Pass
φT 0.6 Fy (shear yielding)	ksi	27.00	27.00	+0.00		Pass
φT Fcr (buckling, Cb Mn / Sx)	ksi	59.22	49.78	-15.94		Deviation AISC-H6-FCR
AISC-H6-FCR: the example multiplies the tabulated Mn (Cb = 1) by Cb = 1.32 without the Mp cap of Eq. F2-2; the module keeps Mn ≤ Mp (Fcr = 55.3 ksi)						
Rotation at midspan under service loads	rad	0.062	0.066	+6.20		Deviation DG9-CHART
DG9-CHART: the guide reads the rotation functions from the Appendix B charts to two digits (0.09 for the exact 0.0955)						

H.6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bending stress σb at midspan	ksi	8.240	8.242	+0.02		Pass
τb in the web	ksi	1.610	1.611	+0.07		Pass
τb in the flange	ksi	0.420	0.420	+0.04		Pass
Warping normal stress σw at midspan	ksi	18.70	19.02	+1.72		Pass
Largest normal stress f_an	ksi	26.90	27.26	+1.35		Pass
τt in the flange at the support	ksi	6.760	6.709	-0.76		Pass
τt in the web at the support	ksi	4.110	4.073	-0.90		Pass
τw in the flange at the support	ksi	0.375	0.380	+1.33		Pass
τw in the flange at midspan	ksi	0.853	0.854	+0.12		Pass
Largest shear stress f_av	ksi	7.560	7.509	-0.68		Pass
f_av in the web at the support	ksi	5.720	5.684	-0.62		Pass
Fy/ΩT (normal stress yielding)	ksi	29.90	29.94	+0.13		Pass
0.6 Fy/ΩT (shear yielding)	ksi	18.00	17.96	-0.20		Pass
Cb Mn / (ΩT Sx), buckling	ksi	39.46	33.12	-16.07		Deviation AISC-H6-FCR
AISC-H6-FCR: the example multiplies the tabulated Mn (Cb = 1) by Cb = 1.32 without the Mp cap of Eq. F2-2; the module keeps Mn ≤ Mp (Fcr = 55.3 ksi)						

UD-8.7-G: King post generated: span 10 m, rise 4 m, 120 kN at the apex

Source: F. Udoeyo, Structural Analysis (Temple University Press, 2020, open textbook), Example 8.7, pp. PDF pp. 222-224. Calculation: Steel truss.

UD-8.7-G · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
AB	kips	-21.59	-21.59	-0.00		Pass
BC	kips	-21.59	-21.59	-0.00		Pass
AD	kips	16.86	16.86	+0.00		Pass
DC	kips	16.86	16.86	+0.00		Pass
BD	kips	0.000	-0.000	+0.00		Pass

UD-8.12-G: Flat Pratt generated: 2 panels of 3 m, 3 m deep, 100 kN at top center. BC and CD are printed wrong in the book, so they are left out; CF is -100 kN in its solution and +100 in its Table 8.9

Source: F. Udoeyo, Structural Analysis (Temple University Press, 2020, open textbook), Example 8.12, pp. PDF pp. 233-235. Calculation: Steel truss.

UD-8.12-G · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
AB, end vertical	kips	-11.24	-11.24	-0.00		Pass
AF, bottom chord	kips	0.000	0.000	+0.00		Pass
BF, diagonal	kips	15.90	15.90	+0.00		Pass
CF, center vertical	kips	-22.48	-22.48	-0.00		Pass

D.3 · Steel truss: WT6X20 tension, U = 0.860

Source: AISC Design Examples v16.0, Example D.3, pp. D-8 to D-10. Calculation: Steel truss.

D.3 · Steel truss · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tensile yielding	kips	263.0	262.8	-0.08		Pass
Tensile rupture	kips	245.0	244.8	-0.06		Pass

D.3 · Steel truss · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tensile yielding	kips	175.0	174.9	-0.09		Pass
Tensile rupture	kips	163.0	163.2	+0.14		Pass

D.6 · Steel truss: 2L4X4X1/2 (3/8 in. separation) tension, U = 0.944, one line of holes

Source: AISC Design Examples v16.0, Example D.6, pp. D-17 to D-19. Calculation: Steel truss.

D.6 · Steel truss · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tensile yielding	kips	338.0	337.5	-0.15		Pass
Tensile rupture	kips	305.0	305.1	+0.04		Pass

D.6 · Steel truss · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Tensile yielding	kips	225.0	224.6	-0.20		Pass
Tensile rupture	kips	204.0	203.4	-0.29		Pass

E.5 · Steel truss: 2L4X3-1/2X3/8 LLBB (3/4 in. separation) compression, 8 ft, two connectors

Source: AISC Design Examples v16.0, Example E.5, pp. E-36 to E-41. Calculation: Steel truss.

E.5 · Steel truss · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	157.0	156.7	-0.19		Pass
Fex	ksi	48.50	48.53	+0.05		Pass
Fey with the modified slenderness 61.0	ksi	76.90	76.90	-0.00		Pass
Fez	ksi	102.0	101.9	-0.10		Pass
Fe flexural-torsional	ksi	60.50	60.43	-0.11		Pass

E.5 · Steel truss · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	104.0	104.3	+0.25		Pass

E.6 · Steel truss: 2L5X3X1/4 LLBB (3/4 in. separation) compression with slender elements, 8 ft

Source: AISC Design Examples v16.0, Example E.6, pp. E-42 to E-48. Calculation: Steel truss.

E.6 · Steel truss · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	73.80	73.83	+0.04		Pass
Fez	ksi	37.80	37.84	+0.11		Pass
Fe flexural-torsional	ksi	26.80	26.83	+0.10		Pass

E.6 · Steel truss · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	49.10	49.12	+0.04		Pass

E.7 · Steel truss: WT7X34 compression, 20 ft

Source: AISC Design Examples v16.0, Example E.7, pp. E-49 to E-53. Calculation: Steel truss.

E.7 · Steel truss · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	128.0	128.5	+0.38		Pass
Fey	ksi	30.00	30.07	+0.24		Pass
Fez	ksi	165.0	165.2	+0.15		Pass
Fe flexural-torsional	ksi	29.50	29.53	+0.11		Pass

E.7 · Steel truss · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available compressive strength	kips	85.00	85.49	+0.58		Pass

F.10 · Steel truss: WT5X6 flexure, stem in tension, continuously braced

Source: AISC Design Examples v16.0, Example F.10, pp. F-45 to F-47. Calculation: Steel truss.

F.10 · Steel truss · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available flexural strength	kip-ft	7.320	7.320	+0.00		Pass

F.10 · Steel truss · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available flexural strength	kip-ft	4.870	4.870	+0.01		Pass

TS-H1: Flat Pratt, 8 panels of 6 ft, 6 ft deep, 10 kips at each interior top joint, pinned: hand statics

Source: Hand calculation, method of sections. Calculation: Steel truss.

TS-H1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Reaction	kips	35.00	35.00	-0.00		Pass
Bottom chord, panel left of midspan, moment about the top joint at 18 ft: (35 × 18 − 10 × 18)/6	kips	75.00	75.00	-0.00		Pass
Top chord, panel left of midspan, moment about the bottom joint at midspan: (35 × 24 − 10 × 36)/6	kips	-80.00	-80.00	-0.00		Pass
Bottom chord, second panel	kips	35.00	35.00	-0.00		Pass
End diagonal, 35 × √2	kips	49.50	49.50	-0.00		Pass

J.7: W24X55 girder, W18X50 beam bearing on its top flange

Source: AISC Design Examples v16.0, Example J.7, pp. J-24 to J-27. Calculation: Concentrated forces on beams.

The default design. The Example rounds h to 21.6 in. and the ratio to 1.59; the App keeps the digits.

J.7 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φRn, web local yielding (J10-2)	kips	248.0	247.9	-0.06		Pass
φRn, web local crippling (J10-4)	kips	212.0	211.5	-0.22		Pass
φRn, web sidesway buckling (J10-6)	kips	142.0	143.2	+0.83		Pass

J.7 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rn/Ω, web local yielding	kips	165.0	165.2	+0.15		Pass
Rn/Ω, web local crippling	kips	141.0	141.0	+0.01		Pass
Rn/Ω, web sidesway buckling	kips	94.90	95.71	+0.85		Pass

II.B-1-T: W14X99 column under the tension flange plate (3/4 x 7 in.)

Source: AISC Design Examples v16.0, Example II.B-1, pp. IIB-18. Calculation: Concentrated forces on beams.

II.B-1-T · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φRn, flange local bending (J10-1)	kips	171.0	171.1	+0.07		Pass
φRn, web local yielding	kips	186.0	185.5	-0.26		Pass

II.B-1-T · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rn/Ω, flange local bending	kips	114.0	113.8	-0.13		Pass
Rn/Ω, web local yielding	kips	124.0	123.7	-0.26		Pass

II.B-1-C: W14X99 column under the compression flange plate

Source: AISC Design Examples v16.0, Example II.B-1, pp. IIB-18, IIB-19. Calculation: Concentrated forces on beams.

II.B-1-C · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φRn, web local yielding	kips	186.0	185.5	-0.26		Pass
φRn, web local crippling (J10-4)	kips	233.0	232.3	-0.31		Pass

II.B-1-C · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rn/Ω, web local yielding	kips	124.0	123.7	-0.26		Pass
Rn/Ω, web local crippling	kips	155.0	154.8	-0.10		Pass

DG13-6-1: W14X53 column, W18X50 beam, 250 kip-ft, 300 kips axial

Source: AISC Design Guide 13 (1999), Example 6-1, pp. 39, 40. Calculation: Concentrated forces on beams.

DG13-6-1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φRv, panel zone (J10-9)	kips	139.0	138.9	-0.10		Pass
φRn, flange local bending	kips	123.0	122.5	-0.40		Pass

HAND-WL-WCB: W14X90 under a pair of compressive forces

Source: Hand calculation (closed form). Calculation: Concentrated forces on beams.

HAND-WL-WCB · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φRn, web compression buckling (J10-8)	kips	194.4	194.4	+0.00		Pass

HAND-WL-WCB · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rn/Ω, web compression buckling	kips	129.4	129.4	+0.00		Pass

HAND-WL-STIFF: The DG13 6-1 joint with stiffeners and a doubler (360-22 J10.8, J10.9)

Source: Hand calculation (closed form). Calculation: Concentrated forces on beams.

Hand calculation; kdes = 1.25 in. of the database.

HAND-WL-STIFF · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Stiffener force in tension: Ru − φRn (flange local bending)	kips	49.70	49.70	+0.00		Pass
Stiffener force in compression: Ru − φRn (web local yielding)	kips	46.05	46.05	+0.00		Pass
φ Fy Ast of the stiffener pair	kips	54.67	54.67	+0.00		Pass
φRn, panel zone with the doubler	kips	240.2	240.2	+0.00		Pass

SD-10-12A: 12-story concrete frame, north-south

Source: FEMA P-1051 (2015), Chapter 10, Berkeley building, pp. pp. 454 to 459, Tables 10-11a, 10-12a. Calculation: Story drift and P-delta.

SD-10-12A · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
θ, Story 12		0.006	0.006	+0.36		Pass
θ, Story 11		0.010	0.010	+0.10		Pass
θ, Story 10		0.015	0.015	+0.02		Pass
θ, Story 9		0.020	0.020	-0.08		Pass
θ, Story 8		0.025	0.025	+0.02		Pass
θ, Story 7		0.030	0.030	-0.23		Pass
θ, Story 6		0.036	0.036	+0.01		Pass
θ, Story 5		0.041	0.041	-0.09		Pass
θ, Story 4		0.046	0.046	-0.02		Pass
θ, Story 3		0.051	0.051	+0.02		Pass
θ, Story 2		0.055	0.055	-0.02		Pass
θ, Story 1		0.049	0.049	+0.04		Pass
Accumulated load, Story 12	kips	3,772	3,772	+0.00		Pass
Accumulated load, Story 9	kips	16,057	16,057	+0.00		Pass
Accumulated load, Story 4	kips	36,532	36,532	+0.00		Pass
Accumulated load, Story 1	kips	48,959	48,959	+0.00		Pass
Drift ratio %, Story 12		0.239	0.238	-0.23		Pass
Drift ratio %, Story 11		0.373	0.373	+0.02		Pass
Drift ratio %, Story 10		0.496	0.496	+0.03		Pass
Drift ratio %, Story 9		0.596	0.596	-0.08		Pass
Drift ratio %, Story 8		0.677	0.677	-0.01		Pass
Drift ratio %, Story 7		0.746	0.746	+0.02		Pass
Drift ratio %, Story 6		0.808	0.808	-0.04		Pass
Drift ratio %, Story 5		0.866	0.866	+0.00		Pass
Drift ratio %, Story 4		0.923	0.923	+0.01		Pass
Drift ratio %, Story 3		0.977	0.977	-0.01		Pass
Drift ratio %, Story 2		1.018	1.017	-0.07		Pass
Drift ratio %, Story 1		0.871	0.871	-0.02		Pass
Δxe, Story 4	in.	0.262	0.262	-0.07		Pass
0.5 / (β Cd)		0.091	0.091	-0.10		Pass
θmax		0.091	0.100	+9.89		Deviation ASCE722-THETAMAX
ASCE722-THETAMAX: 7-22 adds that θmax need not be taken less than 0.10; the book is to 7-10						

SD-10-12B: 12-story concrete frame, east-west

Source: FEMA P-1051 (2015), Chapter 10, Berkeley building, pp. p. 460, Table 10-12b. Calculation: Story drift and P-delta.

SD-10-12B · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
θ, Story 12		0.009	0.009	-0.15		Pass
θ, Story 11		0.011	0.011	-0.02		Pass
θ, Story 10		0.014	0.014	-0.17		Pass
θ, Story 9		0.018	0.018	+0.04		Pass
θ, Story 8		0.021	0.021	-0.17		Pass
θ, Story 7		0.024	0.024	+0.18		Pass
θ, Story 6		0.026	0.027	+0.18		Pass
θ, Story 5		0.028	0.028	+0.07		Pass
θ, Story 4		0.028	0.028	+0.14		Pass
θ, Story 3		0.026	0.026	-0.17		Pass
θ, Story 2		0.024	0.024	+0.02		Pass
θ, Story 1		0.018	0.018	+0.04		Pass

SD-9.1: One-story industrial frame, transverse

Source: FEMA P-1051 (2015), Example 9.1, pp. pp. 369 to 375. Calculation: Story drift and P-delta.

SD-9.1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
δx = Cd δe / Ie	in.	18.00	18.04	+0.22		Pass
Allowable drift at the ridge	in.	10.28	10.28	-0.05		Pass
θmax		0.125	0.125	+0.00		Pass
θ		0.069	0.054	-21.11		Deviation P1051-9-1-THETA
P1051-9-1-THETA: the printed 0.069 does not follow from the printed numbers						

SD-4-7-X: 23-story steel building, X direction

Source: FEMA P-2192-V1 (2020), Table 4-7, pp. p. 151. Calculation: Story drift and P-delta.

SD-4-7-X · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Relative drift %, L23		1.000	0.992	-0.83		Pass
Relative drift %, L22		1.020	1.017	-0.33		Pass
Relative drift %, L21		1.030	1.042	+1.13		Pass
Relative drift %, L20		1.050	1.050	-0.00		Pass
Relative drift %, L19		1.070	1.067	-0.31		Pass
Relative drift %, L18		1.080	1.092	+1.08		Pass
Relative drift %, L17		1.100	1.092	-0.76		Pass
Relative drift %, L16		1.100	1.108	+0.76		Pass
Relative drift %, L15		1.110	1.108	-0.15		Pass
Relative drift %, L14		1.110	1.108	-0.15		Pass
Relative drift %, L13		1.110	1.108	-0.15		Pass
Relative drift %, L12		1.100	1.100	-0.00		Pass
Relative drift %, L11		1.090	1.092	+0.15		Pass
Relative drift %, L10		1.080	1.083	+0.31		Pass
Relative drift %, L09		1.060	1.058	-0.16		Pass
Relative drift %, L08		1.040	1.042	+0.16		Pass
Relative drift %, L07		1.000	0.992	-0.83		Pass
Relative drift %, L06		0.950	0.958	+0.88		Pass
Relative drift %, L05		0.890	0.883	-0.75		Pass
Relative drift %, L04		0.800	0.801	+0.16		Pass
Relative drift %, L03		0.590	0.583	-1.13		Pass
Relative drift %, L02		0.280	0.282	+0.73		Pass
Allowable, typical story	in.	2.400	2.400	+0.00		Pass

SD-4-7-Y: 23-story steel building, Y direction

Source: FEMA P-2192-V1 (2020), Table 4-7, pp. p. 151. Calculation: Story drift and P-delta.

SD-4-7-Y · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Relative drift %, L23		1.070	1.067	-0.31		Pass
Relative drift %, L22		1.090	1.092	+0.15		Pass
Relative drift %, L21		1.110	1.108	-0.15		Pass
Relative drift %, L20		1.130	1.133	+0.29		Pass
Relative drift %, L19		1.150	1.150	-0.00		Pass
Relative drift %, L18		1.170	1.167	-0.28		Pass
Relative drift %, L17		1.180	1.183	+0.28		Pass
Relative drift %, L16		1.190	1.183	-0.56		Pass
Relative drift %, L15		1.190	1.200	+0.84		Pass
Relative drift %, L14		1.200	1.192	-0.69		Pass
Relative drift %, L13		1.190	1.192	+0.14		Pass
Relative drift %, L12		1.190	1.192	+0.14		Pass
Relative drift %, L11		1.180	1.183	+0.28		Pass
Relative drift %, L10		1.170	1.175	+0.43		Pass
Relative drift %, L09		1.150	1.150	+0.00		Pass
Relative drift %, L08		1.130	1.125	-0.44		Pass
Relative drift %, L07		1.090	1.100	+0.92		Pass
Relative drift %, L06		1.040	1.042	+0.16		Pass
Relative drift %, L05		0.980	0.975	-0.51		Pass
Relative drift %, L04		0.870	0.872	+0.21		Pass
Relative drift %, L03		0.670	0.667	-0.50		Pass
Relative drift %, L02		0.320	0.318	-0.64		Pass

SD-4-7-E: 23-story steel building, amplification

Source: FEMA P-2192-V1 (2020), Table 4-7, pp. p. 151. Calculation: Story drift and P-delta.

SD-4-7-E · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
δx, L23		26.840	26.880	+0.15		Pass
δx, L18		20.640	20.640	+0.00		Pass
δx, L12		12.700	12.720	+0.16		Pass
δx, L07		6.250	6.240	-0.16		Pass
δx, L02		0.550	0.560	+1.82		Pass

SD-5-5: 18-story coupled composite walls, displacement amplified

Source: FEMA P-2192-V1 (2020), Table 5-5, pp. pp. 197 to 198. Calculation: Story drift and P-delta.

SD-5-5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Amplified displacement, Roof		38.240	38.225	-0.04		Pass
Amplified displacement, Level 15		29.800	29.810	+0.03		Pass
Amplified displacement, Level 11		19.940	19.965	+0.13		Pass
Amplified displacement, Level 7		9.810	9.790	-0.20		Pass
Amplified displacement, Level 3		1.830	1.815	-0.82		Pass

SD-5-5M: 18-story coupled composite walls, largest drift

Source: FEMA P-2192-V1 (2020), Table 5-5, pp. pp. 197 to 198. Calculation: Story drift and P-delta.

SD-5-5M · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Largest drift %		1.650	1.654	+0.23		Pass

ST-ASDIP: Exterior column at a property line, pressures at one service combination

Source: ASDIP, Strap Footing Example Using ASDIP FOUNDATION (2024), a software output, pp. screenshot 1. Calculation: Strap footing.

ST-ASDIP · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Exterior q max	ksf	3.200	3.377	+5.54		Deviation ASDIP-STRAP-WEIGHTS
ASDIP-STRAP-WEIGHTS: the post does not state the soil weight and shows water at the surface, so the footing and soil weights are not known						
Exterior q min	ksf	2.300	2.484	+7.99		Deviation ASDIP-STRAP-WEIGHTS
ASDIP-STRAP-WEIGHTS: the post does not state the soil weight and shows water at the surface, so the footing and soil weights are not known						
Interior q max	ksf	3.500	3.614	+3.26		Deviation ASDIP-STRAP-WEIGHTS
ASDIP-STRAP-WEIGHTS: the post does not state the soil weight and shows water at the surface, so the footing and soil weights are not known						
Interior q min	ksf	2.500	2.704	+8.17		Deviation ASDIP-STRAP-WEIGHTS
ASDIP-STRAP-WEIGHTS: the post does not state the soil weight and shows water at the surface, so the footing and soil weights are not known						

AV-5.9 · Wood stud wall: 2x6 DF-L No. 2 exterior stud wall, axial + wind

Source: Aghayere & Vigil, Structural Wood Design, 2nd ed. (2017), Example 5.9 (values as tabulated in calcs.com, Wood Column Validation Examples (NDS 2018)), pp. p. 313. Calculation: Wood stud wall.

AV-5.9 · Wood stud wall · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
P = D + 0.75(L + S)	lb	3,000	3,000	+0.00		Pass
CP (CD = 1.15)		0.492	0.491	-0.11		Pass
Fc'	psi	840.0	839.3	-0.08		Pass
Axial utilization		0.433	0.433	+0.06		Pass
Plate Fc⊥'	psi	625.0	625.0	+0.00		Pass
Fb' (CD = 1.6, CF 1.3, Cr 1.15)	psi	2,153	2,153	-0.01		Pass
Fc' under D + 0.75(L + S + 0.6W)	psi	896.0	893.7	-0.25		Pass
CP under D + 0.75(L + S + 0.6W)		0.377	0.376	-0.22		Pass
Interaction (Eq. 3.9-3)		0.490	0.491	+0.21		Pass

HAND-1 · Wood stud wall: 2x6 Stud grade wall, axial load and wind

Source: Hand calculation (closed form). Calculation: Wood stud wall.

HAND-1 · Wood stud wall · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fc' (D + L)	psi	597.6	597.6	+0.00		Pass
fc (D + L)	psi	113.1	113.1	+0.00		Pass
Interaction D + 0.6W (Eq. 3.9-3)		0.330	0.330	+0.00		Pass
Plate Fc⊥' with Cb	psi	781.2	781.2	+0.00		Pass
Wind deflection	in.	0.108	0.108	+0.00		Pass

HAND-1 · Wood stud wall · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Interaction 1.2D + 1.0W + L		0.433	0.433	+0.00		Pass

HUD-5.4: 2x4 SPF Stud at 24 in, 8 ft, wind and D

Source: HUD, Residential Structural Design Guide, 2nd ed. (2017), pp. Example 5.4, pp. 5-59 to 5-61. Calculation: Wood stud wall.

HUD-5.4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
fb under D + 0.6W	psi	1,004	1,003	-0.09		Pass
FcE (guide 0.3 E')	psi	479.0	480.7	+0.37		Pass
Fc' at CD 1.6	psi	426.0	433.0	+1.64		Deviation HUD-5.4-ROUND
HUD-5.4-ROUND: the guide rounds Cp to 0.35; unrounded 0.355 gives 433 psi						
Fb' with the guide's system factor 1.5	psi	1,782	1,366	-23.33		Deviation HUD-5.4-SYSTEM
HUD-5.4-SYSTEM: the guide's system factor 1.5 is not in the NDS						

HUD-5.4B: Same wall, axial only at CD 1.25

Source: HUD, Residential Structural Design Guide, 2nd ed. (2017), pp. Example 5.4, step 5, p. 5-60. Calculation: Wood stud wall.

HUD-5.4B · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fc' at CD 1.25	psi	419.0	416.1	-0.70		Pass

HUD-5.5J: Jack studs under a 6.25 ft header, 600 plf

Source: HUD, Residential Structural Design Guide, 2nd ed. (2017), pp. Example 5.5, steps 5, 6, pp. 5-63 to 5-64. Calculation: Wood stud wall.

HUD-5.5J · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Header span	in.	78.00	78.00	+0.00		Pass
Reaction R1 = R2	lb	1,950	1,950	+0.00		Pass
Bearing stress on 3 in. (hand, the guide's 650 / lb)	psi	216.7	216.7	+0.00		Pass

HUD-5.6: 4x4 SPF No. 2 column 7.3 ft as a solid jack stud

Source: HUD, Residential Structural Design Guide, 2nd ed. (2017), pp. Example 5.6, p. 5-65. Calculation: Wood stud wall.

HUD-5.6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fc' (guide rounds Cp to 0.44)	psi	582.0	579.0	-0.51		Pass
Capacity	lb	7,129	7,093	-0.50		Pass

HAND-OPEN: 2x6 DF-L No. 2, 6 ft opening, 2 jacks, 2 kings

Source: Hand calculation (closed form). Calculation: Wood stud wall.

HAND-OPEN · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Reaction on the jacks, D + L	lb	2,188	2,188	+0.00		Pass
fc jack	psi	132.6	132.6	+0.00		Pass
Fc' jack	psi	1,189	1,189	+0.00		Pass
Plate Fc⊥ with Cb = 1.125	psi	703.1	703.1	+0.00		Pass
Header bearing stress	psi	243.1	243.1	+0.00		Pass
Eq. 3.9-3 king studs, D + 0.6W		0.295	0.295	+0.00		Pass
King wind deflection	in.	0.130	0.130	+0.00		Pass
King shear stress	psi	25.00	25.00	+0.00		Pass

DG25-A1: Equivalent moment of inertia, 18 to 36 in. web over 30 ft

Source: AISC Design Guide 25 (2nd Ed., 2021), Example A1, pp. 351, 352. Calculation: Web-tapered member.

DG25-A1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
x = 0.5 L (Is/Il)^0.0732	in.	161.6	161.6	-0.04		Pass
Equivalent I (Eq. A-3)	in.⁴	1,690	1,690	+0.01		Pass
PeL (Eq. A-3)	kips	3,730	3,733	+0.07		Pass

DG25-5.2a: Linearly tapered member in axial compression, brace at 90 in.

Source: AISC Design Guide 25 (2nd Ed., 2021), Example 5.2a, pp. 55 to 70. Calculation: Web-tapered member.

DG25-5.2a · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
PeLx (Eq. 4-4)	kips	3,990	3,971	-0.48		Pass
Pey1 of the lower 90 in. length	kips	318.0	318.1	+0.03		Pass
Pey2 of the upper 54 in. length	kips	883.0	883.7	+0.08		Pass
ye of the lower length		28.10	28.15	+0.18		Pass
Pn at the governing section of the lower length	kips	134.0	133.7	-0.26		Pass

DG25-5.2a-ASD: The same, ASD

Source: AISC Design Guide 25 (2nd Ed., 2021), Example 5.2a, pp. 58, 70. Calculation: Web-tapered member.

DG25-5.2a-ASD · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ye of the lower length		42.40	42.41	+0.03		Pass
Pn at the governing section	kips	134.0	133.7	-0.26		Pass

DG25-5.2b: Flexure of the same member, 1,800 kip-in. at the top (LRFD)

Source: AISC Design Guide 25 (2nd Ed., 2021), Example 5.2b, pp. 84 to 99. Calculation: Web-tapered member.

DG25-5.2b · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cb of the lower length (Eq. 5-29)		1.520	1.523	+0.17		Pass
γeLTB1 (Eq. 5-28)		2.800	2.792	-0.30		Pass
Mn for LTB at U1, capped at Rpg Rpc Myc	kip-ft	1,980	1,985	+0.24		Pass
Mn for FLB at U1 (Eq. 5-42)	kip-ft	1,690	1,694	+0.22		Pass
FLB ratio Mr/(φMn) at U1		0.736	0.738	+0.28		Pass

DG25-5.2b-ASD: The same, ASD (1,200 kip-in.)

Source: AISC Design Guide 25 (2nd Ed., 2021), Example 5.2b, pp. 88, 89. Calculation: Web-tapered member.

DG25-5.2b-ASD · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
γeLTB1		4.180	4.187	+0.18		Pass
FLB ratio Mr Ω/Mn at U1		0.741	0.740	-0.20		Pass

TH-1: Steel member, 100 ft, ΔT = 100 °F

Source: Gere and Goodno, Mechanics of Materials, Sec. 2.5 (by hand). Calculation: Thermal movement.

TH-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Free movement	in.	0.780	0.780	-0.00		Pass
Restrained stress	ksi	18.85	18.85	-0.00		Pass
Restrained force	kips	188.5	188.5	-0.00		Pass

TH-2: Concrete segment, 150 ft, ΔT = 60 °F

Source: Gere and Goodno, Sec. 2.5 (by hand). Calculation: Thermal movement.

TH-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Free movement	in.	0.594	0.594	+0.00		Pass

TH-3: Aluminum rod at half restraint

Source: Gere and Goodno, Sec. 2.5 (by hand). Calculation: Thermal movement.

TH-3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Force at 50 % restraint	kips	6.565	6.565	-0.00		Pass

TR65-1: TR-65 adjustments: air-conditioned, fixed bases

Source: FCC Technical Report 65 (1974), as quoted by AISC [verify]. Calculation: Thermal movement.

TR65-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Adjusted allowable length	ft	293.2	293.2	+0.00		Pass

TR65-2: TR-65 adjustments: unheated, stiffer at one end

Source: FCC Technical Report 65 (1974), as quoted by AISC [verify]. Calculation: Thermal movement.

TR65-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Adjusted allowable length	ft	201.0	201.0	+0.00		Pass

SP-TU · Tilt-up wall panel: Solid tilt-up panel, slender wall method (1.2D + 1.6Lr + 0.5W)

Source: StructurePoint, Reinforced Concrete Tilt-Up Wall Panel Analysis and Design (ACI 318-19 - ACI 551), pp. pp. 8–12 (folios 5–9), 36 (Table 1). Calculation: Tilt-up wall panel.

Per panel (15 ft). The example's service wind 0.7 × 27.2/1.6 psf is entered as the service factor 0.4375 on W; Lr is not in the service combination (factor 0).

SP-TU · Tilt-up wall panel · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Self-weight above midheight (19.04 kips)	kips	19.04	19.04	+0.02		Pass
Pua = 1.2D + 1.6Lr (20.64 kips)	kips	20.64	20.64	+0.00		Pass
Pum at midheight (43.49 kips)	kips	43.49	43.49	+0.00		Pass
wu = 0.5W × 15 ft (0.204 kip/ft)	kip/ft	0.204	0.204	+0.00		Pass
Mua (24.77 kip-ft)	kip-ft	24.77	24.77	+0.01		Pass
Icr (353.56 in.⁴)	in.⁴	353.6	353.6	-0.00		Pass
Kb = 48 Ec Icr / (5 ℓc²) (97.64 kips)	kips	97.64	97.64	+0.00		Pass
Mu with P-Δ (61.00 kip-ft)	kip-ft	61.00	61.00	-0.00		Pass
Mn at Pum (106.55 kip-ft)	kip-ft	106.5	106.5	-0.00		Pass
Mcr (46.32 kip-ft)	kip-ft	46.32	46.32	+0.01		Pass
Ps = D + self-weight (26.24 kips)	kips	26.24	26.24	+0.01		Pass
Msa (20.32 kip-ft)	kip-ft	20.32	20.32	-0.01		Pass
Δcr (0.550 in.)	in.	0.550	0.550	-0.07		Pass
Ma = Msa + Ps Δs (20.84 kip-ft)	kip-ft	20.84	20.86	+0.09		Pass
Service deflection Δs (0.247 in.)	in.	0.247	0.247	+0.20		Pass
ℓc/150 (2.36 in.)	in.	2.360	2.360	+0.00		Pass

SP-TUO-L: Panel with a door opening: left leg (design strip 4 ft + 5 ft tributary)

Source: StructurePoint, Reinforced Concrete Tilt-Up Wall Panel with Opening Analysis and Design (ACI 318-19 - ACI 551), pp. pp. 8–13 (folios 5–10), 27 (Table 1). Calculation: Tilt-up wall panel.

7 #6 in the 4 ft leg entered as #6 at 12 in. plus 3 added jamb bars (3.08 in²).

SP-TUO-L · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Self-weight above midheight (15.86 kips)	kips	15.86	15.86	-0.00		Pass
Joist dead load to the left leg (4.48 kips)	kips	4.480	4.480	-0.00		Pass
Joist roof live load to the left leg (4.67 kips)	kips	4.670	4.667	-0.07		Pass
Pua (12.84 kips)	kips	12.84	12.84	+0.02		Pass
Pum (31.87 kips)	kips	31.87	31.87	+0.01		Pass
wu (0.122 kip/ft)	kip/ft	0.122	0.122	+0.33		Pass
Mua (14.92 kip-ft)	kip-ft	14.92	14.92	+0.00		Pass
c for Icr (1.562 in.)	in.	1.562	1.562	-0.00		Pass
Icr (290.85 in.⁴)	in.⁴	290.9	290.9	+0.00		Pass
Kb (80.32 kips)	kips	80.32	80.32	+0.00		Pass
Mu with P-Δ (31.68 kip-ft)	kip-ft	31.68	31.68	+0.01		Pass
φMn (60.13 kip-ft) The example takes Mn = Ase fy (d − a/2) with Ase from Pum and a from Pum/φ; ILX Calcs uses strain compatibility at Pum (60.31 kip-ft, +0.3 %)	kip-ft	60.13	60.31	+0.30		Pass
Δu = Mu / (0.75 Kb) (6.311 in.)	in.	6.311	6.311	+0.00		Pass
Mcr (24.21 kip-ft)	kip-ft	24.21	24.21	+0.00		Pass
Pum / Ag (75.89 psi)	psi	75.89	75.89	+0.00		Pass
0.06 f'c (240 psi)	psi	240.0	240.0	+0.00		Pass
Msa (12.21 kip-ft)	kip-ft	12.21	12.21	+0.00		Pass
Ps = D + self-weight (20.34 kips)	kips	20.34	20.34	-0.00		Pass
Δcr (0.393 in.)	in.	0.393	0.393	-0.10		Pass
Ma (12.55 kip-ft)	kip-ft	12.55	12.56	+0.04		Pass
Service deflection Δs (0.203 in.)	in.	0.203	0.204	+0.29		Pass

SP-TUO-R: Panel with a door opening: right leg (design strip 6 ft + 5 ft tributary)

Source: StructurePoint, Reinforced Concrete Tilt-Up Wall Panel with Opening Analysis and Design (ACI 318-19 - ACI 551), pp. p. 14 (folio 11), 27 (Table 1). Calculation: Tilt-up wall panel.

7 #6 in the 6 ft leg entered as #6 at 12 in. plus 1 added jamb bar (3.08 in²).

SP-TUO-R · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Joist dead load to the right leg (5.12 kips)	kips	5.120	5.120	-0.00		Pass
Joist roof live load to the right leg (5.33 kips)	kips	5.330	5.333	+0.06		Pass
Pua (14.68 kips)	kips	14.68	14.68	-0.02		Pass
Pum (37.97 kips)	kips	37.97	37.97	+0.01		Pass
wu (0.150 kip/ft)	kip/ft	0.150	0.150	-0.27		Pass
Mua (18.11 kip-ft)	kip-ft	18.11	18.11	-0.01		Pass
c for Icr (1.071 in.)	in.	1.071	1.071	-0.04		Pass
Icr (355.58 in.⁴)	in.⁴	355.6	355.6	-0.00		Pass
Kb (98.20 kips)	kips	98.20	98.20	-0.00		Pass
Mu with P-Δ (37.38 kip-ft)	kip-ft	37.38	37.38	+0.01		Pass
φMn (65.35 kip-ft) Strain compatibility at Pum (65.50 kip-ft, +0.2 %)	kip-ft	65.35	65.50	+0.22		Pass
Δu (6.091 in.)	in.	6.091	6.091	+0.00		Pass
Ig (4,019.53 in.⁴)	in.⁴	4,020	4,020	+0.00		Pass
Mcr (36.32 kip-ft)	kip-ft	36.32	36.32	-0.01		Pass
Pum / Ag (60.28 psi)	psi	60.28	60.28	-0.01		Pass
Msa (14.88 kip-ft)	kip-ft	14.88	14.88	-0.00		Pass
Ma (15.21 kip-ft)	kip-ft	15.21	15.22	+0.04		Pass
Service deflection Δs (0.164 in.)	in.	0.164	0.164	+0.30		Pass

TU-1: Solid panel under wind only: 0.9D + 1.0W, every step of 11.8.3

Source: Hand calculation (closed form), pp. ACI 318-19 Eq. 11.8.3.1b to d, R11.8.3.1, 19.2.3.1. Calculation: Tilt-up wall panel.

Per 12 ft panel; no roof load, so 0.9D + 1.0W has the full wind and the least axial load.

TU-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pu = 0.9 × self-weight above midheight	kips	11.74	11.74	+0.00		Pass
Mua = wu ℓc²/8	kip-ft	25.92	25.92	-0.00		Pass
Icr (Eq. 11.8.3.1c)	in.⁴	303.7	303.7	+0.00		Pass
Mu (Eq. 11.8.3.1d)	kip-ft	29.58	29.58	+0.00		Pass
φMn at Pu	kip-ft	59.65	59.65	-0.00		Pass
Δu (Eq. 11.8.3.1b)	in.	3.735	3.735	+0.00		Pass
Mcr = 7.5√f'c Ig / (h/2)	kip-ft	49.87	49.87	+0.00		Pass

TU-2: Design strips: roof load shared between the legs, self-weight above midheight

Source: Hand calculation (closed form), pp. ACI 551.2R-15 7.2 as applied by StructurePoint. Calculation: Tilt-up wall panel.

TU-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Left leg share of a 10 kip load at 4 ft	kips	10.00	10.00	+0.00		Pass
Right leg share	kips	0.000	0.000	+0.00		Pass
Left leg self-weight above midheight	kips	17.60	17.60	+0.00		Pass
Left leg wu = 1.0W × (8 + 3 ft)	kip/ft	0.220	0.220	+0.00		Pass

T13.2A-4in-2m: 4 in. split ring, Douglas Fir-Larch, two members

Source: NDS 2024 Table 13.2A, pp. p. 130. Calculation: Split-ring and shear-plate connections.

T13.2A-4in-2m · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
P, group B, one face, 1-5/8 in. or thicker	lb	5,260	5,260	+0.00		Pass
Q, group B, one face, 1-5/8 in. or thicker	lb	3,660	3,660	+0.00		Pass
Capacity of one unit, CD = 1.0	lb	5,260	5,260	+0.00		Pass

T13.2A-4in-3m: 4 in. split rings, 2-1/2 in. main member with rings on both faces

Source: NDS 2024 Table 13.2A, pp. p. 130. Calculation: Split-ring and shear-plate connections.

T13.2A-4in-3m · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
P, main member, two faces, 2-1/2 in.	lb	5,000	5,000	+0.00		Pass
Q, main member, two faces, 2-1/2 in.	lb	3,480	3,480	+0.00		Pass

T13.2A-2.5in: 2-1/2 in. split ring, Hem-Fir, 1 in. members

Source: NDS 2024 Table 13.2A, pp. p. 130. Calculation: Split-ring and shear-plate connections.

T13.2A-2.5in · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
P, group C, one face, 1 in.	lb	1,900	1,900	+0.00		Pass
Q, group C, one face, 1 in.	lb	1,350	1,350	+0.00		Pass

T13.2B-2.625: 2-5/8 in. shear plates, Spruce-Pine-Fir, steel side plates

Source: NDS 2024 Table 13.2B, pp. p. 131. Calculation: Split-ring and shear-plate connections.

T13.2B-2.625 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
P, group C, two faces, 2 in.	lb	2,270	2,270	+0.00		Pass
Q, group C, two faces, 2 in.	lb	1,580	1,580	+0.00		Pass

T13.2B-limit: 4 in. shear plate in mixed oak with a steel side plate: the 3/4 in. bolt limit

Source: NDS 2024 Table 13.2B footnote 2; Table 13.2.4, pp. pp. 131-132. Calculation: Split-ring and shear-plate connections.

T13.2B-limit · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
P, group A, one face, 1-3/4 in. or thicker	lb	5,090	5,090	+0.00		Pass
Limit with a 3/4 in. bolt (P × Cst = 6,006 lb exceeds it)	lb	4,400	4,400	+0.00		Pass

T11.3.6B-a: Group action, As/Am = 1, As = 12 in.², 4 in a row

Source: NDS 2024 Table 11.3.6B, pp. p. 75. Calculation: Split-ring and shear-plate connections.

T11.3.6B-a · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cg, 4 connectors		0.830	0.826	-0.53		Pass

T11.3.6B-b: Group action, As/Am = 1, As = 12 in.², 6 in a row

Source: NDS 2024 Table 11.3.6B, pp. p. 75. Calculation: Split-ring and shear-plate connections.

T11.3.6B-b · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cg, 6 connectors		0.630	0.625	-0.73		Pass

T11.3.6B-c: Group action, As/Am = 0.5, As = 5 in.², 2 in a row

Source: NDS 2024 Table 11.3.6B, pp. p. 75. Calculation: Split-ring and shear-plate connections.

T11.3.6B-c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cg, 2 connectors		0.900	0.902	+0.24		Pass

T11.3.6B-d: Group action, As/Am = 1, As = 64 in.², 8 in a row

Source: NDS 2024 Table 11.3.6B, pp. p. 75. Calculation: Split-ring and shear-plate connections.

T11.3.6B-d · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cg, 8 connectors		0.770	0.766	-0.56		Pass

HC-INTERP · Split-ring and shear-plate connections: Main member 2-1/4 in. between the 2 and 2-1/2 in. rows

Source: Hand calculation (closed form). Calculation: Split-ring and shear-plate connections.

HC-INTERP · Split-ring and shear-plate connections · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
P = 4,250 + 0.5 × (5,000 − 4,250)	lb	4,625	4,625	+0.00		Pass
Q = 2,960 + 0.5 × (3,480 − 2,960)	lb	3,220	3,220	+0.00		Pass

HC-ANGLE · Split-ring and shear-plate connections: Load at 45° to the main member's grain

Source: Hand calculation (closed form). Calculation: Split-ring and shear-plate connections.

HC-ANGLE · Split-ring and shear-plate connections · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
N' = 5,260 × 3,660 / (0.5 × 5,260 + 0.5 × 3,660)	lb	4,316	4,317	+0.00		Pass

HC-CDELTA: End distance 5-1/4 in. and spacing 7 in., 4 in. rings parallel to grain

Source: Hand calculation (closed form). Calculation: Split-ring and shear-plate connections.

HC-CDELTA · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
CΔ end = 0.63 + 0.37 × 1.75 / 3.5		0.815	0.815	+0.00		Pass
CΔ spacing = 0.5 + 0.5 × 2 / 4		0.750	0.750	+0.00		Pass
CΔ on P (the least)		0.750	0.750	+0.00		Pass

T6B: Southern Pine and Western Red Cedar construction poles

Source: NDS 2024 Supplement Table 6B, pp. p. 91. Calculation: Round timber poles and piles.

T6B · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fb, Southern Pine	psi	1,950	1,950	+0.00		Pass
Fc, Southern Pine	psi	1,250	1,250	+0.00		Pass
Emin, Southern Pine	psi	600,000	600,000	+0.00		Pass

T6B-WRC: Western Red Cedar pole

Source: NDS 2024 Supplement Table 6B, pp. p. 91. Calculation: Round timber poles and piles.

T6B-WRC · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fb, Western Red Cedar	psi	1,250	1,250	+0.00		Pass

T6.3.5: Kiln dried before treatment

Source: NDS 2024 Table 6.3.5, pp. p. 48. Calculation: Round timber poles and piles.

T6.3.5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cct, kiln dried		0.900	0.900	+0.00		Pass

T6.3.11: Southern Pine piles, three in a capped group

Source: NDS 2024 Table 6.3.11, pp. p. 49. Calculation: Round timber poles and piles.

T6.3.11 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cls on Fc		1.090	1.090	+0.00		Pass
Cls on Fb		1.070	1.070	+0.00		Pass

PDH-S235: Nonconstrained: 1,200 lb at 16 ft, 32 in. footing, sandy clay ×2

Source: PDHonline S235 (IBC Eq. 18-1), pp. pp. 3-5. Calculation: Round timber poles and piles.

PDH-S235 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required depth d	ft	7.310	7.312	+0.03		Pass

CALCBOOK: Constrained: 6 kip at 2.25 ft, 2 ft footing, clay class 5

Source: CalcBook, Pole Foundation Design (IBC 2021 1807.3). Calculation: Round timber poles and piles.

CALCBOOK · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required depth d (Eq. 18-2)	ft	6.600	6.595	-0.07		Pass

HC-COLUMN · Round timber poles and piles: 10 in. / 7 in. Southern Pine pole, 14 ft cantilever, axial D + S

Source: Hand calculation (closed form). Calculation: Round timber poles and piles.

HC-COLUMN · Round timber poles and piles · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Representative diameter (Eq. 3.7-2)	in.	8.965	8.965	+0.00		Pass
le/d of the equal-area square		44.41	44.41	+0.00		Pass
Fc' = Fc* CP	psi	242.7	242.7	-0.00		Pass

HC-BENDING: Wind only, ASD 0.6W at 12 ft

Source: Hand calculation (closed form). Calculation: Round timber poles and piles.

HC-BENDING · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
fb = M / (π d³ / 32)	psi	880.1	880.1	+0.00		Pass
Fb' = 1,950 × 1.6	psi	3,120	3,120	+0.00		Pass

HC-CCS: Critical section 20 ft from the tip

Source: Hand calculation (closed form). Calculation: Round timber poles and piles.

HC-CCS · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ccs = 1 + 0.004 × 20		1.080	1.080	+0.00		Pass

T14.2.1C: 2-1/2 in. rivets, plates on both faces of a 6-3/4 in. glulam, 10 per row, 6 rows

Source: NDS 2024 Table 14.2.1C, pp. p. 146. Calculation: Timber rivet connections.

T14.2.1C · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pw, member dimension 6.75 in., 10 per row, 6 rows	lb	21,020	21,020	+0.00		Pass
Pr = 188 × 2.125^0.32 × 60	lb	14,357	14,357	+0.00		Pass

T14.2.1A: 1-1/2 in. rivets, one plate on a 2-1/2 in. member (member dimension 5 in.)

Source: NDS 2024 Table 14.2.1A, pp. p. 144. Calculation: Timber rivet connections.

T14.2.1A · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pw, member dimension 5 in., 6 per row, 4 rows	lb	8,190	8,190	+0.00		Pass
Pr = 188 × 1.125^0.32 × 24	lb	4,685	4,685	+0.00		Pass

HC-INTERP · Timber rivet connections: Member thickness 7-5/8 in. between the 6.75 and 8.5 in. blocks of Table 14.2.1C

Source: Hand calculation (closed form). Calculation: Timber rivet connections.

HC-INTERP · Timber rivet connections · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pw = (12,550 + 13,920) / 2	lb	13,235	13,235	+0.00		Pass

T14.2.2: Load perpendicular to grain: 6 rivets per row across the grain, 4 rows, ep = 5 in.

Source: NDS 2024 Table 14.2.2A, 14.2.2B, pp. p. 150. Calculation: Timber rivet connections.

T14.2.2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
qw, sq = 1 in., 6 per row, 4 rows	lb	1,007	1,007	+0.00		Pass
CΔ at ep / ((nC − 1) sq) = 1.0		1.200	1.200	+0.00		Pass
Qw = 1,007 × 2.125^0.8 × 1.20	lb	2,208	2,209	+0.00		Pass

T14.2.3: 3/16 in. side plates: the rivet capacity reduced

Source: NDS 2024 Table 14.2.3, pp. p. 142. Calculation: Timber rivet connections.

T14.2.3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cst, 3/16 in. ≤ tp < 1/4 in.		0.900	0.900	+0.00		Pass
P = 0.90 × 188 × 2.1875^0.32 × 32	lb	6,956	6,956	-0.00		Pass

T14.3.2: Nine rows across the grain: the end distance parallel to grain

Source: NDS 2024 Table 14.3.2, pp. p. 143. Calculation: Timber rivet connections.

T14.3.2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ap for 9 and 10 rows	in.	4.000	4.000	+0.00		Pass

HC-ANGLE · Timber rivet connections: Load at 45° to grain on the default group

Source: Hand calculation (closed form). Calculation: Timber rivet connections.

HC-ANGLE · Timber rivet connections · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
CΔ = 1.10 − 0.08 × 0.1333 / 0.2		1.047	1.047	-0.00		Pass
Qw = 1,098 × 1.8276 × 1.0467	lb	2,100	2,100	-0.00		Pass
N = 2PQ / (P + Q), one plate	lb	3,296	3,297	+0.00		Pass
Z' = 2 plates × N	lb	6,593	6,593	+0.00		Pass

HC-DEFAULT · Timber rivet connections: Default: two plates, 4 rows of 8 rivets 2-1/2 in. long, 6-3/4 in. glulam

Source: Hand calculation (closed form). Calculation: Timber rivet connections.

HC-DEFAULT · Timber rivet connections · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z' = 2 × 7,657.1 × 1.0	lb	15,314	15,314	+0.00		Pass

HC-DEFAULT · Timber rivet connections · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z' = 2 × 7,657.1 × 3.32 × 0.65 × 0.8	lb	26,438	26,438	+0.00		Pass

SCHOOL: 1-story school, Evansville, VT 80 mph, partially enclosed

Source: NCSEA Wind Engineering Committee, Tornado Loads on Schools and Hospitals (11/2023), school, pp. 3 to 8. Calculation: Tornado loads.

SCHOOL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
qhT	psf	16.20	16.16	-0.24		Pass
Windward wall, positive internal	psf	-0.100	-0.097	-3.04		Pass
Windward wall, negative internal	psf	17.70	17.68	-0.11		Pass
Leeward wall, L/B 1.8, positive internal	psf	-12.70	-12.62	-0.59		Pass
Leeward wall, L/B 1.8, negative internal	psf	5.100	5.152	+1.02		Pass
Side walls, positive internal	psf	-16.60	-16.58	-0.11		Pass
Side walls, negative internal	psf	1.200	1.196	-0.34		Pass
Roof 0 to h/2, positive internal	psf	-19.80	-19.77	-0.16		Pass
Roof 0 to h/2, negative internal	psf	-2.000	-1.991	-0.45		Pass
Roof h to 2h, positive internal	psf	-14.90	-14.93	+0.22		Pass
Roof h to 2h, negative internal	psf	2.800	2.844	+1.58		Pass
Roof past 2h, positive internal	psf	-12.50	-12.51	+0.12		Pass
Roof past 2h, negative internal	psf	5.300	5.262	-0.72		Pass
Roof, other case, positive internal	psf	-11.10	-11.06	-0.32		Pass
North-south, leeward wall, L/B under 1, positive internal	psf	-14.40	-14.38	-0.12		Pass
Zone 1 prime, 10 sq ft, down	psf	12.50	13.25	+6.01		Deviation NCSEA-ZONE1P
NCSEA-ZONE1P: the source uses a directionality factor of 0.75 here against the table's 0.90						
Zone 1 prime, 10 sq ft, up	psf	-24.60	-24.60	-0.01		Pass
Zone 1, 10 sq ft, up	psf	-33.60	-33.61	+0.04		Pass
Zone 2, 10 sq ft, up	psf	-38.20	-38.16	-0.11		Pass
Zone 3, 10 sq ft, up	psf	-49.60	-49.61	+0.03		Pass
Zone 4, 10 sq ft, in	psf	19.80	19.80	-0.02		Pass
Zone 4, 10 sq ft, out	psf	-20.90	-20.89	-0.06		Pass
Zone 5, 10 sq ft, out	psf	-24.20	-24.16	-0.16		Pass
Zone 1, 100 sq ft, up	psf	-27.60	-27.62	+0.08		Pass
Zone 2, 100 sq ft, up	psf	-31.40	-31.42	+0.06		Pass
Zone 3, 100 sq ft, up	psf	-36.10	-36.13	+0.08		Pass
Zone 4, 100 sq ft, in	psf	17.90	17.87	-0.16		Pass
Zone 5, 100 sq ft, out	psf	-20.30	-20.31	+0.04		Pass

HOSPITAL: 4-story hospital, Oklahoma City, VT 104 mph, enclosed, Essential Facility

Source: NCSEA Wind Engineering Committee, Tornado Loads on Schools and Hospitals (11/2023), hospital, pp. 14 to 21. Calculation: Tornado loads.

HOSPITAL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
qhT	psf	26.50	26.51	+0.04		Pass
Windward wall, positive internal	psf	-0.200	-0.159	-20.46		Pass
Windward wall, negative internal	psf	19.20	19.19	-0.03		Pass
Leeward wall, positive internal	psf	-23.60	-23.60	-0.02		Pass
Side walls, positive internal	psf	-27.20	-27.20	+0.00		Pass
Roof 0 to h/2, positive internal	psf	-32.40	-32.43	+0.09		Pass
Roof 0 to h/2, negative internal	psf	-13.10	-13.08	-0.19		Pass
Roof h to 2h, positive internal	psf	-24.50	-24.50	-0.01		Pass
Roof past 2h, positive internal	psf	-20.50	-20.53	+0.15		Pass
Roof, other case, positive internal	psf	-18.20	-18.15	-0.27		Pass
North-south, leeward wall, L/B 1.22	psf	-22.80	-22.80	+0.01		Pass
Zone 1 prime, 10 sq ft, up	psf	-43.20	-43.21	+0.03		Pass
Zone 1, 10 sq ft, up	psf	-68.70	-68.67	-0.05		Pass
Zone 2, 10 sq ft, up	psf	-78.60	-78.61	+0.01		Pass
Zone 3, 10 sq ft, up	psf	-103.7	-103.7	-0.04		Pass
Zone 4, 10 sq ft, in	psf	28.60	28.63	+0.11		Pass
Zone 4, 10 sq ft, out	psf	-40.80	-40.83	+0.07		Pass
Zone 5, 10 sq ft, out	psf	-48.00	-47.99	-0.03		Pass
Zone 1, 100 sq ft, up	psf	-55.60	-55.56	-0.08		Pass
Zone 2, 100 sq ft, up	psf	-63.90	-63.86	-0.06		Pass
Zone 3, 100 sq ft, up	psf	-74.20	-74.17	-0.04		Pass
Zone 4, 100 sq ft, in	psf	24.40	24.42	+0.08		Pass
Zone 5, 100 sq ft, out	psf	-39.60	-39.56	-0.10		Pass

KZ-100: KzTor at 100 ft

Source: ASCE 7-22 Table 32.10-1, pp. 390. Calculation: Tornado loads.

KZ-100 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
qhT	psf	25.60	25.60	+0.00		Pass

KZ-250: KzTor at 250 ft

Source: ASCE 7-22 Table 32.10-1, pp. 390. Calculation: Tornado loads.

KZ-250 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
qhT	psf	24.58	24.63	+0.23		Pass

KZ-300: KzTor at 300 ft

Source: ASCE 7-22 Table 32.10-1, pp. 390. Calculation: Tornado loads.

KZ-300 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
qhT	psf	23.55	23.68	+0.56		Pass

KZ-400: KzTor at 400 ft

Source: ASCE 7-22 Table 32.10-1, pp. 390. Calculation: Tornado loads.

KZ-400 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
qhT	psf	23.04	23.04	-0.00		Pass

MGZ-2.1: Two-bar truss: displacement of the loaded joint

Source: W. McGuire, R. H. Gallagher, R. D. Ziemian, Matrix Structural Analysis, 2nd Ed. (2000; free edition 2014), pp. Example 2.1, pp. 21-22 (PDF 42-43). Calculation: 2-D truss analysis.

MGZ-2.1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
x component of bar ab at a, F_xa (kN)	kips	74.93	74.94	+0.01		Pass
x component of bar ac at a, F_xa (kN)	kips	37.48	37.47	-0.02		Pass
u at a (mm)	in.	0.095	0.095	+0.05		Pass
v at a (mm)	in.	0.028	0.028	+0.46		Pass

MGZ-3.2: Three-bar truss on a pin and a roller, inclined load

Source: W. McGuire, R. H. Gallagher, R. D. Ziemian, Matrix Structural Analysis, 2nd Ed. (2000; free edition 2014), pp. Example 3.2, pp. 36-38 (PDF 57-59). Calculation: 2-D truss analysis.

MGZ-3.2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Δ1, u at a (mm)	in.	0.034	0.034	-0.09		Pass
Δ2, v at a (mm)	in.	0.049	0.049	-0.09		Pass
Δ3, u at b (mm)	in.	-0.008	-0.008	-0.04		Pass
Ryb (kN)	kips	-14.30	-14.29	-0.07		Pass
Rxc (kN)	kips	-86.19	-86.11	-0.10		Pass
Ryc (kN)	kips	-58.02	-57.96	-0.10		Pass
Bar ab (kN)	kips	20.23	20.21	-0.13		Pass
Bar bc (kN)	kips	-14.30	-14.29	-0.07		Pass
Bar ac (kN)	kips	116.0	115.9	-0.10		Pass

MGZ-3.3: Example 3.2 with a horizontal tie to a wall (indeterminate)

Source: W. McGuire, R. H. Gallagher, R. D. Ziemian, Matrix Structural Analysis, 2nd Ed. (2000; free edition 2014), pp. Example 3.3, pp. 38-39 (PDF 59-60). Calculation: 2-D truss analysis.

MGZ-3.3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Δ1, u at a (mm)	in.	0.015	0.015	-0.29		Pass
Δ2, v at a (mm)	in.	0.048	0.048	-0.01		Pass
Δ3, u at b (mm)	in.	-0.017	-0.017	+0.21		Pass
Ryb (kN)	kips	-32.44	-32.43	-0.03		Pass
Rxc (kN)	kips	-36.69	-36.54	-0.41		Pass
Ryc (kN)	kips	-39.88	-39.82	-0.15		Pass
Rxd (kN)	kips	-49.71	-49.57	-0.27		Pass

MGZ-3.5: Parallelogram truss, load at 45° (five bars, determinate)

Source: W. McGuire, R. H. Gallagher, R. D. Ziemian, Matrix Structural Analysis, 2nd Ed. (2000; free edition 2014), pp. Example 3.5, pp. 44-46 (PDF 65-67). Calculation: 2-D truss analysis.

MGZ-3.5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Δ3, u at b (mm)	in.	-0.016	-0.016	+0.31		Pass
Δ5, u at c (mm)	in.	0.386	0.386	+0.03		Pass
Δ6, v at c (mm)	in.	-0.088	-0.088	-0.06		Pass
Δ7, u at d (mm)	in.	0.430	0.430	+0.01		Pass
Δ8, v at d (mm)	in.	-0.307	-0.307	+0.01		Pass
Rxa (kN)	kips	-63.60	-63.58	-0.02		Pass
Rya (kN)	kips	-173.6	-173.7	+0.09		Pass
Ryb (kN)	kips	237.4	237.3	-0.06		Pass
Bar ab (kN)	kips	-36.60	-36.71	+0.31		Pass
Bar cd (kN)	kips	100.4	100.3	-0.15		Pass
Bar ac (kN)	kips	200.4	200.6	+0.10		Pass
Bar bc (kN)	kips	-173.8	-173.7	-0.06		Pass
Bar bd (kN)	kips	-73.47	-73.42	-0.06		Pass

MGZ-3.6: Example 3.5 with b pinned and c held horizontally (indeterminate)

Source: W. McGuire, R. H. Gallagher, R. D. Ziemian, Matrix Structural Analysis, 2nd Ed. (2000; free edition 2014), pp. Example 3.6, p. 46 (PDF 67). Calculation: 2-D truss analysis.

MGZ-3.6 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Δ6, v at c (mm)	in.	0.000	0.000	+0.00		Pass
Δ7, u at d (mm)	in.	0.044	0.044	+0.12		Pass
Δ8, v at d (mm)	in.	-0.075	-0.075	+0.00		Pass

UD-5.2: Method of joints: four-joint truss, upward and horizontal load

Source: F. Udoeyo, Structural Analysis (Temple University Press, 2020, open textbook), pp. Example 5.2, pp. 124-125 (PDF). Calculation: 2-D truss analysis.

The printed F_BC = 5.42 kN uses 15 kN for the 12 kN horizontal load; joint B gives 9.17 kN (F_AB − F_BC = 15 and F_AB + F_BC = 33.33), which the app computes. It is not compared.

UD-5.2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
F_AB (kN)	kips	5.434	5.433	-0.01		Pass
F_AD (kN)	kips	-1.650	-1.649	-0.09		Pass
F_DC (kN)	kips	-1.650	-1.649	-0.09		Pass
F_DB (kN)	kips	0.000	0.000	+0.00		Pass
A_y (kN)	kips	-3.260	-3.260	+0.00		Pass
C_y (kN)	kips	-1.236	-1.236	+0.00		Pass
A_x (kN)	kips	-2.698	-2.698	+0.00		Pass

UD-5.3: Method of joints: three-panel truss, two top-chord loads

Source: F. Udoeyo, Structural Analysis (Temple University Press, 2020, open textbook), pp. Example 5.3, pp. 127-128 (PDF). Calculation: 2-D truss analysis.

UD-5.3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
F_CD (kN)	kips	-17.98	-17.98	+0.00		Pass
F_HG (kN)	kips	17.98	17.98	+0.00		Pass
F_CG (kN)	kips	0.000	-0.000	+0.00		Pass
A_y (kN)	kips	17.98	17.98	+0.00		Pass

UD-8.6: Virtual work: horizontal displacement of a loaded joint

Source: F. Udoeyo, Structural Analysis (Temple University Press, 2020, open textbook), pp. Example 8.6, pp. 219-222 (PDF). Calculation: 2-D truss analysis.

E = 12,000 ksi and A = 3 in² as the textbook states. At joint D the textbook takes cos 36.87° for the angle of DC with the horizontal (53.13°) and prints F_DE = 60 kips; statics gives 45 kips (0.6 × 75), which the app computes. The printed horizontal displacement at B, 0.47 in., carries that error (its virtual-work table uses 60 kips and 0.67 for DE); with DE = 45 kips and 0.5 the sum is 0.450 in., the app's value. Neither is compared.

UD-8.6 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
F_AB	kips	60.00	60.00	+0.00		Pass
F_AE	kips	90.00	90.00	+0.00		Pass
F_BC	kips	-45.00	-45.00	-0.00		Pass
F_BE	kips	-75.00	-75.00	-0.00		Pass
F_CE	kips	60.00	60.00	+0.00		Pass
F_CD	kips	-75.00	-75.00	+0.00		Pass

UD-8.7: Virtual work: triangular truss with a midspan load

Source: F. Udoeyo, Structural Analysis (Temple University Press, 2020, open textbook), pp. Example 8.7, pp. 222-224 (PDF). Calculation: 2-D truss analysis.

E = 200 GPa, A = 5 cm². The printed vertical displacement at D, 1.45 mm, takes the virtual forces n = −0.08 and 0.062 for −0.80 and 0.625 (joint A: n_AB sin 38.66° = −0.5); the corrected virtual-work sum gives 14.5 mm. It is not compared.

UD-8.7 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
F_AB (kN)	kips	-21.59	-21.59	-0.00		Pass
F_AD (kN)	kips	16.86	16.86	+0.00		Pass
F_BD (kN)	kips	0.000	0.000	+0.00		Pass

UD-8.11: Virtual work: square truss with one diagonal, lateral load

Source: F. Udoeyo, Structural Analysis (Temple University Press, 2020, open textbook), pp. Example 8.11, pp. 231-233 (PDF). Calculation: 2-D truss analysis.

The printed displacement (1 in.) takes 1.14 for 1.41 in the virtual-work sum; it is not compared.

UD-8.11 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
F_AB	kips	30.00	30.00	+0.00		Pass
F_BC	kips	30.00	30.00	+0.00		Pass
F_CD	kips	0.000	-0.000	+0.00		Pass
F_AD	kips	30.00	30.00	+0.00		Pass
F_BD	kips	-42.43	-42.43	-0.01		Pass

UD-10.8: Force method: truss pinned to a wall at two joints (indeterminate, 2nd degree)

Source: F. Udoeyo, Structural Analysis (Temple University Press, 2020, open textbook), pp. Example 10.8, pp. 309-313 (PDF). Calculation: 2-D truss analysis.

EA constant; the published forces are multiples of P (P = 100 kips here). Bar AB joins the two wall pins and carries no force.

UD-10.8 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
F_AC = −0.624P	kips	-62.40	-62.54	+0.23		Pass
F_AD = −0.559P	kips	-55.90	-55.78	-0.22		Pass
F_BC = 0.441P	kips	44.10	44.22	+0.28		Pass
F_BD = 0.79P	kips	79.00	78.88	-0.15		Pass
F_CD = 0.441P	kips	44.10	44.22	+0.28		Pass

UD-10.9: Force method: cantilever truss with a redundant diagonal

Source: F. Udoeyo, Structural Analysis (Temple University Press, 2020, open textbook), pp. Example 10.9, pp. 313-315 (PDF). Calculation: 2-D truss analysis.

EA constant. The redundant F_AD is compared as a magnitude, as the textbook gives it.

UD-10.9 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
F_AD (kN)	kips	8.437	8.436	-0.01		Pass

SP-TWFP: Flat plate by the direct design method: end span moments, punching shear

Source: StructurePoint, Two-Way Flat Plate Concrete Floor System Analysis and Design (ACI 318-14), pp. pp. 5–13 (Tables 1–3). Calculation: Two-way slab.

Spans 18 ft (x) × 14 ft, 16 in. square columns, h = 7 in., SDL = 20 psf, L = 40 psf, self-weight 150 pcf; #4 bars, d = 6.0 / 5.5 in. Strip moments are compared per foot of the 7 ft strips. The punching values are those of the preliminary check ($V_u = q_u(\ell_1\ell_2 - b^2)$).

SP-TWFP · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Minimum thickness, exterior panel $\ell_n/30$	in.	6.670	6.667	-0.05		Pass
$M_o = q_u \ell_2 \ell_n^2/8$	kip-ft	93.82	93.82	-0.00		Pass
Exterior negative 0.26Mo	kip-ft	24.39	24.39	+0.01		Pass
Positive 0.52Mo	kip-ft	48.79	48.79	-0.01		Pass
Interior negative 0.70Mo	kip-ft	65.67	65.67	+0.01		Pass
Column strip, exterior negative (24.39 kip-ft / 7 ft)	kip-ft	3.484	3.485	+0.01		Pass
Column strip, positive (29.27 kip-ft / 7 ft)	kip-ft	4.181	4.182	+0.01		Pass
Column strip, interior negative (49.25 kip-ft / 7 ft)	kip-ft	7.036	7.036	+0.01		Pass
Middle strip, positive (19.52 kip-ft / 7 ft)	kip-ft	2.789	2.788	-0.03		Pass
Middle strip, interior negative (16.42 kip-ft / 7 ft)	kip-ft	2.346	2.345	-0.01		Pass
$A_{s,min} = 0.0018\ b\ h$ (1.06 in² per 84 in.)	in.²	0.151	0.151	-0.15		Pass
Interior column: V_u	kips	48.00	48.00	+0.00		Pass
Interior column: b_o	in.	87.00	87.00	+0.00		Pass
$v_c = 4\lambda\sqrt{f'_c}$ (d = 5.75 in., λ_s = 1)	psi	253.0	253.0	+0.00		Pass
φv_c	psi	189.7	189.7	-0.00		Pass

SP-TWDP: Flat slab with drop panels: minimum thickness and punching sections

Source: StructurePoint, Two-Way Flat Slab (Concrete Floor with Drop Panels) System Analysis and Design (ACI 318-14), pp. pp. 12–18. Calculation: Two-way slab.

30 × 30 ft panels, 20 in. columns, h = 10 in., drop panels 10 × 10 ft projecting 4.25 in., f'c = 5,000 psi, SDL = 20 psf, L = 60 psf, #6 bars.

SP-TWDP · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Minimum thickness with drop panels, exterior panel ℓn/33	in.	10.30	10.30	+0.03		Pass
d at the column (slab + drop panel)	in.	12.75	12.75	+0.00		Pass
bo at d/2 from the column	in.	131.0	131.0	+0.00		Pass
bo at d/2 from the drop panel	in.	514.0	514.0	+0.00		Pass
vc at the column = 4λ√f'c	psi	282.8	265.2	-6.24		Deviation ACI318-19-LS
ACI318-19-LS: the example uses vc = 4λ√f'c of ACI 318-14; ACI 318-19 Table 22.6.5.2 multiplies it by the size effect factor λs = √(2/(1 + d/10)) (0.938 for d = 12.75 in.)						
vc at the drop panel = 4λ√f'c	psi	282.8	188.2	-33.46		Deviation SP-TWDP-VC
SP-TWDP-VC: the example's preliminary check takes vc = 4λ√f'c around the drop panel; Table 22.6.5.2(c), (2 + αs d/bo)λ√f'c = 2.66λ√f'c for bo = 514 in., governs and ILX Calcs uses it						

SP-TWB: Slab with beams: αfm and minimum thickness (Table 8.3.1.2)

Source: StructurePoint, Two-Way Concrete Floor Slab with Beams System Analysis and Design (ACI 318-14), pp. pp. 5–9. Calculation: Two-way slab.

Spans 22 × 17.5 ft, 18 in. columns, interior beams 14 × 20 in., h = 6 in.; interior panel.

SP-TWB · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
αfm (interior panel, αf = 3.16 and 3.98)		3.570	3.558	-0.33		Pass
β = clear span ratio		1.280	1.276	-0.35		Pass
hmin = ℓn(0.8 + fy/200,000)/(36 + 9β)	in.	5.690	5.792	+1.79		Deviation SP-TWB-LN

SP-TWB-LN: the example takes ℓn = 246 in. face to face of the columns; Table 8.3.1.2 note [2] measures ℓn face to face of the beams (250 in.), as ILX Calcs does

ACI-HB-TW1: Flat plate interior strip by the direct design method

Source: ACI MNL-17(21), Two-way Slab Example 1, pp. pp. 97-108. Calculation: Two-way slab.

ℓ1 = 18 ft, ℓ2 = 14 ft, ℓn = 16 ft, 24 in. columns, h = 7 in., f'c = 5,000 psi, SDL = 15 psf, L = 100 psf, No. 5 bars, the exterior edge on a basement wall (fully restrained). The handbook rounds d to 5.6 in. in the shear stresses (5.63 in. from its own expression); its vu = 0.121 ksi is not compared for that reason.

ACI-HB-TW1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Minimum thickness ℓn/33 p. 97	in.	5.800	5.818	+0.31		Pass
Mo = qu ℓ2 ℓn²/8 p. 99	kip-ft	127.0	126.8	-0.17		Pass
Interior negative 0.65Mo p. 100	kip-ft	83.00	82.41	-0.71		Pass
Column strip negative 0.75 × 83 = 63 kip-ft over 7 ft p. 100	kip-ft	9.000	8.830	-1.89		Pass
Column strip positive 0.60 × 45 = 27 kip-ft over 7 ft p. 100	kip-ft	3.857	3.804	-1.39		Pass
Middle strip positive 18 kip-ft over 7 ft p. 100	kip-ft	2.571	2.536	-1.39		Pass
Flexural transfer γf Msc = 0.6 × 20.1 p. 102	kip-ft	12.10	12.04	-0.48		Pass
bo at the interior column p. 103	in.	118.4	118.5	+0.08		Pass
Punching Vu at the interior column p. 104	kips	70.00	69.59	-0.58		Pass
φvc = 0.75 × (2 + αs d/bo) √f'c p. 108	psi	206.0	206.8	+0.37		Pass

TW-1: Flat plate end panel, direct design method and punching at an interior column

Source: Hand calculation (closed form), pp. ACI 318-14 8.10; ACI 318-19 Tables 8.3.1.1, 22.6.5.2, Eq. 8.4.2.2.2, R8.4.4.2.3. Calculation: Two-way slab.

Unbalanced moment at the interior column by ACI 318-14 Eq. 8.10.7.2 with equal adjacent spans.

TW-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Minimum thickness ℓn/30 (exterior panel, no edge beam)	in.	7.467	7.467	+0.00		Pass
Mo = qu ℓ2 ℓn²/8	kip-ft	195.1	195.1	+0.00		Pass
Column strip, interior negative 0.70 × 0.75 Mo per ft (10 ft strip)	kip-ft	10.24	10.24	+0.00		Pass
Column strip, exterior negative 0.26 × 1.00 Mo per ft	kip-ft	5.073	5.073	+0.00		Pass
Middle strip, positive 0.52 × 0.40 Mo per ft	kip-ft	4.059	4.059	+0.00		Pass
Interior span column strip, interior negative 0.65 × 0.75 Mo per ft (y)	kip-ft	9.513	9.513	+0.00		Pass
Punching vu = vuv + γv Msc c / Jc	psi	168.4	168.4	+0.00		Pass
φvc = 0.75 × 4λsλ√f'c	psi	189.7	189.7	+0.00		Pass
Flexural transfer γf Msc	kip-ft	11.71	11.71	+0.00		Pass

SP-TWFP-EFM: Flat plate by the equivalent frame method: stiffnesses, moments

Source: StructurePoint, Two-Way Flat Plate Concrete Floor System Analysis and Design (ACI 318-14), pp. pp. 18–28 (printed 18 to 25, Table 5, Table 6). Calculation: Two-way slab.

ℓ1 = 18 ft, ℓ2 = 14 ft, h = 7 in., 16 in. columns, 9 ft stories, f'c = 4,000 psi slab and 6,000 psi columns (Ec by wc = 150 pcf), three spans; L/D = 0.37: all spans fully loaded (6.4.3.2). The module integrates the non-prismatic members numerically: 4.130 / 0.509 against the table's 4.127 / 0.507.

SP-TWFP-EFM · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Slab-beam stiffness factor kNF (PCA Table A1)		4.127	4.130	+0.07		Pass
Slab-beam carry-over factor		0.507	0.509	+0.43		Pass
Fixed-end moment factor mNF		0.084	0.084	+0.06		Pass
Column stiffness factor kAB (PCA Table A7)		4.740	4.740	-0.01		Pass
Torsional constant C		1,325	1,325	+0.01		Pass
Kt per arm (kip-in.)		367,484	367,509	+0.01		Pass
Equivalent column Kec (kip-in.)		554,074	554,092	+0.00		Pass
Distribution factor, exterior joint		0.388	0.389	+0.13		Pass
Distribution factor, interior joint		0.280	0.280	-0.07		Pass
End span, exterior centreline moment	kip-ft	46.65	46.69	+0.08		Pass
End span, interior centreline moment	kip-ft	83.91	84.01	+0.12		Pass
Interior span centreline moment	kip-ft	76.21	76.26	+0.06		Pass
End span positive moment	kip-ft	44.94	44.88	-0.14		Pass
Exterior negative at the column face	kip-ft	32.42	32.46	+0.11		Pass
Interior negative at the column face	kip-ft	66.99	67.02	+0.04		Pass
Mo for 8.11.6.5	kip-ft	93.82	93.82	-0.00		Pass

SP-TWDP-EFM: Flat slab with drop panels by the equivalent frame method: stiffnesses

Source: StructurePoint, Two-Way Flat Slab (with drop panels) Concrete Floor System Analysis and Design (ACI 318-14), pp. pp. 25–28 (printed 21 to 24). Calculation: Two-way slab.

ℓ1 = ℓ2 = 30 ft, h = 10 in., 4.25 in. drops 10 × 10 ft, 20 in. columns, 13 ft stories, f'c = 5,000 psi slab, 6,000 psi columns. The drop weight is averaged over the panel as in the direct design path (the example applies it as partial loads), so its moments are not compared.

SP-TWDP-EFM · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Drop panel slab-beam kNF (PCA Tables A2, A3)		5.587	5.575	-0.21		Pass
Drop panel slab-beam carry-over factor		0.578	0.578	+0.04		Pass
Drop panel fixed-end moment factor mNF1		0.091	0.092	+0.10		Pass
Column below kAB (ta = h/2 + drop)		5.318	5.325	+0.12		Pass
Column above kAB		4.879	4.884	+0.11		Pass
Torsional constant C with the drop		10,632	10,632	-0.00		Pass
Kt per arm with the drop (kip-in.)		1,352,595	1,352,540	-0.00		Pass
Kec with drop panels (kip-in.)		1,628,679	1,629,403	+0.04		Pass
Drop panel DF, exterior joint		0.551	0.550	-0.18		Pass
Drop panel DF, interior joint		0.355	0.355	-0.04		Pass

UC-1: 1 ft in mm

Source: NIST SP 811 (2008) Appendix B (exact definitions). Calculation: Unit converter.

UC-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 ft in mm		304.8	304.8	+0.00		Pass

UC-2: 1 kip in kN

Source: NIST SP 811 (2008) Appendix B (exact definitions). Calculation: Unit converter.

UC-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 kip in kN		4.448	4.448	+0.00		Pass

UC-3: 1 ksi in MPa

Source: NIST SP 811 (2008) Appendix B (exact definitions). Calculation: Unit converter.

UC-3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 ksi in MPa		6.895	6.895	+0.00		Pass

UC-4: 1 psf in Pa

Source: NIST SP 811 (2008) Appendix B (exact definitions). Calculation: Unit converter.

UC-4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 psf in Pa		47.88	47.88	+0.00		Pass

UC-5: 1 kip-ft in kN-m

Source: NIST SP 811 (2008) Appendix B (exact definitions). Calculation: Unit converter.

UC-5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 kip-ft in kN-m		1.356	1.356	+0.00		Pass

UC-6: 1 klf in kN/m

Source: NIST SP 811 (2008) Appendix B (exact definitions). Calculation: Unit converter.

UC-6 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 klf in kN/m		14.59	14.59	+0.00		Pass

UC-7: 1 pcf in N/m³

Source: NIST SP 811 (2008) Appendix B (exact definitions). Calculation: Unit converter.

UC-7 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 pcf in N/m³		157.1	157.1	+0.00		Pass

UC-8: 1 in⁴ in mm⁴

Source: NIST SP 811 (2008) Appendix B (exact definitions). Calculation: Unit converter.

UC-8 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 in⁴ in mm⁴		416,231	416,231	-0.00		Pass

UC-9: 100 mph in m/s

Source: NIST SP 811 (2008) Appendix B (exact definitions). Calculation: Unit converter.

UC-9 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
100 mph in m/s		44.70	44.70	+0.00		Pass

UC-10: 32 °F in °C

Source: NIST SP 811 (2008) Appendix B (exact definitions). Calculation: Unit converter.

UC-10 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
32 °F in °C		0.000	0.000	+0.00		Pass

UC-11: 212 °F in °C

Source: NIST SP 811 (2008) Appendix B (exact definitions). Calculation: Unit converter.

UC-11 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
212 °F in °C		100.0	100.0	+0.00		Pass

UC-12: 1 lb/ft³ in kg/m³

Source: NIST SP 811 (2008) Appendix B (exact definitions). Calculation: Unit converter.

UC-12 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 lb/ft³ in kg/m³		16.02	16.02	+0.00		Pass

SP811-1: 1 kip in N

Source: NIST SP 811 (2008), Appendix B.8 Factors for units listed alphabetically, pp. PDF p. 63. Calculation: Unit converter.

SP811-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 kip in N		4,448	4,448	-0.00		Pass

SP811-2: 1 ksi in kPa

Source: NIST SP 811 (2008), Appendix B.8 Factors for units listed alphabetically, pp. PDF p. 63. Calculation: Unit converter.

SP811-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 ksi in kPa		6,895	6,895	+0.00		Pass

SP811-3: 1 psi in Pa

Source: NIST SP 811 (2008), Appendix B.8 Factors for units listed alphabetically, pp. PDF p. 65. Calculation: Unit converter.

SP811-3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 psi in Pa		6,895	6,895	+0.00		Pass

SP811-4: 1 psf in Pa

Source: NIST SP 811 (2008), Appendix B.8 Factors for units listed alphabetically, pp. PDF p. 65. Calculation: Unit converter.

SP811-4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 psf in Pa		47.88	47.88	-0.00		Pass

SP811-5: 1 lbf-ft in N-m

Source: NIST SP 811 (2008), Appendix B.8 Factors for units listed alphabetically, pp. PDF p. 65. Calculation: Unit converter.

SP811-5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 lbf-ft in N-m		1.356	1.356	-0.00		Pass

SP811-6: 1 lbf-in in N-m

Source: NIST SP 811 (2008), Appendix B.8 Factors for units listed alphabetically, pp. PDF p. 65. Calculation: Unit converter.

SP811-6 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 lbf-in in N-m		0.113	0.113	+0.00		Pass

SP811-7: 1 kgf-m in N-m

Source: NIST SP 811 (2008), Appendix B.8 Factors for units listed alphabetically, pp. PDF p. 63. Calculation: Unit converter.

SP811-7 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 kgf-m in N-m		9.807	9.807	+0.00		Pass

SP811-8: 1 lbf/ft in N/m

Source: NIST SP 811 (2008), Appendix B.8 Factors for units listed alphabetically, pp. PDF p. 65. Calculation: Unit converter.

SP811-8 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 lbf/ft in N/m		14.59	14.59	+0.00		Pass

SP811-9: 1 lbf/in in N/m

Source: NIST SP 811 (2008), Appendix B.8 Factors for units listed alphabetically, pp. PDF p. 65. Calculation: Unit converter.

SP811-9 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 lbf/in in N/m		175.1	175.1	+0.00		Pass

SP811-10: 1 ton-force (2000 lbf) in kN

Source: NIST SP 811 (2008), Appendix B.8 Factors for units listed alphabetically, pp. PDF p. 67. Calculation: Unit converter.

SP811-10 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 ton-force (2000 lbf) in kN		8.896	8.896	+0.00		Pass

SP811-11: 1 kgf in N

Source: NIST SP 811 (2008), Appendix B.8 Factors for units listed alphabetically, pp. PDF p. 63. Calculation: Unit converter.

SP811-11 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 kgf in N		9.807	9.807	+0.00		Pass

SP811-12: 1 in⁴ in m⁴

Source: NIST SP 811 (2008), Appendix B.8 Factors for units listed alphabetically, pp. PDF p. 62. Calculation: Unit converter.

SP811-12 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 in⁴ in m⁴		0.000	0.000	+0.00		Pass

SP811-13: 1 ft⁴ in m⁴

Source: NIST SP 811 (2008), Appendix B.8 Factors for units listed alphabetically, pp. PDF p. 61. Calculation: Unit converter.

SP811-13 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 ft⁴ in m⁴		0.009	0.009	-0.00		Pass

SP811-14: 1 in² in m²

Source: NIST SP 811 (2008), Appendix B.8 Factors for units listed alphabetically, pp. PDF p. 67. Calculation: Unit converter.

SP811-14 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 in² in m²		0.001	0.001	+0.00		Pass

SP811-15: 1 ft² in m²

Source: NIST SP 811 (2008), Appendix B.8 Factors for units listed alphabetically, pp. PDF p. 66. Calculation: Unit converter.

SP811-15 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 ft² in m²		0.093	0.093	+0.00		Pass

SP811-16: 1 mile in km

Source: NIST SP 811 (2008), Appendix B.8 Factors for units listed alphabetically, pp. PDF p. 64. Calculation: Unit converter.

SP811-16 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 mile in km		1.609	1.609	+0.00		Pass

SP811-17: 1 yd in m

Source: NIST SP 811 (2008), Appendix B.8 Factors for units listed alphabetically, pp. PDF p. 68. Calculation: Unit converter.

SP811-17 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 yd in m		0.914	0.914	+0.00		Pass

SP811-18: 1 mph in km/h

Source: NIST SP 811 (2008), Appendix B.8 Factors for units listed alphabetically, pp. PDF p. 64. Calculation: Unit converter.

SP811-18 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 mph in km/h		1.609	1.609	-0.00		Pass

SP811-19: 1 ft/s in m/s

Source: NIST SP 811 (2008), Appendix B.8 Factors for units listed alphabetically, pp. PDF p. 61. Calculation: Unit converter.

SP811-19 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 ft/s in m/s		0.305	0.305	+0.00		Pass

SP811-20: 1 lb/ft³ in kg/m³

Source: NIST SP 811 (2008), Appendix B.8 Factors for units listed alphabetically, pp. PDF p. 66. Calculation: Unit converter.

SP811-20 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 lb/ft³ in kg/m³		16.02	16.02	+0.00		Pass

SP811-21: 1 standard atmosphere in kPa

Source: NIST SP 811 (2008), Appendix B.8 Factors for units listed alphabetically, pp. PDF p. 57. Calculation: Unit converter.

SP811-21 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 standard atmosphere in kPa		101.3	101.3	+0.00		Pass

SP811-22: 1 bar in kPa

Source: NIST SP 811 (2008), Appendix B.8 Factors for units listed alphabetically, pp. PDF p. 57. Calculation: Unit converter.

SP811-22 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
1 bar in kPa		100.0	100.0	+0.00		Pass

14.2-SIDE: Masonry warehouse, side walls (8 in. CMU, 65 psf) at the wood roof, Lf = 200 ft

Source: FEMA P-1051 (2015), NEHRP Recommended Seismic Provisions: Design Examples, pp. §14.2.6, §14.2.4.4, pp. 14-47 to 14-51.
Calculation: Seismic wall anchorage.

14.2-SIDE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ka = 1 + 200/100 = 3.0 → 2.0		2.000	2.000	+0.00		Pass
Fp coefficient 0.4 SDS ka Ie		1.144	1.144	+0.00		Pass
Fp per ft = 1.14 (65)(16)	kip/ft	1.190	1.190	-0.02		Pass
Force per anchor at 4 ft	kips	4.760	4.759	-0.02		Pass
Continuous crosstie force at 20 ft	kips	23.80	23.80	-0.02		Pass
Subdiaphragm shear 1.19 (10) / 20	kip/ft	0.595	0.595	-0.02		Pass

14.2-END: Masonry warehouse, end walls (12 in. CMU, 103 psf), Lf = 100 ft, 8 ft subdiaphragm

Source: FEMA P-1051 (2015), NEHRP Recommended Seismic Provisions: Design Examples, pp. §14.2.6, pp. 14-53 to 14-55. Calculation: Seismic wall anchorage.

14.2-END · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ka = 1 + 100/100		2.000	2.000	+0.00		Pass
Fp per ft = 1.14 (103)(16)	kip/ft	1.890	1.885	-0.25		Pass
Force per anchor at 4 ft	kips	7.560	7.541	-0.25		Pass
Continuous crosstie force at 20 ft	kips	37.80	37.71	-0.25		Pass
Minimum subdiaphragm depth 20 / 2.5	ft	8.000	8.000	+0.00		Pass
Subdiaphragm shear at 8 ft depth	kip/ft	2.360	2.357	-0.14		Pass

14.2-END-16: Masonry warehouse end walls, 16 ft subdiaphragm

Source: FEMA P-1051 (2015), NEHRP Recommended Seismic Provisions: Design Examples, pp. §14.2.6, p. 14-55. Calculation: Seismic wall anchorage.

14.2-END-16 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Subdiaphragm shear at 16 ft depth (printed 1.17 / 1.18)	kip/ft	1.180	1.178	-0.14		Pass

11.1-PLANK-C: Five-story masonry, untopped plank (rigid), SDC C: anchorage at a floor

Source: FEMA P-1051 (2015), NEHRP Recommended Seismic Provisions: Design Examples, pp. §11.1.1.5, p. 11-15. Calculation: Seismic wall anchorage.

11.1-PLANK-C · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Eq. 12.11-1: 0.4 (0.37)(1.0)(1.0)(48)(8.67)	kip/ft	0.062	0.062	-0.01		Pass
Wall anchorage force	kip/ft	0.062	0.083	+35.12		Deviation FEMA-P1051-11.1-ANCHM
FEMA-P1051-11.1-ANCHMIN: published value below the 12.11.2.1 minimum 0.2 ka Ie Wp (ILX 0.0832 klf)						

11.1-PLANK-D: Five-story masonry, topped plank (rigid), SDC D: anchorage at 4 ft

Source: FEMA P-1051 (2015), NEHRP Recommended Seismic Provisions: Design Examples, pp. §11.1.2.5.5, p. 11-31. Calculation: Seismic wall anchorage.

11.1-PLANK-D · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fp = 0.4 (1.0)(1.0)(1.0)(60)(8.67)	kip/ft	0.208	0.208	+0.04		Pass
Force per anchor at 4 ft	kips	0.830	0.832	+0.28		Pass

13.1-WALL: Masonry warehouse side wall, out-of-plane force (SDC D)

Source: FEMA P-1051 (2015), NEHRP Recommended Seismic Provisions: Design Examples, pp. §13.1.5.2, p. 13-10. Calculation: Seismic wall anchorage.

13.1-WALL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fp = 0.4 (1.43)(1.0)(65)	psf	37.00	37.18	+0.49		Pass

13.2-WALL-B: Masonry building, SDC B: out-of-plane force, minimum governs

Source: FEMA P-1051 (2015), NEHRP Recommended Seismic Provisions: Design Examples, pp. §13.2.4.7, p. 13-73. Calculation: Seismic wall anchorage.

13.2-WALL-B · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
0.4 SDS Ie Ww	psf	4.300	4.320	+0.47		Pass
Fp = 0.10 Ww (governs)	psf	4.500	4.500	+0.00		Pass

13.2-WALL-C: Masonry building, SDC C, wall D: out-of-plane force

Source: FEMA P-1051 (2015), NEHRP Recommended Seismic Provisions: Design Examples, pp. §13.2.5.7, p. 13-85. Calculation: Seismic wall anchorage.

13.2-WALL-C · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fp = 0.4 (0.37)(1.0)(48)	psf	7.100	7.104	+0.06		Pass

HC-MIN: Low SDS at a rigid diaphragm: 0.2 ka Ie Wp minimum governs

Source: Hand calculation (closed form). Calculation: Seismic wall anchorage.

HC-MIN · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fp = 0.2 (1.0)(1.0)(48)(8.67)	kip/ft	0.083	0.083	+0.00		Pass

HC-REDUCE: Below the roof, (1 + 2z/h)/3 with the 12.11.1 floor

Source: Hand calculation (closed form). Calculation: Seismic wall anchorage.

HC-REDUCE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
(1 + 2 × 0.2)/3		0.467	0.467	-0.00		Pass
Fp = max(0.4667 × 0.24, 12.11.1 force 0.24, 0.2 Wp 0.12)	kip/ft	0.240	0.240	+0.00		Pass

HC-STEEL: Steel strap, SDC D, ASD: 0.7 × 1.4 × Fp s

Source: Hand calculation (closed form). Calculation: Seismic wall anchorage.

HC-STEEL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ka = 1 + 50/100		1.500	1.500	+0.00		Pass
Fp = 0.4 (1.0)(1.5)(1.0)(80)(10)	kip/ft	0.480	0.480	+0.00		Pass
Design force = 0.7 × 1.4 × 0.48 × 6	kips	2.822	2.822	+0.00		Pass

HC-SDC-A: SDC A: 1.4.4, 0.2 Wp not less than 5 psf

Source: Hand calculation (closed form). Calculation: Seismic wall anchorage.

HC-SDC-A · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
F = max(0.2 × 20 × 6, 5 × 6) = 30 plf	kip/ft	0.030	0.030	+0.00		Pass

MNL-F2: Concrete wall, 12 in., 10 ft by 24 in. footing (ACI 318-19)

Source: ACI MNL-17(21), Foundation Example 2, pp. pp. 488-494. Calculation: Wall footing.

MNL-F2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Factored pressure	ksf	5.260	4.986	-5.22		Deviation MNL17-F2-QU
MNL17-F2-QU: the handbook divides 50 kips per foot by 9.5 ft (5.26 ksf) and uses it on the 10 ft footing; 10 ft gives 5.0 ksf						
Effective depth d	in.	20.50	20.50	+0.00		Pass
Mu at the wall face	kip-ft	53.30	50.48	-5.29		Deviation MNL17-F2-QU
MNL17-F2-QU: the handbook divides 50 kips per foot by 9.5 ft (5.26 ksf) and uses it on the 10 ft footing; 10 ft gives 5.0 ksf						
As,min = 0.0018 b h	in.²	0.430	0.518	+20.56		Deviation MNL17-F2-H20
MNL17-F2-H20: the handbook takes 20 in. (an earlier trial thickness) for As,min; the adopted footing is 24 in.						
Shrinkage and temperature steel along the wall, 0.0018 Ag	in.²	5.200	5.184	-0.31		Pass
ℓd of No. 8, (cb + Ktr)/db = 2.5	in.	28.50	28.46	-0.14		Pass
Bar length available	in.	51.00	51.00	+0.00		Pass

WF-SP-13: Concrete wall, 12 in, h = 13 in (Wight Ex. 15-1)

Source: StructurePoint, Reinforced Concrete Shear Wall Foundation (Strip Footing) Analysis and Design (ACI 318-14), after Wight, Reinforced Concrete Mechanics and Design, 7th Ed., Example 15-1, pp. pp. 4-9. Calculation: Wall footing.

WF-SP-13 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Factored net pressure	ksf	6.190	6.194	+0.06		Pass
Effective depth d	in.	9.750	9.750	+0.00		Pass
Vu at d from the wall face	kips	7.870	7.871	+0.01		Pass
Mu at the wall face	kip-ft	13.40	13.44	+0.30		Pass
As required	in.²	0.316	0.316	+0.13		Pass
As,min = 0.0018 b h	in.²	0.281	0.281	-0.07		Pass
Maximum bar spacing	in.	18.00	18.00	+0.00		Pass
Bar length available	in.	22.00	22.00	+0.00		Pass
Shrinkage and temperature steel along the wall	in.²	1.450	1.451	+0.06		Pass
Spacing of 5 #5 along the wall	in.	13.84	13.84	+0.03		Pass
Maximum spacing along the wall	in.	18.00	18.00	+0.00		Pass
φVc one-way, 13 in	kips	9.610	5.502	-42.74		Deviation WF-ACI19-ONEWAY
WF-ACI19-ONEWAY: the publication uses 2√f'c bw d; ACI 318-19 Table 22.5.5.1(c) applies to a footing without stirrups						
ℓd of #4	in.	21.90	13.15	-39.98		Deviation WF-LD-SIMPLIFIED
WF-LD-SIMPLIFIED: the publication uses the simplified table; the program uses the general equation 25.4.2.4(a)						

WF-SP-12: Same footing, first trial h = 12 in

Source: StructurePoint, Reinforced Concrete Shear Wall Foundation (Strip Footing) Analysis and Design (ACI 318-14), after Wight, Reinforced Concrete Mechanics and Design, 7th Ed., Example 15-1, pp. pp. 5-6. Calculation: Wall footing.

WF-SP-12 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable pressure net of the weights	ksf	4.370	4.370	+0.00		Pass
Width required (D + L) / net pressure	ft	5.150	5.149	-0.02		Pass
Effective depth d	in.	8.750	8.750	+0.00		Pass
Vu at d from the wall face	kips	8.380	8.387	+0.08		Pass
φVc one-way, 12 in	kips	8.260	5.119	-38.02		Deviation WF-ACI19-ONEWAY

WF-ACI19-ONEWAY: the publication uses 2√f'c bw d; ACI 318-19 Table 22.5.5.1(c) applies to a footing without stirrups

WF-UET-9.1: Concrete wall, 12 in, f'c = 3,500 psi

Source: Qaisar Ali, UET Peshawar, CE 320 Reinforced Concrete Design I, Lecture 09 (2023), Example 9.1, pp. slides 44-54. Calculation: Wall footing.

WF-UET-9.1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable pressure net of the weights (γ = 120 pcf) Slide 46 prints 0.1 in the substitution but its result, and slide 44, use 0.120 kcf	ksf	4.370	4.370	+0.00		Pass
Factored pressure	ksf	6.190	6.194	+0.06		Pass
Vu at d from the wall face	kips	8.380	8.387	+0.08		Pass
Mu at the wall face	kip-ft	13.43	13.44	+0.06		Pass
As required	in.²	0.350	0.353	+0.96		Pass
As,min = 0.0018 b h	in.²	0.260	0.259	-0.31		Pass
Maximum bar spacing	in.	18.00	18.00	+0.00		Pass
Shrinkage and temperature steel	in.²	1.340	1.339	-0.06		Pass
φVc one-way	kips	9.320	5.668	-39.19		Deviation WF-ACI19-ONEWAY
WF-ACI19-ONEWAY: the publication uses 2√f'c bw d; ACI 318-19 Table 22.5.5.1(c) applies to a footing without stirrups						

WF-ASDIP-W: Wall 6 in off center with wind: soil and stability

Source: J. Encinas, Wall Footing Design Example Using ASDIP FOUNDATION, ASDIP blog (Dec 2022), program screenshots, pp. At a Glance and Condensed tabs. Calculation: Wall footing.

Wall thickness, offset and cover read from the Detailed tab; passive pressure = Kp × γ = 4.33 × 110. The end cover of 2 in that ASDIP uses for the bar length is not modeled.

WF-ASDIP-W · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Maximum bearing pressure	ksf	2.900	2.931	+1.07		Pass
Eccentricity / width		0.160	0.161	+0.79		Pass
Overturning safety factor		2.730	2.745	+0.54		Pass
Sliding safety factor		2.930	2.929	-0.04		Pass
Sliding force, 0.6D + 0.6W	kips	0.600	0.600	+0.00		Pass
Friction force	kips	1.000	1.043	+4.29		Pass
Passive force	kips	0.700	0.714	+2.06		Pass
Footing weight × 0.6	kips	0.300	0.324	+8.00		Pass
Soil cover weight × 0.6	kips	0.200	0.194	-3.20		Pass
Plain concrete φMn at the top	kip-ft	3.600	2.739	-23.93		Deviation WF-ASDIP-PLAIN
WF-ASDIP-PLAIN: the publication uses φ = 0.55 and the full thickness; ACI 318-19 gives φ = 0.60 and takes 2 in off concrete cast against soil						

WF-ASDIP-G: Same footing, the published combination 1.2D + 1.6L: concrete

Source: J. Encinas, Wall Footing Design Example Using ASDIP FOUNDATION, ASDIP blog (Dec 2022), program screenshots, pp. Condensed and Detailed tabs. Calculation: Wall footing.

ASDIP's strength combinations with wind use 0.5L (ASCE 7-22 2.3.1 exception 1), which the program does not model, so the values are read at the combination the publication prints.

WF-ASDIP-G · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mu, − side	kip-ft	1.700	1.695	-0.28		Pass
Mu, + side	kip-ft	1.500	1.467	-2.19		Pass
φMn	kip-ft	11.70	11.70	-0.04		Pass
Effective depth of the X bars	in.	8.700	8.688	-0.14		Pass
Min. steel ratio As,min / As		0.840	0.836	-0.46		Pass
Z bars As,min	in.²	0.900	0.933	+3.68		Pass
Vu, − side	kips	1.100	1.053	-4.30		Pass
Vu, + side	kips	0.900	0.804	-10.65		Deviation WF-ASDIP-SHEAR
WF-ASDIP-SHEAR: printed to one decimal and not reproduced on this side at d = 8.7 in; the moment on the same side matches						
φVc	kips	5.000	4.927	-1.47		Deviation WF-ASDIP-SHEAR
WF-ASDIP-SHEAR: Table 22.5.5.1(c) with the printed values gives 4.93 kip/ft, printed as 5.0						
ℓd with the excess reinforcement reduction	in.	12.00	13.74	+14.49		Deviation WF-ASDIP-LD
WF-ASDIP-LD: the publication takes As,required from the moment alone; the program takes the larger of that and As,min						

WF-CE-10: 8 in masonry wall (ACI 318-05)

Source: CE-Ref.com, Design of wall footings, Example 10 (ACI 318-05), pp. pp. 2-3. Calculation: Wall footing.

WF-CE-10 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable pressure net of the weights	ksf	2.308	2.308	+0.01		Pass
Width required	ft	2.400	2.383	-0.72		Pass
Factored pressure	ksf	3.040	3.040	-0.00		Pass
Effective depth d	in.	6.750	6.750	+0.00		Pass
Mu	kip-ft	1.270	1.784	+40.46		Deviation WF-CE-MASONRY
WF-CE-MASONRY: the publication takes the moment at the wall face; Table 13.2.7.1 takes it halfway between the center and the face of a masonry wall						
vu	psi	40.50	19.55	-51.73		Deviation WF-CE-MASONRY
WF-CE-MASONRY: the publication takes the shear at t/4 inside the face, without the distance d of 7.4.3.2						
φvc	psi	75.00	38.80	-48.26		Deviation WF-CE-VC
WF-CE-VC: the publication uses 2√f'c with f'c = 2,500 psi on a 3,000 psi footing; ACI 318-19 Table 22.5.5.1(c) applies						
Steel along the wall	in.²	0.525	0.540	+2.86		Deviation WF-CE-TEMP
WF-CE-TEMP: the publication uses 0.002 and a depth of 8.75 in; ACI 318-19 gives 0.0018 Ag						

WF-H1: Concentric wall, the default design

Source: Hand calculation (closed form). Calculation: Wall footing.

WF-H1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Service pressure D + L	ksf	2.000	2.000	+0.00		Pass
Mu at the wall face	kip-ft	3.333	3.300	-1.00		Pass
φMn	kip-ft	12.98	12.98	+0.00		Pass
Vu at d	kips	2.250	2.228	-1.00		Pass
φVc, Table 22.5.5.1(c)	kips	5.119	5.119	+0.00		Pass
ℓd, Eq. 25.4.2.4	in.	13.15	13.15	+0.00		Pass
Crack control limit, Table 24.3.2	in.	7.500	7.500	+0.00		Pass

WF-H2: Masonry wall: critical section at t/4

Source: Hand calculation (closed form). Calculation: Wall footing.

WF-H2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mu at t/4 from the centerline	kip-ft	4.033	4.033	+0.00		Pass
Vu at d beyond it	kips	2.650	2.650	+0.00		Pass

WF-H3: Wall offset past the kern: partial contact

Source: Hand calculation (closed form). Calculation: Wall footing.

WF-H3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
q max = 2P / (3 (B/2 − e))	ksf	5.359	5.359	-0.00		Pass

WF-H4: Size effect applied, d over 10 in

Source: Hand calculation (closed form). Calculation: Wall footing.

WF-H4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φVc with λs	kips	7.342	7.342	-0.00		Pass

WF-H5: Steel studs on a sill: halfway to the sill edge

Source: Hand calculation (closed form). Calculation: Wall footing.

WF-H5 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mu	kip-ft	3.502	3.467	-1.00		Pass

WF-H6: Wind moment: overturning and sliding

Source: Hand calculation (closed form). Calculation: Wall footing.

WF-H6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Overturning moment, 0.6D + 0.6W	kip-ft	3.000	3.000	+0.00		Pass
Factor of safety		3.375	3.375	+0.00		Pass
Sliding force	kips	1.200	1.200	+0.00		Pass
Sliding factor of safety		1.350	1.350	+0.00		Pass

TM-1: 12 ft by 20 ft wall, centered 4 ft window

Source: TM 5-809-3 / NAVFAC DM-2.9 (1992), Design Example 1, pp. 7-10, 7-11. Calculation: Wall and pier rigidity.

TM-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Solid wall deflection	in.	0.346	0.346	+0.03		Pass
Total deflection	in.	0.373	0.373	+0.05		Pass
k total, as printed, 1/deflection		2.680	2.683	+0.10		Pass
Pier B deflection	in.	0.211	0.211	+0.08		Pass

TM-2: 12 ft by 20 ft wall, door and window

Source: TM 5-809-3 / NAVFAC DM-2.9 (1992), Design Example 2, pp. 7-12, 7-13. Calculation: Wall and pier rigidity.

TM-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Solid wall deflection	in.	0.483	0.481	-0.33		Pass
Total deflection	in.	0.647	0.645	-0.26		Pass
k total, as printed, 1/deflection		1.550	1.550	-0.01		Pass
Pier B deflection	in.	5.239	5.248	+0.17		Pass
Pier E deflection	in.	0.105	0.104	-0.87		Pass
Pier C deflection	in.	1.259	1.255	-0.35		Pass
Pier D deflection	in.	0.439	0.441	+0.54		Pass
Share of pier B		0.076	0.076	-0.14		Pass
Share through pier E, carrying C and D		0.924	0.924	+0.01		Pass
Share of pier C		0.240	0.241	+0.21		Pass
Share of pier D		0.684	0.684	-0.06		Pass

TM-F-fixed-rect: Chart equation, h/d = 1, fixed, rect

Source: TM 5-809-3 / NAVFAC DM-2.9 (1992), Figure 7-5a, pp. 7-10. Calculation: Wall and pier rigidity.

TM-F-fixed-rect · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Deflection	in.	0.247	0.247	+0.01		Pass

TM-F-cantilever-rect: Chart equation, h/d = 1, cantilever, rect

Source: TM 5-809-3 / NAVFAC DM-2.9 (1992), Figure 7-5a, pp. 7-10. Calculation: Wall and pier rigidity.

TM-F-cantilever-rect · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Deflection	in.	0.432	0.432	-0.00		Pass

TM-F-fixed-corner: Chart equation, h/d = 1, fixed, corner

Source: TM 5-809-3 / NAVFAC DM-2.9 (1992), Figure 7-5a, pp. 7-10. Calculation: Wall and pier rigidity.

TM-F-fixed-corner · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Deflection	in.	0.196	0.195	-0.01		Pass

TM-F-cantilever-corner: Chart equation, h/d = 1, cantilever, corner

Source: TM 5-809-3 / NAVFAC DM-2.9 (1992), Figure 7-5a, pp. 7-10. Calculation: Wall and pier rigidity.

TM-F-cantilever-corner · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Deflection	in.	0.319	0.319	+0.01		Pass

CM-1: 24 ft long, 16 ft high, 4 ft door 8 ft high

Source: CMACN Masonry Chronicles, Summer 2002, pp. 3. Calculation: Wall and pier rigidity.

CM-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Solid wall deflection	in.	0.280	0.278	-0.54		Pass
Wall with the opening	in.	0.315	0.315	+0.04		Pass
Added by the opening	in.	0.035	0.037	+4.66		Pass

CM-2: 16 ft long, 24 ft high, the same door

Source: CMACN Masonry Chronicles, Summer 2002, pp. 4, 5. Calculation: Wall and pier rigidity.

CM-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Solid wall deflection	in.	1.570	1.574	+0.24		Pass
Wall with the opening	in.	1.710	1.710	+0.01		Pass
Rigidity of the wall, as printed		0.585	0.585	-0.05		Pass
Added by the opening	in.	0.140	0.136	-2.56		Pass

YAW-T2: Solid cantilever walls 12 ft high

Source: L. Yaw, Rigid Diaphragm Analysis, Walla Walla University (2022), Table 2, pp. 3. Calculation: Wall and pier rigidity.

YAW-T2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R, 50 ft wall		1.290	1.290	+0.00		Pass
R, 44 ft wall		1.112	1.112	+0.00		Pass
R, 20 ft wall		0.375	0.375	-0.01		Pass

CS-T1: Five piers, the first a cantilever, the others fixed

Source: CMACN Masonry Chronicles, Spring 2002, Table 1, pp. 2. Calculation: Wall and pier rigidity.

CS-T1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R of pier 1		1.580	1.582	+0.14		Pass
R of pier 2		0.040	0.036	-10.31		Pass
R of pier 3		0.190	0.194	+2.25		Pass
R of pier 4		0.140	0.140	-0.26		Pass
R of pier 5		1.460	1.457	-0.21		Pass

II.A-26A: Eccentric weld group, IC method, vertical load (Table 8-8)

Source: AISC Design Examples v16.0, Example II.A-26, pp. IIA-260 to IIA-261. Calculation: Eccentric weld group.

II.A-26A · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
x-bar l	in.	1.250	1.250	+0.00		Pass
a l	in.	8.750	8.750	+0.00		Pass
C		1.880	1.874	-0.30		Pass
Manual table C		1.880	1.877	-0.14		Pass
Rn = C C1 D l	kips	113.0	112.5	-0.48		Pass
Available strength	kips	84.80	84.34	-0.54		Pass

II.A-26A · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available strength	kips	56.50	56.23	-0.48		Pass

II.A-26B: Eccentric weld group, IC method, load at 75 degrees (Table 8-8)

Source: AISC Design Examples v16.0, Example II.A-26, pp. IIA-262. Calculation: Eccentric weld group.

II.A-26B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.450	3.458	+0.24		Pass
Rn = C C1 D l	kips	207.0	207.5	+0.24		Pass
Available strength	kips	155.0	155.6	+0.40		Pass

II.A-26B · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available strength	kips	104.0	103.7	-0.24		Pass

II.A-27: Eccentric weld group, elastic method

Source: AISC Design Examples v16.0, Example II.A-27, pp. IIA-263 to IIA-265. Calculation: Eccentric weld group.

II.A-27 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ix		333.0	333.3	+0.10		Pass
Iy		52.10	52.08	-0.03		Pass
Ip		385.0	385.4	+0.11		Pass
r per unit load		0.177	0.176	-0.29		Pass
Available strength	kips	47.20	47.33	+0.27		Pass

II.A-27 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Available strength	kips	31.50	31.55	+0.16		Pass

II.A-2A: Double-angle welds, Table 8-4, k = 0, a = 0.170

Source: AISC Design Examples v16.0, Example II.A-2A, pp. IIA-49. Calculation: Eccentric weld group.

II.A-2A · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Manual table C		3.610	3.604	-0.16		Pass
C		3.610	3.613	+0.07		Pass

II.A-2B: Double-angle welds at 30 degrees, Table 8-8, k = 0.190

Source: AISC Design Examples v16.0, Example II.A-2B, pp. IIA-56. Calculation: Eccentric weld group.

II.A-2B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
x-bar		0.027	0.026	-3.06		Deviation AISC-XBAR-INTERP
AISC-XBAR-INTERP: the example interpolates x-bar in the table; the exact centroid is 2 to 3 % less						
a		0.214	0.215	+0.61		Pass
Manual table C		2.690	2.689	-0.05		Pass
C		2.690	2.689	-0.05		Pass

II.A-10: Skewed bent plate welds, Table 8-8, k = 0.294

Source: AISC Design Examples v16.0, Example II.A-10, pp. IIA-117. Calculation: Eccentric weld group.

II.A-10 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
x-bar l	in.	0.462	0.463	+0.21		Pass
a		0.372	0.372	+0.00		Pass
C		2.520	2.517	-0.13		Pass
Required size (sixteenths)		3.110	3.117	+0.21		Pass

II.A-11B: Shear end plate welds at 30 degrees, Table 8-4, k = 0, a = 0

Source: AISC Design Examples v16.0, Example II.A-11B, pp. IIA-136. Calculation: Eccentric weld group.

II.A-11B · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		4.370	4.369	-0.03		Pass

II.A-21: Shear splice plate welds, Table 8-8, k = 0.292

Source: AISC Design Examples v16.0, Example II.A-21, pp. IIA-237 to IIA-238. Calculation: Eccentric weld group.

II.A-21 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
x-bar l	in.	0.646	0.645	-0.20		Pass
a		0.488	0.488	-0.01		Pass
C		2.150	2.146	-0.20		Pass
Required size (sixteenths)		2.480	2.486	+0.23		Pass

II.A-23: Bracket plate welds, Table 8-8, k = 0.167, one of two plates

Source: AISC Design Examples v16.0, Example II.A-23, pp. IIA-252 to IIA-253. Calculation: Eccentric weld group.

II.A-23 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		1.460	1.460	+0.02		Pass
Required size (sixteenths)		1.370	1.370	-0.03		Pass

II.A-29: Single-angle welds, Table 8-10, k = 0.348

Source: AISC Design Examples v16.0, Example II.A-29, pp. IIA-288 to IIA-289. Calculation: Eccentric weld group.

II.A-29 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
x-bar		0.046	0.045	-1.58		Deviation AISC-XBAR-INTERP
AISC-XBAR-INTERP: the example interpolates x-bar in the table; the exact centroid is 2 to 3 % less						
a		0.319	0.319	+0.15		Pass
Manual table C		2.190	2.195	+0.24		Pass
C		2.190	2.197	+0.33		Pass
Available strength	kips	56.70	56.85	+0.27		Pass

II.C-1: Truss support welds, Table 8-8, a = 0.644, one of two welds

Source: AISC Design Examples v16.0, Example II.C-1, pp. IIC-13 to IIC-14. Calculation: Eccentric weld group.

II.C-1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
x-bar l	in.	0.443	0.443	+0.08		Pass
a		0.644	0.644	-0.03		Pass
C		1.500	1.495	-0.33		Pass
Required size (sixteenths)		3.140	3.151	+0.36		Pass

Table 8-4 0 k0.5 a0.2: Table 8-4: 0 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-4, pp. 8-71 (PDF page 985). Calculation: Eccentric weld group.

Table 8-4 0 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.460	3.455	-0.14		Pass

Table 8-4 0 k0.5 a1.0: Table 8-4: 0 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-4, pp. 8-71 (PDF page 985). Calculation: Eccentric weld group.

Table 8-4 0 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		1.490	1.496	+0.42		Pass

Table 8-4 0 k1.0 a0.2: Table 8-4: 0 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-4, pp. 8-71 (PDF page 985). Calculation: Eccentric weld group.

Table 8-4 0 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.380	3.370	-0.30		Pass

Table 8-4 0 k1.0 a1.0: Table 8-4: 0 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-4, pp. 8-71 (PDF page 985). Calculation: Eccentric weld group.

Table 8-4 0 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		1.770	1.769	-0.08		Pass

Table 8-4 45 k0.5 a0.2: Table 8-4: 45 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-4, pp. 8-74 (PDF page 988). Calculation: Eccentric weld group.

Table 8-4 45 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		4.030	4.040	+0.24		Pass

Table 8-4 45 k0.5 a1.0: Table 8-4: 45 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-4, pp. 8-74 (PDF page 988). Calculation: Eccentric weld group.

Table 8-4 45 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		1.950	1.956	+0.31		Pass

Table 8-4 45 k1.0 a0.2: Table 8-4: 45 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-4, pp. 8-74 (PDF page 988). Calculation: Eccentric weld group.

Table 8-4 45 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		4.260	4.256	-0.09		Pass

Table 8-4 45 k1.0 a1.0: Table 8-4: 45 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-4, pp. 8-74 (PDF page 988). Calculation: Eccentric weld group.

Table 8-4 45 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		2.360	2.358	-0.09		Pass

Table 8-4 75 k0.5 a0.2: Table 8-4: 75 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-4, pp. 8-76 (PDF page 990). Calculation: Eccentric weld group.

Table 8-4 75 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		5.250	5.254	+0.08		Pass

Table 8-4 75 k0.5 a1.0: Table 8-4: 75 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-4, pp. 8-76 (PDF page 990). Calculation: Eccentric weld group.

Table 8-4 75 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.650	3.662	+0.32		Pass

Table 8-4 75 k1.0 a0.2: Table 8-4: 75 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-4, pp. 8-76 (PDF page 990). Calculation: Eccentric weld group.

Table 8-4 75 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		5.420	5.424	+0.08		Pass

Table 8-4 75 k1.0 a1.0: Table 8-4: 75 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-4, pp. 8-76 (PDF page 990). Calculation: Eccentric weld group.

Table 8-4 75 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		4.490	4.499	+0.20		Pass

Table 8-5 0 k0.5 a0.2: Table 8-5: 0 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-5, pp. 8-77 (PDF page 991). Calculation: Eccentric weld group.

Table 8-5 0 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		4.200	4.207	+0.18		Pass

Table 8-5 0 k0.5 a1.0: Table 8-5: 0 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-5, pp. 8-77 (PDF page 991). Calculation: Eccentric weld group.

Table 8-5 0 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		1.540	1.544	+0.25		Pass

Table 8-5 0 k1.0 a0.2: Table 8-5: 0 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-5, pp. 8-77 (PDF page 991). Calculation: Eccentric weld group.

Table 8-5 0 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		4.970	4.973	+0.05		Pass

Table 8-5 0 k1.0 a1.0: Table 8-5: 0 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-5, pp. 8-77 (PDF page 991). Calculation: Eccentric weld group.

Table 8-5 0 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		2.120	2.123	+0.12		Pass

Table 8-5 45 k0.5 a0.2: Table 8-5: 45 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-5, pp. 8-80 (PDF page 994). Calculation: Eccentric weld group.

Table 8-5 45 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		4.030	4.040	+0.24		Pass

Table 8-5 45 k0.5 a1.0: Table 8-5: 45 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-5, pp. 8-80 (PDF page 994). Calculation: Eccentric weld group.

Table 8-5 45 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		1.950	1.956	+0.31		Pass

Table 8-5 45 k1.0 a0.2: Table 8-5: 45 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-5, pp. 8-80 (PDF page 994). Calculation: Eccentric weld group.

Table 8-5 45 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		4.260	4.256	-0.09		Pass

Table 8-5 45 k1.0 a1.0: Table 8-5: 45 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-5, pp. 8-80 (PDF page 994). Calculation: Eccentric weld group.

Table 8-5 45 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		2.360	2.358	-0.09		Pass

Table 8-5 75 k0.5 a0.2: Table 8-5: 75 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-5, pp. 8-82 (PDF page 996). Calculation: Eccentric weld group.

Table 8-5 75 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.830	3.827	-0.08		Pass

Table 8-5 75 k0.5 a1.0: Table 8-5: 75 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-5, pp. 8-82 (PDF page 996). Calculation: Eccentric weld group.

Table 8-5 75 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.250	3.259	+0.28		Pass

Table 8-5 75 k1.0 a0.2: Table 8-5: 75 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-5, pp. 8-82 (PDF page 996). Calculation: Eccentric weld group.

Table 8-5 75 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.800	3.791	-0.24		Pass

Table 8-5 75 k1.0 a1.0: Table 8-5: 75 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-5, pp. 8-82 (PDF page 996). Calculation: Eccentric weld group.

Table 8-5 75 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.280	3.282	+0.06		Pass

Table 8-6 0 k0.5 a0.2: Table 8-6: 0 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-6, pp. 8-83 (PDF page 997). Calculation: Eccentric weld group.

Table 8-6 0 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		5.660	5.675	+0.26		Pass

Table 8-6 0 k0.5 a1.0: Table 8-6: 0 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-6, pp. 8-83 (PDF page 997). Calculation: Eccentric weld group.

Table 8-6 0 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		2.450	2.451	+0.06		Pass

Table 8-6 0 k1.0 a0.2: Table 8-6: 0 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-6, pp. 8-83 (PDF page 997). Calculation: Eccentric weld group.

Table 8-6 0 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		8.030	8.038	+0.10		Pass

Table 8-6 0 k1.0 a1.0: Table 8-6: 0 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-6, pp. 8-83 (PDF page 997). Calculation: Eccentric weld group.

Table 8-6 0 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.940	3.952	+0.29		Pass

Table 8-6 45 k0.5 a0.2: Table 8-6: 45 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-6, pp. 8-86 (PDF page 1000). Calculation: Eccentric weld group.

Table 8-6 45 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		6.330	6.342	+0.19		Pass

Table 8-6 45 k0.5 a1.0: Table 8-6: 45 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-6, pp. 8-86 (PDF page 1000). Calculation: Eccentric weld group.

Table 8-6 45 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.080	3.083	+0.11		Pass

Table 8-6 45 k1.0 a0.2: Table 8-6: 45 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-6, pp. 8-86 (PDF page 1000). Calculation: Eccentric weld group.

Table 8-6 45 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		8.850	8.849	-0.01		Pass

Table 8-6 45 k1.0 a1.0: Table 8-6: 45 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-6, pp. 8-86 (PDF page 1000). Calculation: Eccentric weld group.

Table 8-6 45 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		5.010	5.015	+0.10		Pass

Table 8-6 75 k0.5 a0.2: Table 8-6: 75 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-6, pp. 8-88 (PDF page 1002). Calculation: Eccentric weld group.

Table 8-6 75 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		7.010	7.018	+0.12		Pass

Table 8-6 75 k0.5 a1.0: Table 8-6: 75 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-6, pp. 8-88 (PDF page 1002). Calculation: Eccentric weld group.

Table 8-6 75 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		5.170	5.177	+0.14		Pass

Table 8-6 75 k1.0 a0.2: Table 8-6: 75 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-6, pp. 8-88 (PDF page 1002). Calculation: Eccentric weld group.

Table 8-6 75 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		9.130	9.134	+0.04		Pass

Table 8-6 75 k1.0 a1.0: Table 8-6: 75 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-6, pp. 8-88 (PDF page 1002). Calculation: Eccentric weld group.

Table 8-6 75 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		7.630	7.646	+0.21		Pass

Table 8-7 0 k0.5 a0.2: Table 8-7: 0 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-7, pp. 8-89 (PDF page 1003). Calculation: Eccentric weld group.

Table 8-7 0 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		5.610	5.624	+0.26		Pass

Table 8-7 0 k0.5 a1.0: Table 8-7: 0 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-7, pp. 8-89 (PDF page 1003). Calculation: Eccentric weld group.

Table 8-7 0 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		2.330	2.334	+0.18		Pass

Table 8-7 0 k1.0 a0.2: Table 8-7: 0 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-7, pp. 8-89 (PDF page 1003). Calculation: Eccentric weld group.

Table 8-7 0 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		8.030	8.038	+0.10		Pass

Table 8-7 0 k1.0 a1.0: Table 8-7: 0 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-7, pp. 8-89 (PDF page 1003). Calculation: Eccentric weld group.

Table 8-7 0 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.940	3.952	+0.29		Pass

Table 8-7 45 k0.5 a0.2: Table 8-7: 45 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-7, pp. 8-92 (PDF page 1006). Calculation: Eccentric weld group.

Table 8-7 45 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		6.330	6.342	+0.19		Pass

Table 8-7 45 k0.5 a1.0: Table 8-7: 45 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-7, pp. 8-92 (PDF page 1006). Calculation: Eccentric weld group.

Table 8-7 45 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.080	3.083	+0.11		Pass

Table 8-7 45 k1.0 a0.2: Table 8-7: 45 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-7, pp. 8-92 (PDF page 1006). Calculation: Eccentric weld group.

Table 8-7 45 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		8.850	8.849	-0.01		Pass

Table 8-7 45 k1.0 a1.0: Table 8-7: 45 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-7, pp. 8-92 (PDF page 1006). Calculation: Eccentric weld group.

Table 8-7 45 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		5.010	5.015	+0.10		Pass

Table 8-7 75 k0.5 a0.2: Table 8-7: 75 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-7, pp. 8-94 (PDF page 1008). Calculation: Eccentric weld group.

Table 8-7 75 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		6.440	6.442	+0.04		Pass

Table 8-7 75 k0.5 a1.0: Table 8-7: 75 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-7, pp. 8-94 (PDF page 1008). Calculation: Eccentric weld group.

Table 8-7 75 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		5.380	5.387	+0.13		Pass

Table 8-7 75 k1.0 a0.2: Table 8-7: 75 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-7, pp. 8-94 (PDF page 1008). Calculation: Eccentric weld group.

Table 8-7 75 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		9.130	9.134	+0.04		Pass

Table 8-7 75 k1.0 a1.0: Table 8-7: 75 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-7, pp. 8-94 (PDF page 1008). Calculation: Eccentric weld group.

Table 8-7 75 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		7.630	7.646	+0.21		Pass

Table 8-8 0 k0.5 a0.2: Table 8-8: 0 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-8, pp. 8-95 (PDF page 1009). Calculation: Eccentric weld group.

Table 8-8 0 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		4.110	4.110	+0.01		Pass

Table 8-8 0 k0.5 a1.0: Table 8-8: 0 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-8, pp. 8-95 (PDF page 1009). Calculation: Eccentric weld group.

Table 8-8 0 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		1.670	1.671	+0.04		Pass

Table 8-8 0 k1.0 a0.2: Table 8-8: 0 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-8, pp. 8-95 (PDF page 1009). Calculation: Eccentric weld group.

Table 8-8 0 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		6.680	6.684	+0.06		Pass

Table 8-8 0 k1.0 a1.0: Table 8-8: 0 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-8, pp. 8-95 (PDF page 1009). Calculation: Eccentric weld group.

Table 8-8 0 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.010	3.012	+0.06		Pass

Table 8-8 45 k0.5 a0.2: Table 8-8: 45 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-8, pp. 8-98 (PDF page 1012). Calculation: Eccentric weld group.

Table 8-8 45 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		4.370	4.372	+0.05		Pass

Table 8-8 45 k0.5 a1.0: Table 8-8: 45 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-8, pp. 8-98 (PDF page 1012). Calculation: Eccentric weld group.

Table 8-8 45 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		2.080	2.081	+0.07		Pass

Table 8-8 45 k1.0 a0.2: Table 8-8: 45 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-8, pp. 8-98 (PDF page 1012). Calculation: Eccentric weld group.

Table 8-8 45 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		6.840	6.844	+0.06		Pass

Table 8-8 45 k1.0 a1.0: Table 8-8: 45 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-8, pp. 8-98 (PDF page 1012). Calculation: Eccentric weld group.

Table 8-8 45 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.750	3.756	+0.16		Pass

Table 8-8 75 k0.5 a0.2: Table 8-8: 75 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-8, pp. 8-100 (PDF page 1014). Calculation: Eccentric weld group.

Table 8-8 75 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		4.440	4.447	+0.16		Pass

Table 8-8 75 k0.5 a1.0: Table 8-8: 75 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-8, pp. 8-100 (PDF page 1014). Calculation: Eccentric weld group.

Table 8-8 75 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.300	3.309	+0.27		Pass

Table 8-8 75 k1.0 a0.2: Table 8-8: 75 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-8, pp. 8-100 (PDF page 1014). Calculation: Eccentric weld group.

Table 8-8 75 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		6.530	6.540	+0.15		Pass

Table 8-8 75 k1.0 a1.0: Table 8-8: 75 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-8, pp. 8-100 (PDF page 1014). Calculation: Eccentric weld group.

Table 8-8 75 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		5.500	5.516	+0.28		Pass

Table 8-9 0 k0.5 a0.2: Table 8-9: 0 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-9, pp. 8-101 (PDF page 1015). Calculation: Eccentric weld group.

Table 8-9 0 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.990	3.998	+0.21		Pass

Table 8-9 0 k0.5 a1.0: Table 8-9: 0 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-9, pp. 8-101 (PDF page 1015). Calculation: Eccentric weld group.

Table 8-9 0 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		1.640	1.641	+0.06		Pass

Table 8-9 0 k1.0 a0.2: Table 8-9: 0 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-9, pp. 8-101 (PDF page 1015). Calculation: Eccentric weld group.

Table 8-9 0 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		6.300	6.305	+0.07		Pass

Table 8-9 0 k1.0 a1.0: Table 8-9: 0 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-9, pp. 8-101 (PDF page 1015). Calculation: Eccentric weld group.

Table 8-9 0 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		2.970	2.971	+0.03		Pass

Table 8-9 45 k0.5 a0.2: Table 8-9: 45 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-9, pp. 8-104 (PDF page 1018). Calculation: Eccentric weld group.

Table 8-9 45 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.990	3.991	+0.03		Pass

Table 8-9 45 k0.5 a1.0: Table 8-9: 45 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-9, pp. 8-104 (PDF page 1018). Calculation: Eccentric weld group.

Table 8-9 45 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		1.980	1.983	+0.15		Pass

Table 8-9 45 k1.0 a0.2: Table 8-9: 45 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-9, pp. 8-104 (PDF page 1018). Calculation: Eccentric weld group.

Table 8-9 45 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		6.240	6.247	+0.11		Pass

Table 8-9 45 k1.0 a1.0: Table 8-9: 45 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-9, pp. 8-104 (PDF page 1018). Calculation: Eccentric weld group.

Table 8-9 45 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.540	3.548	+0.22		Pass

Table 8-9 75 k0.5 a0.2: Table 8-9: 75 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-9, pp. 8-106 (PDF page 1020). Calculation: Eccentric weld group.

Table 8-9 75 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		4.240	4.241	+0.02		Pass

Table 8-9 75 k0.5 a1.0: Table 8-9: 75 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-9, pp. 8-106 (PDF page 1020). Calculation: Eccentric weld group.

Table 8-9 75 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.180	3.193	+0.40		Pass

Table 8-9 75 k1.0 a0.2: Table 8-9: 75 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-9, pp. 8-106 (PDF page 1020). Calculation: Eccentric weld group.

Table 8-9 75 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		6.280	6.282	+0.04		Pass

Table 8-9 75 k1.0 a1.0: Table 8-9: 75 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-9, pp. 8-106 (PDF page 1020). Calculation: Eccentric weld group.

Table 8-9 75 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		5.240	5.249	+0.17		Pass

Table 8-10 0 k0.5 a0.2: Table 8-10: 0 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-10, pp. 8-107 (PDF page 1021). Calculation: Eccentric weld group.

Table 8-10 0 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		2.870	2.879	+0.31		Pass

Table 8-10 0 k0.5 a1.0: Table 8-10: 0 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-10, pp. 8-107 (PDF page 1021). Calculation: Eccentric weld group.

Table 8-10 0 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		1.090	1.096	+0.57		Pass

Table 8-10 0 k1.0 a0.2: Table 8-10: 0 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-10, pp. 8-107 (PDF page 1021). Calculation: Eccentric weld group.

Table 8-10 0 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		4.110	4.113	+0.08		Pass

Table 8-10 0 k1.0 a1.0: Table 8-10: 0 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-10, pp. 8-107 (PDF page 1021). Calculation: Eccentric weld group.

Table 8-10 0 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		1.760	1.769	+0.51		Pass

Table 8-10 45 k0.5 a0.2: Table 8-10: 45 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-10, pp. 8-110 (PDF page 1024). Calculation: Eccentric weld group.

Table 8-10 45 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.420	3.427	+0.21		Pass

Table 8-10 45 k0.5 a1.0: Table 8-10: 45 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-10, pp. 8-110 (PDF page 1024). Calculation: Eccentric weld group.

Table 8-10 45 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		1.460	1.461	+0.05		Pass

Table 8-10 45 k1.0 a0.2: Table 8-10: 45 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-10, pp. 8-110 (PDF page 1024). Calculation: Eccentric weld group.

Table 8-10 45 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		4.840	4.841	+0.02		Pass

Table 8-10 45 k1.0 a1.0: Table 8-10: 45 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-10, pp. 8-110 (PDF page 1024). Calculation: Eccentric weld group.

Table 8-10 45 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		2.420	2.424	+0.17		Pass

Table 8-10 75 k0.5 a0.2: Table 8-10: 75 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-10, pp. 8-112 (PDF page 1026). Calculation: Eccentric weld group.

Table 8-10 75 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.680	3.681	+0.02		Pass

Table 8-10 75 k0.5 a1.0: Table 8-10: 75 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-10, pp. 8-112 (PDF page 1026). Calculation: Eccentric weld group.

Table 8-10 75 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		2.650	2.658	+0.30		Pass

Table 8-10 75 k1.0 a0.2: Table 8-10: 75 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-10, pp. 8-112 (PDF page 1026). Calculation: Eccentric weld group.

Table 8-10 75 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		4.680	4.679	-0.03		Pass

Table 8-10 75 k1.0 a1.0: Table 8-10: 75 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-10, pp. 8-112 (PDF page 1026). Calculation: Eccentric weld group.

Table 8-10 75 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		4.020	4.033	+0.32		Pass

Table 8-10a 15 k0.5 a0.2: Table 8-10a: 15 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-10a, pp. 8-113 (PDF page 1027). Calculation: Eccentric weld group.

Table 8-10a 15 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		2.820	2.823	+0.09		Pass

Table 8-10a 15 k0.5 a1.0: Table 8-10a: 15 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-10a, pp. 8-113 (PDF page 1027). Calculation: Eccentric weld group.

Table 8-10a 15 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		1.120	1.128	+0.71		Pass

Table 8-10a 15 k1.0 a0.2: Table 8-10a: 15 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-10a, pp. 8-113 (PDF page 1027). Calculation: Eccentric weld group.

Table 8-10a 15 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		4.000	4.008	+0.21		Pass

Table 8-10a 15 k1.0 a1.0: Table 8-10a: 15 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-10a, pp. 8-113 (PDF page 1027). Calculation: Eccentric weld group.

Table 8-10a 15 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		1.780	1.789	+0.51		Pass

Table 8-10a 45 k0.5 a0.2: Table 8-10a: 45 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-10a, pp. 8-115 (PDF page 1029). Calculation: Eccentric weld group.

Table 8-10a 45 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		2.950	2.955	+0.16		Pass

Table 8-10a 45 k0.5 a1.0: Table 8-10a: 45 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-10a, pp. 8-115 (PDF page 1029). Calculation: Eccentric weld group.

Table 8-10a 45 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		1.420	1.426	+0.42		Pass

Table 8-10a 45 k1.0 a0.2: Table 8-10a: 45 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-10a, pp. 8-115 (PDF page 1029). Calculation: Eccentric weld group.

Table 8-10a 45 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		4.080	4.084	+0.09		Pass

Table 8-10a 45 k1.0 a1.0: Table 8-10a: 45 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-10a, pp. 8-115 (PDF page 1029). Calculation: Eccentric weld group.

Table 8-10a 45 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		2.170	2.174	+0.20		Pass

Table 8-10a 75 k0.5 a0.2: Table 8-10a: 75 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-10a, pp. 8-117 (PDF page 1031). Calculation: Eccentric weld group.

Table 8-10a 75 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.220	3.224	+0.12		Pass

Table 8-10a 75 k0.5 a1.0: Table 8-10a: 75 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-10a, pp. 8-117 (PDF page 1031). Calculation: Eccentric weld group.

Table 8-10a 75 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		2.350	2.355	+0.22		Pass

Table 8-10a 75 k1.0 a0.2: Table 8-10a: 75 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-10a, pp. 8-117 (PDF page 1031). Calculation: Eccentric weld group.

Table 8-10a 75 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		4.460	4.461	+0.03		Pass

Table 8-10a 75 k1.0 a1.0: Table 8-10a: 75 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-10a, pp. 8-117 (PDF page 1031). Calculation: Eccentric weld group.

Table 8-10a 75 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.470	3.477	+0.21		Pass

Table 8-11 0 k0.5 a0.2: Table 8-11: 0 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-11, pp. 8-118 (PDF page 1032). Calculation: Eccentric weld group.

Table 8-11 0 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		2.780	2.788	+0.28		Pass

Table 8-11 0 k0.5 a1.0: Table 8-11: 0 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-11, pp. 8-118 (PDF page 1032). Calculation: Eccentric weld group.

Table 8-11 0 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		1.060	1.060	-0.02		Pass

Table 8-11 0 k1.0 a0.2: Table 8-11: 0 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-11, pp. 8-118 (PDF page 1032). Calculation: Eccentric weld group.

Table 8-11 0 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.760	3.761	+0.02		Pass

Table 8-11 0 k1.0 a1.0: Table 8-11: 0 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-11, pp. 8-118 (PDF page 1032). Calculation: Eccentric weld group.

Table 8-11 0 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		1.690	1.699	+0.53		Pass

Table 8-11 45 k0.5 a0.2: Table 8-11: 45 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-11, pp. 8-121 (PDF page 1035). Calculation: Eccentric weld group.

Table 8-11 45 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		2.940	2.943	+0.09		Pass

Table 8-11 45 k0.5 a1.0: Table 8-11: 45 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-11, pp. 8-121 (PDF page 1035). Calculation: Eccentric weld group.

Table 8-11 45 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		1.430	1.439	+0.63		Pass

Table 8-11 45 k1.0 a0.2: Table 8-11: 45 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-11, pp. 8-121 (PDF page 1035). Calculation: Eccentric weld group.

Table 8-11 45 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		4.150	4.146	-0.09		Pass

Table 8-11 45 k1.0 a1.0: Table 8-11: 45 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-11, pp. 8-121 (PDF page 1035). Calculation: Eccentric weld group.

Table 8-11 45 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		2.280	2.288	+0.33		Pass

Table 8-11 75 k0.5 a0.2: Table 8-11: 75 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-11, pp. 8-123 (PDF page 1037). Calculation: Eccentric weld group.

Table 8-11 75 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.190	3.202	+0.36		Pass

Table 8-11 75 k0.5 a1.0: Table 8-11: 75 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-11, pp. 8-123 (PDF page 1037). Calculation: Eccentric weld group.

Table 8-11 75 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		2.360	2.365	+0.19		Pass

Table 8-11 75 k1.0 a0.2: Table 8-11: 75 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-11, pp. 8-123 (PDF page 1037). Calculation: Eccentric weld group.

Table 8-11 75 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		4.300	4.307	+0.17		Pass

Table 8-11 75 k1.0 a1.0: Table 8-11: 75 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-11, pp. 8-123 (PDF page 1037). Calculation: Eccentric weld group.

Table 8-11 75 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.520	3.526	+0.16		Pass

Table 8-11a 15 k0.5 a0.2: Table 8-11a: 15 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-11a, pp. 8-124 (PDF page 1038). Calculation: Eccentric weld group.

Table 8-11a 15 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		2.790	2.797	+0.24		Pass

Table 8-11a 15 k0.5 a1.0: Table 8-11a: 15 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-11a, pp. 8-124 (PDF page 1038). Calculation: Eccentric weld group.

Table 8-11a 15 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		1.080	1.082	+0.18		Pass

Table 8-11a 15 k1.0 a0.2: Table 8-11a: 15 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-11a, pp. 8-124 (PDF page 1038). Calculation: Eccentric weld group.

Table 8-11a 15 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.760	3.761	+0.03		Pass

Table 8-11a 15 k1.0 a1.0: Table 8-11a: 15 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-11a, pp. 8-124 (PDF page 1038). Calculation: Eccentric weld group.

Table 8-11a 15 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		1.730	1.734	+0.21		Pass

Table 8-11a 45 k0.5 a0.2: Table 8-11a: 45 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-11a, pp. 8-126 (PDF page 1040). Calculation: Eccentric weld group.

Table 8-11a 45 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		2.980	2.982	+0.08		Pass

Table 8-11a 45 k0.5 a1.0: Table 8-11a: 45 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-11a, pp. 8-126 (PDF page 1040). Calculation: Eccentric weld group.

Table 8-11a 45 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		1.380	1.380	+0.01		Pass

Table 8-11a 45 k1.0 a0.2: Table 8-11a: 45 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-11a, pp. 8-126 (PDF page 1040). Calculation: Eccentric weld group.

Table 8-11a 45 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		4.080	4.084	+0.09		Pass

Table 8-11a 45 k1.0 a1.0: Table 8-11a: 45 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-11a, pp. 8-126 (PDF page 1040). Calculation: Eccentric weld group.

Table 8-11a 45 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		2.170	2.174	+0.20		Pass

Table 8-11a 75 k0.5 a0.2: Table 8-11a: 75 degrees, k = 0.5, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-11a, pp. 8-128 (PDF page 1042). Calculation: Eccentric weld group.

Table 8-11a 75 k0.5 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.630	3.626	-0.11		Pass

Table 8-11a 75 k0.5 a1.0: Table 8-11a: 75 degrees, k = 0.5, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-11a, pp. 8-128 (PDF page 1042). Calculation: Eccentric weld group.

Table 8-11a 75 k0.5 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		2.520	2.524	+0.15		Pass

Table 8-11a 75 k1.0 a0.2: Table 8-11a: 75 degrees, k = 1.0, a = 0.2

Source: AISC Steel Construction Manual, 16th Ed., Table 8-11a, pp. 8-128 (PDF page 1042). Calculation: Eccentric weld group.

Table 8-11a 75 k1.0 a0.2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		4.640	4.654	+0.29		Pass

Table 8-11a 75 k1.0 a1.0: Table 8-11a: 75 degrees, k = 1.0, a = 1.0

Source: AISC Steel Construction Manual, 16th Ed., Table 8-11a, pp. 8-128 (PDF page 1042). Calculation: Eccentric weld group.

Table 8-11a 75 k1.0 a1.0 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		3.730	3.735	+0.13		Pass

Table 8-11a 75 k1.2 a0.1 (deviation): Table 8-11a: 75 degrees, k = 1.2, a = 0.1

Source: AISC Steel Construction Manual, 16th Ed., Table 8-11a, pp. 8-128 (PDF page 1042). Calculation: Eccentric weld group.

Table 8-11a 75 k1.2 a0.1 (deviation) · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		5.030	5.112	+1.63		Deviation AISC8-11A-75
AISC8-11A-75: printed value equals the a = 0 row; the method gives more						

Table 8-10 0 k2.0 a0.1 (deviation): Table 8-10: 0 degrees, k = 2.0, a = 0.1

Source: AISC Steel Construction Manual, 16th Ed., Table 8-10, pp. 8-107 (PDF page 1021). Calculation: Eccentric weld group.

Table 8-10 0 k2.0 a0.1 (deviation) · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		7.100	7.194	+1.32		Deviation AISC8-10-0
AISC8-10-0: one solution at 7.19 against the printed 7.10, not explained						

Table 8-4 0 k2.0 a2.4 (deviation): Table 8-4: 0 degrees, k = 2.0, a = 2.4

Source: AISC Steel Construction Manual, 16th Ed., Table 8-4, pp. 8-71 (PDF page 985). Calculation: Eccentric weld group.

Table 8-4 0 k2.0 a2.4 (deviation) · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
C		1.240	1.227	-1.09		Deviation AISC8-4-K2
AISC8-4-K2: printed value 1 % above the method at the edge of the table						

WE-F1-0: Figure 28.3-1, Load Case 1, flat roof

Source: ASCE 7-22, Figure 28.3-1, pp. p. 356. Calculation: Wind loads, envelope procedure.

WE-F1-0 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Zone 1		0.400	0.400	+0.00		Pass
Zone 2		-0.690	-0.690	-0.00		Pass
Zone 3		-0.370	-0.370	-0.00		Pass
Zone 4		-0.290	-0.290	-0.00		Pass
Zone 1E		0.610	0.610	+0.00		Pass
Zone 2E		-1.070	-1.070	-0.00		Pass
Zone 3E		-0.530	-0.530	-0.00		Pass
Zone 4E		-0.430	-0.430	-0.00		Pass

WE-F1-20: Figure 28.3-1, Load Case 1, 20 degrees

Source: ASCE 7-22, Figure 28.3-1, pp. p. 356. Calculation: Wind loads, envelope procedure.

WE-F1-20 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Zone 1		0.530	0.530	+0.00		Pass
Zone 2		-0.690	-0.690	-0.00		Pass
Zone 3		-0.480	-0.480	-0.00		Pass
Zone 4		-0.430	-0.430	-0.00		Pass
Zone 1E		0.800	0.800	+0.00		Pass
Zone 2E		-1.070	-1.070	-0.00		Pass
Zone 3E		-0.690	-0.690	-0.00		Pass
Zone 4E		-0.640	-0.640	-0.00		Pass

WE-F1-30: Figure 28.3-1, Load Case 1, 30 to 45 degrees

Source: ASCE 7-22, Figure 28.3-1, pp. p. 356. Calculation: Wind loads, envelope procedure.

WE-F1-30 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Zone 1		0.560	0.560	+0.00		Pass
Zone 2		0.210	0.210	+0.00		Pass
Zone 3		-0.430	-0.430	-0.00		Pass
Zone 4		-0.370	-0.370	-0.00		Pass
Zone 1E		0.690	0.690	+0.00		Pass
Zone 2E		0.270	0.270	+0.00		Pass
Zone 3E		-0.530	-0.530	-0.00		Pass
Zone 4E		-0.480	-0.480	-0.00		Pass

WE-F1-LC2: Figure 28.3-1, Load Case 2

Source: ASCE 7-22, Figure 28.3-1, pp. p. 356. Calculation: Wind loads, envelope procedure.

WE-F1-LC2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Zone 1		-0.450	-0.450	-0.00		Pass
Zone 2		-0.690	-0.690	-0.00		Pass
Zone 3		-0.370	-0.370	-0.00		Pass
Zone 4		-0.450	-0.450	-0.00		Pass
Zone 5		0.400	0.400	+0.00		Pass
Zone 6		-0.290	-0.290	-0.00		Pass
Zone 1E		-0.480	-0.480	-0.00		Pass
Zone 2E		-1.070	-1.070	-0.00		Pass
Zone 3E		-0.530	-0.530	-0.00		Pass
Zone 4E		-0.480	-0.480	-0.00		Pass
Zone 5E		0.610	0.610	+0.00		Pass
Zone 6E		-0.430	-0.430	-0.00		Pass

WE-F2-0: Figure 28.3-2, Load Cases 3 and 4, flat roof

Source: ASCE 7-22, Figure 28.3-2, pp. p. 357. Calculation: Wind loads, envelope procedure.

WE-F2-0 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Zone 1T		0.100	0.100	+0.00		Pass
Zone 2T		-0.170	-0.170	-0.00		Pass
Zone 3T		-0.090	-0.090	-0.00		Pass
Zone 4T		-0.070	-0.070	-0.00		Pass
Zone 5T		0.100	0.100	+0.00		Pass
Zone 6T		-0.070	-0.070	-0.00		Pass

WE-F2-30: Figure 28.3-2, Load Case 3, 30 degrees

Source: ASCE 7-22, Figure 28.3-2, pp. p. 357. Calculation: Wind loads, envelope procedure.

WE-F2-30 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Zone 1T		0.140	0.140	+0.00		Pass
Zone 2T		0.050	0.050	+0.00		Pass
Zone 3T		-0.110	-0.110	-0.00		Pass
Zone 4T		-0.090	-0.090	-0.00		Pass

C26.11-1 · Gust-effect factor: Gust-effect factors of a 600 ft building, n1 = 0.2 Hz, β = 1 %

Source: ASCE/SEI 7-22 Commentary, Tables C26.11-1 and C26.11-2, pp. PDF p. 943 (printed 882). Calculation: Gust-effect factor.

C26.11-1 · Gust-effect factor · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Equivalent height z̄ = 0.6h	ft	360.0	360.0	+0.00		Pass
Turbulence intensity Iz		0.201	0.201	+0.22		Pass
Integral length scale Lz	ft	710.0	709.7	-0.04		Pass
Background response Q²		0.616	0.616	-0.07		Pass
Rigid G (Eq. 26.11-6)		0.860	0.818	-4.91		Deviation C26.11-1-G
C26.11-1-G: the table's 0.860 does not follow from its own Iz and Q² by Eq. 26.11-6, which gives 0.818						
Mean hourly speed V̄z (ft/s)		135.0	134.8	-0.14		Pass
Reduced frequency N1		1.053	1.053	-0.02		Pass
Rn		0.128	0.128	-0.16		Pass
ηh		4.094	4.094	+0.01		Pass
ηB		0.682	0.682	+0.06		Pass
ηL		2.285	2.285	-0.02		Pass
Rh		0.214	0.214	+0.20		Pass
RB		0.666	0.666	-0.01		Pass
RL		0.343	0.343	-0.03		Pass
Resonant response R²		1.261	1.261	+0.02		Pass
Resonant peak factor gR		3.787	3.787	-0.01		Pass
Flexible Gf (Eq. 26.11-10)		1.162	1.162	+0.01		Pass

C26.11-2: Along-wind response at the top of the same building

Source: ASCE/SEI 7-22 Commentary, Tables C26.11-1 and C26.11-2, pp. PDF p. 944 (printed 883). Calculation: Gust-effect factor.

C26.11-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Modal load parameter K		0.501	0.501	+0.02		Pass
Modal mass m1 (slug)		745,400	745,944	+0.07		Pass
3 s gust speed at $\bar{z}$ (ft/s)		195.0	194.8	-0.08		Pass
Peak displacement Xmax(h) = 1.76 ft	in.	21.12	21.08	-0.19		Pass
Mean speed at 76 mi/h (ft/s)		89.10	89.10	-0.00		Pass
Peak factor $g_{\dot{x}}$		3.790	3.787	-0.09		Pass
RMS acceleration 0.176 ft/s²	%g	0.547	0.392	-28.26		Deviation C26.11-2-SIGMA
C26.11-2-SIGMA: the table uses R = 1.123 of the 115 mph case; R at the 76 mph service speed gives about 0.126 ft/s²						
Peak acceleration 0.668 ft/s²	%g	2.076	1.486	-28.43		Deviation C26.11-2-SIGMA
C26.11-2-SIGMA: follows the RMS acceleration						

NA-STEEL: Steel moment frame, h = 300 ft: na = 22.2 / h^0.8

Source: Hand calculation (closed form, ASCE/SEI 7-22 26.11.3). Calculation: Gust-effect factor.

NA-STEEL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
na = 22.2 / 300^0.8	Hz	0.232	0.232	+0.00		Pass

NA-CONC: Concrete moment frame, h = 200 ft: na = 43.5 / h^0.9

Source: Hand calculation (closed form, ASCE/SEI 7-22 26.11.3). Calculation: Gust-effect factor.

NA-CONC · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
na = 43.5 / 200^0.9	Hz	0.369	0.369	-0.00		Pass

NA-OTHER: Other lateral system, h = 150 ft: na = 75 / h

Source: Hand calculation (closed form, ASCE/SEI 7-22 26.11.3). Calculation: Gust-effect factor.

NA-OTHER · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
na = 75 / 150	Hz	0.500	0.500	+0.00		Pass

W1: Flat-roof building, Exposure C: velocity pressure, MWFRS base shear, C&C

Source: Hand calculation (closed form). Calculation: Wind loads.

W1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Kh at 15 ft		0.851	0.851	+0.00		Pass
qh	psf	21.79	21.79	-0.00		Pass
Base shear, wind normal to the long side	kips	30.70	30.70	-0.00		Pass
Overturning moment, wind normal to the long side	kip-ft	230.2	230.2	+0.02		Pass
Base shear, wind on the end wall	kips	12.99	12.99	-0.02		Pass
C&C wall zone 4, A = 100 ft², positive	psf	17.06	17.06	-0.00		Pass
C&C wall zone 5, A = 10 ft², suction	psf	-26.67	-26.67	+0.00		Pass
C&C roof zone 3, A = 10 ft², suction	psf	-62.60	-62.60	+0.00		Pass
C&C roof zone 2, A = 50 ft², suction	psf	-39.07	-39.07	+0.01		Pass

W2-B: Kz, Exposure B at 33 ft

Source: Hand calculation (closed form). Calculation: Wind loads.

W2-B · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Kh		0.707	0.707	+0.01		Pass

W2-D: Kz, Exposure D at 60 ft

Source: Hand calculation (closed form). Calculation: Wind loads.

W2-D · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Kh		1.317	1.317	+0.00		Pass

W2-Ke: Ground elevation factor Ke at 5,000 ft

Source: Hand calculation (closed form). Calculation: Wind loads.

W2-Ke · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ke		0.834	0.834	+0.00		Pass
Kh		0.981	0.980	-0.00		Pass

W3: Topographic factor, 2-D escarpment

Source: Hand calculation (closed form). Calculation: Wind loads.

W3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Kzt at h		1.486	1.486	+0.00		Pass

W4: Gust-effect factor of a rigid building

Source: Hand calculation (closed form). Calculation: Wind loads.

W4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
G, wind normal to the long side		0.863	0.863	-0.00		Pass

W5: Fig. 27.3-1 roof and wall Cp, gable roof at 20°

Source: Hand calculation (closed form). Calculation: Wind loads.

W5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Windward roof Cp, negative case		-0.300	-0.300	-0.00		Pass
Windward roof Cp, positive case		0.200	0.200	+0.00		Pass
Leeward roof Cp		-0.600	-0.600	-0.00		Pass
Leeward wall Cp, L/B = 0.5		-0.500	-0.500	-0.00		Pass
Leeward wall Cp, L/B = 2		-0.300	-0.300	-0.00		Pass

T26.10-1-B: Table 26.10-1 velocity pressure exposure coefficients, Exposure B

Source: ASCE/SEI 7-22 Table 26.10-1, pp. p. 338. Calculation: Wind loads.

T26.10-1-B · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Kz at 15 ft table rounded to 2 decimals; the note 1 formula is used		0.570	0.573	+0.51		Pass
Kz at 30 ft table rounded to 2 decimals; the note 1 formula is used		0.700	0.689	-1.54		Pass
Kz at 60 ft table rounded to 2 decimals; the note 1 formula is used		0.830	0.829	-0.10		Pass
Kz at 100 ft table rounded to 2 decimals; the note 1 formula is used		0.950	0.950	+0.01		Pass
Kz at 200 ft table rounded to 2 decimals; the note 1 formula is used		1.140	1.143	+0.27		Pass
Kz at 500 ft (Kh) table rounded to 2 decimals; the note 1 formula is used		1.460	1.459	-0.04		Pass

T26.10-1-C: Table 26.10-1 velocity pressure exposure coefficients, Exposure C

Source: ASCE/SEI 7-22 Table 26.10-1, pp. p. 338. Calculation: Wind loads.

T26.10-1-C · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Kz at 15 ft table rounded to 2 decimals; the note 1 formula is used		0.850	0.851	+0.14		Pass
Kz at 30 ft table rounded to 2 decimals; the note 1 formula is used		0.980	0.980	+0.05		Pass
Kz at 60 ft table rounded to 2 decimals; the note 1 formula is used		1.130	1.129	-0.05		Pass
Kz at 100 ft table rounded to 2 decimals; the note 1 formula is used		1.260	1.254	-0.51		Pass
Kz at 200 ft table rounded to 2 decimals; the note 1 formula is used		1.440	1.444	+0.28		Pass
Kz at 500 ft (Kh) table rounded to 2 decimals; the note 1 formula is used		1.740	1.741	+0.06		Pass

T26.10-1-D: Table 26.10-1 velocity pressure exposure coefficients, Exposure D

Source: ASCE/SEI 7-22 Table 26.10-1, pp. p. 338. Calculation: Wind loads.

T26.10-1-D · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Kz at 15 ft table rounded to 2 decimals; the note 1 formula is used		1.030	1.035	+0.49		Pass
Kz at 30 ft table rounded to 2 decimals; the note 1 formula is used		1.160	1.168	+0.66		Pass
Kz at 60 ft table rounded to 2 decimals; the note 1 formula is used		1.310	1.317	+0.55		Pass
Kz at 100 ft table rounded to 2 decimals; the note 1 formula is used		1.430	1.440	+0.67		Pass
Kz at 200 ft table rounded to 2 decimals; the note 1 formula is used		1.610	1.624	+0.87		Pass
Kz at 500 ft (Kh) table rounded to 2 decimals; the note 1 formula is used		1.890	1.905	+0.77		Pass

F26.8-1-ridge: Fig. 26.8-1 topographic multipliers, 2-D ridge, x/Lh = 0.50 upwind

Source: ASCE/SEI 7-22 Fig. 26.8-1, pp. p. 337. Calculation: Wind loads.

F26.8-1-ridge · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
K1 (H/Lh = 0.40)		0.580	0.580	+0.00		Pass
K2		0.670	0.667	-0.50		Pass
K3 (z/Lh = 0.20)		0.550	0.549	-0.22		Pass

F26.8-1-escarpment: Fig. 26.8-1 topographic multipliers, 2-D escarpment, x/Lh = 1.00 downwind

Source: ASCE/SEI 7-22 Fig. 26.8-1, pp. p. 337. Calculation: Wind loads.

F26.8-1-escarpment · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
K1 (H/Lh = 0.40)		0.340	0.340	+0.00		Pass
K2		0.750	0.750	+0.00		Pass
K3 (z/Lh = 0.20)		0.610	0.607	-0.57		Pass

F26.8-1-hill: Fig. 26.8-1 topographic multipliers, 3-D axisymmetrical hill at the crest

Source: ASCE/SEI 7-22 Fig. 26.8-1, pp. p. 337. Calculation: Wind loads.

F26.8-1-hill · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
K1 (H/Lh = 0.40)		0.420	0.420	+0.00		Pass
K2		1.000	1.000	+0.00		Pass
K3 (z/Lh = 0.20)		0.450	0.449	-0.15		Pass

F30.3-1: Fig. 30.3-1: wall GCp (θ = 20°, no 10 % reduction)

Source: ASCE/SEI 7-22 Fig. 30.3-1, pp. p. 378. Calculation: Wind loads.

F30.3-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
wall zone 4, A = 10 ft², GCp+		1.000	1.000	+0.00		Pass
wall zone 4, A = 500 ft², GCp+		0.700	0.700	+0.00		Pass
wall zone 4, A = 10 ft², GCp−		-1.100	-1.100	-0.00		Pass
wall zone 4, A = 500 ft², GCp−		-0.800	-0.800	-0.00		Pass
wall zone 5, A = 10 ft², GCp−		-1.400	-1.400	-0.00		Pass
wall zone 5, A = 500 ft², GCp−		-0.800	-0.800	-0.00		Pass

F30.3-2A: Fig. 30.3-2A: roof GCp, θ ≤ 7°

Source: ASCE/SEI 7-22 Fig. 30.3-2A, pp. p. 380. Calculation: Wind loads.

F30.3-2A · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
roof zone 1, A = 10 ft², GCp+		0.300	0.300	+0.00		Pass
roof zone 1, A = 100 ft², GCp+		0.200	0.200	+0.00		Pass
roof zone 1′, A = 100 ft², GCp−		-0.900	-0.900	-0.00		Pass
roof zone 1′, A = 1000 ft², GCp−		-0.400	-0.400	-0.00		Pass
roof zone 1, A = 10 ft², GCp−		-1.700	-1.700	-0.00		Pass
roof zone 1, A = 500 ft², GCp−		-1.000	-1.000	-0.00		Pass
roof zone 2, A = 10 ft², GCp−		-2.300	-2.300	-0.00		Pass
roof zone 2, A = 500 ft², GCp−		-1.400	-1.400	-0.00		Pass
roof zone 3, A = 10 ft², GCp−		-3.200	-3.200	-0.00		Pass
roof zone 3, A = 500 ft², GCp−		-1.400	-1.400	-0.00		Pass

F30.3-2B: Fig. 30.3-2B: gable roof GCp, 7° < θ ≤ 20° (θ = 15°)

Source: ASCE/SEI 7-22 Fig. 30.3-2B, pp. p. 381. Calculation: Wind loads.

F30.3-2B · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
roof zone 1, A = 10 ft², GCp+		0.600	0.600	+0.00		Pass
roof zone 1, A = 200 ft², GCp+		0.300	0.300	+0.00		Pass
roof zone 1, A = 10 ft², GCp−		-2.000	-2.000	-0.00		Pass
roof zone 1, A = 300 ft², GCp−		-0.500	-0.500	-0.00		Pass
roof zone 2, A = 10 ft², GCp−		-2.700	-2.700	-0.00		Pass
roof zone 2, A = 200 ft², GCp−		-1.000	-1.000	-0.00		Pass
roof zone 3, A = 10 ft², GCp−		-3.600	-3.600	-0.00		Pass
roof zone 3, A = 100 ft², GCp−		-1.800	-1.800	-0.00		Pass

F30.3-2C: Fig. 30.3-2C: gable roof GCp, 20° < θ ≤ 27° (θ = 25°)

Source: ASCE/SEI 7-22 Fig. 30.3-2C, pp. p. 382. Calculation: Wind loads.

F30.3-2C · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
roof zone 1, A = 10 ft², GCp+		0.600	0.600	+0.00		Pass
roof zone 1, A = 200 ft², GCp+		0.300	0.300	+0.00		Pass
roof zone 1, A = 10 ft², GCp−		-1.500	-1.500	-0.00		Pass
roof zone 1, A = 200 ft², GCp−		-0.800	-0.800	-0.00		Pass
roof zone 2, A = 10 ft², GCp−		-2.500	-2.500	-0.00		Pass
roof zone 2, A = 100 ft², GCp−		-1.200	-1.200	-0.00		Pass
roof zone 3, A = 10 ft², GCp−		-3.000	-3.000	-0.00		Pass
roof zone 3, A = 100 ft², GCp−		-1.400	-1.400	-0.00		Pass

F30.3-2D: Fig. 30.3-2D: gable roof GCp, 27° < θ ≤ 45° (θ = 35°)

Source: ASCE/SEI 7-22 Fig. 30.3-2D, pp. p. 383. Calculation: Wind loads.

F30.3-2D · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
roof zone 1, A = 10 ft², GCp+		0.900	0.900	+0.00		Pass
roof zone 1, A = 200 ft², GCp+		0.500	0.500	+0.00		Pass
roof zone 1, A = 10 ft², GCp−		-1.800	-1.800	-0.00		Pass
roof zone 1, A = 100 ft², GCp−		-0.800	-0.800	-0.00		Pass
roof zone 2, A = 10 ft², GCp−		-2.000	-2.000	-0.00		Pass
roof zone 2, A = 200 ft², GCp−		-1.000	-1.000	-0.00		Pass
roof zone 3, A = 10 ft², GCp−		-2.500	-2.500	-0.00		Pass
roof zone 3, A = 200 ft², GCp−		-1.000	-1.000	-0.00		Pass

F30.3-2E: Fig. 30.3-2E: hip roof GCp, 7° < θ ≤ 20° (θ = 15°)

Source: ASCE/SEI 7-22 Fig. 30.3-2E, pp. p. 384. Calculation: Wind loads.

F30.3-2E · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
roof zone 1, A = 10 ft², GCp+		0.700	0.700	+0.00		Pass
roof zone 1, A = 100 ft², GCp+		0.300	0.300	+0.00		Pass
roof zone 1, A = 10 ft², GCp−		-1.800	-1.800	-0.00		Pass
roof zone 1, A = 200 ft², GCp−		-0.800	-0.800	-0.00		Pass
roof zone 2, A = 10 ft², GCp−		-2.400	-2.400	-0.00		Pass
roof zone 2, A = 200 ft², GCp−		-1.300	-1.300	-0.00		Pass
roof zone 3, A = 10 ft², GCp−		-2.600	-2.600	-0.00		Pass
roof zone 3, A = 200 ft², GCp−		-1.400	-1.400	-0.00		Pass

F30.3-2F: Fig. 30.3-2F: hip roof GCp, 20° < θ ≤ 27° (θ = 25°)

Source: ASCE/SEI 7-22 Fig. 30.3-2F, pp. p. 385. Calculation: Wind loads.

F30.3-2F · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
roof zone 1, A = 10 ft², GCp+		0.700	0.700	+0.00		Pass
roof zone 1, A = 100 ft², GCp+		0.300	0.300	+0.00		Pass
roof zone 1, A = 10 ft², GCp−		-1.400	-1.400	-0.00		Pass
roof zone 1, A = 100 ft², GCp−		-0.800	-0.800	-0.00		Pass
roof zone 2, A = 10 ft², GCp−		-2.000	-2.000	-0.00		Pass
roof zone 3, A = 100 ft², GCp−		-1.000	-1.000	-0.00		Pass

F30.3-2G: Fig. 30.3-2G: hip roof GCp, θ = 45°

Source: ASCE/SEI 7-22 Fig. 30.3-2G, pp. p. 386. Calculation: Wind loads.

F30.3-2G · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
roof zone 1, A = 10 ft², GCp+		0.700	0.700	+0.00		Pass
roof zone 1, A = 100 ft², GCp+		0.300	0.300	+0.00		Pass
roof zone 1, A = 10 ft², GCp−		-1.500	-1.500	-0.00		Pass
roof zone 1, A = 100 ft², GCp−		-0.700	-0.700	-0.00		Pass
roof zone 2, A = 10 ft², GCp−		-1.800	-1.800	-0.00		Pass
roof zone 2, A = 100 ft², GCp−		-0.800	-0.800	-0.00		Pass
roof zone 3, A = 10 ft², GCp−		-2.400	-2.400	-0.00		Pass
roof zone 3, A = 100 ft², GCp−		-1.000	-1.000	-0.00		Pass

C26.11-1 · Wind loads: Gust-effect factor example, rigid building (Table C26.11-1)

Source: ASCE/SEI 7-22 Commentary Table C26.11-1, pp. p. 943. Calculation: Wind loads.

C26.11-1 · Wind loads · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Effective height $\bar{z}$	ft	360.0	360.0	+0.00		Pass
Turbulence intensity $I_{\bar{z}}$		0.201	0.201	+0.22		Pass
Integral length scale $L_{\bar{z}}$	ft	710.0	709.7	-0.04		Pass
Background response Q^2		0.616	0.616	-0.07		Pass
Gust-effect factor G		0.860	0.818	-4.91		Deviation ASCE7-C26.11-1-G

ASCE7-C26.11-1-G: the table's G = 0.860 does not follow from its own $I_{\bar{z}}$ = 0.201 and Q^2 = 0.616 by Eq. 26.11-6, which gives 0.818 (the program's value)

AISC-III-wind: Four-story steel office building, MWFRS directional procedure (Tables III-5 to III-7)

Source: AISC Design Examples v16.0 (Companion to the Manual, Vol. 1), Part III building design example: wind load determination, pp. pp. III-59 to III-63 (PDF pp. 999 to 1003). Calculation: Wind loads.

ASCE/SEI 7-22, V = 107 mph, Exposure C, Kd = 0.85, Ke = 1.0, G = 0.85 (rigid assumed), enclosed, flat roof, h = 55 ft, plan 213 ft × 123 ft. Table III-6 takes GCpi = −0.18 only (p = the program's upper value). The floor loads w = (p windward − p leeward) × tributary wall height (Table III-7); the program integrates qz over each level's band of wall. The roof level (parapet and screen wall, 27.3.4) is not compared: parapets are outside the module.

AISC-III-wind · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Kh at 55 ft (interpolated in Table 26.10-1)		1.110	1.110	-0.04		Pass
qh	psf	32.50	32.52	+0.07		Pass
qz at the 4th floor (40.5 ft)	psf	30.50	30.55	+0.17		Pass
qz at the 3rd floor (27 ft)	psf	28.10	28.13	+0.09		Pass
qz at the 2nd floor (13.5 ft, Kz at 15 ft)	psf	24.90	24.95	+0.19		Pass
Leeward wall Cp, N-S wind (L/B = 0.577)		-0.500	-0.500	-0.00		Pass
Leeward wall Cp, E-W wind (L/B = 1.73) the example rounds the interpolated −0.354 to −0.35		-0.350	-0.354	+1.05		Pass
Windward wall p at the roof (GCpi = −0.18)	psf	23.80	23.77	-0.11		Pass
Windward wall p at the 4th floor	psf	22.60	22.64	+0.16		Pass
Windward wall p at the 3rd floor	psf	21.20	21.23	+0.15		Pass
Windward wall p at the 2nd floor	psf	19.40	19.40	-0.03		Pass
Leeward wall p, N-S wind	psf	-6.780	-6.773	-0.11		Pass
Leeward wall p, E-W wind	psf	-3.250	-3.334	+2.59		Pass
4th floor diaphragm load w (N-S wind)	kip/ft	0.411	0.413	+0.38		Pass
3rd floor diaphragm load w (N-S wind)	kip/ft	0.378	0.377	-0.27		Pass
2nd floor diaphragm load w (N-S wind)	kip/ft	0.353	0.355	+0.60		Pass

WW-wind-T: Six-story building (five wood stories over a podium), transverse wind (Table 4.2A)

Source: WoodWorks, Five-Story Light-Frame Wood Structure Over Podium, design example, 2nd ed. (Nov. 2025), Section 4.3.1, pp. pp. 55 to 56 (PDF pp. 61 to 62). Calculation: Wind loads.

ASCE 7-22, V = 120 mph, Exposure C, Kd = 0.85, Kzt = Ke = 1.0, G = 0.85, enclosed, flat roof, h = 62 ft, plan 189 ft × 76 ft. Case (a) is +GCpi (the program's lower value on suction surfaces, upper on the windward wall). The text of Sections 4.3.1 / 4.3.2 swaps the two leeward L/B ratios, but Tables 4.2A and 4.2B use Cp = −0.50 (transverse, L/B = 0.40) and −0.276 (longitudinal, L/B = 2.49), as here. The roof zone beyond 2h (124 ft) does not exist across a 76 ft depth and is not compared; parapets are outside the module.

WW-wind-T · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Kh at 62 ft		1.137	1.137	+0.01		Pass
qh	psf	41.90	41.92	+0.04		Pass
qz at 42 ft	psf	38.70	38.71	+0.04		Pass
qz at 22 ft	psf	33.90	33.93	+0.08		Pass
Windward wall p at the roof, case (a)	psf	30.60	30.64	+0.13		Pass
Windward wall p at the roof, case (b)	psf	17.80	17.81	+0.08		Pass
Windward wall p at the 4th floor (32 ft), case (a)	psf	27.60	27.58	-0.07		Pass
Windward wall p at the 2nd floor (12 ft), case (b)	psf	11.70	11.72	+0.19		Pass
Leeward wall p, case (a)	psf	-8.700	-8.729	+0.33		Pass
Leeward wall p, case (b)	psf	-21.60	-21.56	-0.21		Pass
Roof Cp 0 to h/2 (h/L = 0.82, interpolated)		-1.150	-1.153	+0.23		Pass
Roof Cp h/2 to h		-0.770	-0.774	+0.48		Pass
Roof Cp h to 2h		-0.630	-0.626	-0.58		Pass
Roof p 0 to h/2, case (a)	psf	-41.30	-41.32	+0.05		Pass
Roof p h/2 to h, case (a)	psf	-29.80	-29.84	+0.15		Pass
Roof p h to 2h, case (a)	psf	-25.40	-25.38	-0.07		Pass
Roof p, case (b) (Cp = −0.18)	psf	1.000	0.962	-3.80		Pass

WW-wind-L: Six-story building over a podium, longitudinal wind (Table 4.2B)

Source: WoodWorks, Five-Story Light-Frame Wood Structure Over Podium, design example, 2nd ed. (Nov. 2025), Section 4.3.2, pp. pp. 57 to 58 (PDF pp. 63 to 64). Calculation: Wind loads.

WW-wind-L · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Leeward wall Cp (L/B = 2.49)		-0.276	-0.276	-0.12		Pass
Leeward wall p, case (a)	psf	-1.900	-1.935	+1.84		Pass
Leeward wall p, case (b)	psf	-14.80	-14.76	-0.26		Pass
Roof Cp 0 to h/2 (h/L = 0.33)		-0.900	-0.900	-0.00		Pass
Roof Cp h to 2h		-0.500	-0.500	-0.00		Pass
Roof Cp beyond 2h		-0.300	-0.300	-0.00		Pass
Roof p 0 to h/2, case (a)	psf	-33.70	-33.67	-0.09		Pass
Roof p h to 2h, case (a)	psf	-21.60	-21.56	-0.21		Pass
Roof p beyond 2h, case (a)	psf	-15.50	-15.50	-0.01		Pass

F30.4-1: C&C for h > 60 ft: Fig. 30.4-1 GCp at the breakpoint areas

Source: ASCE/SEI 7-22, pp. Fig. 30.4-1, p. 395. Calculation: Wind loads.

F30.4-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Wall zone 4, A = 20 ft², GCp+		0.900	0.900	+0.00		Pass
Wall zone 4, A = 20 ft², GCp−		-0.900	-0.900	-0.00		Pass
Wall zone 5, A = 500 ft², GCp+		0.600	0.600	+0.00		Pass
Wall zone 5, A = 500 ft², GCp−		-1.000	-1.000	-0.00		Pass
Roof zone 1, A = 10 ft²		-1.400	-1.400	-0.00		Pass
Roof zone 2, A = 500 ft²		-1.600	-1.600	-0.00		Pass
Roof zone 3, A = 10 ft²		-3.200	-3.200	-0.00		Pass

F30.4-1-N7: Fig. 30.4-1 note 7: parapet ≥ 3 ft, zone 3 as zone 2

Source: ASCE/SEI 7-22, pp. Fig. 30.4-1, p. 395. Calculation: Wind loads.

F30.4-1-N7 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Roof zone 3 with a parapet, A = 10 ft²		-2.300	-2.300	-0.00		Pass

W-P2: C&C pressures for h = 100 ft (Eq. 30.4-1)

Source: Hand calculation (closed form). Calculation: Wind loads.

W-P2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
qh	psf	42.44	42.44	+0.00		Pass
Wall zone 4 at 40 ft, positive	psf	33.42	33.42	+0.01		Pass
Wall zone 4, suction	psf	-38.96	-38.96	+0.00		Pass
Roof zone 3, suction	psf	-121.9	-121.9	+0.00		Pass

W-ENC: Enclosure from the openings: a large door, partially enclosed

Source: Hand calculation (closed form). Calculation: Wind loads.

W-ENC · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
GCpi		0.550	0.550	+0.00		Pass

W-ENC-RI: Partially enclosed large volume: Ri

Source: Hand calculation (closed form). Calculation: Wind loads.

W-ENC-RI · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ri		0.990	0.990	+0.00		Pass
GCpi		0.545	0.545	+0.00		Pass

F29.3-1-AB: Solid signs: Cf of Cases A and B at tabulated B/s and s/h

Source: ASCE/SEI 7-22, pp. Fig. 29.3-1, p. 362. Calculation: Wind on other structures.

F29.3-1-AB · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cf, B/s = 1, s/h = 1		1.450	1.450	+0.00		Pass

F29.3-1-AB2: Cf, B/s = 10, s/h = 0.5

Source: ASCE/SEI 7-22, pp. Fig. 29.3-1, p. 362. Calculation: Wind on other structures.

F29.3-1-AB2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cf		1.700	1.700	+0.00		Pass

F29.3-1-AB3: Cf, B/s = 0.5, s/h = 0.2

Source: ASCE/SEI 7-22, pp. Fig. 29.3-1, p. 362. Calculation: Wind on other structures.

F29.3-1-AB3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cf		1.800	1.800	+0.00		Pass

F29.3-1-AB4: Cf, B/s = 45, s/h = 0.16

Source: ASCE/SEI 7-22, pp. Fig. 29.3-1, p. 362. Calculation: Wind on other structures.

F29.3-1-AB4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cf		1.950	1.950	+0.00		Pass

F29.3-1-C5: Case C, B/s = 5, s/h = 0.5: Cf by region

Source: ASCE/SEI 7-22, pp. Fig. 29.3-1, p. 363. Calculation: Wind on other structures.

F29.3-1-C5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cf, 0 to s		3.100	3.100	+0.00		Pass
Cf, s to 2s		2.000	2.000	+0.00		Pass
Cf, 2s to 3s		1.450	1.450	+0.00		Pass
Cf, 3s to 10s		1.050	1.050	+0.00		Pass

F29.3-1-C5LR: Case C, B/s = 5 with a return corner Lr/s = 1

Source: ASCE/SEI 7-22, pp. Fig. 29.3-1, p. 363. Calculation: Wind on other structures.

F29.3-1-C5LR · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cf, 0 to s (3.10 × 0.75)		2.325	2.325	+0.00		Pass

F29.3-1-C13: Case C, B/s = 13, s/h = 0.5: Cf by region

Source: ASCE/SEI 7-22, pp. Fig. 29.3-1, p. 363. Calculation: Wind on other structures.

F29.3-1-C13 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cf, 0 to s		4.000	4.000	+0.00		Pass
Cf, s to 2s		2.600	2.600	+0.00		Pass
Cf, 2s to 3s		2.000	2.000	+0.00		Pass
Cf, 3s to 4s		1.500	1.500	+0.00		Pass
Cf, 4s to 5s		1.350	1.350	+0.00		Pass
Cf, 5s to 10s		0.900	0.900	+0.00		Pass
Cf, beyond 10s		0.550	0.550	+0.00		Pass

F29.4-1-SQ: Chimney, square normal to a face, h/D = 7

Source: ASCE/SEI 7-22, pp. Fig. 29.4-1, p. 364. Calculation: Wind on other structures.

F29.4-1-SQ · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cf		1.400	1.400	+0.00		Pass
Kd (Table 26.6-1)		0.900	0.900	+0.00		Pass

F29.4-1-RD: Round, moderately smooth, h/D = 25, D √qz > 2.5

Source: ASCE/SEI 7-22, pp. Fig. 29.4-1, p. 364. Calculation: Wind on other structures.

F29.4-1-RD · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cf		0.700	0.700	+0.00		Pass
Kd (Table 26.6-1)		1.000	1.000	+0.00		Pass

F29.4-1-HX: Hexagonal, h/D = 1

Source: ASCE/SEI 7-22, pp. Fig. 29.4-1, p. 364. Calculation: Wind on other structures.

F29.4-1-HX · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cf		1.000	1.000	+0.00		Pass
Kd (Table 26.6-1)		0.950	0.950	+0.00		Pass

F29.4-1-RL: Round, D √qz ≤ 2.5, h/D = 25

Source: ASCE/SEI 7-22, pp. Fig. 29.4-1, p. 364. Calculation: Wind on other structures.

F29.4-1-RL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cf		1.200	1.200	+0.00		Pass

F29.4-2-FL: Open sign, flat-sided members, ε = 0.2

Source: ASCE/SEI 7-22, pp. Fig. 29.4-2, p. 364. Calculation: Wind on other structures.

F29.4-2-FL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cf		1.800	1.800	+0.00		Pass

F29.4-2-FL05: Open frame, flat-sided members, ε = 0.05

Source: ASCE/SEI 7-22, pp. Fig. 29.4-2, p. 364. Calculation: Wind on other structures.

F29.4-2-FL05 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cf		2.000	2.000	+0.00		Pass

F29.4-2-RL: Rounded members, D √qz ≤ 2.5, ε = 0.5

Source: ASCE/SEI 7-22, pp. Fig. 29.4-2, p. 364. Calculation: Wind on other structures.

F29.4-2-RL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cf		1.500	1.500	+0.00		Pass

F29.4-2-RH: Rounded members, D √qz > 2.5, ε = 0.5

Source: ASCE/SEI 7-22, pp. Fig. 29.4-2, p. 364. Calculation: Wind on other structures.

F29.4-2-RH · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cf		1.100	1.100	+0.00		Pass

F29.4-3-SQ: Square trussed tower, ε = 0.3, wind along the diagonal

Source: ASCE/SEI 7-22, pp. Fig. 29.4-3, p. 365. Calculation: Wind on other structures.

F29.4-3-SQ · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cf = 4.0ε² − 5.9ε + 4.0		2.590	2.590	+0.00		Pass
Diagonal factor 1 + 0.75ε ≤ 1.2		1.200	1.200	+0.00		Pass

F29.4-3-TR: Triangular tower, ε = 0.3, rounded members

Source: ASCE/SEI 7-22, pp. Fig. 29.4-3, p. 365. Calculation: Wind on other structures.

F29.4-3-TR · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cf = (3.4ε² − 4.7ε + 3.4)(0.51ε² + 0.57)		1.414	1.414	+0.00		Pass

O1: Freestanding sign 30 × 10 ft at 25 ft: Cases A and B

Source: Hand calculation (closed form). Calculation: Wind on other structures.

O1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
qh	psf	31.98	31.98	+0.01		Pass
Cf		1.750	1.750	+0.00		Pass
F	kips	12.13	12.13	+0.01		Pass
Height of F	ft	20.00	20.00	+0.00		Pass
Case B eccentricity	ft	6.000	6.000	+0.00		Pass

O2: Rooftop unit: lateral and uplift forces

Source: Hand calculation (closed form). Calculation: Wind on other structures.

O2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
qh	psf	35.20	35.20	+0.01		Pass
Fh	kips	2.729	2.729	-0.00		Pass
Fv	kips	2.873	2.873	-0.02		Pass

O2-R: Large rooftop unit with the (GCr) reduction

Source: Hand calculation (closed form). Calculation: Wind on other structures.

O2-R · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
(GCr) lateral		1.850	1.850	-0.00		Pass
Fh	kips	33.21	33.21	+0.01		Pass

O3: Short round stack: force and base moment

Source: Hand calculation (closed form). Calculation: Wind on other structures.

O3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cf		0.567	0.567	-0.01		Pass
F	kips	0.625	0.625	+0.00		Pass
Base moment	kip-ft	4.685	4.685	-0.01		Pass

O4: Case C on a wall with s/h = 1 (note 3 reduction)

Source: Hand calculation (closed form). Calculation: Wind on other structures.

O4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cf, 0 to s (3.10 × 0.8)		2.480	2.480	+0.00		Pass
Force, 0 to s	kips	5.163	5.163	+0.01		Pass
Force, 3s to 5s	kips	3.498	3.498	-0.01		Pass
Total Case C force	kips	14.41	14.41	-0.02		Pass

BREYER-6-18 · Sawn lumber beam: 2x6 rafter, braced: adjusted values and allowable M, V (ASD and LRFD)

Source: Breyer, Design of Wood Structures ASD/LRFD, Examples 6-18 and 6-19 (values as tabulated in calcs.com, Wood Beam Validation Examples), pp. Ex. 6-18 (ASD), 6-19 (LRFD). Calculation: Sawn lumber beam.

BREYER-6-18 · Sawn lumber beam · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fb'	psi	1,870	1,869	-0.07		Pass
Allowable M = Fb' S	lb-ft	1,178	1,178	-0.03		Pass
Fv'	psi	225.0	225.0	+0.00		Pass
Allowable V = (2/3) Fv' A	lb	1,238	1,238	+0.00		Pass
Fc⊥'	psi	625.0	625.0	+0.00		Pass

BREYER-6-18 · Sawn lumber beam · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fb'	psi	2,580	2,582	+0.08		Pass
M' = Fb' S	lb-ft	1,625	1,627	+0.14		Pass
Fv'	psi	311.0	311.0	+0.01		Pass
V' = (2/3) Fv' A	lb	1,710	1,711	+0.04		Pass
Fc⊥'	psi	938.0	939.4	+0.15		Pass

HAND-1 · Sawn lumber beam: 2x10 joist, simple span, braced, repetitive

Source: Hand calculation (closed form). Calculation: Sawn lumber beam.

HAND-1 · Sawn lumber beam · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bending stress fb	psi	1,031	1,031	-0.00		Pass
Fb'	psi	1,138	1,138	+0.00		Pass
Shear stress at d from the support	psi	49.49	49.49	-0.00		Pass
Fv'	psi	180.0	180.0	+0.00		Pass
Bearing stress fc⊥	psi	116.7	116.7	-0.00		Pass
Fc⊥'	psi	625.0	625.0	+0.00		Pass
Live load deflection	in.	0.300	0.300	-0.00		Pass
Total deflection with creep	in.	0.464	0.464	-0.00		Pass

HAND-1 · Sawn lumber beam · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bending stress fbu	psi	1,539	1,539	-0.00		Pass
Fb'	psi	1,966	1,966	+0.00		Pass
Fv'	psi	311.0	311.0	+0.00		Pass
Fc⊥'	psi	939.4	939.4	+0.00		Pass

HAND-2 · Sawn lumber beam: 4x10 beam, unbraced compression edge (beam stability CL)

Source: Hand calculation (closed form). Calculation: Sawn lumber beam.

CL = 0.979 (ASD); the beam is over-stressed in bending (fb/Fb' = 1.23), a deliberate hand case.

HAND-2 · Sawn lumber beam · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
CL (Eq. 3.3-6)		0.979	0.979	+0.00		Pass
RB		14.08	14.08	+0.00		Pass
Fb' = Fb* CL	psi	1,057	1,057	-0.00		Pass
fb	psi	1,298	1,298	-0.00		Pass

HAND-2 · Sawn lumber beam · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
CL (Eq. 3.3-6)		0.974	0.974	+0.00		Pass
Fb' = Fb* CL	psi	1,817	1,817	+0.00		Pass

HUD-5.8: Ridge beam 13 ft: D + S and 0.6D + 0.6W

Source: HUD, Residential Structural Design Guide, 2nd ed. (2017), pp. Example 5.8, pp. 5-71 to 5-72. Calculation: Sawn lumber beam.

HUD-5.8 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Line load D + S	plf	469.0	469.0	-0.00		Pass
Shear D + S	lb	3,049	3,048	-0.02		Pass
Moment D + S	lb-ft	9,908	9,908	-0.00		Pass
Shear 0.6D + 0.6W (uplift)	lb	124.0	120.9	-2.50		Deviation HUD-5.8-ROUND
HUD-5.8-ROUND: the example rounds the net load to 19 plf; exact 18.6 plf						
Moment 0.6D + 0.6W (uplift)	lb-ft	401.0	392.9	-2.01		Deviation HUD-5.8-ROUND
HUD-5.8-ROUND: the example rounds the net load to 19 plf; exact 18.6 plf						

HUD-5.5A: Header 2-2x10, 6.5 ft, floor load 600 plf

Source: HUD, Residential Structural Design Guide, 2nd ed. (2017), pp. Example 5.5, steps 3, 5, 6, 7, pp. 5-63 to 5-64. Calculation: Sawn lumber beam.

HUD-5.5A · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Moment	lb-ft	3,169	3,169	-0.01		Pass
Section modulus of two 2x10	in.³	42.78	42.78	+0.00		Pass
Shear	lb	1,950	1,950	-0.00		Pass
Shear stress fv	psi	106.0	105.4	-0.56		Pass
Bearing stress on 3 in. (hand, from the example's 650 / lb)	psi	216.7	216.7	-0.00		Pass
Live load deflection	in.	0.110	0.111	+0.66		Pass
Limit L/240	in.	0.325	0.325	+0.00		Pass
Fb' with the guide's factors	psi	1,454	1,066	-26.71		Deviation HUD-5.5-SYSTEM
HUD-5.5-SYSTEM: the guide's system factors 1.3 and 1.05 are not NDS factors						
Fv' with the guide's CH = 2	psi	175.0	87.50	-50.00		Deviation HUD-5.5-SYSTEM
HUD-5.5-SYSTEM: the shear stress factor CH is no longer in the NDS						

HUD-5.5B: Header 2-2x10, 6.5 ft, floor and wall 960 plf

Source: HUD, Residential Structural Design Guide, 2nd ed. (2017), pp. Example 5.5, step 4, p. 5-63. Calculation: Sawn lumber beam.

HUD-5.5B · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Moment	lb-ft	5,070	5,070	-0.00		Pass
Fb' with the guide's 1.8 system factor	psi	1,918	1,066	-44.44		Deviation HUD-5.5-SYSTEM
HUD-5.5-SYSTEM: the guide's system factor 1.8 is not an NDS factor						

HAND-HIP: Hip rafter, triangular load 0 to 200 plf, 17 ft plan length

Source: Hand calculation (closed form). Calculation: Sawn lumber beam.

Beam tables: triangular load on a simple span; the valley preset is the same beam.

HAND-HIP · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Shear at the heavy end wL/3	lb	1,133	1,133	-0.00		Pass
Reaction at the light end wL/6	lb	566.7	566.7	-0.00		Pass
Moment wL²/(9√3)	lb-ft	3,708	3,707	-0.02		Pass
Bending stress	psi	703.1	703.0	-0.02		Pass
Deflection 0.01304 W L³ / EI, W = wL/2	in.	0.330	0.331	+0.03		Pass

HAND-HIP · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Moment 1.4D	lb-ft	5,191	5,190	-0.02		Pass

HAND-OVERHANG: Joist with an overhang: L on part of the member

Source: Hand calculation (closed form). Calculation: Sawn lumber beam.

HAND-OVERHANG · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Midspan moment, L on the back span	lb-ft	973.2	973.2	-0.01		Pass
Same, L on the full length (lower)	lb-ft	816.7	816.7	+0.00		Pass
Bending stress governs from the partial case	psi	546.0	546.0	-0.01		Pass
Reaction at the far end, L on the overhang	lb	61.25	61.25	-0.00		Pass
Moment at the support, L on the overhang	lb-ft	459.4	459.4	+0.00		Pass

AWC-E1.3 · Wood bearing and notches: Glulam beam end bearing, 6 in

Source: AWC 2015/2018 Structural Wood Design Examples, Example E1.3 (values as tabulated in Trimble Tekla Tedds 2026, Verification Example - Glulam Beam Design (ASD)), pp. AWC pp. 16-20. Calculation: Wood bearing and notches.

AWC-E1.3 · Wood bearing and notches · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Reaction R	lb	12,988	12,988	-0.00		Pass
Fc⊥'	psi	650.0	650.0	+0.00		Pass
fc⊥ = R / (b lb)	psi	433.0	432.9	-0.02		Pass

BREYER-6-18 · Wood bearing and notches: 2x6 rafter end bearing: Fc⊥' (ASD and LRFD)

Source: Breyer, Design of Wood Structures ASD/LRFD, Examples 6-18 and 6-19 (values as tabulated in calcs.com, Wood Beam Validation Examples), pp. Ex. 6-18 (ASD), 6-19 (LRFD). Calculation: Wood bearing and notches.

BREYER-6-18 · Wood bearing and notches · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fc⊥'	psi	625.0	625.0	+0.00		Pass

BREYER-6-18 · Wood bearing and notches · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fc⊥' = Fc⊥ KF φ	psi	938.0	939.4	+0.15		Pass

AV-5.9 · Wood bearing and notches: Stud on the bottom plate

Source: Aghayere & Vigil, Structural Wood Design, 2nd ed. (2017), Example 5.9 (values as tabulated in calcs.com, Wood Column Validation Examples (NDS 2018)), pp. p. 313. Calculation: Wood bearing and notches.

AV-5.9 · Wood bearing and notches · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fc⊥'	psi	625.0	625.0	+0.00		Pass
P = D + 0.75(L + S)	lb	3,000	3,000	+0.00		Pass

HAND-1 · Wood bearing and notches: Bearing perpendicular to grain at the member end

Source: Hand calculation (closed form). Calculation: Wood bearing and notches.

HAND-1 · Wood bearing and notches · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fc⊥'	psi	625.0	625.0	+0.00		Pass
fc⊥	psi	381.0	381.0	+0.00		Pass

HAND-1 · Wood bearing and notches · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fc⊥'	psi	939.4	939.4	+0.00		Pass
fc⊥	psi	552.4	552.4	+0.00		Pass

HAND-2 · Wood bearing and notches: Bearing perpendicular to grain with Cb

Source: Hand calculation (closed form). Calculation: Wood bearing and notches.

HAND-2 · Wood bearing and notches · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fc⊥' = Fc⊥ Cb	psi	703.1	703.1	+0.00		Pass

HAND-3 · Wood bearing and notches: Bearing at 45° to grain (Hankinson)

Source: Hand calculation (closed form). Calculation: Wood bearing and notches.

HAND-3 · Wood bearing and notches · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fθ' (Eq. 3.10-1)	psi	924.7	924.7	+0.00		Pass

HAND-4 · Wood bearing and notches: Bearing parallel to grain

Source: Hand calculation (closed form). Calculation: Wood bearing and notches.

HAND-4 · Wood bearing and notches · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fc*	psi	1,350	1,350	+0.00		Pass

HAND-5: Notch on the tension face at the support

Source: Hand calculation (closed form). Calculation: Wood bearing and notches.

HAND-5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vr' (Eq. 3.4-3)	lb	2,071	2,071	+0.00		Pass

HAND-6: Notch on the compression face at the support

Source: Hand calculation (closed form). Calculation: Wood bearing and notches.

HAND-6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vr' (Eq. 3.4-5)	lb	3,689	3,689	+0.00		Pass

F15C: Figure 15C: three 2x6 with two rows of 30d nails

Source: NDS 2024 Figure 15C, pp. p. 157. Calculation: Built-up and spaced columns.

F15C · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Every nailing rule of 15.3.3.1 met (1 = yes)		1.000	1.000	+0.00		Pass

F15D: Figure 15D: four 2x8 with two rows of 1/2 in. bolts

Source: NDS 2024 Figure 15D, pp. p. 157. Calculation: Built-up and spaced columns.

F15D · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Every bolting rule of 15.3.4.1 met (1 = yes)		1.000	1.000	+0.00		Pass

HC-NAILED: Three 2x6 DF-L No. 2 nailed, 10 ft

Source: Hand calculation (closed form). Calculation: Built-up and spaced columns.

HC-NAILED · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
CP = 0.6 × CP(le2/d2)		0.239	0.239	-0.00		Pass
Fc'	psi	355.2	355.2	-0.00		Pass
Fc' A	lb	8,791	8,791	-0.00		Pass

HC-NAILED · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
CP = 0.6 × CP(le2/d2)		0.211	0.211	+0.00		Pass
Fc' A	lb	13,432	13,432	+0.00		Pass

HC-BOLTED: Three 2x6 DF-L No. 2 bolted (Kf = 0.75), 10 ft

Source: Hand calculation (closed form). Calculation: Built-up and spaced columns.

HC-BOLTED · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
CP = 0.75 × CP(le2/d2)		0.299	0.299	+0.00		Pass
Fc'	psi	444.0	444.0	+0.00		Pass

HC-SPACED: Two 3x6 DF-L No. 2 spaced, condition a, 10 ft

Source: Hand calculation (closed form). Calculation: Built-up and spaced columns.

HC-SPACED · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
CP = min(CP1 with Kx = 2.5, CP on l2/d2)		0.319	0.319	+0.00		Pass
Capacity 2 × A × Fc'	lb	13,010	13,010	-0.00		Pass
Ks = 8.14 (48 − 11)		301.2	301.2	+0.00		Pass
Required end-block capacity A Ks	lb	4,141	4,141	+0.00		Pass

HC-SPACED-NOKX: The same spaced column with FcE as the 2024 printing writes it (no Kx)

Source: Hand calculation (closed form). Calculation: Built-up and spaced columns.

HC-SPACED-NOKX · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
CP1 without Kx		0.135	0.135	+0.00		Pass

AWC-E1.4a · Wood column and post: 4x4 SP No. 2 post, 10 ft (CP)

Source: AWC 2015/2018 Structural Wood Design Examples, Example E1.4 (values as tabulated in Trimble Tekla Tedds 2026, Verification Example - Axial Compression of Wood Column (ASD)), pp. AWC pp. 23-27. Calculation: Wood column and post.

AWC-E1.4a · Wood column and post · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fc*	psi	1,450	1,450	+0.00		Pass
FcE	psi	357.0	356.6	-0.10		Pass
CP		0.232	0.232	-0.03		Pass
Fc'	psi	336.0	336.3	+0.09		Pass
Capacity P = Fc' A	lb	4,120	4,120	-0.00		Pass

AWC-E1.4b · Wood column and post: 6x6 SP No. 2 post (timber), 10 ft (CP)

Source: AWC 2015/2018 Structural Wood Design Examples, Example E1.4 (values as tabulated in Trimble Tekla Tedds 2026, Verification Example - Axial Compression of Wood Column (ASD)), pp. AWC pp. 23-27. Calculation: Wood column and post.

AWC-E1.4b · Wood column and post · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fc*	psi	525.0	525.0	+0.00		Pass
FcE	psi	760.0	759.8	-0.03		Pass
CP		0.801	0.801	+0.03		Pass
Fc'	psi	421.0	420.6	-0.08		Pass
Capacity P = Fc' A	lb	12,725	12,725	-0.00		Pass

AV-5.6: 6x6 DF-L No. 1 column, 12 ft, D + S (CP, ASD and LRFD)

Source: Aghayere & Vigil, Structural Wood Design, 2nd ed. (2017), Example 5.6 (values as tabulated in calcs.com, Wood Column Validation Examples (NDS 2018)), pp. p. 299. Calculation: Wood column and post.

AV-5.6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Design load D + S	lb	17,000	17,000	+0.00		Pass
FcE	psi	695.0	695.5	+0.07		Pass
CP		0.502	0.503	+0.20		Pass
Allowable capacity Fc' A	lb	17,463	17,498	+0.20		Pass

AV-5.6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
FcE (Emin' = Emin KF φ)	psi	1,042	1,040	-0.15		Pass
CP		0.502	0.501	-0.13		Pass
Capacity Fc' A (λ = 0.8)	lb	26,300	26,205	-0.36		Pass

NDS-E.6: SPF No. 2 2x4 side member, single bolt: net section tension

Source: AWC NDS 2024, Appendix E sample solutions, pp. p. 175 (E.6). Calculation: Wood column and post.

NDS-E.6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ft' = Ft CF = 450 × 1.5	psi	675.0	675.0	+0.00		Pass
ft at Z_NT' = 2,468 lb	psi	675.0	675.0	+0.00		Pass

NDS-E.6m: SPF No. 2 4x4 main member: Ft'

Source: AWC NDS 2024, Appendix E sample solutions, pp. p. 175 (E.6). Calculation: Wood column and post.

NDS-E.6m · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ft' = Ft CF = 450 × 1.5	psi	675.0	675.0	+0.00		Pass

NDS-E.6v: SPF No. 2 2x4: Fv'

Source: AWC NDS 2024, Appendix E sample solutions, pp. p. 175 (E.6). Calculation: Wood column and post.

NDS-E.6v · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fv'	psi	135.0	135.0	+0.00		Pass

NDS-E.8: Hem-Fir No. 2 2x4 side member, row of bolts: net section tension

Source: AWC NDS 2024, Appendix E sample solutions, pp. p. 178 (E.8). Calculation: Wood column and post.

NDS-E.8 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ft' = Ft CF = 525 × 1.5	psi	788.0	787.5	-0.06		Pass
ft at Z_NT' = 3,470 lb	psi	788.0	787.5	-0.06		Pass

NDS-E.8v: Hem-Fir No. 2 2x4: Fv'

Source: AWC NDS 2024, Appendix E sample solutions, pp. p. 178 (E.8). Calculation: Wood column and post.

NDS-E.8v · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fv'	psi	150.0	150.0	+0.00		Pass

NDS-E.9: Southern Pine No. 2 2x4 (Table 4B): Ft' and Fv'

Source: AWC NDS 2024, Appendix E sample solutions, pp. pp. 178-179 (E.9). Calculation: Wood column and post.

NDS-E.9 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ft'	psi	675.0	675.0	+0.00		Pass

NDS-E.9v: Southern Pine No. 2 2x4: Fv'

Source: AWC NDS 2024, Appendix E sample solutions, pp. pp. 178-179 (E.9). Calculation: Wood column and post.

NDS-E.9v · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fv'	psi	175.0	175.0	+0.00		Pass

HAND-1 · Wood column and post: 6x6 post in axial compression (CP)

Source: Hand calculation (closed form). Calculation: Wood column and post.

HAND-1 · Wood column and post · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fc' = Fc* CP	psi	691.5	691.5	+0.00		Pass
fc	psi	528.9	528.9	+0.00		Pass

HAND-1 · Wood column and post · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fc' = Fc* CP	psi	1,106	1,106	+0.00		Pass
fc	psi	766.9	766.9	+0.00		Pass

HAND-2 · Wood column and post: 6x6 post with axial load and wind (Eq. 3.9-3)

Source: Hand calculation (closed form). Calculation: Wood column and post.

HAND-2 · Wood column and post · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Interaction, D + 0.6W		0.332	0.332	+0.00		Pass

HAND-3 · Wood column and post: 2x6 tension member (3.8)

Source: Hand calculation (closed form). Calculation: Wood column and post.

HAND-3 · Wood column and post · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ft'	psi	747.5	747.5	+0.00		Pass
ft	psi	606.1	606.1	+0.00		Pass

HAND-3 · Wood column and post · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ft'	psi	1,292	1,292	-0.00		Pass
ft	psi	872.7	872.7	+0.00		Pass

NDS24-12A-1: 1/2 in bolt, single shear, tm = 1.5 in, ts = 1.5 in, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood fastener connection.

NDS24-12A-1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	480.0	483.2	+0.68		Pass

NDS24-12A-2: 1/2 in bolt, single shear, tm = 1.5 in, ts = 1.5 in, G = 0.50, Zs⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood fastener connection.

NDS24-12A-2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zs⊥)	lb	300.0	298.6	-0.45		Pass

NDS24-12A-3: 1/2 in bolt, single shear, tm = 1.5 in, ts = 1.5 in, G = 0.50, Zm⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood fastener connection.

NDS24-12A-3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zm⊥)	lb	300.0	298.6	-0.45		Pass

NDS24-12A-4: 1/2 in bolt, single shear, tm = 1.5 in, ts = 1.5 in, G = 0.50, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood fastener connection.

NDS24-12A-4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z⊥)	lb	220.0	218.0	-0.92		Pass

NDS24-12A-5: 1/2 in bolt, single shear, tm = 3.5 in, ts = 1.5 in, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood fastener connection.

NDS24-12A-5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	610.0	614.8	+0.79		Pass

NDS24-12A-6: 1/2 in bolt, single shear, tm = 3.5 in, ts = 1.5 in, G = 0.50, Zs⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood fastener connection.

NDS24-12A-6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zs⊥)	lb	370.0	366.8	-0.87		Pass

NDS24-12A-7: 1/2 in bolt, single shear, tm = 3.5 in, ts = 1.5 in, G = 0.50, Zm⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood fastener connection.

NDS24-12A-7 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zm⊥)	lb	430.0	432.5	+0.58		Pass

NDS24-12A-8: 1/2 in bolt, single shear, tm = 3.5 in, ts = 1.5 in, G = 0.50, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood fastener connection.

NDS24-12A-8 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z⊥)	lb	330.0	331.0	+0.30		Pass

NDS24-12A-9: 3/4 in bolt, single shear, tm = 3.5 in, ts = 1.5 in, G = 0.55, Z∥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood fastener connection.

NDS24-12A-9 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z∥)	lb	1,270	1,275	+0.40		Pass

NDS24-12A-10: 3/4 in bolt, single shear, tm = 3.5 in, ts = 1.5 in, G = 0.55, Zs⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood fastener connection.

NDS24-12A-10 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zs⊥)	lb	660.0	666.1	+0.92		Pass

NDS24-12A-11: 3/4 in bolt, single shear, tm = 3.5 in, ts = 1.5 in, G = 0.55, Zm⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood fastener connection.

NDS24-12A-11 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zm⊥)	lb	690.0	691.8	+0.26		Pass

NDS24-12A-12: 3/4 in bolt, single shear, tm = 3.5 in, ts = 1.5 in, G = 0.55, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood fastener connection.

NDS24-12A-12 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z⊥)	lb	580.0	579.3	-0.11		Pass

NDS24-12A-13: 1 in bolt, single shear, tm = 3.5 in, ts = 1.5 in, G = 0.67, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood fastener connection.

NDS24-12A-13 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	2,410	2,409	-0.04		Pass

NDS24-12A-14: 1 in bolt, single shear, tm = 3.5 in, ts = 1.5 in, G = 0.67, Zm⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood fastener connection.

NDS24-12A-14 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zm⊥)	lb	1,080	1,080	+0.04		Pass

NDS24-12A-15: 1 in bolt, single shear, tm = 3.5 in, ts = 1.5 in, G = 0.67, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood fastener connection.

NDS24-12A-15 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z⊥)	lb	890.0	890.6	+0.07		Pass

NDS24-12A-16: 5/8 in bolt, single shear, tm = 2.5 in, ts = 1.5 in, G = 0.46, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood fastener connection.

NDS24-12A-16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	780.0	780.2	+0.03		Pass

NDS24-12A-17: 5/8 in bolt, single shear, tm = 2.5 in, ts = 1.5 in, G = 0.46, Zs⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood fastener connection.

NDS24-12A-17 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zs⊥)	lb	470.0	469.2	-0.16		Pass

NDS24-12A-18: 5/8 in bolt, single shear, tm = 2.5 in, ts = 1.5 in, G = 0.46, Zm⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood fastener connection.

NDS24-12A-18 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zm⊥)	lb	390.0	391.1	+0.28		Pass

NDS24-12A-19: 5/8 in bolt, single shear, tm = 2.5 in, ts = 1.5 in, G = 0.46, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood fastener connection.

NDS24-12A-19 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z⊥)	lb	300.0	303.2	+1.06		Pass

NDS24-12A-20: 7/8 in bolt, single shear, tm = 3.5 in, ts = 1.75 in, G = 0.49, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood fastener connection.

NDS24-12A-20 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	1,590	1,586	-0.25		Pass

NDS24-12A-21: 7/8 in bolt, single shear, tm = 3.5 in, ts = 1.75 in, G = 0.49, Zs⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood fastener connection.

NDS24-12A-21 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zs⊥)	lb	700.0	709.9	+1.41		Pass

NDS24-12A-22: 7/8 in bolt, single shear, tm = 3.5 in, ts = 1.75 in, G = 0.49, Zm⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood fastener connection.

NDS24-12A-22 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zm⊥)	lb	690.0	692.8	+0.41		Pass

NDS24-12A-23: 7/8 in bolt, single shear, tm = 3.5 in, ts = 1.75 in, G = 0.49, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood fastener connection.

NDS24-12A-23 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z⊥)	lb	530.0	535.9	+1.12		Pass

NDS24-12A-24: 3/4 in bolt, single shear, tm = 3.5 in, ts = 1.5 in, G = 0.43, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 102. Calculation: Wood fastener connection.

NDS24-12A-24 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	1,100	1,098	-0.22		Pass

NDS24-12A-25: 3/4 in bolt, single shear, tm = 3.5 in, ts = 1.5 in, G = 0.43, Zs⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 102. Calculation: Wood fastener connection.

NDS24-12A-25 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zs⊥)	lb	460.0	466.1	+1.33		Pass

NDS24-12A-26: 3/4 in bolt, single shear, tm = 3.5 in, ts = 1.5 in, G = 0.43, Zm⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 102. Calculation: Wood fastener connection.

NDS24-12A-26 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zm⊥)	lb	500.0	500.0	+0.00		Pass

NDS24-12A-27: 3/4 in bolt, single shear, tm = 3.5 in, ts = 1.5 in, G = 0.43, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 102. Calculation: Wood fastener connection.

NDS24-12A-27 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z⊥)	lb	400.0	405.4	+1.36		Pass

NDS24-12A-28: 5/8 in bolt, single shear, tm = 3.5 in, ts = 1.75 in, G = 0.42, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 102. Calculation: Wood fastener connection.

NDS24-12A-28 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	820.0	824.2	+0.51		Pass

NDS24-12A-29: 5/8 in bolt, single shear, tm = 3.5 in, ts = 1.75 in, G = 0.42, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 102. Calculation: Wood fastener connection.

NDS24-12A-29 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z⊥)	lb	360.0	362.2	+0.61		Pass

NDS24-12A-30: 1/2 in bolt, single shear, tm = 1.5 in, ts = 1.5 in, G = 0.37, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 102. Calculation: Wood fastener connection.

NDS24-12A-30 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	360.0	357.6	-0.67		Pass

NDS24-12A-31: 1/2 in bolt, single shear, tm = 1.5 in, ts = 1.5 in, G = 0.37, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 102. Calculation: Wood fastener connection.

NDS24-12A-31 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z⊥)	lb	140.0	140.9	+0.62		Pass

NDS24-12B-32: 1/2 in bolt, 1/4 in A36 side plate, tm = 3.5 in, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12B, pp. p. 103. Calculation: Wood fastener connection.

NDS24-12B-32 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	830.0	825.7	-0.51		Pass

NDS24-12B-33: 1/2 in bolt, 1/4 in A36 side plate, tm = 3.5 in, G = 0.50, Zm⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12B, pp. p. 103. Calculation: Wood fastener connection.

NDS24-12B-33 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zm⊥)	lb	510.0	513.5	+0.69		Pass

NDS24-12B-34: 3/4 in bolt, 1/4 in A36 side plate, tm = 3.5 in, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12B, pp. p. 103. Calculation: Wood fastener connection.

NDS24-12B-34 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	1,670	1,671	+0.08		Pass

NDS24-12B-35: 3/4 in bolt, 1/4 in A36 side plate, tm = 3.5 in, G = 0.50, Zm⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12B, pp. p. 103. Calculation: Wood fastener connection.

NDS24-12B-35 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zm⊥)	lb	680.0	676.5	-0.52		Pass

NDS24-12B-36: 5/8 in bolt, 1/4 in A36 side plate, tm = 3.5 in, G = 0.55, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12B, pp. p. 103. Calculation: Wood fastener connection.

NDS24-12B-36 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	1,260	1,258	-0.19		Pass

NDS24-12B-37: 5/8 in bolt, 1/4 in A36 side plate, tm = 3.5 in, G = 0.55, Zm⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12B, pp. p. 103. Calculation: Wood fastener connection.

NDS24-12B-37 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zm⊥)	lb	690.0	690.1	+0.01		Pass

NDS24-12B-38: 3/4 in bolt, 1/4 in A36 side plate, tm = 1.5 in, G = 0.43, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12B, pp. p. 103. Calculation: Wood fastener connection.

NDS24-12B-38 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	780.0	784.0	+0.51		Pass

NDS24-12B-39: 3/4 in bolt, 1/4 in A36 side plate, tm = 1.5 in, G = 0.43, Zm⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12B, pp. p. 103. Calculation: Wood fastener connection.

NDS24-12B-39 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zm⊥)	lb	360.0	366.9	+1.91		Pass

NDS24-12B-40: 7/8 in bolt, 1/4 in A36 side plate, tm = 5.5 in, G = 0.42, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12B, pp. p. 103. Calculation: Wood fastener connection.

NDS24-12B-40 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	2,050	2,054	+0.22		Pass

NDS24-12B-41: 7/8 in bolt, 1/4 in A36 side plate, tm = 5.5 in, G = 0.42, Zm⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12B, pp. p. 103. Calculation: Wood fastener connection.

NDS24-12B-41 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zm⊥)	lb	860.0	858.5	-0.18		Pass

NDS24-12F-42: 1/2 in bolt, double shear, tm = 3.5 in, ts = 1.5 in, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12F, pp. p. 107. Calculation: Wood fastener connection.

NDS24-12F-42 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	1,230	1,230	-0.03		Pass

NDS24-12F-43: 1/2 in bolt, double shear, tm = 3.5 in, ts = 1.5 in, G = 0.50, Zs⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12F, pp. p. 107. Calculation: Wood fastener connection.

NDS24-12F-43 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zs⊥)	lb	730.0	733.6	+0.49		Pass

NDS24-12F-44: 1/2 in bolt, double shear, tm = 3.5 in, ts = 1.5 in, G = 0.50, Zm⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12F, pp. p. 107. Calculation: Wood fastener connection.

NDS24-12F-44 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zm⊥)	lb	860.0	865.0	+0.58		Pass

NDS24-12F-45: 3/4 in bolt, double shear, tm = 3.5 in, ts = 1.5 in, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12F, pp. p. 107. Calculation: Wood fastener connection.

NDS24-12F-45 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	2,400	2,404	+0.16		Pass

NDS24-12F-46: 3/4 in bolt, double shear, tm = 3.5 in, ts = 1.5 in, G = 0.50, Zs⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12F, pp. p. 107. Calculation: Wood fastener connection.

NDS24-12F-46 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zs⊥)	lb	1,170	1,160	-0.84		Pass

NDS24-12F-47: 3/4 in bolt, double shear, tm = 3.5 in, ts = 1.5 in, G = 0.50, Zm⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12F, pp. p. 107. Calculation: Wood fastener connection.

NDS24-12F-47 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zm⊥)	lb	1,370	1,354	-1.20		Pass

NDS24-12F-48: 5/8 in bolt, double shear, tm = 3.5 in, ts = 1.5 in, G = 0.55, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12F, pp. p. 107. Calculation: Wood fastener connection.

NDS24-12F-48 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	1,870	1,873	+0.15		Pass

NDS24-12F-49: 5/8 in bolt, double shear, tm = 3.5 in, ts = 1.5 in, G = 0.55, Zm⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12F, pp. p. 107. Calculation: Wood fastener connection.

NDS24-12F-49 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zm⊥)	lb	1,290	1,287	-0.21		Pass

NDS24-12F-50: 1/2 in bolt, double shear, tm = 1.5 in, ts = 1.5 in, G = 0.67, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12F, pp. p. 107. Calculation: Wood fastener connection.

NDS24-12F-50 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	1,410	1,407	-0.21		Pass

NDS24-12F-51: 1/2 in bolt, double shear, tm = 1.5 in, ts = 1.5 in, G = 0.67, Zs⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12F, pp. p. 107. Calculation: Wood fastener connection.

NDS24-12F-51 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zs⊥)	lb	960.0	954.5	-0.57		Pass

NDS24-12F-52: 1/2 in bolt, double shear, tm = 1.5 in, ts = 1.5 in, G = 0.67, Zm⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12F, pp. p. 107. Calculation: Wood fastener connection.

NDS24-12F-52 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zm⊥)	lb	730.0	724.0	-0.82		Pass

NDS24-12F-53: 3/4 in bolt, double shear, tm = 3.5 in, ts = 3.5 in, G = 0.46, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12F, pp. p. 107. Calculation: Wood fastener connection.

NDS24-12F-53 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	3,090	3,091	+0.02		Pass

NDS24-12F-54: 3/4 in bolt, double shear, tm = 3.5 in, ts = 3.5 in, G = 0.46, Zs⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12F, pp. p. 107. Calculation: Wood fastener connection.

NDS24-12F-54 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zs⊥)	lb	1,610	1,599	-0.69		Pass

NDS24-12F-55: 3/4 in bolt, double shear, tm = 3.5 in, ts = 3.5 in, G = 0.46, Zm⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12F, pp. p. 107. Calculation: Wood fastener connection.

NDS24-12F-55 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zm⊥)	lb	1,210	1,199	-0.88		Pass

NDS24-12J-56: 1/2 in lag screw, ts = 1.5 in, p = 8D, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12J, pp. p. 112. Calculation: Wood fastener connection.

NDS24-12J-56 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	390.0	394.2	+1.08		Pass

NDS24-12J-57: 1/2 in lag screw, ts = 1.5 in, p = 8D, G = 0.50, Zs⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12J, pp. p. 112. Calculation: Wood fastener connection.

NDS24-12J-57 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zs⊥)	lb	220.0	224.9	+2.21		Pass

NDS24-12J-58 · Wood fastener connection: 1/2 in lag screw, ts = 1.5 in, p = 8D, G = 0.50, Zm⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12J, pp. p. 112. Calculation: Wood fastener connection.

NDS24-12J-58 · Wood fastener connection · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zm⊥)	lb	270.0	267.8	-0.81		Pass

NDS24-12J-59: 1/2 in lag screw, ts = 1.5 in, p = 8D, G = 0.50, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12J, pp. p. 112. Calculation: Wood fastener connection.

NDS24-12J-59 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z⊥)	lb	200.0	204.5	+2.25		Pass

NDS24-12J-60: 5/8 in lag screw, ts = 1.5 in, p = 8D, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12J, pp. p. 112. Calculation: Wood fastener connection.

NDS24-12J-60 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	560.0	561.8	+0.32		Pass

NDS24-12J-61: 5/8 in lag screw, ts = 1.5 in, p = 8D, G = 0.50, Zs⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12J, pp. p. 112. Calculation: Wood fastener connection.

NDS24-12J-61 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zs⊥)	lb	310.0	313.2	+1.02		Pass

NDS24-12J-62: 5/8 in lag screw, ts = 1.5 in, p = 8D, G = 0.50, Zm⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12J, pp. p. 112. Calculation: Wood fastener connection.

NDS24-12J-62 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zm⊥)	lb	380.0	384.6	+1.20		Pass

NDS24-12J-63: 5/8 in lag screw, ts = 1.5 in, p = 8D, G = 0.50, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12J, pp. p. 112. Calculation: Wood fastener connection.

NDS24-12J-63 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z⊥)	lb	280.0	278.1	-0.68		Pass

NDS24-12J-64: 3/4 in lag screw, ts = 1.5 in, p = 8D, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12J, pp. p. 112. Calculation: Wood fastener connection.

NDS24-12J-64 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	770.0	774.5	+0.58		Pass

NDS24-12J-65: 3/4 in lag screw, ts = 1.5 in, p = 8D, G = 0.50, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12J, pp. p. 112. Calculation: Wood fastener connection.

NDS24-12J-65 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z⊥)	lb	380.0	379.4	-0.16		Pass

NDS24-12J-66: 1/4 in lag screw, ts = 0.5 in, p = 8D, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12J, pp. p. 112. Calculation: Wood fastener connection.

NDS24-12J-66 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	120.0	119.1	-0.78		Pass

NDS24-12J-67: 1/4 in lag screw, ts = 0.5 in, p = 8D, G = 0.50, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12J, pp. p. 112. Calculation: Wood fastener connection.

NDS24-12J-67 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z⊥)	lb	80.00	82.42	+3.03		Pass

NDS24-12J-68: 1 in lag screw, ts = 1.75 in, p = 8D, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12J, pp. p. 112. Calculation: Wood fastener connection.

NDS24-12J-68 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	1,340	1,339	-0.06		Pass

NDS24-12J-69: 1 in lag screw, ts = 1.75 in, p = 8D, G = 0.50, Zs⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12J, pp. p. 112. Calculation: Wood fastener connection.

NDS24-12J-69 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zs⊥)	lb	610.0	609.5	-0.08		Pass

NDS24-12J-70: 1 in lag screw, ts = 1.75 in, p = 8D, G = 0.50, Zm⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12J, pp. p. 112. Calculation: Wood fastener connection.

NDS24-12J-70 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zm⊥)	lb	850.0	845.9	-0.48		Pass

NDS24-12J-71: 1/2 in lag screw, ts = 1.5 in, p = 8D, G = 0.55, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12J, pp. p. 112. Calculation: Wood fastener connection.

NDS24-12J-71 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	410.0	413.5	+0.84		Pass

NDS24-12J-72: 1/2 in lag screw, ts = 1.5 in, p = 8D, G = 0.55, Zm⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12J, pp. p. 112. Calculation: Wood fastener connection.

NDS24-12J-72 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zm⊥)	lb	290.0	284.7	-1.82		Pass

NDS24-12K-73: 1/2 in lag screw, ts = 0.25 in steel, p = 8D, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12K, pp. p. 114. Calculation: Wood fastener connection.

NDS24-12K-73 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	520.0	517.2	-0.54		Pass

NDS24-12K-74: 1/2 in lag screw, ts = 0.25 in steel, p = 8D, G = 0.50, Zm⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12K, pp. p. 114. Calculation: Wood fastener connection.

NDS24-12K-74 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zm⊥)	lb	320.0	323.1	+0.96		Pass

NDS24-12K-75: 3/4 in lag screw, ts = 0.25 in steel, p = 8D, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12K, pp. p. 114. Calculation: Wood fastener connection.

NDS24-12K-75 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	1,060	1,057	-0.31		Pass

NDS24-12K-76: 3/4 in lag screw, ts = 0.25 in steel, p = 8D, G = 0.50, Zm⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12K, pp. p. 114. Calculation: Wood fastener connection.

NDS24-12K-76 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zm⊥)	lb	600.0	597.9	-0.36		Pass

NDS24-12K-77: 1/2 in lag screw, ts = 0.239 in steel, p = 8D, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12K, pp. p. 114. Calculation: Wood fastener connection.

NDS24-12K-77 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	460.0	456.3	-0.81		Pass

NDS24-12K-78: 1/2 in lag screw, ts = 0.239 in steel, p = 8D, G = 0.50, Zm⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12K, pp. p. 114. Calculation: Wood fastener connection.

NDS24-12K-78 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zm⊥)	lb	290.0	286.3	-1.28		Pass

NDS24-12K-79: 3/8 in lag screw, ts = 0.239 in steel, p = 8D, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12K, pp. p. 114. Calculation: Wood fastener connection.

NDS24-12K-79 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	270.0	272.4	+0.88		Pass

NDS24-12K-80: 5/16 in lag screw, ts = 0.105 in steel, p = 8D, G = 0.42, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12K, pp. p. 114. Calculation: Wood fastener connection.

NDS24-12K-80 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	190.0	185.7	-2.24		Pass

NDS24-12K-81: 5/16 in lag screw, ts = 0.105 in steel, p = 8D, G = 0.42, Zm⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12K, pp. p. 114. Calculation: Wood fastener connection.

NDS24-12K-81 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Zm⊥)	lb	120.0	123.6	+2.96		Pass

NDS24-12L-82: No. 10 wood screw, ts = 0.75 in, p = 10D, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12L, pp. p. 115. Calculation: Wood fastener connection.

NDS24-12L-82 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	107.0	106.3	-0.64		Pass

NDS24-12L-83: No. 6 wood screw, ts = 0.5 in, p = 10D, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12L, pp. p. 115. Calculation: Wood fastener connection.

NDS24-12L-83 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	59.00	59.17	+0.28		Pass

NDS24-12L-84: No. 14 wood screw, ts = 1.5 in, p = 10D, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12L, pp. p. 115. Calculation: Wood fastener connection.

NDS24-12L-84 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	163.0	162.4	-0.35		Pass

NDS24-12L-85: No. 8 wood screw, ts = 1 in, p = 10D, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12L, pp. p. 115. Calculation: Wood fastener connection.

NDS24-12L-85 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	92.00	92.00	-0.00		Pass

NDS24-12L-86: No. 12 wood screw, ts = 1 in, p = 10D, G = 0.43, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12L, pp. p. 115. Calculation: Wood fastener connection.

NDS24-12L-86 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	118.0	118.6	+0.52		Pass

NDS24-12L-87: No. 8 wood screw, ts = 0.75 in, p = 10D, G = 0.42, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12L, pp. p. 115. Calculation: Wood fastener connection.

NDS24-12L-87 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	69.00	68.77	-0.33		Pass

NDS24-12M-88: No. 10 wood screw, ts = 0.06 in steel, p = 10D, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12M, pp. p. 116. Calculation: Wood fastener connection.

NDS24-12M-88 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	116.0	115.7	-0.29		Pass

NDS24-12M-89: No. 14 wood screw, ts = 0.12 in steel, p = 10D, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12M, pp. p. 116. Calculation: Wood fastener connection.

NDS24-12M-89 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	175.0	174.9	-0.05		Pass

NDS24-12M-90: No. 8 wood screw, ts = 0.075 in steel, p = 10D, G = 0.55, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12M, pp. p. 116. Calculation: Wood fastener connection.

NDS24-12M-90 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	103.0	102.5	-0.52		Pass

NDS24-12M-91: No. 12 wood screw, ts = 0.239 in steel, p = 10D, G = 0.43, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12M, pp. p. 116. Calculation: Wood fastener connection.

NDS24-12M-91 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	176.0	176.2	+0.10		Pass

NDS24-12N-92: 16d nail, ts = 1.5 in, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12N, pp. p. 117. Calculation: Wood fastener connection.

NDS24-12N-92 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	141.0	140.7	-0.22		Pass

NDS24-12N-93: 10d nail, ts = 1.5 in, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12N, pp. p. 117. Calculation: Wood fastener connection.

NDS24-12N-93 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	118.0	117.4	-0.49		Pass

NDS24-12N-94: 8d nail, ts = 0.75 in, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12N, pp. p. 117. Calculation: Wood fastener connection.

NDS24-12N-94 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	90.00	90.12	+0.13		Pass

NDS24-12N-95: 20d nail, ts = 0.75 in, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12N, pp. p. 117. Calculation: Wood fastener connection.

NDS24-12N-95 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	138.0	138.2	+0.12		Pass

NDS24-12N-96: 50d nail, ts = 0.75 in, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12N, pp. p. 117. Calculation: Wood fastener connection.

NDS24-12N-96 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	162.0	161.9	-0.08		Pass

NDS24-12N-97: 16d nail, ts = 1.5 in, G = 0.55, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12N, pp. p. 117. Calculation: Wood fastener connection.

NDS24-12N-97 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	154.0	153.6	-0.27		Pass

NDS24-12N-98: 16d nail, ts = 1.5 in, G = 0.42, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12N, pp. p. 117. Calculation: Wood fastener connection.

NDS24-12N-98 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	120.0	119.8	-0.13		Pass

NDS24-12N-99: 10d nail, ts = 1.5 in, G = 0.43, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12N, pp. p. 117. Calculation: Wood fastener connection.

NDS24-12N-99 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	102.0	102.2	+0.21		Pass

NDS24-12N-100: 16d_box nail, ts = 1.5 in, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12N, pp. p. 117. Calculation: Wood fastener connection.

NDS24-12N-100 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	103.0	103.0	-0.01		Pass

NDS24-12N-101: 16d_sinker nail, ts = 1.5 in, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12N, pp. p. 117. Calculation: Wood fastener connection.

NDS24-12N-101 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	118.0	117.4	-0.49		Pass

NDS24-12P-102: 16d nail, ts = 0.06 in steel, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12P, pp. p. 118. Calculation: Wood fastener connection.

NDS24-12P-102 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	138.0	138.0	+0.02		Pass

NDS24-12P-103: 8d nail, ts = 0.048 in steel, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12P, pp. p. 118. Calculation: Wood fastener connection.

NDS24-12P-103 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	95.00	94.78	-0.23		Pass

NDS24-12P-104: 10d nail, ts = 0.06 in steel, G = 0.55, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12P, pp. p. 118. Calculation: Wood fastener connection.

NDS24-12P-104 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	126.0	125.4	-0.49		Pass

NDS24-12P-105: 8d nail, ts = 0.036 in steel, G = 0.50, Z‖

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12P, pp. p. 118. Calculation: Wood fastener connection.

NDS24-12P-105 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (Z‖)	lb	94.00	93.82	-0.20		Pass

NDS24-12.2A-106: Withdrawal per inch, lag 1/2, G = 0.50

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12.2A, pp. p. 85. Calculation: Wood fastener connection.

NDS24-12.2A-106 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
W (lb/in)	lb	378.0	378.4	+0.11		Pass

NDS24-12.2A-107: Withdrawal per inch, lag 3/4, G = 0.55

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12.2A, pp. p. 85. Calculation: Wood fastener connection.

NDS24-12.2A-107 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
W (lb/in)	lb	592.0	591.7	-0.05		Pass

NDS24-12.2A-108: Withdrawal per inch, lag 3/8, G = 0.43

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12.2A, pp. p. 85. Calculation: Wood fastener connection.

NDS24-12.2A-108 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
W (lb/in)	lb	243.0	243.2	+0.09		Pass

NDS24-12.2B-109: Withdrawal per inch, wood screw 10, G = 0.50

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12.2B, pp. p. 86. Calculation: Wood fastener connection.

NDS24-12.2B-109 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
W (lb/in)	lb	135.0	135.4	+0.28		Pass

NDS24-12.2B-110: Withdrawal per inch, wood screw 8, G = 0.42

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12.2B, pp. p. 86. Calculation: Wood fastener connection.

NDS24-12.2B-110 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
W (lb/in)	lb	82.00	82.45	+0.55		Pass

NDS24-12.2C-111: Withdrawal per inch, nail 16d, G = 0.50

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12.2C, pp. p. 87. Calculation: Wood fastener connection.

NDS24-12.2C-111 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
W (lb/in)	lb	40.00	39.52	-1.20		Pass

NDS24-12.2C-112: Withdrawal per inch, nail 8d, G = 0.50

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12.2C, pp. p. 87. Calculation: Wood fastener connection.

NDS24-12.2C-112 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
W (lb/in)	lb	32.00	31.96	-0.13		Pass

NDS24-12.2C-113: Withdrawal per inch, nail 10d, G = 0.55

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12.2C, pp. p. 87. Calculation: Wood fastener connection.

NDS24-12.2C-113 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
W (lb/in)	lb	46.00	45.82	-0.39		Pass

NDS24-12.2C-114: Withdrawal per inch, nail 50d, G = 0.42

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12.2C, pp. p. 87. Calculation: Wood fastener connection.

NDS24-12.2C-114 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
W (lb/in)	lb	38.00	38.49	+1.30		Pass

NDS24-12.2F-1: Head pull-through, 16d common (DH = 0.344 in), G = 0.50, tns = 1-1/2 in

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12.2F, pp. p. 90. Calculation: Wood fastener connection.

NDS24-12.2F-1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
WH	lb	160.0	160.3	+0.20		Pass

NDS24-12.2F-2: Head pull-through, 16d common (DH = 0.344 in), G = 0.42, tns = 1/2 in

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12.2F, pp. p. 90. Calculation: Wood fastener connection.

NDS24-12.2F-2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
WH	lb	66.00	65.77	-0.35		Pass

NDS-B1: 1/2 in bolt, single shear, DF-L 1-1/2 in to 3-1/2 in, parallel to grain

Source: Hand calculation (closed form). Calculation: Wood fastener connection.

NDS-B1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mode Im	lb	2,450	2,450	+0.00		Pass
Mode Is	lb	1,050	1,050	+0.00		Pass
Mode II	lb	913.3	913.3	+0.00		Pass
Mode IIIm	lb	1,103	1,103	+0.00		Pass
Mode IIIs	lb	614.8	614.8	+0.00		Pass
Mode IV	lb	716.0	716.0	-0.00		Pass
Z (mode IIIs) NDS 2024 Table 12A (p. 101) lists 610 lb for this connection	lb	614.8	614.8	+0.00		Pass
Z' (CD = 1.0)	lb	614.8	614.8	+0.00		Pass

NDS-B1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z' = Z KF φz λ (λ = 0.8)	lb	1,061	1,061	+0.00		Pass

NDS-B2: 3/4 in bolt, double shear, 1/4 in A36 side plates, perpendicular to grain

Source: Hand calculation (closed form). Calculation: Wood fastener connection.

NDS-B2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fem = Fe⊥	psi	2,578	2,578	+0.00		Pass
Fes = 1.5 Fu	psi	87,000	87,000	+0.00		Pass
Mode Im	lb	1,354	1,354	+0.00		Pass
Mode Is	lb	6,525	6,525	+0.00		Pass
Mode IIIs	lb	1,881	1,881	+0.00		Pass
Mode IV	lb	2,438	2,438	+0.00		Pass
Z	lb	1,354	1,354	+0.00		Pass

NDS-B3: 5/8 in bolt at 45° to grain (Hankinson), Southern Pine

Source: Hand calculation (closed form). Calculation: Wood fastener connection.

NDS-B3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Feθ (Hankinson)	psi	4,249	4,249	+0.00		Pass
Mode IIIs	lb	766.4	766.4	+0.00		Pass
Mode IV	lb	942.4	942.4	-0.00		Pass

NDS-L1: 1/2 × 6 in lag screw (D = Dr), lateral, withdrawal and combined at 30°

Source: Hand calculation (closed form). Calculation: Wood fastener connection.

NDS-L1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mode IIIs	lb	400.0	400.0	+0.00		Pass
Mode II	lb	835.7	835.7	+0.00		Pass
Mode IV	lb	394.2	394.2	+0.00		Pass
Z	lb	394.2	394.2	+0.00		Pass
W (lb/in)	lb	378.4	378.4	+0.00		Pass
W'p	lb	1,206	1,206	+0.00		Pass
Z'α (Eq. 12.4-1)	lb	474.0	474.0	+0.00		Pass

NDS-N1: 16d common nail, DF-L 1-1/2 in side member, lateral

Source: Hand calculation (closed form). Calculation: Wood fastener connection.

NDS-N1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fe = 16,600 G^1.84	psi	4,637	4,637	+0.00		Pass
Mode Im	lb	627.6	627.6	+0.00		Pass
Mode Is	lb	512.1	512.1	+0.00		Pass
Mode II	lb	238.1	238.1	+0.00		Pass
Mode IIIm	lb	224.7	224.7	+0.00		Pass
Mode IIIs	lb	189.5	189.5	+0.00		Pass
Mode IV	lb	140.7	140.7	+0.00		Pass
Z NDS 2024 Table 12N (p. 117) lists 141 lb	lb	140.7	140.7	+0.00		Pass

NDS-N2: 16d common nail in withdrawal

Source: Hand calculation (closed form). Calculation: Wood fastener connection.

NDS-N2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
W (lb/in)	lb	39.52	39.52	+0.00		Pass
W'p = W × 2.0 in	lb	79.04	79.04	+0.00		Pass

NDS-N3: 16d common nail at 40° to the surface (Eq. 12.4-2)

Source: Hand calculation (closed form). Calculation: Wood fastener connection.

NDS-N3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z'α (Eq. 12.4-2)	lb	73.65	73.65	+0.00		Pass

NDS-S1: No. 10 rolled thread wood screw, lateral, withdrawal and pull-through

Source: Hand calculation (closed form). Calculation: Wood fastener connection.

NDS-S1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z	lb	106.3	106.3	+0.00		Pass
W (lb/in)	lb	135.4	135.4	+0.00		Pass
W'p	lb	225.6	225.6	+0.00		Pass
W'H (Eq. 12.2-6a)	lb	147.5	147.5	+0.00		Pass

NDS-G1: Four 3/4 in bolts in a row: Cg, CΔ, CD, CM, Ct

Source: Hand calculation (closed form). Calculation: Wood fastener connection.

NDS-G1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cg (Eq. 11.3-1)		0.977	0.977	+0.00		Pass
CΔ end distance		0.714	0.714	+0.00		Pass
Z	lb	2,404	2,404	+0.00		Pass
n Z'	lb	5,262	5,262	+0.00		Pass

TR12-3.1-0-0: 1/2 in bolt, single shear, 1-1/2 in members, main ‖ / side ‖, no gap

Source: AWC Technical Report 12, TR12-1510, General Dowel Equations (2015), pp. Example 3.1, p. 17. Calculation: Wood fastener connection.

TR12-3.1-0-0 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mode Im	lb	900.0	903.0	+0.33		Pass
Mode Is	lb	900.0	903.0	+0.33		Pass
Mode II	lb	414.0	415.6	+0.39		Pass
Mode IIIm	lb	550.0	551.2	+0.22		Pass
Mode IIIs	lb	550.0	551.2	+0.22		Pass
Mode IV	lb	663.0	664.0	+0.15		Pass
Z	lb	414.0	415.6	+0.39		Pass

TR12-3.1-0-90: 1/2 in bolt, single shear, 1-1/2 in members, main ∥ / side ⊥, no gap

Source: AWC Technical Report 12, TR12-1510, General Dowel Equations (2015), pp. Example 3.1, p. 17. Calculation: Wood fastener connection.

TR12-3.1-0-90 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mode Im	lb	720.0	722.4	+0.33		Pass
Mode Is	lb	383.0	380.6	-0.63		Pass
Mode II	lb	250.0	250.0	-0.01		Pass
Mode IIIm	lb	380.0	380.2	+0.05		Pass
Mode IIIs	lb	324.0	323.9	-0.03		Pass
Mode IV	lb	442.0	441.3	-0.16		Pass
Z	lb	250.0	250.0	-0.01		Pass

TR12-3.1-90-90: 1/2 in bolt, single shear, 1-1/2 in members, main ⊥ / side ⊥, no gap

Source: AWC Technical Report 12, TR12-1510, General Dowel Equations (2015), pp. Example 3.1, p. 17. Calculation: Wood fastener connection.

TR12-3.1-90-90 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mode Im	lb	383.0	380.6	-0.63		Pass
Mode Is	lb	383.0	380.6	-0.63		Pass
Mode II	lb	176.0	175.2	-0.47		Pass
Mode IIIm	lb	289.0	288.3	-0.24		Pass
Mode IIIs	lb	289.0	288.3	-0.24		Pass
Mode IV	lb	387.0	385.6	-0.37		Pass
Z	lb	176.0	175.2	-0.47		Pass

TR12-3.2-1-0: 3/8 in lag screw, Case 1 (NDS basis, D = Dr), side member ‖

Source: AWC Technical Report 12, TR12-1510, General Dowel Equations (2015), pp. Example 3.2, pp. 17-19 (Figure 3-2 table). Calculation: Wood fastener connection.

TR12-3.2-1-0 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mode Im	lb	1,113	1,113	-0.00		Pass
Mode Is	lb	557.0	556.5	-0.09		Pass
Mode II	lb	420.0	420.1	+0.03		Pass
Mode IIIm	lb	478.0	478.2	+0.03		Pass
Mode IIIs	lb	260.0	260.1	+0.04		Pass
Mode IV	lb	201.0	201.1	+0.07		Pass
Z	lb	201.0	201.1	+0.07		Pass

TR12-3.2-1-90: 3/8 in lag screw, Case 1 (NDS basis, D = Dr), side member ⊥

Source: AWC Technical Report 12, TR12-1510, General Dowel Equations (2015), pp. Example 3.2, pp. 17-19 (Figure 3-2 table). Calculation: Wood fastener connection.

TR12-3.2-1-90 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mode Im	lb	890.0	890.4	+0.04		Pass
Mode Is	lb	290.0	289.9	-0.05		Pass
Mode II	lb	304.0	304.3	+0.10		Pass
Mode IIIm	lb	353.0	352.5	-0.15		Pass
Mode IIIs	lb	153.0	153.2	+0.11		Pass
Mode IV	lb	143.0	142.9	-0.07		Pass
Z	lb	143.0	142.9	-0.07		Pass

TR12-3.4: 8d nail through 16 gage steel into wood (NDS case, lm = p − E/2)

Source: AWC Technical Report 12, TR12-1510, General Dowel Equations (2015), pp. Example 3.4, p. 22. Calculation: Wood fastener connection.

TR12-3.4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (mode IIIs)	lb	97.00	96.39	-0.63		Pass
Mode IIIs	lb	97.00	96.39	-0.63		Pass

AWC-E2.5: 1/2 in bolt, single shear, Hem-Fir 4x to 4x

Source: AWC Structural Wood Design Examples 2015/2018, as quoted on the Trimble Tekla Tedds 2026 verification page "Single Bolt Lateral Design - Single Shear - Wood-to-Wood … (ASD)", pp. AWC pp. 97-101. Calculation: Wood fastener connection.

AWC-E2.5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fem = Fes (Table 12.3.3) NDS Table 12.3.3 value; the module computes 11,200 G = 4,816 psi	psi	4,800	4,816	+0.33		Pass
Mode Im	lb	2,100	2,107	+0.33		Pass
Mode Is	lb	2,100	2,107	+0.33		Pass
Mode II	lb	966.0	969.7	+0.39		Pass
Mode IIIm	lb	957.0	959.7	+0.28		Pass
Mode IIIs	lb	957.0	959.7	+0.28		Pass
Mode IV	lb	663.0	664.0	+0.15		Pass
Z	lb	663.0	664.0	+0.15		Pass

AWC-E2.2: 10d common nail, DF-L 1x side member into 3x main member

Source: AWC Structural Wood Design Examples 2015/2018, as quoted on the Trimble Tekla Tedds 2026 verification page "Single Nail Lateral Design - Single Shear - Wood-to-Wood … (ASD)", pp. AWC pp. 86-90. Calculation: Wood fastener connection.

AWC-E2.2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mode Im	lb	658.0	655.7	-0.35		Pass
Mode Is	lb	235.0	233.9	-0.45		Pass
Mode II	lb	219.0	218.6	-0.16		Pass
Mode IIIm	lb	230.0	228.9	-0.46		Pass
Mode IIIs	lb	105.0	105.1	+0.09		Pass
Mode IV	lb	118.0	117.4	-0.49		Pass
Z	lb	105.0	105.1	+0.09		Pass

NDS24-11.3.6A-0.5-5-2: Group action Cg, 2 bolts of 1 in at 4 in, As = 5 in², As/Am = 0.5

Source: AWC NDS 2024 (National Design Specification for Wood Construction), pp. Table 11.3.6A, PDF p. 87. Calculation: Wood fastener connection.

NDS24-11.3.6A-0.5-5-2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cg		0.980	0.977	-0.34		Pass

NDS24-11.3.6A-0.5-5-6: Group action Cg, 6 bolts of 1 in at 4 in, As = 5 in², As/Am = 0.5

Source: AWC NDS 2024 (National Design Specification for Wood Construction), pp. Table 11.3.6A, PDF p. 87. Calculation: Wood fastener connection.

NDS24-11.3.6A-0.5-5-6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cg		0.680	0.677	-0.49		Pass

NDS24-11.3.6A-0.5-5-12: Group action Cg, 12 bolts of 1 in at 4 in, As = 5 in², As/Am = 0.5

Source: AWC NDS 2024 (National Design Specification for Wood Construction), pp. Table 11.3.6A, PDF p. 87. Calculation: Wood fastener connection.

NDS24-11.3.6A-0.5-5-12 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cg		0.380	0.382	+0.62		Pass

NDS24-11.3.6A-0.5-20-4: Group action Cg, 4 bolts of 1 in at 4 in, As = 20 in², As/Am = 0.5

Source: AWC NDS 2024 (National Design Specification for Wood Construction), pp. Table 11.3.6A, PDF p. 87. Calculation: Wood fastener connection.

NDS24-11.3.6A-0.5-20-4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cg		0.950	0.948	-0.24		Pass

NDS24-11.3.6A-0.5-20-8: Group action Cg, 8 bolts of 1 in at 4 in, As = 20 in², As/Am = 0.5

Source: AWC NDS 2024 (National Design Specification for Wood Construction), pp. Table 11.3.6A, PDF p. 87. Calculation: Wood fastener connection.

NDS24-11.3.6A-0.5-20-8 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cg		0.780	0.785	+0.61		Pass

NDS24-11.3.6A-0.5-64-10: Group action Cg, 10 bolts of 1 in at 4 in, As = 64 in², As/Am = 0.5

Source: AWC NDS 2024 (National Design Specification for Wood Construction), pp. Table 11.3.6A, PDF p. 87. Calculation: Wood fastener connection.

NDS24-11.3.6A-0.5-64-10 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cg		0.870	0.868	-0.22		Pass

NDS24-11.3.6A-1-5-3: Group action Cg, 3 bolts of 1 in at 4 in, As = 5 in², As/Am = 1

Source: AWC NDS 2024 (National Design Specification for Wood Construction), pp. Table 11.3.6A, PDF p. 87. Calculation: Wood fastener connection.

NDS24-11.3.6A-1-5-3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cg		0.970	0.969	-0.11		Pass

NDS24-11.3.6A-1-5-7: Group action Cg, 7 bolts of 1 in at 4 in, As = 5 in², As/Am = 1

Source: AWC NDS 2024 (National Design Specification for Wood Construction), pp. Table 11.3.6A, PDF p. 87. Calculation: Wood fastener connection.

NDS24-11.3.6A-1-5-7 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cg		0.710	0.707	-0.38		Pass

NDS24-11.3.6A-1-5-11: Group action Cg, 11 bolts of 1 in at 4 in, As = 5 in², As/Am = 1

Source: AWC NDS 2024 (National Design Specification for Wood Construction), pp. Table 11.3.6A, PDF p. 87. Calculation: Wood fastener connection.

NDS24-11.3.6A-1-5-11 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cg		0.490	0.493	+0.59		Pass

NDS24-11.3.6A-1-12-5: Group action Cg, 5 bolts of 1 in at 4 in, As = 12 in², As/Am = 1

Source: AWC NDS 2024 (National Design Specification for Wood Construction), pp. Table 11.3.6A, PDF p. 87. Calculation: Wood fastener connection.

NDS24-11.3.6A-1-12-5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cg		0.930	0.925	-0.52		Pass

NDS24-11.3.6A-1-40-9: Group action Cg, 9 bolts of 1 in at 4 in, As = 40 in², As/Am = 1

Source: AWC NDS 2024 (National Design Specification for Wood Construction), pp. Table 11.3.6A, PDF p. 87. Calculation: Wood fastener connection.

NDS24-11.3.6A-1-40-9 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cg		0.900	0.897	-0.32		Pass

NDS24-11.3.6A-1-64-12: Group action Cg, 12 bolts of 1 in at 4 in, As = 64 in², As/Am = 1

Source: AWC NDS 2024 (National Design Specification for Wood Construction), pp. Table 11.3.6A, PDF p. 87. Calculation: Wood fastener connection.

NDS24-11.3.6A-1-64-12 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cg		0.880	0.877	-0.36		Pass

NDS24-11.3.6C-12-5-2: Group action Cg, steel side plates, 2 bolts of 1 in at 4 in, Am = 5 in², Am/As = 12

Source: AWC NDS 2024 (National Design Specification for Wood Construction), pp. Table 11.3.6C, PDF p. 88. Calculation: Wood fastener connection.

NDS24-11.3.6C-12-5-2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cg		0.970	0.972	+0.19		Pass

NDS24-11.3.6C-12-5-6: Group action Cg, steel side plates, 6 bolts of 1 in at 4 in, Am = 5 in², Am/As = 12

Source: AWC NDS 2024 (National Design Specification for Wood Construction), pp. Table 11.3.6C, PDF p. 88. Calculation: Wood fastener connection.

NDS24-11.3.6C-12-5-6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cg		0.620	0.625	+0.85		Pass

NDS24-11.3.6C-12-5-12: Group action Cg, steel side plates, 12 bolts of 1 in at 4 in, Am = 5 in², Am/As = 12

Source: AWC NDS 2024 (National Design Specification for Wood Construction), pp. Table 11.3.6C, PDF p. 88. Calculation: Wood fastener connection.

NDS24-11.3.6C-12-5-12 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cg		0.340	0.339	-0.31		Pass

NDS24-11.3.6C-12-16-5: Group action Cg, steel side plates, 5 bolts of 1 in at 4 in, Am = 16 in², Am/As = 12

Source: AWC NDS 2024 (National Design Specification for Wood Construction), pp. Table 11.3.6C, PDF p. 88. Calculation: Wood fastener connection.

NDS24-11.3.6C-12-16-5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cg		0.860	0.864	+0.45		Pass

NDS24-11.3.6C-12-40-4: Group action Cg, steel side plates, 4 bolts of 1 in at 4 in, Am = 40 in², Am/As = 12

Source: AWC NDS 2024 (National Design Specification for Wood Construction), pp. Table 11.3.6C, PDF p. 88. Calculation: Wood fastener connection.

NDS24-11.3.6C-12-40-4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cg		0.960	0.963	+0.34		Pass

NDS24-11.3.6C-12-40-8: Group action Cg, steel side plates, 8 bolts of 1 in at 4 in, Am = 40 in², Am/As = 12

Source: AWC NDS 2024 (National Design Specification for Wood Construction), pp. Table 11.3.6C, PDF p. 88. Calculation: Wood fastener connection.

NDS24-11.3.6C-12-40-8 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cg		0.830	0.835	+0.55		Pass

NDS24-11.3.6C-12-64-10: Group action Cg, steel side plates, 10 bolts of 1 in at 4 in, Am = 64 in², Am/As = 12

Source: AWC NDS 2024 (National Design Specification for Wood Construction), pp. Table 11.3.6C, PDF p. 88. Calculation: Wood fastener connection.

NDS24-11.3.6C-12-64-10 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cg		0.830	0.828	-0.18		Pass

DCA6-T2-SP: Southern Pine 2x8 at 16 in.

Source: AWC DCA 6-2015 Table 2, pp. p. 4. Calculation: Wood deck framing.

DCA6-T2-SP · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable joist span 11 ft 10 in.	ft	11.83	11.83	+0.00		Pass
Allowable overhang 2 ft 0 in.	ft	2.000	2.000	+0.00		Pass

DCA6-T2-DFL: Douglas Fir-Larch 2x10 at 16 in.

Source: AWC DCA 6-2015 Table 2, pp. p. 4. Calculation: Wood deck framing.

DCA6-T2-DFL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Allowable joist span 13 ft 7 in.	ft	13.58	13.58	+0.00		Pass
Allowable overhang 3 ft 2 in.	ft	3.167	3.167	-0.01		Pass

DCA6-T3A: Southern Pine 2-2x10 beam, joists to 10 ft

Source: AWC DCA 6-2015 Table 3A, pp. p. 6. Calculation: Wood deck framing.

DCA6-T3A · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Beam span 7 ft 9 in.	ft	7.750	7.750	+0.00		Pass

DCA6-T3A-DFL: Douglas Fir-Larch 3-2x10 beam, joists to 14 ft

Source: AWC DCA 6-2015 Table 3A, pp. p. 6. Calculation: Wood deck framing.

DCA6-T3A-DFL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Beam span 7 ft 7 in.	ft	7.583	7.583	+0.00		Pass

DCA6-T4: Beam span 8 ft, joists to 10 ft, Southern Pine 6x6

Source: AWC DCA 6-2015 Table 4, pp. p. 12. Calculation: Wood deck framing.

DCA6-T4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Post height 14 ft	ft	14.00	14.00	+0.00		Pass
Round footing 20 in.	in.	20.00	20.00	+0.00		Pass
Square footing 18 in.	in.	18.00	18.00	+0.00		Pass
Footing thickness 8 in.	in.	8.000	8.000	+0.00		Pass

DCA6-T4-HF: Beam span 12 ft, joists to 14 ft, Hem-Fir 6x6

Source: AWC DCA 6-2015 Table 4, pp. p. 12. Calculation: Wood deck framing.

DCA6-T4-HF · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Post height 9 ft	ft	9.000	9.000	+0.00		Pass
Round footing 30 in.	in.	30.00	30.00	+0.00		Pass

DCA6-T5: 1/2 in. lag screws, joists 8 ft 1 in. to 10 ft

Source: AWC DCA 6-2015 Table 5, pp. p. 15. Calculation: Wood deck framing.

DCA6-T5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Lag screw spacing 18 in.	in.	18.00	18.00	+0.00		Pass

HC-DECK: Default deck, ASD

Source: Hand calculation (closed form). Calculation: Wood deck framing.

HC-DECK · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Joist fb	psi	761.0	761.0	-0.00		Pass
Joist Fb' = 925 × 1.15	psi	1,064	1,064	+0.00		Pass
Joist live deflection	in.	0.200	0.200	+0.02		Pass
Overhang tip deflection	in.	0.055	0.055	+0.05		Pass
Beam fb	psi	652.1	652.1	-0.00		Pass
Post fc	psi	81.97	81.97	+0.00		Pass
Soil pressure	psf	1,237	1,237	+0.00		Pass
Guard post fb	psi	1,008	1,008	-0.00		Pass
Guard post Fb'	psi	1,100	1,100	+0.00		Pass

AWC-E1.4a · Wood design values: 4x4 Southern Pine No. 2 post, le = 10 ft both axes

Source: AWC 2015/2018 Structural Wood Design Examples, Example E1.4 (values as tabulated in Trimble Tekla Tedds 2026, Verification Example - Axial Compression of Wood Column (ASD)), pp. AWC pp. 23-27. Calculation: Wood design values.

AWC-E1.4a · Wood design values · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fc* = Fc CD CM Ct CF Ci	psi	1,450	1,450	+0.00		Pass
Column stability factor CP		0.232	0.232	-0.03		Pass
Adjusted compression Fc'	psi	336.0	336.3	+0.09		Pass

AWC-E1.4b · Wood design values: 6x6 Southern Pine No. 2 post (Table 4D), le = 10 ft

Source: AWC 2015/2018 Structural Wood Design Examples, Example E1.4 (values as tabulated in Trimble Tekla Tedds 2026, Verification Example - Axial Compression of Wood Column (ASD)), pp. AWC pp. 23-27. Calculation: Wood design values.

AWC-E1.4b · Wood design values · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fc* (Table 4D, wet-service set)	psi	525.0	525.0	+0.00		Pass
Column stability factor CP		0.801	0.801	+0.03		Pass
Adjusted compression Fc'	psi	421.0	420.6	-0.08		Pass

AWC-E1.3 · Wood design values: 5 x 22 24F-E1 SP/SP glulam, CD = 1.15, le = 1.54 lu, lu = 8 ft, L = 32 ft (CV)

Source: AWC 2015/2018 Structural Wood Design Examples, Example E1.3 (values as tabulated in Trimble Tekla Tedds 2026, Verification Example - Glulam Beam Design (ASD)), pp. AWC Example E1.3. Calculation: Wood design values.

AWC-E1.3 · Wood design values · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Slenderness ratio RB		11.41	11.41	+0.00		Pass
Fbx+* = Fbx+ CD	psi	2,760	2,760	+0.00		Pass
Volume factor CV		0.951	0.951	+0.01		Pass
Adjusted bending Fbx+'	psi	2,625	2,625	+0.00		Pass

SUPP-4B: Southern Pine No. 2 2x6: Ft (2024 Table 4B)

Source: NDS 2024 Supplement, pp. Table 4B p. 40. Calculation: Wood design values.

SUPP-4B · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ft, 5-6 in. wide	psi	600.0	600.0	+0.00		Pass
Fb, 5-6 in. wide	psi	1,000	1,000	+0.00		Pass

SUPP-4C: 1650f-1.5E MSR, Douglas Fir-Larch (footnote 2)

Source: NDS 2024 Supplement, pp. Table 4C pp. 43, 45. Calculation: Wood design values.

SUPP-4C · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fb	psi	1,650	1,650	+0.00		Pass
Ft	psi	1,020	1,020	+0.00		Pass
Fv (footnote 2)	psi	180.0	180.0	+0.00		Pass
Fc⊥ (footnote 2)	psi	625.0	625.0	+0.00		Pass
G (footnote 2)		0.500	0.500	+0.00		Pass

SUPP-5AX: 24F-V8 DF/DF glulam combination

Source: NDS 2024 Supplement, pp. Table 5A Expanded p. 82. Calculation: Wood design values.

SUPP-5AX · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fbx−	psi	2,400	2,400	+0.00		Pass
Fby	psi	1,550	1,550	+0.00		Pass
Ex,min	psi	950,000	950,000	+0.00		Pass

HC-1 · Wood design values: DF-L No. 2 2x10, dry, CD = 1.0: CF and LRFD format factors

Source: Hand calculation (closed form), pp. NDS 2024 Table 4.3.1; Supplement Table 4A. Calculation: Wood design values.

HC-1 · Wood design values · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
F'b ASD = 900 × 1.1	psi	990.0	990.0	+0.00		Pass
F't ASD = 575 × 1.1	psi	632.5	632.5	+0.00		Pass
F'b LRFD = 990 × 2.54 × 0.85 × 0.8	psi	1,710	1,710	+0.00		Pass
F'c LRFD = 1,350 × 2.40 × 0.90 × 0.8	psi	2,333	2,333	+0.00		Pass
F'c⊥ LRFD = 625 × 1.67 × 0.90	psi	939.4	939.4	-0.00		Pass
E'min LRFD = 580,000 × 1.76 × 0.85	psi	867,680	867,680	+0.00		Pass

HC-2 · Wood design values: DF-L No. 2 2x10, wet, incised, repetitive

Source: Hand calculation (closed form), pp. Supplement Table 4A p. 32; NDS Table 4.3.8. Calculation: Wood design values.

HC-2 · Wood design values · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
F'b = 900 × CM 1.0 (Fb CF = 990 ≤ 1,150) × 1.1 × 0.80 × 1.15	psi	910.8	910.8	+0.00		Pass
F'c = 1,350 × 0.8 × 0.80	psi	864.0	864.0	+0.00		Pass
F'c⊥ = 625 × 0.67	psi	418.8	418.8	+0.00		Pass
F'v = 180 × 0.97 × 0.80	psi	139.7	139.7	+0.00		Pass
E' = 1,600,000 × 0.9 × 0.95	psi	1,368,000	1,368,000	+0.00		Pass

HC-3 · Wood design values: DF-L No. 2 2x10, lu = 8 ft, uniform load (CL)

Source: Hand calculation (closed form), pp. NDS 2024 Table 3.3.3, Eq. 3.3-6. Calculation: Wood design values.

HC-3 · Wood design values · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
RB = √(184.23 × 9.25 / 1.5²)		27.52	27.52	+0.00		Pass
CL		0.785	0.785	-0.01		Pass
F'b = 990 × 0.785	psi	777.1	777.1	+0.00		Pass

HC-4 · Wood design values: Hem-Fir Utility 2x3: Utility size factors

Source: Hand calculation (closed form), pp. Supplement Table 4A pp. 32, 35. Calculation: Wood design values.

HC-4 · Wood design values · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
F'b = 250 × 0.4	psi	100.0	100.0	+0.00		Pass
F't = 150 × 0.4	psi	60.00	60.00	+0.00		Pass
F'c = 850 × 0.6	psi	510.0	510.0	+0.00		Pass

HC-5 · Wood design values: 1650f-1.5E MSR 2x6 flatwise (Table 4C flat use)

Source: Hand calculation (closed form), pp. Supplement Table 4C p. 42. Calculation: Wood design values.

HC-5 · Wood design values · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
F'b = 1,650 × 1.15	psi	1,898	1,898	-0.00		Pass

HC-6 · Wood design values: DF-L No. 1 6x14 beam and stringer (CF)

Source: Hand calculation (closed form), pp. Supplement Table 4D p. 46, NDS Eq. 4.3-1. Calculation: Wood design values.

HC-6 · Wood design values · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
F'b = 1,350 × (12/13.5)^(1/9)	psi	1,332	1,332	+0.00		Pass

HC-7 · Wood design values: DF-L Select Dex 2x6 decking, repetitive

Source: Hand calculation (closed form), pp. Supplement Table 4E pp. 53-54. Calculation: Wood design values.

HC-7 · Wood design values · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
F'b = (Fb)(Cr) 2,000 × CF 1.10	psi	2,200	2,200	+0.00		Pass

HC-8 · Wood design values: 24F-1.8E 5-1/8 in. wide: Fby with the flat use factor

Source: Hand calculation (closed form), pp. Supplement Table 5A pp. 79-80. Calculation: Wood design values.

HC-8 · Wood design values · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
F'by = 1,450 × 1.10	psi	1,595	1,595	+0.00		Pass

HC-9: Bearing area 3 in. away from the end; 2x4 sheathed truss chord (CT)

Source: Hand calculation (closed form), pp. NDS Eq. 3.10-2, Eq. 4.4-1. Calculation: Wood design values.

HC-9 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
F'c⊥ = 625 × (3 + 0.375)/3	psi	703.1	703.1	+0.00		Pass
E'min = 580,000 × (1 + 2,300 × 96/(0.59 × 1,600,000))	psi	715,661	715,661	+0.00		Pass

WW25-DIA: 36 × 24 ft unblocked diaphragm: shear, chord force, Eq. 4.2-1

Source: WoodWorks, Introduction to Wood: Structural Lateral Framing Design (Cloninger / Romanowski, 2025-01), pp. slides 36-39, 41, 47-48.
Calculation: Wood diaphragm.

WW25-DIA · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Wind v = 4,500 / 24	plf	188.0	187.5	-0.27		Pass
Seismic v = 2,502 / 24	plf	104.0	104.2	+0.24		Pass
Wind capacity vn / 2.0 = 505 / 2.0	plf	253.0	252.5	-0.20		Pass
Seismic capacity vn / 2.8 = 505 / 2.8	plf	180.0	180.4	+0.20		Pass
Wind M = wL² / 8	kip-ft	40.50	40.50	+0.00		Pass
Wind T = C = M / W	kips	1.688	1.688	-0.03		Pass
Seismic M	kip-ft	22.52	22.52	+0.00		Pass
Seismic T = C	kips	0.938	0.938	+0.03		Pass
Chord deformation 5vL³ / (8EAW)	in.	0.017	0.017	+1.52		Pass
Panel shear + nail slip 0.25vL / (1000 Ga)	in.	0.282	0.281	-0.27		Pass
Chord splice slip Σ(xΔc) / (2W)	in.	0.025	0.025	+0.00		Pass
δdia	in.	0.324	0.324	-0.15		Pass

WW24-DIA: 19/32 in sheathing, 10d at 6 in, blocked: nominal and ASD seismic capacity

Source: WoodWorks, Wood Diaphragm Deflections and Flexibility (Malone / Breneman, 2024-03), pp. slides 34-35. Calculation: Wood diaphragm.

WW24-DIA · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
vn	plf	895.0	895.0	+0.00		Pass
ASD seismic capacity vn / 2.8	plf	319.0	319.6	+0.20		Pass

WWC3-DIA: 15/32 in sheathing, 10d, blocked 6 / 6 in, 2 in framing: ASD seismic

Source: WoodWorks, Cantilever Wood Diaphragm Webinar Series Part 3 (Malone / Breneman), reproducing SDPWS 2015 Table 4.2A, pp. slide 16. Calculation: Wood diaphragm.

WWC3-DIA · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
vw (SDPWS 2015) = vn (SDPWS 2021)	plf	810.0	810.0	+0.00		Pass
ASD seismic 0.5 × 580 (SDPWS 2015) = vn / 2.8	plf	290.0	289.3	-0.25		Pass

WWC3-T4.2A-2-4: Table 4.2A, 15/32 in sheathing, 10d, 2 in framing, boundary nailing 4 in: vw

Source: WoodWorks, Cantilever Wood Diaphragm Webinar Series Part 3 (Malone / Breneman), reproducing SDPWS 2015 Table 4.2A, pp. slide 16. Calculation: Wood diaphragm.

WWC3-T4.2A-2-4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
vw (SDPWS 2015) = vn (SDPWS 2021)	plf	1,080	1,080	+0.00		Pass

WWC3-T4.2A-2-2.5: Table 4.2A, 15/32 in sheathing, 10d, 2 in framing, boundary nailing 2.5 in: vw

Source: WoodWorks, Cantilever Wood Diaphragm Webinar Series Part 3 (Malone / Breneman), reproducing SDPWS 2015 Table 4.2A, pp. slide 16. Calculation: Wood diaphragm.

WWC3-T4.2A-2-2.5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
vw (SDPWS 2015) = vn (SDPWS 2021)	plf	1,610	1,610	+0.00		Pass

WWC3-T4.2A-2-2: Table 4.2A, 15/32 in sheathing, 10d, 2 in framing, boundary nailing 2 in: vw

Source: WoodWorks, Cantilever Wood Diaphragm Webinar Series Part 3 (Malone / Breneman), reproducing SDPWS 2015 Table 4.2A, pp. slide 16. Calculation: Wood diaphragm.

WWC3-T4.2A-2-2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
vw (SDPWS 2015) = vn (SDPWS 2021)	plf	1,835	1,835	+0.00		Pass

WWC3-T4.2A-3-6: Table 4.2A, 15/32 in sheathing, 10d, 3 in framing, boundary nailing 6 in: vw

Source: WoodWorks, Cantilever Wood Diaphragm Webinar Series Part 3 (Malone / Breneman), reproducing SDPWS 2015 Table 4.2A, pp. slide 16. Calculation: Wood diaphragm.

WWC3-T4.2A-3-6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
vw (SDPWS 2015) = vn (SDPWS 2021)	plf	910.0	910.0	+0.00		Pass

WWC3-T4.2A-3-4: Table 4.2A, 15/32 in sheathing, 10d, 3 in framing, boundary nailing 4 in: vw

Source: WoodWorks, Cantilever Wood Diaphragm Webinar Series Part 3 (Malone / Breneman), reproducing SDPWS 2015 Table 4.2A, pp. slide 16. Calculation: Wood diaphragm.

WWC3-T4.2A-3-4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
vw (SDPWS 2015) = vn (SDPWS 2021)	plf	1,205	1,205	+0.00		Pass

WWC3-T4.2A-3-2.5: Table 4.2A, 15/32 in sheathing, 10d, 3 in framing, boundary nailing 2.5 in: vw

Source: WoodWorks, Cantilever Wood Diaphragm Webinar Series Part 3 (Malone / Breneman), reproducing SDPWS 2015 Table 4.2A, pp. slide 16. Calculation: Wood diaphragm.

WWC3-T4.2A-3-2.5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
vw (SDPWS 2015) = vn (SDPWS 2021)	plf	1,820	1,820	+0.00		Pass

WWC3-T4.2A-3-2: Table 4.2A, 15/32 in sheathing, 10d, 3 in framing, boundary nailing 2 in: vw

Source: WoodWorks, Cantilever Wood Diaphragm Webinar Series Part 3 (Malone / Breneman), reproducing SDPWS 2015 Table 4.2A, pp. slide 16. Calculation: Wood diaphragm.

WWC3-T4.2A-3-2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
vw (SDPWS 2015) = vn (SDPWS 2021)	plf	2,060	2,060	+0.00		Pass

WWDE-ASD: Right cantilever 35 × 40 ft, Method 2B, ASD: shear, torsional shear, chord force, open-front limits

Source: WoodWorks, Design Example of a Cantilever Wood Diaphragm (updated May 2026), pp. pp. 29, 33-34, 37-38. Calculation: Wood diaphragm.

WWDE-ASD · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Shear at grid 3, 7,052 lb / 40 ft	plf	176.3	176.3	-0.02		Pass
With the torsional unit shear	plf	200.5	200.6	+0.03		Pass
15/32 in, 10d at 6 in, 810 / 2.8	plf	289.3	289.3	-0.00		Pass
Bending chord force at 35 ft	kips	3.327	3.327	-0.01		Pass
L/W = 35 / 40		0.875	0.875	+0.00		Pass

WWDE-STR: Right cantilever, strength level: Eq. 4.2-2, flexibility, drift at the edge

Source: WoodWorks, Design Example of a Cantilever Wood Diaphragm (updated May 2026), pp. pp. 40-47. Calculation: Wood diaphragm.

WWDE-STR · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
3vL³ / (EAW), v = 236 plf	in.	0.027	0.027	+0.20		Pass
0.5vL / (1000 Ga)	in.	0.165	0.165	+0.12		Pass
Slip	in.	0.075	0.075	+0.00		Pass
δ	in.	0.267	0.267	+0.10		Pass
2 × Δ at grid 3	in.	0.428	0.428	+0.00		Pass
Δ = 4 × 0.365 + 3 × 0.267	in.	2.260	2.262	+0.08		Pass
0.02 hsx	in.	2.400	2.400	+0.00		Pass

HUD-6.4: Two spans of 24 ft on rigid wall lines, 24 ft deep, 200 plf

Source: HUD Residential Structural Design Guide, 2nd Ed. (2017), Example 6.4, pp. pp. 6-56 to 6-57. Calculation: Wood diaphragm.

HUD-6.4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vmax = 5/8 w l/2	kips	3.000	3.000	-0.00		Pass
v = 125 plf	plf	125.0	125.0	-0.00		Pass
Middle wall line, 2 × 125 plf × 24 ft	kips	6.000	6.000	-0.00		Pass
Mmax	kip-ft	14.40	14.40	-0.00		Pass
Chord force 600 lb	kips	0.600	0.600	-0.00		Pass

DIA-CANT: Cantilever 30 ft, 200 plf and 2 kips at the free edge: statics and Eqs. 4.2-2, 4.2-3

Source: Hand calculation (closed form). Calculation: Wood diaphragm.

DIA-CANT · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
V = wL + P	kips	8.000	8.000	+0.00		Pass
v = V / b	plf	200.0	200.0	+0.00		Pass
M = wL² / 2 + PL	kip-ft	150.0	150.0	+0.00		Pass
T = M / b	kips	3.750	3.750	+0.00		Pass
Bending	in.	0.022	0.022	+0.00		Pass
Shear	in.	0.188	0.188	+0.00		Pass

DIA-TRIB: Spans 20 + 40 ft, each simple: largest shear from the longer span, the middle line takes both

Source: Hand calculation (closed form). Calculation: Wood diaphragm.

DIA-TRIB · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
V = w 40 / 2	kips	6.000	6.000	+0.00		Pass
Middle line = w (20 + 40) / 2	kips	9.000	9.000	+0.00		Pass
M = w 40^2 / 8	kip-ft	60.00	60.00	+0.00		Pass

DIA-OPEN: Opening 8 × 8 ft in a 60 × 40 ft span: strips, tie, chord, transfer zone

Source: Hand calculation (closed form). Calculation: Wood diaphragm.

DIA-OPEN · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
V at the centre = 0.3 × 6 ft	kips	1.800	1.800	-0.00		Pass
vs = 1.8 / 32 ft	plf	56.25	56.25	-0.00		Pass
F = vs lo / 2	kips	0.225	0.225	-0.00		Pass
Chord = M(28 ft) / b + F	kips	3.585	3.585	+0.00		Pass
v net = 105 + 22.5	plf	127.5	127.5	+0.00		Pass

DIA-1: Blocked diaphragm 60 × 40 ft: unit shear, chord force, deflection

Source: Hand calculation (closed form). Calculation: Wood diaphragm.

DIA-1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
v = wL / 2b (seismic)	plf	225.0	225.0	+0.00		Pass
φD vn = 0.50 × 810 (seismic)	plf	405.0	405.0	+0.00		Pass
v (wind)	plf	300.0	300.0	+0.00		Pass
φD vw = 0.80 × 810	plf	648.0	648.0	+0.00		Pass
M = wL² / 8	kip-ft	135.0	135.0	+0.00		Pass
T = C = M / b	kips	3.375	3.375	+0.00		Pass
δ bending	in.	0.029	0.029	+0.00		Pass
δ shear and nail slip	in.	0.338	0.338	+0.00		Pass
δ chord splices	in.	0.030	0.030	+0.00		Pass
δ (Eq. 4.2-1)	in.	0.396	0.396	+0.00		Pass

DIA-1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
v = 0.7wL / 2b	plf	157.5	157.5	+0.00		Pass
vn / 2.8 (seismic)	plf	289.3	289.3	+0.00		Pass
T = 0.7M / b	kips	2.362	2.362	+0.00		Pass

DIA-2: Collector along a support line with a 25 ft shear wall, Ω0 = 2.5

Source: Hand calculation (closed form). Calculation: Wood diaphragm.

DIA-2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Drag force v (b − Lw)	kips	3.375	3.375	+0.00		Pass
× Ω0	kips	8.438	8.438	+0.00		Pass

DIA-3: Unblocked, 3 in framing, case 3, Hem-Fir

Source: Hand calculation (closed form). Calculation: Wood diaphragm.

DIA-3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φD vn × 0.93 = 0.50 × 600 × 0.93	plf	279.0	279.0	+0.00		Pass
v = wL / 2b	plf	112.5	112.5	+0.00		Pass

T16.3.1: Char depths of sawn lumber, glulam and SCL

Source: NDS 2024 Table 16.3.1, pp. p. 162. Calculation: Fire design of exposed wood.

T16.3.1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
achar, 1 hour	in.	1.500	1.500	+0.00		Pass
aeff, 1 hour	in.	1.800	1.800	-0.00		Pass

T16.3.1-1.5: Char depths at 1-1/2 hours

Source: NDS 2024 Table 16.3.1, pp. p. 162. Calculation: Fire design of exposed wood.

T16.3.1-1.5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
achar, 1-1/2 hours	in.	2.100	2.086	-0.68		Pass
aeff, 1-1/2 hours	in.	2.500	2.503	+0.11		Pass

T16.3.1-2: Char depths at 2 hours

Source: NDS 2024 Table 16.3.1, pp. p. 162. Calculation: Fire design of exposed wood.

T16.3.1-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
achar, 2 hours	in.	2.600	2.635	+1.36		Pass
aeff, 2 hours	in.	3.200	3.162	-1.18		Pass

T16.3.2-a: CLT, 1-3/8 in. laminations

Source: NDS 2024 Table 16.3.2, pp. p. 162. Calculation: Fire design of exposed wood.

T16.3.2-a · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
aeff, 1 hour, 1-3/8 in.	in.	1.900	1.930	+1.59		Pass

T16.3.2-b: CLT, 3/4 in. laminations

Source: NDS 2024 Table 16.3.2, pp. p. 162. Calculation: Fire design of exposed wood.

T16.3.2-b · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
aeff, 1 hour, 3/4 in.	in.	2.200	2.179	-0.93		Pass

T16.3.2-c: CLT, 1-3/8 in. laminations, 1-1/2 hours

Source: NDS 2024 Table 16.3.2, pp. p. 162. Calculation: Fire design of exposed wood.

T16.3.2-c · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
aeff, 1-1/2 hours, 1-3/8 in.	in.	2.800	2.841	+1.45		Pass

T16.3.2-d: CLT, 1-1/2 in. laminations, 2 hours

Source: NDS 2024 Table 16.3.2, pp. p. 162. Calculation: Fire design of exposed wood.

T16.3.2-d · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
aeff, 2 hours, 1-1/2 in.	in.	3.600	3.600	-0.00		Pass

T16.3.2-e: CLT, 2 in. laminations, 1-1/2 hours

Source: NDS 2024 Table 16.3.2, pp. p. 162. Calculation: Fire design of exposed wood.

T16.3.2-e · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
aeff, 1-1/2 hours, 2 in.	in.	2.600	2.620	+0.78		Pass

HC-BEAM: 8x14 beam, three sides, 1 hour

Source: Hand calculation (closed form). Calculation: Fire design of exposed wood.

HC-BEAM · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Residual width	in.	3.900	3.900	+0.00		Pass
Residual depth	in.	11.70	11.70	+0.00		Pass
fb	psi	3,021	3,021	-0.00		Pass
Fb fire = 2.85 Fb CF	psi	3,798	3,797	-0.00		Pass
fv	psi	184.1	184.1	-0.01		Pass
Fv fire = 2.75 Fv	psi	467.5	467.5	+0.00		Pass

HC-COLUMN · Fire design of exposed wood: 8x8 post, four sides, 1 hour

Source: Hand calculation (closed form). Calculation: Fire design of exposed wood.

HC-COLUMN · Fire design of exposed wood · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
fc	psi	1,315	1,315	+0.00		Pass
Fc' = 2.58 Fc CP	psi	920.2	920.2	+0.00		Pass

APA-Z725: Default live load deflection limit: the APA PRI basis L/480

Source: APA Z725H-2022, pp. p. 4. Calculation: Wood floor vibration.

APA-Z725 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
L/480 for a 13 ft span	in.	0.325	0.325	+0.00		Pass

HC-SAWN: 2x10 DF-L No. 2 at 16 in., 13 ft

Source: Hand calculation (criteria from knowledge, to confirm against the source documents). Calculation: Wood floor vibration.

HC-SAWN · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Live load deflection	in.	0.217	0.217	+0.00		Pass
1 kN deflection d1 (mm)		1.141	1.141	-0.00		Pass
Onysko limit 8 / L^1.3 (in.)	in.	0.053	0.053	+0.00		Pass
Frequency f1 (Hz)		15.14	15.14	-0.00		Pass

HC-HU: The same floor by Hu and Chui

Source: Hand calculation (criteria from knowledge, to confirm against the source documents). Calculation: Wood floor vibration.

HC-HU · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
f1 / d1^0.44		14.28	14.28	-0.00		Pass

HC-IJOIST: I-joist EI = 300 × 10⁶ lb-in.², 16 ft, the full point load

Source: Hand calculation (criteria from knowledge, to confirm against the source documents). Calculation: Wood floor vibration.

HC-IJOIST · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
d1 (mm)		2.807	2.807	-0.00		Pass
Onysko limit (in.)	in.	0.040	0.040	-0.00		Pass

HAND-1 · Wood I-joist: 11-7/8 in. PRI-40 at 16 in., 16 ft, D 15 + L 40 psf

Source: Hand calculation (closed form). Calculation: Wood I-joist.

HAND-1 · Wood I-joist · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Moment	lb-ft	2,347	2,347	+0.00		Pass
M' = Mr CD (Table 9)	lb-ft	3,545	3,545	+0.00		Pass
Shear, no reduction (7.4.7)	lb	586.7	586.7	+0.00		Pass
V' = Vr CD	lb	1,420	1,420	+0.00		Pass
End reaction	lb	586.7	586.7	+0.00		Pass
R' at 1-3/4 in.	lb	1,200	1,200	+0.00		Pass
Live deflection, bending and shear (Table 9 note h)	in.	0.278	0.278	+0.00		Pass
Limit L/480	in.	0.400	0.400	+0.00		Pass
Total with creep 1.5 on D	in.	0.434	0.434	+0.00		Pass

HAND-1 · Wood I-joist · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
M' = Mr KF φ λ	lb-ft	6,123	6,123	+0.00		Pass
V' = Vr KF φ λ	lb	2,454	2,454	+0.00		Pass
R' = ER KF φ λ	lb	2,074	2,074	+0.00		Pass
Moment 1.2D + 1.6L	lb-ft	3,499	3,499	+0.00		Pass

HAND-2 · Wood I-joist: Snow duration, interpolated end reaction

Source: Hand calculation (closed form). Calculation: Wood I-joist.

HAND-2 · Wood I-joist · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R' interpolated × CD	lb	1,506	1,506	+0.00		Pass
M' = Mr × 1.15	lb-ft	4,077	4,077	+0.00		Pass

HAND-3 · Wood I-joist: Bearing limit of Table 9 note i governs

Source: Hand calculation (closed form). Calculation: Wood I-joist.

HAND-3 · Wood I-joist · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R' = Cb bbrg Lbrg Fc⊥	lb	708.8	708.8	+0.00		Pass

HAND-4 · Wood I-joist: Negative moment, bottom flange as a column (7.3.5.3)

Source: Hand calculation (closed form). Calculation: Wood I-joist.

HAND-4 · Wood I-joist · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
M' = Mr CD CL	lb-ft	1,322	1,322	+0.00		Pass

APA-T1-1: Table 1: 11-7/8 in. PRI-40 at 16 in.: 19 ft 4 in. less 12 in.

Source: APA Z725H-2022, Performance Rated I-Joists, pp. Table 1, p. 4; Table 9, p. 31. Calculation: Wood I-joist.

APA-T1-1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Live deflection ratio to L/480		1.000	1.021	+2.09		Pass

APA-T1-2: Table 1: 14 in. PRI-60 at 19.2 in.: 21 ft 9 in. less 12 in.

Source: APA Z725H-2022, Performance Rated I-Joists, pp. Table 1, p. 4; Table 9, p. 31. Calculation: Wood I-joist.

APA-T1-2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Live deflection ratio to L/480		1.000	1.034	+3.35		Pass

APA-T1-3: Table 1: 16 in. PRI-90 at 12 in.: 31 ft 7 in. less 12 in.

Source: APA Z725H-2022, Performance Rated I-Joists, pp. Table 1, p. 4; Table 9, p. 31. Calculation: Wood I-joist.

APA-T1-3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Live deflection ratio to L/480		1.000	0.985	-1.48		Pass

APA-T1-4: Table 1: 11-7/8 in. PRI-40 at 24 in., 16 ft 8 in.: moment governs

Source: APA Z725H-2022, Performance Rated I-Joists, pp. Table 1, p. 4; Table 9, p. 31. Calculation: Wood I-joist.

APA-T1-4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Moment against Mr = 3,545 lb-ft		1.000	0.979	-2.08		Pass

APA-T2-1: Table 2: 14 in. PRI-50 at 24 in., two spans 16 ft 1 in.: interior reaction governs

Source: APA Z725H-2022, Performance Rated I-Joists, pp. Table 2, p. 5; Table 9, p. 31. Calculation: Wood I-joist.

APA-T2-1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Interior reaction against IR = 2,040 lb		1.000	0.985	-1.45		Pass

NDS-E.7: Staggered 1 in. bolts, 3-1/8 x 12 DF glulam, 1/4 in. A36 side plates

Source: NDS 2024 Appendix E, sample solution E.7 (staggered bolts, steel side plates), pp. pp. 176-177. Calculation: Steel side and knife plate connections.

NDS-E.7 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z of one bolt (Table 12I: 4,380 lb)	lb	4,380	4,375	-0.11		Pass
Row tear-out Z'RT, row 1 (3 bolts)	lb	7,163	7,155	-0.11		Pass
Row tear-out Z'RT, row 2 (2 bolts)	lb	4,775	4,770	-0.10		Pass
Row tear-out Z'RT, total	lb	19,101	19,080	-0.11		Pass
Net section Z'NT	lb	34,424	34,424	-0.00		Pass
Group tear-out Z'GT	lb	18,393	18,385	-0.04		Pass

HC-KNIFE: Default: 3/4 in. bolts through a 3/8 in. knife plate in a 5-1/8 in. 24F-1.8E glulam

Source: Hand calculation (closed form), pp. NDS 2024 Table 12.3.1A. Calculation: Steel side and knife plate connections.

HC-KNIFE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mode Im = D lm Fem / Rd (steel plate)	lb	6,117	6,117	-0.00		Pass
Mode Is = 2 D ls Fes / Rd (wood, ls = 2.3125 in.)	lb	4,856	4,856	-0.00		Pass
Mode IIIs (governs)	lb	3,564	3,564	+0.00		Pass
Mode IV	lb	4,417	4,417	+0.00		Pass

HC-SIDE2: DF-L No. 1 6x10 with two 1/4 in. side plates, 3/4 in. bolts

Source: Hand calculation (closed form), pp. NDS 2024 Table 12.3.1A. Calculation: Steel side and knife plate connections.

HC-SIDE2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mode Im = 0.75 × 5.5 × 5,600 / 4	lb	5,775	5,775	+0.00		Pass
Mode IIIs (governs)	lb	3,343	3,343	-0.00		Pass

HC-PLATE · Steel side and knife plate connections: Default plate: 3/8 x 10 A36, three rows of three 3/4 in. bolts

Source: Hand calculation (closed form), pp. AISC 360-22 J3.11, J4.1, J4.3. Calculation: Steel side and knife plate connections.

HC-PLATE · Steel side and knife plate connections · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bearing and tear-out Rn / Ω	lb	160,270	160,270	+0.00		Pass
Tension yielding Rn / Ω = 135,000 / 1.67	lb	80,838	80,838	+0.00		Pass
Tension rupture Rn / Ω = 160,406 / 2.00	lb	80,203	80,203	+0.00		Pass
Block shear Rn / Ω = 216,656 / 2.00	lb	108,328	108,328	+0.00		Pass

NDS24-12E-0.55-12: 1/2 in anchor bolt, 1-1/2 in ledger (G = 0.55) to concrete, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12E, pp. p. 106 (NDS 2018 p. 99). Calculation: Wood ledger.

NDS24-12E-0.55-12 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z⊥ (reference)	lb	410.0	409.6	-0.09		Pass

NDS24-12E-0.55-58: 5/8 in anchor bolt, 1-1/2 in ledger (G = 0.55) to concrete, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12E, pp. p. 106 (NDS 2018 p. 99). Calculation: Wood ledger.

NDS24-12E-0.55-58 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z⊥ (reference)	lb	580.0	579.0	-0.17		Pass

NDS24-12E-0.55-34: 3/4 in anchor bolt, 1-1/2 in ledger (G = 0.55) to concrete, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12E, pp. p. 106 (NDS 2018 p. 99). Calculation: Wood ledger.

NDS24-12E-0.55-34 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z⊥ (reference)	lb	660.0	666.1	+0.92		Pass

NDS24-12E-0.50-12: 1/2 in anchor bolt, 1-1/2 in ledger (G = 0.50) to concrete, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12E, pp. p. 106 (NDS 2018 p. 99). Calculation: Wood ledger.

NDS24-12E-0.50-12 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z⊥ (reference)	lb	380.0	381.8	+0.47		Pass

NDS24-12E-0.50-58: 5/8 in anchor bolt, 1-1/2 in ledger (G = 0.50) to concrete, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12E, pp. p. 106 (NDS 2018 p. 99). Calculation: Wood ledger.

NDS24-12E-0.50-58 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z⊥ (reference)	lb	530.0	529.5	-0.09		Pass

NDS24-12E-0.50-34: 3/4 in anchor bolt, 1-1/2 in ledger (G = 0.50) to concrete, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12E, pp. p. 106 (NDS 2018 p. 99). Calculation: Wood ledger.

NDS24-12E-0.50-34 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z⊥ (reference)	lb	590.0	580.1	-1.68		Pass

NDS24-12E-0.46-12: 1/2 in anchor bolt, 1-1/2 in ledger (G = 0.46) to concrete, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12E, pp. p. 106 (NDS 2018 p. 99). Calculation: Wood ledger.

NDS24-12E-0.46-12 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z⊥ (reference)	lb	360.0	359.6	-0.11		Pass

NDS24-12E-0.46-58: 5/8 in anchor bolt, 1-1/2 in ledger (G = 0.46) to concrete, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12E, pp. p. 106 (NDS 2018 p. 99). Calculation: Wood ledger.

NDS24-12E-0.46-58 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z⊥ (reference)	lb	470.0	469.2	-0.16		Pass

NDS24-12E-0.46-34: 3/4 in anchor bolt, 1-1/2 in ledger (G = 0.46) to concrete, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12E, pp. p. 106 (NDS 2018 p. 99). Calculation: Wood ledger.

NDS24-12E-0.46-34 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z⊥ (reference)	lb	520.0	514.0	-1.15		Pass

NDS24-12A-1.5-12-0.50: 1/2 in bolt, 1-1/2 in ledger to a 1.5 in rim, G = 0.50, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood ledger.

NDS24-12A-1.5-12-0.50 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z⊥ (reference)	lb	220.0	218.0	-0.92		Pass

NDS24-12A-1.5-12-0.37: 1/2 in bolt, 1-1/2 in ledger to a 1.5 in rim, G = 0.37, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood ledger.

NDS24-12A-1.5-12-0.37 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z⊥ (reference)	lb	140.0	140.9	+0.62		Pass

NDS24-12A-3.5-12-0.50: 1/2 in bolt, 1-1/2 in ledger to a 3.5 in rim, G = 0.50, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood ledger.

NDS24-12A-3.5-12-0.50 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z⊥ (reference)	lb	330.0	331.0	+0.30		Pass

NDS24-12A-3.5-34-0.55: 3/4 in bolt, 1-1/2 in ledger to a 3.5 in rim, G = 0.55, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood ledger.

NDS24-12A-3.5-34-0.55 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z⊥ (reference)	lb	580.0	579.3	-0.11		Pass

NDS24-12A-3.5-34-0.43: 3/4 in bolt, 1-1/2 in ledger to a 3.5 in rim, G = 0.43, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood ledger.

NDS24-12A-3.5-34-0.43 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z⊥ (reference)	lb	400.0	405.4	+1.36		Pass

NDS24-12A-2.5-58-0.46: 5/8 in bolt, 1-1/2 in ledger to a 2.5 in rim, G = 0.46, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12A, pp. p. 101. Calculation: Wood ledger.

NDS24-12A-2.5-58-0.46 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z⊥ (reference)	lb	300.0	303.2	+1.06		Pass

NDS24-12J-12: 1/2 in lag screw, 1-1/2 in ledger, p = 8D, G = 0.50, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12J, pp. p. 112. Calculation: Wood ledger.

NDS24-12J-12 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z⊥ (reference)	lb	200.0	204.5	+2.25		Pass

NDS24-12J-58 · Wood ledger: 5/8 in lag screw, 1-1/2 in ledger, p = 8D, G = 0.50, Z⊥

Source: AWC NDS 2024 (National Design Specification for Wood Construction), Table 12J, pp. p. 112. Calculation: Wood ledger.

NDS24-12J-58 · Wood ledger · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z⊥ (reference)	lb	280.0	278.1	-0.68		Pass

TR12-3.1-g0: 1/2 in bolt, 1-1/2 in members perpendicular to grain, gap 0 in

Source: AWC Technical Report 12, General Dowel Equations (2015), Example 3.1, pp. p. 17. Calculation: Wood ledger.

TR12-3.1-g0 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mode Im	lb	383.0	380.6	-0.63		Pass
Mode Is	lb	383.0	380.6	-0.63		Pass
Mode II	lb	176.0	175.2	-0.47		Pass
Mode IIIm	lb	289.0	288.3	-0.24		Pass
Mode IIIs	lb	289.0	288.3	-0.24		Pass
Mode IV	lb	387.0	385.6	-0.37		Pass
Z (mode II)	lb	176.0	175.2	-0.47		Pass

TR12-3.1-g0.25: 1/2 in bolt, 1-1/2 in members perpendicular to grain, gap 0.25 in

Source: AWC Technical Report 12, General Dowel Equations (2015), Example 3.1, pp. p. 17. Calculation: Wood ledger.

TR12-3.1-g0.25 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mode Im	lb	383.0	380.6	-0.63		Pass
Mode Is	lb	383.0	380.6	-0.63		Pass
Mode II	lb	157.0	156.4	-0.36		Pass
Mode IIIm	lb	258.0	256.8	-0.46		Pass
Mode IIIs	lb	258.0	256.8	-0.46		Pass
Mode IV	lb	349.0	348.0	-0.30		Pass
Z (mode II)	lb	157.0	156.4	-0.36		Pass

TR12-3.1-g0.5: 1/2 in bolt, 1-1/2 in members perpendicular to grain, gap 0.5 in

Source: AWC Technical Report 12, General Dowel Equations (2015), Example 3.1, pp. p. 17. Calculation: Wood ledger.

TR12-3.1-g0.5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mode Im	lb	383.0	380.6	-0.63		Pass
Mode Is	lb	383.0	380.6	-0.63		Pass
Mode II	lb	142.0	141.0	-0.73		Pass
Mode IIIm	lb	231.0	230.1	-0.40		Pass
Mode IIIs	lb	231.0	230.1	-0.40		Pass
Mode IV	lb	315.0	314.4	-0.20		Pass
Z (mode II)	lb	142.0	141.0	-0.73		Pass

IRC21-R507.9.1.3-lag: IRC deck ledger table, lag, joist span 6 ft

Source: IRC 2021 Table R507.9.1.3(1) / AWC DCA 6-09 Prescriptive Residential Wood Deck Construction Guide, Table 5, pp. DCA 6-09 p. 12.
Calculation: Wood ledger.

IRC21-R507.9.1.3-lag · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing, 6 ft span	in.	30.00	30.00	+0.00		Pass

IRC21-R507.9.1.3-lag-8: IRC deck ledger table, lag, joist span 8 ft

Source: IRC 2021 Table R507.9.1.3(1) / AWC DCA 6-09 Prescriptive Residential Wood Deck Construction Guide, Table 5, pp. DCA 6-09 p. 12.
Calculation: Wood ledger.

IRC21-R507.9.1.3-lag-8 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing, 8 ft span	in.	23.00	23.00	+0.00		Pass

IRC21-R507.9.1.3-lag-10: IRC deck ledger table, lag, joist span 10 ft

Source: IRC 2021 Table R507.9.1.3(1) / AWC DCA 6-09 Prescriptive Residential Wood Deck Construction Guide, Table 5, pp. DCA 6-09 p. 12.
Calculation: Wood ledger.

IRC21-R507.9.1.3-lag-10 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing, 10 ft span	in.	18.00	18.00	+0.00		Pass

IRC21-R507.9.1.3-lag-12: IRC deck ledger table, lag, joist span 12 ft

Source: IRC 2021 Table R507.9.1.3(1) / AWC DCA 6-09 Prescriptive Residential Wood Deck Construction Guide, Table 5, pp. DCA 6-09 p. 12.
Calculation: Wood ledger.

IRC21-R507.9.1.3-lag-12 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing, 12 ft span	in.	15.00	15.00	+0.00		Pass

IRC21-R507.9.1.3-lag-14: IRC deck ledger table, lag, joist span 14 ft

Source: IRC 2021 Table R507.9.1.3(1) / AWC DCA 6-09 Prescriptive Residential Wood Deck Construction Guide, Table 5, pp. DCA 6-09 p. 12.
Calculation: Wood ledger.

IRC21-R507.9.1.3-lag-14 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing, 14 ft span	in.	13.00	13.00	+0.00		Pass

IRC21-R507.9.1.3-lag-16: IRC deck ledger table, lag, joist span 16 ft

Source: IRC 2021 Table R507.9.1.3(1) / AWC DCA 6-09 Prescriptive Residential Wood Deck Construction Guide, Table 5, pp. DCA 6-09 p. 12.
Calculation: Wood ledger.

IRC21-R507.9.1.3-lag-16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing, 16 ft span	in.	11.00	11.00	+0.00		Pass

IRC21-R507.9.1.3-lag-18: IRC deck ledger table, lag, joist span 18 ft

Source: IRC 2021 Table R507.9.1.3(1) / AWC DCA 6-09 Prescriptive Residential Wood Deck Construction Guide, Table 5, pp. DCA 6-09 p. 12.
Calculation: Wood ledger.

IRC21-R507.9.1.3-lag-18 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing, 18 ft span	in.	10.00	10.00	+0.00		Pass

IRC21-R507.9.1.3-bolt: IRC deck ledger table, bolt, joist span 6 ft

Source: IRC 2021 Table R507.9.1.3(1) / AWC DCA 6-09 Prescriptive Residential Wood Deck Construction Guide, Table 5, pp. DCA 6-09 p. 12.
Calculation: Wood ledger.

IRC21-R507.9.1.3-bolt · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing, 6 ft span	in.	36.00	36.00	+0.00		Pass

IRC21-R507.9.1.3-bolt-8: IRC deck ledger table, bolt, joist span 8 ft

Source: IRC 2021 Table R507.9.1.3(1) / AWC DCA 6-09 Prescriptive Residential Wood Deck Construction Guide, Table 5, pp. DCA 6-09 p. 12.
Calculation: Wood ledger.

IRC21-R507.9.1.3-bolt-8 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing, 8 ft span	in.	36.00	36.00	+0.00		Pass

IRC21-R507.9.1.3-bolt-10: IRC deck ledger table, bolt, joist span 10 ft

Source: IRC 2021 Table R507.9.1.3(1) / AWC DCA 6-09 Prescriptive Residential Wood Deck Construction Guide, Table 5, pp. DCA 6-09 p. 12.
Calculation: Wood ledger.

IRC21-R507.9.1.3-bolt-10 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing, 10 ft span	in.	34.00	34.00	+0.00		Pass

IRC21-R507.9.1.3-bolt-12: IRC deck ledger table, bolt, joist span 12 ft

Source: IRC 2021 Table R507.9.1.3(1) / AWC DCA 6-09 Prescriptive Residential Wood Deck Construction Guide, Table 5, pp. DCA 6-09 p. 12.
Calculation: Wood ledger.

IRC21-R507.9.1.3-bolt-12 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing, 12 ft span	in.	29.00	29.00	+0.00		Pass

IRC21-R507.9.1.3-bolt-14: IRC deck ledger table, bolt, joist span 14 ft

Source: IRC 2021 Table R507.9.1.3(1) / AWC DCA 6-09 Prescriptive Residential Wood Deck Construction Guide, Table 5, pp. DCA 6-09 p. 12.
Calculation: Wood ledger.

IRC21-R507.9.1.3-bolt-14 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing, 14 ft span	in.	24.00	24.00	+0.00		Pass

IRC21-R507.9.1.3-bolt-16: IRC deck ledger table, bolt, joist span 16 ft

Source: IRC 2021 Table R507.9.1.3(1) / AWC DCA 6-09 Prescriptive Residential Wood Deck Construction Guide, Table 5, pp. DCA 6-09 p. 12.
Calculation: Wood ledger.

IRC21-R507.9.1.3-bolt-16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing, 16 ft span	in.	21.00	21.00	+0.00		Pass

IRC21-R507.9.1.3-bolt-18: IRC deck ledger table, bolt, joist span 18 ft

Source: IRC 2021 Table R507.9.1.3(1) / AWC DCA 6-09 Prescriptive Residential Wood Deck Construction Guide, Table 5, pp. DCA 6-09 p. 12.
Calculation: Wood ledger.

IRC21-R507.9.1.3-bolt-18 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing, 18 ft span	in.	19.00	19.00	+0.00		Pass

IRC21-R507.9.1.3-bolt_washers: IRC deck ledger table, bolt + washers, joist span 6 ft

Source: IRC 2021 Table R507.9.1.3(1) / AWC DCA 6-09 Prescriptive Residential Wood Deck Construction Guide, Table 5, pp. DCA 6-09 p. 12.
Calculation: Wood ledger.

IRC21-R507.9.1.3-bolt_washers · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing, 6 ft span	in.	36.00	36.00	+0.00		Pass

IRC21-R507.9.1.3-bolt_washers-8: IRC deck ledger table, bolt + washers, joist span 8 ft

Source: IRC 2021 Table R507.9.1.3(1) / AWC DCA 6-09 Prescriptive Residential Wood Deck Construction Guide, Table 5, pp. DCA 6-09 p. 12.
Calculation: Wood ledger.

IRC21-R507.9.1.3-bolt_washers-8 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing, 8 ft span	in.	36.00	36.00	+0.00		Pass

IRC21-R507.9.1.3-bolt_washers-10: IRC deck ledger table, bolt + washers, joist span 10 ft

Source: IRC 2021 Table R507.9.1.3(1) / AWC DCA 6-09 Prescriptive Residential Wood Deck Construction Guide, Table 5, pp. DCA 6-09 p. 12.
Calculation: Wood ledger.

IRC21-R507.9.1.3-bolt_washers-10 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing, 10 ft span	in.	29.00	29.00	+0.00		Pass

IRC21-R507.9.1.3-bolt_washers-12: IRC deck ledger table, bolt + washers, joist span 12 ft

Source: IRC 2021 Table R507.9.1.3(1) / AWC DCA 6-09 Prescriptive Residential Wood Deck Construction Guide, Table 5, pp. DCA 6-09 p. 12.
Calculation: Wood ledger.

IRC21-R507.9.1.3-bolt_washers-12 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing, 12 ft span	in.	24.00	24.00	+0.00		Pass

IRC21-R507.9.1.3-bolt_washers-14: IRC deck ledger table, bolt + washers, joist span 14 ft

Source: IRC 2021 Table R507.9.1.3(1) / AWC DCA 6-09 Prescriptive Residential Wood Deck Construction Guide, Table 5, pp. DCA 6-09 p. 12.
Calculation: Wood ledger.

IRC21-R507.9.1.3-bolt_washers-14 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing, 14 ft span	in.	21.00	21.00	+0.00		Pass

IRC21-R507.9.1.3-bolt_washers-16: IRC deck ledger table, bolt + washers, joist span 16 ft

Source: IRC 2021 Table R507.9.1.3(1) / AWC DCA 6-09 Prescriptive Residential Wood Deck Construction Guide, Table 5, pp. DCA 6-09 p. 12.
Calculation: Wood ledger.

IRC21-R507.9.1.3-bolt_washers-16 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing, 16 ft span	in.	18.00	18.00	+0.00		Pass

IRC21-R507.9.1.3-bolt_washers-18: IRC deck ledger table, bolt + washers, joist span 18 ft

Source: IRC 2021 Table R507.9.1.3(1) / AWC DCA 6-09 Prescriptive Residential Wood Deck Construction Guide, Table 5, pp. DCA 6-09 p. 12.
Calculation: Wood ledger.

IRC21-R507.9.1.3-bolt_washers-18 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Spacing, 18 ft span	in.	16.00	16.00	+0.00		Pass

HAND-LEDGER-DEFAULT: Default design: 1/2 in bolts through 15/32 in sheathing, wet service, ASD

Source: Hand calculation (closed form). Calculation: Wood ledger.

HAND-LEDGER-DEFAULT · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z (TR12 mode II with the gap)	lb	170.3	170.3	+0.00		Pass
Z' = Z CD CM	lb	119.2	119.2	+0.00		Pass
Load per fastener w s	lb	104.2	104.2	+0.00		Pass
Required spacing Z' / w	in.	5.721	5.721	+0.00		Pass

HAND-LEDGER-LRFD: Default design in LRFD (1.2D + 1.6L, λ = 0.8)

Source: Hand calculation (closed form). Calculation: Wood ledger.

HAND-LEDGER-LRFD · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z' = Z KF φz λ CM	lb	205.8	205.8	-0.00		Pass
Required spacing	in.	6.498	6.498	-0.00		Pass

HAND-LEDGER-CONC2000: 1/2 in anchor in 2,000 psi concrete: Fe = 3 f'c

Source: Hand calculation (closed form). Calculation: Wood ledger.

HAND-LEDGER-CONC2000 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Mode IIIs	lb	396.7	396.7	+0.00		Pass

HAND-TMS-ANCHOR: 1/2 in headed A307 anchor bolt in grouted masonry, shear (TMS 402-22)

Source: Hand calculation (closed form). Calculation: Wood ledger.

HAND-TMS-ANCHOR · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Bvc = 350 (f'm Ab)^0.25	lb	1,437	1,437	+0.00		Pass
Bvs = 0.25 Ab fu	lb	2,128	2,130	+0.07		Pass
Bvpry = 2.5 Apt √f'm	lb	5,620	5,620	+0.00		Pass
Bvb = 1.25 Apv √f'm	lb	3,161	3,161	+0.00		Pass
Bv (least)	lb	1,437	1,437	+0.00		Pass

HAND-TMS-ANCHOR · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φBvnc = 0.5 × 1050 (f'm Ab)^0.25	lb	2,155	2,155	+0.00		Pass
φBvns = 0.65 × 0.6 Ab fu	lb	3,320	3,323	+0.07		Pass
φBvnpry = 0.5 × 8 Apt √f'm	lb	8,992	8,992	+0.00		Pass
φBvnb = 0.5 × 4 Apv √f'm	lb	5,058	5,058	+0.00		Pass

HAND-LEDGER-PAIRED-CG: Vertical pair of 1/2 in bolts: group action Cg (Eq. 11.3-1)

Source: Hand calculation (closed form). Calculation: Wood ledger.

HAND-LEDGER-PAIRED-CG · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Cg		0.993	0.993	+0.00		Pass

T12A-1: One 1/2 in. bolt, DF-L, load along both grains

Source: NDS 2024 Table 12A, pp. p. 101. Calculation: Moment and eccentric fastener groups.

T12A-1 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z‖	lb	610.0	614.8	+0.79		Pass

T12A-2: One 1/2 in. bolt, DF-L, across the main grain, along the side grain

Source: NDS 2024 Table 12A, pp. p. 101. Calculation: Moment and eccentric fastener groups.

T12A-2 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Zm⊥	lb	430.0	432.5	+0.58		Pass

T12A-3: One 1/2 in. bolt, DF-L, across both grains

Source: NDS 2024 Table 12A, pp. p. 101. Calculation: Moment and eccentric fastener groups.

T12A-3 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z⊥	lb	330.0	331.0	+0.30		Pass

T12A-4: One 3/4 in. bolt, Southern Pine, along both grains

Source: NDS 2024 Table 12A, pp. p. 101. Calculation: Moment and eccentric fastener groups.

T12A-4 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z‖	lb	1,270	1,275	+0.40		Pass

T12A-5: One 3/4 in. bolt, Southern Pine, across both grains

Source: NDS 2024 Table 12A, pp. p. 101. Calculation: Moment and eccentric fastener groups.

T12A-5 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Z⊥	lb	580.0	579.3	-0.11		Pass

HC-MOMENT: 2 × 2 bolts 1/2 in. under a pure moment of 10,000 lb-in.

Source: Hand calculation (closed form, elastic group and Table 12.3.1A). Calculation: Moment and eccentric fastener groups.

HC-MOMENT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R = M r / J	lb	883.9	883.9	+0.00		Pass
Z at 45° to both grains (Feθ, Kθ = 1.125)	lb	433.2	433.2	-0.00		Pass

HC-KNEE: Default knee brace group, 3 × 2 bolts 3/4 in., double shear, side grain at 45°

Source: Hand calculation (closed form, elastic group and Table 12.3.1A). Calculation: Moment and eccentric fastener groups.

HC-KNEE · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
R of the corner bolt	lb	625.3	625.3	-0.00		Pass
Z at θm = 69.0°, θs = 66.0°	lb	1,337	1,337	-0.00		Pass
Z' = Z × CD 1.15	lb	1,537	1,537	+0.00		Pass

HC-TENSION · Notched and tapered member ends: 4x12 DF-L No. 2, tension-face end notch 2 in., span 12 ft

Source: Hand calculation (NDS 2024 equations, closed form). Calculation: Notched and tapered member ends.

HC-TENSION · Notched and tapered member ends · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
V = R = 580 plf × 6 ft	lb	3,480	3,480	+0.00		Pass
Vr' = (2/3) F'v b dn (dn/d)², F'v = 311.04 psi	lb	4,538	4,539	+0.00		Pass
fc⊥ = R / (b lb)	psi	284.1	284.1	+0.00		Pass
F'c⊥ = 625 × 1.67 × 0.90	psi	939.4	939.4	-0.00		Pass

HC-TENSION · Notched and tapered member ends · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vr' = (2/3)(180)(3.5)(9.25)(9.25/11.25)²	lb	2,626	2,626	+0.00		Pass

HC-COMP-SHORT: Compression-face end notch, e = 4 in. ≤ dn

Source: Hand calculation (NDS 2024 equations, closed form). Calculation: Notched and tapered member ends.

HC-COMP-SHORT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vr' = (2/3) F'v b [d − ((d − dn)/dn) e]	lb	4,362	4,362	-0.00		Pass
fb at the end of the notch, 6M / (b dn²)	psi	265.4	265.4	-0.00		Pass

HC-COMP-LONG: Compression-face end notch, e = 10 in. > dn

Source: Hand calculation (NDS 2024 equations, closed form). Calculation: Notched and tapered member ends.

HC-COMP-LONG · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vr' = (2/3) F'v b dn	lb	3,885	3,885	+0.00		Pass

HC-GLULAM: Glulam 5-1/8 × 15 in. 24F-1.8E, tension-face end notch 1-1/2 in., Cvr = 0.72

Source: Hand calculation (NDS 2024 equations, closed form). Calculation: Notched and tapered member ends.

HC-GLULAM · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vr' = (2/3)(265 × 0.72)(5.125)(13.5)(13.5/15)²	lb	7,128	7,129	+0.00		Pass

HC-CONN-NEAR: 4x12 hung on bolts 6 in. from its end, de = 9 in.

Source: Hand calculation (NDS 2024 equations, closed form). Calculation: Notched and tapered member ends.

HC-CONN-NEAR · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vr' = (2/3) F'v b de (de/d)²	lb	2,419	2,419	+0.00		Pass

HC-CONN-FAR: 4x12 hung on bolts 60 in. from its end (≥ 5d), de = 9 in.

Source: Hand calculation (NDS 2024 equations, closed form). Calculation: Notched and tapered member ends.

HC-CONN-FAR · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vr' = (2/3) F'v b de	lb	3,780	3,780	+0.00		Pass

HC-INT-T: 2x12, interior tension-face notch 1-1/2 in., 2 ft from the support

Source: Hand calculation (NDS 2024 equations, closed form). Calculation: Notched and tapered member ends.

HC-INT-T · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
V = 600 − 8.333 × 24	lb	400.0	400.0	+0.00		Pass
Vr' = (2/3)(180)(1.5)(9.75)(9.75/11.25)²	lb	1,318	1,318	+0.00		Pass
fb = 6M / (b dn²) at 28 in.	psi	569.5	569.4	-0.00		Pass

HC-INT-C: 2x12, interior compression-face notch 1-1/2 in.

Source: Hand calculation (NDS 2024 equations, closed form). Calculation: Notched and tapered member ends.

HC-INT-C · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Vr' = (2/3)(180)(1.5)(9.75)	lb	1,755	1,755	+0.00		Pass

STJR-EX2: Table R-1 (Example 2): 2x6 at 16 in, Fb = 1400 psi, 20 + 10 psf, L/240

Source: AWC STJR-2024, Span Tables for Joists and Rafters, pp. p. 13 (Table R-1), p. A-4 (Example 2). Calculation: Rafters and ceiling ties.

STJR-EX2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span at Fb = 1400 psi	ft	13.25	13.28	+0.25		Pass
Required E (million psi)		1.350	1.352	+0.18		Pass

STJR-R1-2x8: Table R-1: 2x8 at 24 in, Fb = 1000 psi, 20 + 10 psf, L/240

Source: AWC STJR-2024, Span Tables for Joists and Rafters, pp. p. 13. Calculation: Rafters and ceiling ties.

STJR-R1-2x8 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span at Fb = 1000 psi	ft	12.08	12.08	-0.00		Pass
Required E (million psi)		0.670	0.667	-0.50		Pass

STJR-R1-2x10: Table R-1: 2x10 at 12 in, Fb = 1200 psi, 20 + 10 psf, L/240

Source: AWC STJR-2024, Span Tables for Joists and Rafters, pp. p. 13. Calculation: Rafters and ceiling ties.

STJR-R1-2x10 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span at Fb = 1200 psi	ft	23.92	23.88	-0.14		Pass
Required E (million psi)		1.240	1.231	-0.72		Pass

STJR-R5-2x8: Table R-5: 2x8 at 16 in, Fb = 1000 psi, 20 + 15 psf, L/240

Source: AWC STJR-2024, Span Tables for Joists and Rafters, pp. p. 17. Calculation: Rafters and ceiling ties.

STJR-R5-2x8 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span at Fb = 1000 psi	ft	13.67	13.70	+0.25		Pass
Required E (million psi)		0.650	0.644	-0.99		Pass

STJR-R13-2x6: Table R-13: 2x6 at 16 in, Fb = 800 psi, 20 + 10 psf, L/180

Source: AWC STJR-2024, Span Tables for Joists and Rafters, pp. p. 25. Calculation: Rafters and ceiling ties.

STJR-R13-2x6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span at Fb = 800 psi	ft	10.00	10.04	+0.42		Pass
Required E (million psi)		0.440	0.438	-0.42		Pass

STJR-R13-2x10: Table R-13: 2x10 at 24 in, Fb = 1200 psi, 20 + 10 psf, L/180

Source: AWC STJR-2024, Span Tables for Joists and Rafters, pp. p. 25. Calculation: Rafters and ceiling ties.

STJR-R13-2x10 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span at Fb = 1200 psi	ft	16.92	16.89	-0.17		Pass
Required E (million psi)		0.660	0.653	-1.08		Pass

STJR-EX2-FCP: Example 2: 89 psi (Table 9.1, 14 ft row, 3.5 in) × 0.60 (Table 9.2)

Source: AWC STJR-2024, Span Tables for Joists and Rafters, pp. p. 3, p. A-4. Calculation: Rafters and ceiling ties.

STJR-EX2-FCP · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required Fc⊥ = R / (b lb)	psi	53.00	53.33	+0.63		Pass

STJR-T91-A: Table 9.1: 12 ft span, 1.5 in bearing, 66.67 plf

Source: AWC STJR-2024, Span Tables for Joists and Rafters, pp. p. 3. Calculation: Rafters and ceiling ties.

STJR-T91-A · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required Fc⊥ = R / (b lb)	psi	178.0	177.8	-0.12		Pass

STJR-T91-B: Table 9.1: 20 ft span, 2.5 in bearing, 66.67 plf

Source: AWC STJR-2024, Span Tables for Joists and Rafters, pp. p. 3. Calculation: Rafters and ceiling ties.

STJR-T91-B · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required Fc⊥ = R / (b lb)	psi	178.0	177.8	-0.12		Pass

CC-GRAV: Raised tie under gravity: 8.5 ft run, 6 ft rise, tie 3 ft below the ridge

Source: ClearCalcs, Wood Roof Tie (ASD), Gravity Roof Tie Example (Aug 2020, NDS 2018), pp. pp. 2-5. Calculation: Rafters and ceiling ties.

CC-GRAV · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
D: tie force	lb	321.0	321.1	+0.03		Pass
D: moment at the tie	lb-ft	723.0	722.5	-0.07		Pass
D: shear perpendicular to the rafter	lb	185.0	185.2	+0.10		Pass
S: tie force	lb	562.0	561.9	-0.01		Pass
S: moment at the tie	lb-ft	1,260	1,264	+0.35		Pass
S: shear perpendicular to the rafter	lb	324.0	324.1	+0.02		Pass

CC-UPL: Tie 2 ft below the ridge, 1.5 ft overhang, 40 psf uplift on 10:12, ridge open under uplift

Source: ClearCalcs, Wood Roof Tie (ASD), Uplift Roof Tie Example (Aug 2020, NDS 2018), pp. pp. 2-5. Calculation: Rafters and ceiling ties.

CC-UPL · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
D: tie force	lb	576.0	576.4	+0.07		Pass
D: positive moment	lb-ft	1,080	1,085	+0.45		Pass
D: shear	lb	369.0	369.0	+0.00		Pass
W up: tie force (ridge open)	lb	697.0	697.4	+0.06		Pass
W up: moment (ridge open)	lb-ft	474.0	473.9	-0.02		Pass
0.6D + 0.6W up: tie force	lb	309.0	309.2	+0.07		Pass
0.6D + 0.6W up: positive moment	lb-ft	115.0	115.4	+0.35		Pass
0.6D + 0.6W up: negative moment	lb-ft	210.0	210.1	+0.06		Pass
0.6D + 0.6W up: shear	lb	124.0	124.1	+0.07		Pass

IRC21-A: 4:12, 16 in, ground snow 30 psf, roof span 24 ft

Source: IRC 2021 Table R802.5.2(1), read in the 2021 Seattle Residential Code, pp. p. 8-25. Calculation: Rafters and ceiling ties.

IRC21-A · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required 16d common nails per heel joint		6.000	6.000	+0.00		Pass

IRC21-B: 3:12, 24 in, ground snow 70 psf, roof span 36 ft

Source: IRC 2021 Table R802.5.2(1), read in the 2021 Seattle Residential Code, pp. p. 8-25. Calculation: Rafters and ceiling ties.

IRC21-B · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required 16d common nails per heel joint		34.00	34.00	+0.00		Pass

IRC21-C: 7:12, 19.2 in, ground snow 50 psf, roof span 24 ft

Source: IRC 2021 Table R802.5.2(1), read in the 2021 Seattle Residential Code, pp. p. 8-25. Calculation: Rafters and ceiling ties.

IRC21-C · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required 16d common nails per heel joint		6.000	6.000	+0.00		Pass

IRC21-D: 12:12, 12 in, ground snow 20 psf, roof span 12 ft

Source: IRC 2021 Table R802.5.2(1), read in the 2021 Seattle Residential Code, pp. p. 8-25. Calculation: Rafters and ceiling ties.

IRC21-D · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required 16d common nails per heel joint		3.000	3.000	+0.00		Pass

IRC21-E: 5:12, 16 in, ground snow 50 psf, roof span 36 ft

Source: IRC 2021 Table R802.5.2(1), read in the 2021 Seattle Residential Code, pp. p. 8-25. Calculation: Rafters and ceiling ties.

IRC21-E · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required 16d common nails per heel joint		11.00	11.00	+0.00		Pass

IRC18-A: 3:12, 24 in, ground snow 70 psf, roof span 36 ft

Source: IRC 2018 Table R802.5.2, read in the 2018 Seattle Residential Code, pp. p. 488. Calculation: Rafters and ceiling ties.

IRC18-A · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required 16d common nails per heel joint		39.00	39.00	+0.00		Pass

IRC18-B: 4:12, 16 in, ground snow 30 psf, roof span 28 ft

Source: IRC 2018 Table R802.5.2, read in the 2018 Seattle Residential Code, pp. p. 488. Calculation: Rafters and ceiling ties.

IRC18-B · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required 16d common nails per heel joint		8.000	8.000	+0.00		Pass

IRC18-C: 7:12, 12 in, ground snow 50 psf, roof span 20 ft

Source: IRC 2018 Table R802.5.2, read in the 2018 Seattle Residential Code, pp. p. 488. Calculation: Rafters and ceiling ties.

IRC18-C · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required 16d common nails per heel joint		4.000	4.000	+0.00		Pass

IRC18-D: 9:12, 24 in, ground snow 20 psf, roof span 36 ft

Source: IRC 2018 Table R802.5.2, read in the 2018 Seattle Residential Code, pp. p. 488. Calculation: Rafters and ceiling ties.

IRC18-D · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required 16d common nails per heel joint		7.000	7.000	+0.00		Pass

IRC18-E: 5:12, 24 in, ground snow 70 psf, roof span 12 ft

Source: IRC 2018 Table R802.5.2, read in the 2018 Seattle Residential Code, pp. p. 488. Calculation: Rafters and ceiling ties.

IRC18-E · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Required 16d common nails per heel joint		7.000	7.000	+0.00		Pass

IRC-HC-1-3: Hc/Hr = 1/3: the thrust over the thrust of a tie at the heel

Source: IRC 2021 Table R802.5.2(1), read in the 2021 Seattle Residential Code, Table R802.5.2(2), pp. p. 8-25. Calculation: Rafters and ceiling ties.

IRC-HC-1-3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Heel joint connection adjustment factor		1.500	1.500	+0.00		Pass

IRC-HC-1-4: Hc/Hr = 1/4: the thrust over the thrust of a tie at the heel

Source: IRC 2021 Table R802.5.2(1), read in the 2021 Seattle Residential Code, Table R802.5.2(2), pp. p. 8-25. Calculation: Rafters and ceiling ties.

IRC-HC-1-4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Heel joint connection adjustment factor		1.330	1.333	+0.25		Pass

IRC-HC-1-5: Hc/Hr = 1/5: the thrust over the thrust of a tie at the heel

Source: IRC 2021 Table R802.5.2(1), read in the 2021 Seattle Residential Code, Table R802.5.2(2), pp. p. 8-25. Calculation: Rafters and ceiling ties.

IRC-HC-1-5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Heel joint connection adjustment factor		1.250	1.250	+0.00		Pass

IRC-HC-1-6: Hc/Hr = 1/6: the thrust over the thrust of a tie at the heel

Source: IRC 2021 Table R802.5.2(1), read in the 2021 Seattle Residential Code, Table R802.5.2(2), pp. p. 8-25. Calculation: Rafters and ceiling ties.

IRC-HC-1-6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Heel joint connection adjustment factor		1.200	1.200	+0.00		Pass

IRC-HC-1-10: Hc/Hr = 1/10: the thrust over the thrust of a tie at the heel

Source: IRC 2021 Table R802.5.2(1), read in the 2021 Seattle Residential Code, Table R802.5.2(2), pp. p. 8-25. Calculation: Rafters and ceiling ties.

IRC-HC-1-10 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Heel joint connection adjustment factor		1.110	1.111	+0.10		Pass

NDS-12N-16d-50: 16d common, side member 1-1/2 in, G = 0.5

Source: NDS 2024 Table 12N, pp. p. 117. Calculation: Rafters and ceiling ties.

NDS-12N-16d-50 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Reference lateral design value Z	lb	141.0	140.7	-0.22		Pass

NDS-12N-16d-55: 16d common, side member 1-1/2 in, G = 0.55

Source: NDS 2024 Table 12N, pp. p. 117. Calculation: Rafters and ceiling ties.

NDS-12N-16d-55 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Reference lateral design value Z	lb	154.0	153.6	-0.27		Pass

NDS-12N-16d-43: 16d common, side member 1-1/2 in, G = 0.43

Source: NDS 2024 Table 12N, pp. p. 117. Calculation: Rafters and ceiling ties.

NDS-12N-16d-43 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Reference lateral design value Z	lb	122.0	122.5	+0.38		Pass

NDS-12N-16d-42: 16d common, side member 1-1/2 in, G = 0.42

Source: NDS 2024 Table 12N, pp. p. 117. Calculation: Rafters and ceiling ties.

NDS-12N-16d-42 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Reference lateral design value Z	lb	120.0	119.8	-0.13		Pass

NDS-12N-10d-50: 10d common, side member 1-1/2 in, G = 0.5

Source: NDS 2024 Table 12N, pp. p. 117. Calculation: Rafters and ceiling ties.

NDS-12N-10d-50 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Reference lateral design value Z	lb	118.0	117.4	-0.49		Pass

NDS-12N-10d-43: 10d common, side member 1-1/2 in, G = 0.43

Source: NDS 2024 Table 12N, pp. p. 117. Calculation: Rafters and ceiling ties.

NDS-12N-10d-43 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Reference lateral design value Z	lb	102.0	102.2	+0.21		Pass

HUD-7.3: Heel joint, 28 ft roof span, 6:12, 16 in, 25 psf snow, 10 psf dead

Source: HUD PDR-20490, Residential Structural Design Guide (2000), Example 7.3, pp. p. 7-33. Calculation: Rafters and ceiling ties.

HUD-7.3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Rafter bearing reaction B	lb	652.0	653.3	+0.20		Pass
Tension in the ceiling joist T	lb	1,337	653.3	-51.13		Deviation HUD-2000-HEEL
HUD-2000-HEEL: pinned-joint analysis of the heel takes the whole reaction through the rafter axis; the statics of the rafter pair give half of it						

HAND-1 · Rafters and ceiling ties: Tie at the heel: thrust, member forces, NDS 3.3, 3.4, 3.10.3, Eq. 3.4-3, nailing

Source: Hand calculation (closed form). Calculation: Rafters and ceiling ties.

HAND-1 · Rafters and ceiling ties · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Thrust H = w L² / (2 Hr)	lb	512.0	512.0	+0.00		Pass
Tie force T	lb	512.0	512.0	+0.00		Pass
Wall reaction R = w L	lb	512.0	512.0	+0.00		Pass
M = w L² / 8	lb-ft	768.0	768.0	+0.00		Pass
V at the heel = w L cos θ / 2	lb	229.0	229.0	+0.00		Pass
Compression at the heel = T cos θ + R sin θ	lb	686.9	686.9	-0.00		Pass
fb = M / S	psi	430.8	430.8	+0.00		Pass
Fb' = Fb CD CF Cr	psi	1,423	1,423	+0.00		Pass
fv = 3V / (2bd)	psi	24.75	24.75	+0.00		Pass
Fv' = Fv CD	psi	225.0	225.0	+0.00		Pass
fθ at the seat	psi	113.8	113.8	+0.00		Pass
Fθ' (Hankinson, Eq. 3.10-1)	psi	715.0	715.0	+0.00		Pass
Notch depth lb sin θ	in.	1.342	1.342	+0.00		Pass
Vr' (Eq. 3.4-3)	lb	1,301	1,301	+0.00		Pass
Tie: ft / Ft' with Ft' = Ft CD CF (no ceiling load)		0.066	0.066	+0.00		Pass
n Z' = 7 × Z CD	lb	1,231	1,231	+0.00		Pass
Live deflection, horizontal basis 5 w L⁴ / (384 E I) equals the sloped one × cos²θ	in.	0.098	0.098	-0.00		Pass

HAND-1 · Rafters and ceiling ties · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Thrust H (1.2D + 1.6Lr)	lb	742.4	742.4	+0.00		Pass
fb = M / S	psi	624.7	624.7	+0.00		Pass
Fb' = Fb CF Cr KF φ λ	psi	1,966	1,966	+0.00		Pass
Fv' = Fv KF φ λ	psi	311.0	311.0	+0.00		Pass
n Z' = 7 × Z × 3.32 × 0.65 × λ	lb	1,700	1,700	+0.00		Pass

HAND-2 · Rafters and ceiling ties: Raised tie, Hc = 2 ft: thrust and the moment at the tie

Source: Hand calculation (closed form). Calculation: Rafters and ceiling ties.

HAND-2 · Rafters and ceiling ties · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
T = w L² / (2 (Hr − Hc))	lb	768.0	768.0	+0.00		Pass
M at the tie = R xc − w xc² / 2	lb-ft	1,707	1,707	+0.00		Pass

HAND-2 · Rafters and ceiling ties · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
T = w L² / (2 (Hr − Hc))	lb	1,114	1,114	+0.00		Pass
M at the tie = R xc − w xc² / 2	lb-ft	2,475	2,475	+0.00		Pass

WW25-SW-L1: Two-story 12 ft wall, lower story: unit shear, capacity, end post forces

Source: WoodWorks, Introduction to Wood: Structural Lateral Framing Design (Cloninger / Romanowski, 2025-01), pp. slides 57-60, 65-66.
Calculation: Wood shear wall.

WW25-SW-L1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Wind v = 6,750 / 12	plf	563.0	562.5	-0.09		Pass
Seismic v = 4,500 / 12	plf	375.0	375.0	+0.00		Pass
Wind capacity vn / 2.0 = 1,540 / 2.0	plf	770.0	770.0	+0.00		Pass
Seismic capacity vn / 2.8 = 1,540 / 2.8	plf	550.0	550.0	+0.00		Pass
T = C, wind = 90,000 / 12	kips	7.500	7.500	+0.00		Pass
T = C, seismic = 65,000 / 12	kips	5.417	5.417	-0.01		Pass

WW25-SW-L2: Two-story 12 ft wall, upper story

Source: WoodWorks, Introduction to Wood: Structural Lateral Framing Design (Cloninger / Romanowski, 2025-01), pp. slides 57-60. Calculation: Wood shear wall.

WW25-SW-L2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Wind v = 2,250 / 12	plf	188.0	187.5	-0.27		Pass
Seismic v = 2,000 / 12	plf	167.0	166.7	-0.20		Pass
T = C, wind = 22,500 / 12	kips	1.875	1.875	+0.00		Pass
T = C, seismic = 20,000 / 12	kips	1.667	1.667	-0.02		Pass

WW25-SW-D: Eq. 4.3-1 deflection of the lower story under wind

Source: WoodWorks, Introduction to Wood: Structural Lateral Framing Design (Cloninger / Romanowski, 2025-01), pp. slides 76-80. Calculation: Wood shear wall.

WW25-SW-D · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ga (Table 4.3A, OSB, 8d at 3 in)		24.00	24.00	+0.00		Pass
End post deformation 8vh³ / (EAb)	in.	0.007	0.007	-1.38		Pass
Panel shear + nail slip vh / (1000 Ga)	in.	0.211	0.211	-0.03		Pass
Anchorage deformation hΔa / b	in.	0.101	0.101	-0.50		Pass
δsw	in.	0.320	0.318	-0.52		Pass

AWC-E3.1: Segmented wall, wind, SDPWS 2015 aspect ratio rule (no gypsum)

Source: AWC Structural Wood Design Examples 2015/2018, as quoted on the Trimble Tekla Tedds 2026 verification page "Wood Shear Wall Design - Segmented - Wind (ASD)", pp. AWC pp. 110-113. Calculation: Wood shear wall.

AWC-E3.1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
WSP nominal capacity vw	plf	1,065	1,065	+0.00		Pass
ASD capacity vw / 2.0	plf	532.5	532.5	+0.00		Pass
Wall shear capacity 532.5 × 14 ft	lb	7,455	7,455	-0.00		Pass
Hold-down T	kips	3.549	3.549	-0.01		Pass

AWC-E3.2: Segmented wall, seismic, SDPWS 2015 aspect ratio rule

Source: AWC Structural Wood Design Examples 2015/2018, as quoted on the Trimble Tekla Tedds 2026 verification page "Wood Shear Wall Design - Segmented - Seismic (ASD)", pp. AWC pp. 114-115. Calculation: Wood shear wall.

AWC-E3.2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ASD capacity vs / 2.0 (SDPWS 2021: vn / 2.8)	plf	380.0	380.4	+0.09		Pass
Wall shear capacity 380 × 14 ft	lb	5,320	5,325	+0.09		Pass
Hold-down T	kips	3.043	3.043	-0.01		Pass

AWC-E3.4: Perforated wall, seismic: Co, capacity, hold-down

Source: AWC Structural Wood Design Examples 2015/2018, as quoted on the Trimble Tekla Tedds 2026 verification page "Wood Shear Wall Design - Perforated - Seismic (ASD)", pp. AWC pp. 119-121. Calculation: Wood shear wall.

AWC-E3.4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Co		0.780	0.784	+0.55		Pass
Shear capacity 380 × 0.78 × 18 ft	lb	5,335	5,370	+0.65		Pass
Hold-down T = 4,733 × 9 / (0.78 × 18)	kips	3.034	3.017	-0.55		Pass

WW5S-SW-Roof: Five-story example, Roof level: 29 ft wall, 15/32 in OSB, 10d at 6 in, one face(s)

Source: WoodWorks, Five-Story Light-Frame Wood Structure over Podium, Design Example, 2nd Ed. (2025), pp. Tables 3.5, 3.13C, 3.18, 3.19 (PDF pp. 36, 47, 54, 56; printed pp. 30, 41, 48, 50). Calculation: Wood shear wall.

WW5S-SW-Roof · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ASD design shear 0.7 Ftotal / l	plf	227.0	226.8	-0.08		Pass
Allowable shear vn / 2.8	plf	310.0	310.7	+0.23		Pass
Ga (Table 4.3A, OSB)		22.00	22.00	+0.00		Pass
1st term 8vh³ / (EAb)	in.	0.002	0.002	-16.54		Pass
2nd term vh / (1000 Ga)	in.	0.147	0.147	+0.20		Pass
3rd term hΔa / b	in.	0.045	0.045	+0.38		Pass
δSW	in.	0.194	0.194	+0.07		Pass
Design story drift Cd δ / Ie	in.	0.780	0.777	-0.45		Pass
Allowable story drift 0.020 hsx	in.	2.400	2.400	+0.00		Pass

WW5S-SW-6th: Five-story example, 6th level: 29 ft wall, 15/32 in OSB, 10d at 4 in, one face(s)

Source: WoodWorks, Five-Story Light-Frame Wood Structure over Podium, Design Example, 2nd Ed. (2025), pp. Tables 3.5, 3.13C, 3.18, 3.19 (PDF pp. 36, 47, 54, 56; printed pp. 30, 41, 48, 50). Calculation: Wood shear wall.

WW5S-SW-6th · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ASD design shear 0.7 Ftotal / l	plf	447.0	447.2	+0.04		Pass
Allowable shear vn / 2.8	plf	460.0	460.7	+0.16		Pass
Ga (Table 4.3A, OSB)		30.00	30.00	+0.00		Pass
1st term 8vh³ / (EAb)	in.	0.003	0.003	-6.10		Pass
2nd term vh / (1000 Ga)	in.	0.213	0.213	-0.03		Pass
3rd term hΔa / b	in.	0.069	0.069	-0.55		Pass
δSW	in.	0.284	0.284	+0.13		Pass
Design story drift Cd δ / Ie	in.	1.140	1.138	-0.22		Pass
Allowable story drift 0.020 hsx	in.	2.400	2.400	+0.00		Pass

WW5S-SW-5th: Five-story example, 5th level: 29 ft wall, 15/32 in OSB, 10d at 2 in, one face(s)

Source: WoodWorks, Five-Story Light-Frame Wood Structure over Podium, Design Example, 2nd Ed. (2025), pp. Tables 3.5, 3.13C, 3.18, 3.19 (PDF pp. 36, 47, 54, 56; printed pp. 30, 41, 48, 50). Calculation: Wood shear wall.

WW5S-SW-5th · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ASD design shear 0.7 Ftotal / l	plf	612.0	612.5	+0.07		Pass
Allowable shear vn / 2.8	plf	770.0	769.6	-0.05		Pass
Ga (Table 4.3A, OSB)		52.00	52.00	+0.00		Pass
1st term 8vh³ / (EAb)	in.	0.003	0.003	-9.86		Pass
2nd term vh / (1000 Ga)	in.	0.168	0.168	+0.15		Pass
3rd term hΔa / b	in.	0.094	0.094	-0.22		Pass
δSW	in.	0.265	0.265	-0.09		Pass
Design story drift Cd δ / Ie	in.	1.060	1.059	-0.09		Pass
Allowable story drift 0.020 hsx	in.	2.400	2.400	+0.00		Pass

WW5S-SW-4th: Five-story example, 4th level: 29 ft wall, 15/32 in OSB, 10d at 2 in, one face(s)

Source: WoodWorks, Five-Story Light-Frame Wood Structure over Podium, Design Example, 2nd Ed. (2025), pp. Tables 3.5, 3.13C, 3.18, 3.19 (PDF pp. 36, 47, 54, 56; printed pp. 30, 41, 48, 50). Calculation: Wood shear wall.

WW5S-SW-4th · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ASD design shear 0.7 Ftotal / l	plf	723.0	722.6	-0.05		Pass
Allowable shear vn / 2.8	plf	770.0	769.6	-0.05		Pass
Ga (Table 4.3A, OSB)		52.00	52.00	+0.00		Pass
1st term 8vh³ / (EAb)	in.	0.002	0.002	+22.64		Pass
2nd term vh / (1000 Ga)	in.	0.199	0.199	-0.24		Pass
3rd term hΔa / b	in.	0.107	0.107	-0.42		Pass
δSW	in.	0.307	0.308	+0.17		Pass
Design story drift Cd δ / Ie	in.	1.230	1.230	+0.01		Pass
Allowable story drift 0.020 hsx	in.	2.400	2.400	+0.00		Pass

WW5S-SW-3rd: Five-story example, 3rd level: 29 ft wall, 15/32 in OSB, 10d at 4 in, two face(s)

Source: WoodWorks, Five-Story Light-Frame Wood Structure over Podium, Design Example, 2nd Ed. (2025), pp. Tables 3.5, 3.13C, 3.18, 3.19 (PDF pp. 36, 47, 54, 56; printed pp. 30, 41, 48, 50). Calculation: Wood shear wall.

WW5S-SW-3rd · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ASD design shear 0.7 Ftotal / l	plf	778.0	777.7	-0.04		Pass
Allowable shear vn / 2.8	plf	920.0	921.4	+0.16		Pass
Ga (Table 4.3A, OSB)		60.00	60.00	+0.00		Pass
1st term 8vh³ / (EAb)	in.	0.002	0.002	+7.32		Pass
2nd term vh / (1000 Ga)	in.	0.185	0.185	+0.09		Pass
3rd term hΔa / b	in.	0.100	0.100	-0.34		Pass
δSW	in.	0.287	0.287	-0.01		Pass
Design story drift Cd δ / Ie	in.	1.150	1.148	-0.18		Pass
Allowable story drift 0.020 hsx	in.	2.400	2.400	+0.00		Pass

WW5S-SW-W3: Five-story example, wind chapter, 3rd level: 2 × 29 ft, 8d at 6 in

Source: WoodWorks, Five-Story Light-Frame Wood Structure over Podium, Design Example, 2nd Ed. (2025), pp. Table 4.5 (PDF p. 67, printed p. 61). Calculation: Wood shear wall.

WW5S-SW-W3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ASD seismic shear 9,128 / 58	plf	158.0	157.4	-0.39		Pass
ASD wind shear 15,114 / 58	plf	261.0	260.6	-0.16		Pass
Adjusted allowable shear, seismic (vn / 2.8)	plf	261.0	260.7	-0.11		Pass
Adjusted allowable shear, wind (vn / 2.0)	plf	365.0	365.0	+0.00		Pass

SW-1 · Wood shear wall: Single 8 ft segment: unit shear, hold-down, drift

Source: Hand calculation (closed form). Calculation: Wood shear wall.

SW-1 · Wood shear wall · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Seismic unit shear ρQE / b	plf	625.0	625.0	+0.00		Pass
φD vn = 0.50 × 1205 (seismic)	plf	602.5	602.5	+0.00		Pass
Wind unit shear W / b	plf	875.0	875.0	+0.00		Pass
φD vw = 0.80 × 1205	plf	964.0	964.0	+0.00		Pass
Hold-down T (wind, 0.9D + 1.0W governs)	kips	7.632	7.632	+0.00		Pass
Hold-down T (seismic, 0.7D + 1.0QE)	kips	5.403	5.403	+0.00		Pass
δxe (Eq. 4.3-1)	in.	0.499	0.499	+0.00		Pass
Δ = Cd δxe / Ie	in.	1.994	1.994	+0.00		Pass
Allowable drift 0.020 hsx	in.	2.160	2.160	+0.00		Pass

SW-1 · Wood shear wall · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Seismic unit shear 0.7QE / b	plf	437.5	437.5	+0.00		Pass
vn / 2.8 (seismic)	plf	430.4	430.4	+0.00		Pass
Hold-down T (wind, 0.6D + 0.6W)	kips	4.528	4.528	-0.00		Pass

SW-2 · Wood shear wall: Narrow segment (h/bs = 3), SPF framing: species and aspect ratio factors

Source: Hand calculation (closed form). Calculation: Wood shear wall.

SW-2 · Wood shear wall · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φD vn × 0.92 × 0.875 (SDPWS 2021, seismic φD = 0.50)	plf	485.0	485.0	+0.00		Pass
φD vw × 0.92 × 0.875	plf	776.0	776.0	+0.00		Pass
Aspect ratio factor		0.875	0.875	+0.00		Pass

SW-2b: Narrow segment under the SDPWS 2015 rule (2bs/h, wind and seismic)

Source: Hand calculation (closed form). Calculation: Wood shear wall.

SW-2b · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φD vn × 0.92 × 2bs/h (seismic)	plf	369.5	369.5	+0.00		Pass
φD vn × 0.92 × 2bs/h (wind)	plf	591.3	591.3	+0.00		Pass

SW-3: Two segments sharing the shear by capacity

Source: Hand calculation (closed form). Calculation: Wood shear wall.

SW-3 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Share of the 8 ft segment		0.800	0.800	+0.00		Pass
Largest unit shear (8 ft segment)	plf	600.0	600.0	+0.00		Pass
Unit shear ratio of the segments (both at the same fraction of capacity)		1.000	1.000	+0.00		Pass
Demand / capacity: v8 / (0.50 vn), the same in both segments (the 3 ft one at 2b/h)		0.996	0.996	+0.00		Pass

SW-3b: Two segments sharing the shear by stiffness (Δa = 0)

Source: Hand calculation (closed form). Calculation: Wood shear wall.

SW-3b · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Share of the 3 ft segment		0.256	0.256	+0.00		Pass
Largest unit shear	plf	557.7	557.7	+0.00		Pass

SW-4: Perforated wall: Co, unit shear and hold-down

Source: Hand calculation (closed form). Calculation: Wood shear wall.

SW-4 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Co = Awall / (3Ao + Afhs) (Eq. 4.3-6)		0.741	0.741	+0.00		Pass
v = V / (Co ΣLi)	plf	675.0	675.0	-0.00		Pass
T = Vh / (Co ΣLi)	kips	5.400	5.400	-0.00		Pass

SW-5: Both faces, different nailing: Kmin (Ga1 + Ga2)

Source: Hand calculation (closed form). Calculation: Wood shear wall.

SW-5 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
φD vn(c), seismic: 0.50 × 56.07 × 32	plf	897.1	897.1	+0.00		Pass
φD vn(c), wind: 0.80 × 56.07 × 32	plf	1,435	1,435	+0.00		Pass
Ga(c) = 18 + 14		32.00	32.00	+0.00		Pass

SW-6: Stacked stories: overturning from the story above

Source: Hand calculation (closed form). Calculation: Wood shear wall.

SW-6 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Hold-down T	kips	8.955	8.955	+0.00		Pass

SW-7: Perforated wall with small openings: Co capped at 1.0

Source: Hand calculation (closed form). Calculation: Wood shear wall.

SW-7 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Co = min(1.0, 180 / (3 × 16 + 108))		1.000	1.000	+0.00		Pass
v = V / (Co Σbi) = 6,000 / 12	plf	500.0	500.0	+0.00		Pass
T = Vh / (Co Σbi) = 6 × 9 / 12	kips	4.500	4.500	+0.00		Pass

SW-8: Perforated wall with a narrow segment: Σbi with 2bi/h

Source: Hand calculation (closed form). Calculation: Wood shear wall.

SW-8 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Co = 160 / (3 × 40 + 8 × 9)		0.833	0.833	+0.00		Pass
Σbi = 6 + 3 × 2 × 3 / 8	ft	8.250	8.250	+0.00		Pass
v = V / (Co Σbi)	plf	872.7	872.7	+0.00		Pass

SW-9: 10d nails, hold-down on the inside face of the end post: vn × 0.92

Source: Hand calculation (closed form). Calculation: Wood shear wall.

SW-9 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
0.80 × 0.92 × 950 (wind)	plf	699.2	699.2	+0.00		Pass

MALONE-1: Force transfer, two openings of different heights, no dead load

Source: WoodWorks, FTAO Analysis for Complex Shear Wall Openings (Malone, 2023), pp. slides 23-32. Calculation: Wood shear wall.

MALONE-1 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fo/t = V h / L	kips	2.077	2.077	+0.00		Pass
Hold-down	kips	2.077	2.077	+0.00		Pass
Vertical shear at opening 1	plf	346.2	346.2	-0.01		Pass
Vertical shear at opening 2	plf	519.2	519.2	+0.01		Pass
Corner force, T1 = 2 ft	lb	692.4	692.3	-0.01		Pass
Corner force, T2 = 1 ft	lb	346.2	346.2	-0.01		Pass
Corner force, T3 = 1.33 ft	lb	690.6	692.3	+0.25		Pass
Corner force, T4 = 3.67 ft	lb	1,906	1,904	-0.09		Pass
Pier 1 shear	plf	346.2	346.2	-0.01		Pass
Pier 2 shear	plf	499.7	500.0	+0.06		Pass
Pier 3 shear	plf	384.8	384.6	-0.05		Pass
Pier 1 above the head	plf	173.1	173.1	-0.01		Pass
Pier 2 above the head	plf	18.70	19.23	+2.84		Pass
Pier 2 between the sills	plf	326.6	326.9	+0.10		Pass
Pier 3 above the head	plf	38.30	38.46	+0.42		Pass

MALONE-2: The same wall with a dead load of 150 plf, factored

Source: WoodWorks, FTAO Analysis for Complex Shear Wall Openings (Malone, 2023), pp. slides 33-41. Calculation: Wood shear wall.

MALONE-2 · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fo/t at the end in tension	lb	614.4	614.4	+0.00		Pass
Fo/t at the other end	lb	3,539	3,539	+0.00		Pass
vv at x = 4 ft	plf	202.4	202.4	+0.00		Pass
vv at x = 7 ft	plf	277.4	277.4	+0.00		Pass
vv at x = 9 ft	plf	491.1	491.1	+0.00		Pass
vv at x = 14 ft	plf	678.6	678.6	+0.00		Pass
Corner force 2(202.4 + 252.4)/2	lb	454.8	454.8	+0.00		Pass
Corner force 1(252.4 + 277.4)/2	lb	264.9	264.9	+0.00		Pass
Corner force 1.33(491.1 + 541)/2	lb	686.3	688.1	+0.27		Pass
Corner force 3.67(541 + 678.6)/2	lb	2,238	2,236	-0.08		Pass

T555-MALONE: APA T555 example as reproduced by Malone (V read from the printed shears)

Source: WoodWorks, FTAO Analysis for Complex Shear Wall Openings (Malone, 2023), pp. slide 20. Calculation: Wood shear wall.

T555-MALONE · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Pier 1	plf	336.3	336.5	+0.07		Pass
Pier 2	plf	387.7	387.8	+0.03		Pass
Pier 3	plf	243.5	243.6	+0.04		Pass
Above and below opening 1	plf	288.0	288.5	+0.16		Pass
Above and below opening 2	plf	288.0	288.5	+0.16		Pass
Corner forces at opening 1	lb	865.0	865.4	+0.04		Pass
At opening 1, the other side	lb	865.0	865.4	+0.04		Pass
At opening 2, APA	lb	308.0	307.7	-0.10		Pass
At opening 2, the other side, APA	lb	269.0	269.2	+0.09		Pass
Pier 1 above the head	plf	120.1	120.2	+0.08		Pass
Pier 2 above the head	plf	94.40	94.55	+0.16		Pass
Pier 3 above the head	plf	166.7	166.7	-0.02		Pass

T555C-2024: APA T555C example: 26 ft wall, 8 ft, two windows, 0.7E = 3,750 lb

Source: APA Technical Note T555C, Design for Force Transfer Around Openings (FTAO), March 2024, pp. pp. 7-9, Figures 3, 4, 6. Calculation: Wood shear wall.

T555C-2024 · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Step 1: hold-down H	lb	1,538	1,538	+0.03		Pass
Step 2: va = vb, first opening	plf	288.0	288.5	+0.16		Pass
Step 2: va = vb, second opening	plf	288.0	288.5	+0.16		Pass
Step 3: O1	lb	1,731	1,731	-0.01		Pass
Step 3: O2	lb	577.0	576.9	-0.01		Pass
Step 4: F1	lb	865.0	865.4	+0.04		Pass
Step 4: F2	lb	865.0	865.4	+0.04		Pass
Step 4: F3	lb	308.0	307.7	-0.10		Pass
Step 4: F4	lb	269.0	269.2	+0.09		Pass
Step 5: T1	ft	3.000	3.000	+0.00		Pass
Step 5: T2	ft	3.000	3.000	+0.00		Pass
Step 5: T3	ft	1.100	1.067	-3.03		Pass
Step 5: T4	ft	0.900	0.933	+3.70		Pass
Step 6: V1	plf	337.0	336.5	-0.14		Pass
Step 6: V2	plf	388.0	387.8	-0.05		Pass
Step 6: V3	plf	244.0	243.6	-0.17		Pass
Step 7: R1	lb	1,346	1,346	+0.01		Pass
Step 7: R2	lb	1,551	1,551	+0.02		Pass
Step 7: R3	lb	853.0	852.6	-0.05		Pass
Step 9: vc1	plf	120.0	120.2	+0.16		Pass
Step 9: vc2	plf	95.00	94.55	-0.47		Pass
Step 9: vc3	plf	167.0	166.7	-0.20		Pass
Step 10: line 1 sums to H	lb	1,538	1,538	+0.03		Pass
Step 10: line 6 sums to H	lb	1,538	1,538	+0.03		Pass
Largest shear (p. 9)	plf	388.0	387.8	-0.05		Pass
15/32 in. rated sheathing, 8d at 4 in. (p. 9)	plf	380.0	380.4	+0.09		Pass
Figure 6: v, pier 1, unfactored	plf	481.0	480.8	-0.05		Pass
Figure 6: v, pier 2	plf	554.0	554.0	+0.01		Pass
Figure 6: v, pier 3	plf	348.0	348.0	-0.00		Pass
Figure 6: pier 1 left	in.	0.680	0.680	+0.02		Pass
Figure 6: pier 1 right	in.	0.218	0.218	+0.14		Pass
Figure 6: pier 2 left	in.	0.252	0.252	-0.17		Pass
Figure 6: pier 2 right	in.	0.252	0.252	-0.17		Pass
Figure 6: pier 3 left	in.	0.170	0.170	+0.07		Pass
Figure 6: pier 3 right	in.	0.542	0.542	-0.06		Pass
Figure 6: total deflection, 3-term	in.	0.352	0.352	+0.06		Pass
Figure 6: percent drift		0.015	0.367	+2395.89		Deviation T555-DRIFT
T555-DRIFT: the worksheet's percent drift, 0.0147 and 0.0137, is the deflection divided by 24; over the 8 ft wall, 0.352 in. is 0.37 percent						
Figure 5: total deflection, 4-term	in.	0.329	0.352	+7.06		Deviation T555-4TERM
T555-4TERM: ILX has the 3-term Eq. 4.3-1 of SDPWS 2021, not the 4-term equation of IBC 2021 Eq. 23-2						

HC-TANG: 10 in. across the grain, Douglas-fir Coast, tangential, 19 % to 10 %

Source: Hand calculation (closed form, FPL Wood Handbook method; coefficients to confirm against the Handbook). Calculation: Wood shrinkage and moisture.

HC-TANG · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ΔD = 10 × 0.00267 × 9	in.	0.240	0.240	+0.00		Pass

HC-RAD: 10 in. across the grain, Douglas-fir Coast, radial, 19 % to 10 %

Source: Hand calculation (closed form, FPL Wood Handbook method; coefficients to confirm against the Handbook). Calculation: Wood shrinkage and moisture.

HC-RAD · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ΔD = 10 × 0.00165 × 9	in.	0.148	0.148	+0.00		Pass

HC-TOTAL: Coefficient from the total tangential shrinkage ST = 7.6 %

Source: Hand calculation (closed form, FPL Wood Handbook method; coefficients to confirm against the Handbook). Calculation: Wood shrinkage and moisture.

HC-TOTAL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ΔD = 10 × 7.6 / 3000 × 9	in.	0.228	0.228	-0.00		Pass

HC-GREEN: Green lumber (35 %) capped at the fiber saturation point, to 12 %

Source: Hand calculation (closed form, FPL Wood Handbook method; coefficients to confirm against the Handbook). Calculation: Wood shrinkage and moisture.

HC-GREEN · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ΔD = 10 × 0.00267 × (30 − 12)	in.	0.481	0.481	+0.00		Pass

HC-STACK: Default three-story stack, average across the grain

Source: Hand calculation (closed form, FPL Wood Handbook method; coefficients to confirm against the Handbook). Calculation: Wood shrinkage and moisture.

HC-STACK · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Level 1 = 13.75 × 0.00216 × 9 + 92.625 × 0.00005 × 9	in.	0.309	0.309	+0.00		Pass
Level 3 = 4.5 × 0.00216 × 9 + 92.625 × 0.00005 × 9	in.	0.129	0.129	+0.00		Pass
Cumulative at the top	in.	0.747	0.747	+0.00		Pass

HC-ENG · Wood shrinkage and moisture: Engineered rim, C entered 0.0012, installed at 12 %, to 8 %

Source: Hand calculation (closed form, FPL Wood Handbook method; coefficients to confirm against the Handbook). Calculation: Wood shrinkage and moisture.

HC-ENG · Wood shrinkage and moisture · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ΔD = 11.875 × 0.0012 × 4	in.	0.057	0.057	-0.00		Pass

HC-SP: Slash pine 2x10 rim, average, 19 % to 12 %

Source: Hand calculation (closed form, FPL Wood Handbook method; coefficients to confirm against the Handbook). Calculation: Wood shrinkage and moisture.

HC-SP · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ΔD = 9.25 × (0.00187 + 0.00267) / 2 × 7	in.	0.147	0.147	+0.00		Pass

HC-SWELL: Swelling: 10 % at installation, 14 % in service, tangential

Source: Hand calculation (closed form, FPL Wood Handbook method; coefficients to confirm against the Handbook). Calculation: Wood shrinkage and moisture.

HC-SWELL · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
ΔD = 10 × 0.00267 × (10 − 14)	in.	-0.107	-0.107	-0.00		Pass

HC-STRINGER: Solid stringer, ASD and LRFD

Source: Hand calculation (closed form). Calculation: Wood stair.

HC-STRINGER · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Span on plan	ft	11.62	11.62	+0.00		Pass
Width on the stringer	ft	1.500	1.500	+0.00		Pass
fb	psi	480.5	480.5	-0.00		Pass
Fb'	psi	900.0	900.0	+0.00		Pass
fv at d from the seat	psi	31.67	31.67	-0.01		Pass
Live deflection with the slope factor	in.	0.131	0.131	-0.04		Pass

HC-STRINGER · LRFD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
fb	psi	730.4	730.4	-0.01		Pass
Fb' = 900 × 2.54 × 0.85 × 0.8	psi	1,554	1,554	-0.00		Pass

HC-TREAD: 2x8 tread at 36 in., the basis of DCA6 Table 6

Source: Hand calculation on the basis of AWC DCA6-2015 Table 6, p. 21 (no published calculation), pp. p. 21. Calculation: Wood stair.

HC-TREAD · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
fb under 300 lb	psi	993.1	993.1	+0.00		Pass
Fb' = 900 × 1.2 × 1.15 × 0.8	psi	993.6	993.6	-0.00		Pass
Deflection under 300 lb	in.	0.104	0.105	+0.04		Pass
Limit L/288	in.	0.125	0.125	+0.00		Pass

HC-CUT: Throat of a cut stringer

Source: Hand calculation (closed form). Calculation: Wood stair.

HC-CUT · —

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Notch: 7.5 × 10.5 / 12.903	in.	6.103	6.103	+0.00		Pass
Throat	in.	5.147	5.147	-0.00		Pass

PB-AWC-E1.4a: 4x4 SP No. 2, 10 ft, CD = 1.0: the post of AWC E1.4 as a chord

Source: AWC 2015/2018 Structural Wood Design Examples, E1.4, as tabulated in the Tekla Tedds 2026 verification example, pp. AWC pp. 23-27.
Calculation: Wood truss.

PB-AWC-E1.4a · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fc'	psi	336.0	336.3	+0.09		Pass

PB-AWC-E1.4b: 6x6 SP No. 2, 10 ft, CD = 1.0: the timber post of AWC E1.4 as a chord

Source: AWC 2015/2018 Structural Wood Design Examples, E1.4, as tabulated in the Tekla Tedds 2026 verification example, pp. AWC pp. 23-27.
Calculation: Wood truss.

PB-AWC-E1.4b · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fc'	psi	421.0	420.6	-0.08		Pass

PB-AV-5.6: 6x6 DF-L No. 1, 12 ft, CD = 1.15: Aghayere & Vigil 5.6 as a chord

Source: Aghayere & Vigil, Structural Wood Design, 2nd ed. (2017), as tabulated in the calcs.com Wood Column Validation Examples, Example 5.6, pp. p. 299. Calculation: Wood truss.

PB-AV-5.6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fc' = 17,463 lb / 30.25 in²	psi	577.3	578.4	+0.20		Pass

PB-AV-5.9a: 2x6 DF-L No. 2, 10 ft, CD = 1.15: Aghayere & Vigil 5.9, axial

Source: Aghayere & Vigil, Structural Wood Design, 2nd ed. (2017), as tabulated in the calcs.com Wood Column Validation Examples, Example 5.9, pp. p. 313. Calculation: Wood truss.

PB-AV-5.9a · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fc'	psi	840.0	839.3	-0.08		Pass

PB-AV-5.9b: 2x6 DF-L No. 2, CD = 1.6, Cr = 1.15, braced: Aghayere & Vigil 5.9, bending

Source: Aghayere & Vigil, Structural Wood Design, 2nd ed. (2017), as tabulated in the calcs.com Wood Column Validation Examples, Example 5.9, pp. p. 313. Calculation: Wood truss.

PB-AV-5.9b · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fb'	psi	2,153	2,153	-0.01		Pass

PB-WW-3.3.5: 2x4 DF-L No. 1, 115.5 in., CD = 1.6: the WoodWorks stud, NDS 2024 Supplement values

Source: WoodWorks DE-2025, Five-Story Light-Frame Wood Over Podium, 2nd ed., sec. 3.3.5, pp. PDF pp. 40-41. Calculation: Wood truss.

PB-WW-3.3.5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fc'	psi	450.0	450.4	+0.09		Pass

PB-HUD-5.6: 4x4 SPF No. 2, 7.3 ft, CD = 1.0: the HUD column as a chord

Source: HUD Residential Structural Design Guide (2017), Example 5.6, pp. PDF p. 261. Calculation: Wood truss.

PB-HUD-5.6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fc'	psi	582.0	579.0	-0.51		Pass

WT-H1: NDS only: top chord compression, CD = 1.25, le/d = 72/5.5, sheathed

Source: Hand calculation from the cited sections, pp. NDS 2024 3.7. Calculation: Wood truss.

WT-H1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fc'	psi	1,651	1,651	+0.00		Pass

WT-H2: NDS only: bottom chord tension, CD = 1.25

Source: Hand calculation from the cited sections, pp. NDS 2024 3.8. Calculation: Wood truss.

WT-H2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ft'	psi	1,097	1,097	+0.00		Pass

WT-H3: NDS only: bearing perpendicular to grain, 3.5 in. at the end of the member

Source: Hand calculation from the cited sections, pp. NDS 2024 3.10.2. Calculation: Wood truss.

WT-H3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fc⊥'	psi	625.0	625.0	+0.00		Pass

WT-G1: Glulam, 24F-V8: top chord compression, CD = 1.25, le = 72 in., sheathed

Source: Hand calculation from the cited sections, pp. NDS 2024 3.7, Chapter 5. Calculation: Wood truss.

WT-G1 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fc'	psi	2,041	2,041	+0.00		Pass

WT-G2: Glulam, 24F-V8: bottom chord tension, CD = 1.25

Source: Hand calculation from the cited sections, pp. NDS 2024 3.8, Chapter 5. Calculation: Wood truss.

WT-G2 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ft'	psi	1,375	1,375	+0.00		Pass

WT-G3: Glulam, 24F-V8: top chord bending, CV below 1.0 on a 40 ft panel 12 in. deep

Source: Hand calculation from the cited sections, pp. NDS 2024 3.3, 5.3.6. Calculation: Wood truss.

WT-G3 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fb'	psi	2,813	2,813	+0.00		Pass

WT-G4: Glulam, 24F-V8: bearing perpendicular to grain at the end

Source: Hand calculation from the cited sections, pp. NDS 2024 3.10.2. Calculation: Wood truss.

WT-G4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fc⊥'	psi	650.0	650.0	+0.00		Pass

WT-H4: TPI: top chord compression with K from E7.2-1 and 10 percent Cr

Source: Hand calculation from the cited sections, pp. ANSI/TPI 1-2022 6.4.2, 7.2.1.1, 7.3.2. Calculation: Wood truss.

WT-H4 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fc'	psi	2,086	2,086	-0.00		Pass

WT-H5: TPI: bottom chord tension with 10 percent Cr

Source: Hand calculation from the cited sections, pp. ANSI/TPI 1-2022 6.4.2.1, 7.3.1. Calculation: Wood truss.

WT-H5 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Ft'	psi	1,207	1,207	+0.00		Pass

WT-H6: TPI: top chord bending with 15 percent Cr, sheathed

Source: Hand calculation from the cited sections, pp. ANSI/TPI 1-2022 6.4.2.1(a), 7.3.3.4. Calculation: Wood truss.

WT-H6 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Fb'	psi	1,869	1,869	+0.00		Pass

WT-H7: TPI: the bearing buckling limit, 0.3 E (d2/d1)²/20

Source: Hand calculation from the cited sections, pp. ANSI/TPI 1-2022 7.3.9, Eq. E7.3-17. Calculation: Wood truss.

WT-H7 · ASD

Limit state	Unit	Published	ILX	Δ %	Δ vs tol.	Status
Limit	psi	1,897	1,897	+0.00		Pass

Documented deviations

A documented deviation is a limit state where ILX differs from the published number by more than the tolerance for a known reason: a calculation method the code permits, or an error or code-edition difference in the source. Each is a strict expected failure in the test suite, so it turns red the moment the behaviour changes.

Code	Explanation
VC-G-EX-98	**Worked stiffness uses the three span factor on four spans** (an error in the publication). VC-G-EX; 1 row. The Vulcraft 2016 catalog works the stiffness of a four span panel on page 11 and prints about 98 kips per inch. Its calculation multiplies the warping term by 0.90, which its own table, and AISI S310 Table 1.3-1, give for three spans. Four spans take 0.80. The warping and slip terms of the example match. **Effect:** ILX Calcs gives 101 kips per inch, 3 percent stiffer than the printed value, as the code's table asks. With 0.90 the two agree. Test record: VC-G-EX-98: the catalog's example multiplies Dn by 0.90, its own factor for three spans; its table and S310 Table 1.3-1 give 0.80 for four
VC-T2-PNT	**Weld tension in a catalog table below the code equation** (a value the publication does not explain). VC-T2-W; 1 row. Table 2 of the Vulcraft 2016 catalog gives 588 pounds allowable for a 3/4 inch arc spot weld on 22 gage, or 1,470 pounds nominal. AISI S100 Equation J2.2.3-2 at the 62 and 50 ksi steel the catalog states gives 1,621 pounds. The ratio is the same at every gage, so the catalog has used a different steel ratio or factor it does not state. **Effect:** ILX Calcs follows the code equation, 10 percent above the catalog's tension value. That is the less conservative side. It enters only the interaction of shear and wind uplift at a weld. The strength in shear of the same welds matches the catalog. Test record: VC-T2-PNT: the catalog's tension values are 9 percent below S100 Eq. J2.2.3-2 at the steel its table states, at every gage
VC-T33-U60	**Catalog wind tables with uplift use an older interaction** (a different edition of the method). VC-T33-U60; 1 row. The Vulcraft 2016 catalog's wind tables with net uplift use an older interaction and a diaphragm safety factor of 2.35, where AISI S310-20 has 2.00. Applied to the catalog's own fastener strengths at 60 psf, the S310 equations give a nominal shear of 1,462 plf against the 1,483 plf the table implies. **Effect:** ILX Calcs is 1.4 percent below, the conservative side. The tables without uplift match within 1 percent. The S310 uplift equations have no published worked example here. Test record: VC-T33-U60: the catalog's tables use an older interaction with a safety factor of 2.35 where S310 has 2.00
UFS-F443-M	**Cantilever moment read off a chart** (a chart reading in the publication). F4-43; 1 row. UFS 3-220-20 Figure 4-43 reads a moment ratio of 0.6 off its chart, to one digit, and gets 31,590 lb-ft per foot using 62.4 pcf, though the example states a soil of 122.4 pcf with 60 pcf buoyant. Equilibrium of the net pressure on the stated soil gives 29,190 lb-ft per foot. The depth matches within 5 percent. **Effect:** ILX Calcs is 8 percent below the printed moment. That is the less conservative side. The second chart example, with clay, matches within 5 percent. No line-by-line published cantilever has been run: use judgment. Test record: UFS-F443-M: the chart ratio is printed as 0.6, on 62.4 pcf; equilibrium on the stated soil gives 29,190 lb-ft/ft
UFS-F417-M2	**One influence factor read off a chart by eye** (a chart reading). F17-2.0; 1 row. UFS 3-220-20 Figure 4-17 has no printed table, so its influence factors were read by eye, and a reading is good to about 0.005. At m = 2.0 the reading is 0.22 and the integrated stress gives 0.2251, just past the comparison's limit of 0.005. **Effect:** ILX Calcs is 0.005 above the reading, the conservative side for pressure on a wall. The other four readings on this chart are within the limit. Test record: UFS-F417-M2: the chart is read by eye; the first reading of 0.22 is kept and the app gives 0.2251

Code	Explanation
SP17-OW3-MU	**Negative moments said to be at the support face** (an error in the publication). OW-3; 2 rows. ACI SP-17 (2014) One-way Example 3 states 12 in. supports and moments at the faces, and prints 6.4 and 5.2 kip-ft with the hyperstatic moment at the second and middle supports. At the face this type gives 5.4 and 4.4 kip-ft. At the support centerline it agrees with the source within 5 percent, which suggests the printed values may be centerline values, but the source does not say so. ACI MNL-17(21) One-way Slab Example 3 (p. 78) prints the same moments with the same label: gravity 7.2 and 5.7, hyperstatic 0.8 and 0.5, design 6.4 and 5.2 kip-ft. Its own moment diagrams (Figs. E3.5 and E3.7) put these peaks on the support centerlines, and its cantilever moment of 0.8 kip-ft is the centerline value (0.166 kip/ft times 3 ft squared over 2 is 0.75), where the face would give about 0.5. The printed values are centerline moments under a face label. **Effect:** ILX Calcs matches the printed moments at the centerline, its default, and the 2021 example is tested there. At the face it gives 5.4 and 4.4 kip-ft by statics, as 7.4.2.1 permits; that is a lower demand only because the section is the face, not an unsafe reading. Test record: SP17-OW3-MU: the source says at the face; its negative moments agree with this type at the centerline, not at the face
UFS-F19-P	**Line load resultant at a distance of 0.4 of the wall height** (rounding in the publication). F19-0.4; 1 row. UFS 3-220-20 Figure 4-19 prints a resultant of 0.55 times the load for distances up to 0.4 of the wall height. The printed equation for those distances integrates over the wall height to 0.539. The figure's other equation, for greater distances, gives 0.552 at 0.4. **Effect:** ILX Calcs integrates the printed pressure, 2 percent below the printed resultant. The pressure at each depth matches the figure, and its resultant follows from that. Test record: UFS-F19-P: the printed 0.55 follows the other branch of the figure; the printed curve for m up to 0.4 integrates to 0.539
SP17-OW3-M2	**Hyperstatic moment at the second support** (rounding in the publication). OW-3; 1 row. ACI SP-17 (2014) prints 0.8 kip-ft from a commercial program, rounded to 0.1. Load balancing on the printed force, eccentricities and spans gives 0.74 kip-ft. **Effect:** ILX Calcs gives 0.74 kip-ft. This lowers the negative moment at the support by 0.06 kip-ft less than the source, about 1 percent, and raises the span moment by less. Test record: SP17-OW3-M2: the source rounds from a program to 0.8; the balancing method here gives 0.74
SP17-E3-VN	**Joint strength coefficient under the 2019 code** (a code change). C-3 · Beam-column joint; 1 row. ACI SP-17 (2014) follows ACI 318-14 and prints a joint strength of 611 kips, from the coefficient 15. ACI 318-19 Table 15.4.2.3 gives 20 for a joint with column and beam continuing past it and not confined by transverse beams. ACI MNL-17(21) Columns Examples 2 and 3 (pp. 410 and 417), to ACI 318-19, take 20 for this joint and print 814 kips, which ILX Calcs matches (tested). **Effect:** ILX Calcs gives 815 kips, following ACI 318-19. A published example to ACI 318-19 has not been run. Test record: SP17-E3-VN: ACI 318-19 Table 15.4.2.3 gives 20 for this joint where 318-14 gave 15
SP17-E3-VCOL	**Column shear from the printed moments** (arithmetic in the publication). C-3-M, MNL-C3-M; 2 rows. ACI SP-17 (2014) prints a column shear of 52 kips. Its printed moments of 6,520 and 2,960 kip-in., beam shears of 77 and 30 kips, column depth of 24 in. and height of 192 in. give 56 kips by the printed formula. ACI MNL-17(21) Columns Example 3 (p. 416) repeats the inputs and the 52 kips. Its Example 2 (p. 409) applies the same formula correctly, (6,520 + 1,970 + (70 + 35) times 12) / 192 = 51 kips, which ILX Calcs matches (tested). **Effect:** ILX Calcs gives 56 kips from those moments, which lowers the joint shear by 4 kips, about 1 percent. With the column shear entered, it gives the printed result. Test record: SP17-E3-VCOL: the printed formula on the printed moments and shears gives 56 kips; the 2021 handbook prints 52 again

Code	Explanation
NCSEA-ZONE1P	**Downward pressure on roof zone 1 prime** (a different reading in the publication). SCHOOL; 1 row. For the school, the NCSEA table prints 12.5 psf downward on roof zone 1 prime, the same as the other roof zones. That uses a directionality factor of 0.75. Its own uplift value for the zone uses 0.90, which is what ASCE 7-22 Table 32.6-1 gives for zone 1 prime without a limit to uplift. **Effect:** ILX Calcs gives 13.3 psf, on the safe side by 0.8 psf. It applies to this one downward value. Uplift matches the source. Test record: NCSEA-ZONE1P: the source uses a directionality factor of 0.75 here against the table's 0.90
WW-T317B-4TH	**A misprint in the WoodWorks table of chord deformation without take-up devices** (misprint in the publication). WW-T317B; 1 row. The table prints 0.466 in. at the 4th level. Its own columns on that row add to 0.418 in., which with the wall length over the lever arm gives 0.446 in., and the accumulated column of the same table follows 0.446 in. **Effect:** ILX Calcs gives 0.446 in. at that level, and matches the accumulated values the table prints. Test record: WW-T317B-4TH: Table 3.17B prints 0.466 in. at the 4th level; its own columns add to 0.418 in., times b/d = 1.067 gives 0.446 in., and its printed accumulated values follow 0.446
FEMA-69-H	**Height used in the FEMA table of CLT shear wall deflection** (the publication's table differs from its equation). FEMA-69; 4 rows. The FEMA equation defines the height as the panel height. The shear and total columns of its table, at the two stories under a floor, come out only with the floor panel above added to that height. ILX Calcs uses the panel height, as the equation is written. **Effect:** The shear term and the total deflection at those two stories are about 0.01 in. lower than printed: 0.319 in. against 0.33 in., and 0.338 in. against 0.35 in. Both remain well under the allowable 0.95 in. in the example. This is on the lower side of the printed value, and it is stated in the chapter. Test record: FEMA-69-H: Table 6-9's shear and total columns at stories 2 and 1 follow panel height plus the floor panel above, while Eq. B-1 defines h as the panel height: ILX uses the panel height, about 0.01 in. less
MDG-T925-NO3	**One rounded cell of the lap splice table** (rounding in the publication). MDG-T925-2000-#3-2c; 1 row. The Masonry Designers' Guide table of lap lengths rounds up to whole inches, for example 19.47 in. to 20 in. For a No. 3 bar at 2 in. cover and a masonry strength of 2,000 psi the equation gives 12.27 in., and the table prints 12 in., where rounding up gives 13 in. **Effect:** ILX Calcs gives 12.27 in. and rounds it up to 13 in. in this comparison, half an inch longer than the table. The other 71 values of the table agree. Test record: MDG-T925-NO3: the table prints 12 in. for 12.27 in., where its other cells round up: the equation gives 13 in. rounded up
T555-DRIFT	**Percent drift printed in the APA force transfer worksheet** (apparent error in the publication). T555C-2024; 1 row. The worksheets in APA Technical Note T555C print a drift of 0.0147 and 0.0137 percent for deflections of 0.352 and 0.329 in. on an 8 ft wall. Both are the deflection divided by 24. The deflection over the 96 in. height is about 0.37 percent. **Effect:** ILX Calcs does not print a percent drift for this wall. The deflection agrees with the note; only the printed percentage differs. Test record: T555-DRIFT: the worksheet's percent drift, 0.0147 and 0.0137, is the deflection divided by 24; over the 8 ft wall, 0.352 in. is 0.37 percent
T555-4TERM	**The four-term deflection equation** (different equation). T555C-2024; 1 row. APA Technical Note T555C shows the deflection two ways: 0.329 in. by the four-term equation of the 2021 IBC and 0.352 in. by the three-term equation of SDPWS 2021. ILX Calcs has the three-term equation of the code it follows, which the note says gives the larger deflection here. **Effect:** ILX Calcs gives 0.352 in., 7 percent above the four-term result, matching the note's own three-term figure. Test record: T555-4TERM: ILX has the 3-term Eq. 4.3-1 of SDPWS 2021, not the 4-term equation of IBC 2021 Eq. 23-2

Code	Explanation
DG2-1986-SHAPES	**Shape dimensions of 1986 in a web opening example** (older edition). DG2-3; 1 row. AISC Design Guide 2 Example 3 uses the 1986 shape tables: a W21X44 is 20.66 in. deep and its top tee 4.83 in. The current shape table prints 20.7 in., so the tee is 4.85 in. The secondary moment ratio of the tee comes out 1.60 here and 1.62 in the guide. **Effect:** About 1.2 % on that ratio. The shear strength that follows from it agrees within 1 %. Test record: DG2-1986-SHAPES: the guide uses d = 20.66 in. and the top tee 4.83 in.; the current shape table prints 20.7 in.
DG2-EX4-QN	**Stud capacity changes within a web opening example** (published value rounded). DG2-4-2A; 1 row. AISC Design Guide 2 Example 4 computes 26.0 kips per stud on one page and uses 26.1 kips on the next, then rounds the concrete force at the low moment end to 127 kips. The distance to that force comes out 0.414 in. here and prints as 0.42 in. **Effect:** No effect on any strength beyond the rounding: the top tee's shear agrees within 1 %. Test record: DG2-EX4-QN: the guide's 26.1 kips per stud here, 26.0 kips on its page before, and its rounding of the force to 127 kips
DG2-EX4-DR	**Assumed bar position in a web opening example** (published value not updated). DG2-4-2B; 1 row. AISC Design Guide 2 Example 4 assumes the bar centroid 3.995 in. from the flange when it works out the bottom tee, then adopts a bar that puts it at 3.93 in., and notes that the value is somewhat less than assumed. This program uses the bar as it is. **Effect:** The ratio is 1.46 against 1.48. The guide says the section remains adequate; the bottom tee's shear agrees within 1 %. Test record: DG2-EX4-DR: the guide computes with an assumed bar centroid of 3.995 in.; the bar it adopts gives 3.93 in., as it says
DG2-EX4-MU	**Two values of the same ratio in a web opening example** (published value not explained). DG2-4-2B; 1 row. AISC Design Guide 2 Example 4 computes the secondary moment ratio of the reinforced top tee as 8.35 on p. 34 and uses 9.05 on p. 35. Its own numbers give 8.35, which is what this program finds, for a shear ratio of 1.43 where the guide prints 1.55. **Effect:** None on the result: the pure shear limit of the top tee, Eq. 3-21, governs with either value, and the shear strengths match. Test record: DG2-EX4-MU: p. 34 computes μ = 8.35, p. 35 uses 9.05 for 1.55; 8.35 gives 1.43. Vmt(sh) governs either way
DG31-FTB	**Tee compression strength printed in AISC Design Guide 31** (apparent error in the publication). DG31-4.1, DG31-4.2; 14 rows. Examples 4.1 and 4.2 of the guide say the warping term is left out of the tee's torsional buckling stress, yet the printed stress still contains it, as if the warping constant were 1 in. to the sixth. Their top tees also measure the distance to the shear center from the tip of the stem, where it belongs at the flange: Example 4.3 does it correctly on its bottom tee. This program applies Section E4 of the specification with the true shear center, with the warping term left out as the User Note allows, or with the tee's own warping constant if selected. It has no option to use the printed values. **Effect:** The available compression of the tee is 51.6 kips here against the 64.9 kips printed for Example 4.1, and 51.7 kips against 65.6 kips for Example 4.2, so the printed strengths are about 26 % high, on the unsafe side. Under LRFD the largest ratios rise from 0.741 to 0.936 and from 0.759 to 0.975, and both beams pass. Under ASD they rise from 0.815 to 1.03 and from 0.835 to 1.07: both beams the guide shows as adequate fail on tee compression here. With the tee's own warping constant, the other option, the ASD ratios are 0.904 and 1.00. Examples 4.3 and 4.4 are not affected, because their tees carry no compression. Test record: DG31-FTB: the guide's Fez keeps a term as if Cw were 1 in.^6, and its yo is measured from the stem tip; AISC 360-22 E4 gives a lower strength

Code	Explanation
DG31-H41	**Flexural constant printed in Example 4.1** (apparent error in the publication). DG31-4.1; 1 row. Example 4.1 divides by the square of the polar radius of gyration squared a second time and prints a flexural constant of 0.880. On the guide's own numbers it would be about 0.25, and with the true shear center about 0.83, which this program uses. **Effect:** No effect of its own on the result here, because the torsional stress is far below the flexural one. It is part of the difference recorded for the tee compression strength. Test record: DG31-H41: the example divides by ro^2 squared and prints H = 0.880
DG31-ROUND	**Web post strength of a cellular beam, sensitive to rounding** (rounding in the publication). DG31-4.2, DG31-4.4; 6 rows. The strength ratio of a cellular web post is a small difference between large terms. The guide prints 0.450 in Example 4.2 and 0.466 in Example 4.4 after rounding the coefficients. This program carries them unrounded and gets about 0.42 and 0.44. **Effect:** The web post strength here is about 6 % lower than printed, on the safe side. Both examples still pass. Test record: DG31-ROUND: Eq. 3-36 is very sensitive to rounding; the printed ratio follows rounded C1, C2, C3 and more, and the module carries them unrounded and comes out lower
DG31-44-ASD	**Horizontal shear printed in Example 4.4, ASD** (apparent error in the publication). DG31-4.4; 1 row. The example's own expression, 84.0 kips divided by 1.50, gives 56.0 kips. It prints 50.3 kips. **Effect:** This program gives 56.0 kips, 11 % above the printed number and the same as Example 4.3, which has the same post. The ratio stays well below 1. Test record: DG31-44-ASD: the example prints 50.3 kips, which is 84.0 / 1.50 = 56.0 kips
DG31-44-I	**Moments of inertia in Example 4.4** (apparent error in the publication). DG31-4.4-D, DG31-4.4-S; 5 rows. At the net section, the example takes the top tee's centroid distance measured from the stem tip as if it were measured from the flange, in its effective depth, its neutral axis and its moment of inertia, and prints 1,710 in. to the fourth. Example 4.3 does the same step correctly, and that way this example gives 2,078. Its composite value then takes the area ratio of the critical section and prints 5,100; this program gets 5,518 from the net section's own values. **Effect:** The moments of inertia here are about 22 % and 8 % higher than printed, and the deflections lower: 1.14 in. against 1.39 in. on the steel alone, on the unsafe side of the printed numbers but from the correct section. Strength is not affected, because the example takes the tee forces from the critical section. The example passes its limits either way. Test record: DG31-44-I: the example measures the top tee's centroid from the stem tip as if from the flange, so its Ix-net of 1,710 in.^4 is low (2,078 by the same equation as Example 4.3); its composite Ix mixes sections too
DG31-42-IX	**Rounded section values in Example 4.2** (rounding in the publication). DG31-4.2, DG31-4.2-S; 2 rows. The example carries its depths at three figures, which moves the tee's moment of inertia and the net section's by about 1 %. This program carries them unrounded. **Effect:** The tee's moment of inertia here is 0.80 in. to the fourth against 0.81 printed, and the dead load deflection 1.63 in. against 1.61 in., on the safe side. Test record: DG31-42-IX: the printed section values follow rounded dimensions; unrounded, Ix of the tee and Ix-net are about 1 % away, and so is the deflection
DG31-44-MCR	**Tee lateral-torsional buckling moment in Example 4.4** (different method). DG31-4.4; 2 rows. The example takes the tee's depth at the critical section and its torsional constant at the center of the opening. This program takes both at the critical section. **Effect:** The critical moments are about 7 % higher here. They do not govern: the yield moment is several times lower in this example, and the strength matches. Test record: DG31-44-MCR: the example mixes the depth at the critical section with J at the center; here both are at the critical section. Mcr does not govern

Code	Explanation
DG31-44-MV	**Top tee Vierendeel moment in Example 4.4** (rounding in the publication). DG31-4.4; 1 row. The example's table prints 92.4 kip-in. at the first opening. The net shear and the tee areas it states give about 91 kip-in., which this program gets. **Effect:** The moment is 1.4 % lower than printed and the largest ratio of the top tee about 0.62 against 0.631, within the tolerance. Neither governs the beam. Test record: DG31-44-MV: the example's own areas give about 91 kip-in.
DG31-J	**Torsional constant of the tees in Example 4.3** (different method). DG31-4.3; 2 rows. This program takes the tee's torsional constant from thin rectangles, with the flange's end correction. The example's values, 0.266 and 0.685 in. to the fourth, come from a method it does not state and are about 1 % higher. The tee's critical moment is very sensitive to this constant. **Effect:** The critical moments are 1 % to 3 % lower here, on the safe side. They do not govern: the yield moment is several times lower in this example. Test record: DG31-J: the printed J is about 1 % above the thin-rectangle value used here, and Mcr is very sensitive to J. Mcr does not govern
DG31-44-VG	**Gross section shear in the Example 4.4 summary** (apparent error in the publication). DG31-4.4; 1 row. The example works out the shear at the gross section as 51.5 kips, then its summary divides the 44.1 kips net of the deck. This program uses 51.5 kips, as Example 4.3 does. **Effect:** The ratio is 0.236 here against 0.202 printed, on the safe side. Test record: DG31-44-VG: the summary prints 44.1 kips, the net shear; the example's own working gives 51.5 kips, which the module uses
DG7-LR	**Limiting length of a runway beam with a cap channel** (different method). DG7-14.1.3, DG7-14.1.4; 5 rows. AISC Design Guide 7 Example 14.1.3 uses Section F5 of the specification with a limiting length of 457 in. from its Table A-2. That number is Equation F4-8; Section F5 sets it by Equation F5-5, which gives 407 in. This program follows F5 and reproduces 457 in. by F4-8 as a separate value. **Effect:** The lateral-torsional buckling moment is about 5 % lower than printed, on the safe side, and the biaxial ratio about 0.02 higher. The example passes either way. Test record: DG7-LR: AISC 360-22 F5-5 gives Lr = 407 in.; the guide's Table A-2 prints 457 in., which is F4-8, and uses it in F5-3
DG7-ROUND	**Rounding in the crane runway examples** (published value rounded). DG7-14.1.1 · Crane runway beam, DG7-14.1.3; 3 rows. AISC Design Guide 7 Example 14.1.1 rounds the web slenderness ratio to 1.28 before cubing it (it is 1.276), so its web sidesway strength is 185 kips and 105 kips available, against 183 and 104 kips here. Example 14.1.3 rounds 3,470 / 1.67 to 2,100 kip-in. (2,078; the plastic modulus from the two shapes is 68.9 in.³ against 69.3). **Effect:** About 1 % on these values, lower here. Nothing else follows from them. Test record: DG7-ROUND: the guide rounds the slenderness ratio to 1.28 before cubing it (exactly 1.276), and 3,470 / 1.67 to 2,100 (2,078)
P2192-T3-2-FLOOR	**Lower limit of the vertical spectrum in a FEMA example** (published value leaves out a code limit). SP-3-2; 3 rows. ASCE 7-22 Equation 11.9-4 says the vertical value shall not be less than half of the horizontal value divided by the direction factor. FEMA P-2192 Table 3-2 does not apply that limit at 1, 1.5 and 2 seconds, where it governs. **Effect:** ILX Calcs applies the limit as the code says, so its values there are higher than printed: 0.449 against 0.425, 0.313 against 0.242 and 0.232 against 0.155 g. The other 20 periods agree within 1 %. Test record: P2192-T3-2-FLOOR: the table leaves out the lower limit of Eq. 11.9-4, 0.5 SaM / Fmd, at 1, 1.5 and 2 s

Code	Explanation
ASDIP-STRAP-WEIGHTS	**Footing and soil weights in a strap footing example** (unstated input). ST-ASDIP; 4 rows. The ASDIP example does not state the soil weight, and its screen shows the water table at the surface. The weights of the footings and soil under its pressures are therefore not known. This run uses 110 pounds per cubic foot for soil and 150 for concrete. **Effect:** The pressures come out up to about 6 % higher than the example's rounded values. The difference between the high and the low side of each footing, which the moment alone sets, agrees. ILX Calcs does not change an input to match. Test record: ASDIP-STRAP-WEIGHTS: the post does not state the soil weight and shows water at the surface, so the footing and soil weights are not known
ASCE722-THETAMAX	**Maximum stability coefficient under ASCE 7-22** (code edition). SD-10-12A; 1 row. FEMA P-1051 is written to ASCE 7-10 and gets a maximum stability coefficient of 0.091 from a deflection factor of 5.5. ASCE 7-22 adds that this maximum need not be taken less than 0.10. **Effect:** ILX Calcs uses 0.10 here, about 10 % above the printed value, as the edition it follows says. The ratio from the equation itself agrees with the book. Test record: ASCE722-THETAMAX: 7-22 adds that θmax need not be taken less than 0.10; the book is to 7-10
P1051-9-1-THETA	**Stability coefficient printed in a one-story example** (published arithmetic). SD-9.1; 1 row. FEMA P-1051, Example 9.1, prints a stability coefficient of 0.069 from a load of 888 kips, a drift of 4.51 in., a shear of 179 kips and a height of 32.375 ft. Those numbers give 0.058. **Effect:** ILX Calcs reports what the numbers give, on the 34.25 ft ridge height the example uses for its drift limit: about 0.054. The value and the printed one are both under the limit, so the conclusion in the book does not change. Test record: P1051-9-1-THETA: the printed 0.069 does not follow from the printed numbers
HUD-5.4-ROUND	**Column stability factor rounded in a stud wall example** (published value rounded). HUD-5.4; 1 row. The HUD guide, Example 5.4, rounds the column stability factor to 0.35 before finding the allowable compression stress of 426 psi. Unrounded it is 0.355. **Effect:** ILX Calcs does not round, so its allowable stress is 433 psi, about 1.6 % higher than printed. The same example's other compression value agrees within 1 %. Test record: HUD-5.4-ROUND: the guide rounds Cp to 0.35; unrounded 0.355 gives 433 psi
HUD-5.4-SYSTEM	**System factor of a stud wall example** (different method). HUD-5.4; 1 row. The HUD Residential Structural Design Guide, Example 5.4, raises the allowable bending stress of a sheathed stud wall by its own system factor of 1.5. The NDS 2024 has only the repetitive member factor of 1.15. **Effect:** ILX Calcs follows the NDS, so its allowable bending stress is lower than the example's. The bending stress, the Euler stress and the compression values of the example agree within 1 %. Test record: HUD-5.4-SYSTEM: the guide's system factor 1.5 is not in the NDS
HUD-5.8-ROUND	**Uplift case of a ridge beam example** (published value rounded). HUD-5.8; 2 rows. The HUD Residential Structural Design Guide, Example 5.8, subtracts a wind uplift of 102 pounds per foot from a dead load of 121 pounds per foot and rounds the net to 19 before finding the shear and moment. The unrounded net is 18.6. **Effect:** ILX Calcs does not round, so its shear and moment in that small uplift case are about 2 % lower than the printed 124 pounds and 401 pound-feet. The gravity case of the same example agrees within 1 %. Test record: HUD-5.8-ROUND: the example rounds the net load to 19 plf; exact 18.6 plf

Code	Explanation
HUD-5.5-SYSTEM	**System factors of a header example** (different method). HUD-5.5A, HUD-5.5B; 3 rows. The HUD guide, Example 5.5, raises the allowable bending stress of a double header by its own system factors of 1.3, 1.05 and 1.8, and the allowable shear by a shear stress factor of 2. These come from the guide's tables and an older NDS: the NDS 2024 has only the repetitive member factor and no such shear factor. **Effect:** ILX Calcs follows the NDS and applies none of them, so its allowable stresses are lower than the example's and a header sized by the guide can fail in ILX Calcs. The moments, shear, bearing stress and deflection of the example agree within 1 %. Test record: HUD-5.5-SYSTEM: the guide's system factors 1.3 and 1.05 are not NDS factors
P2192-T7-9-L6	**Acceleration coefficient at one level of a six-story example** (published value inconsistent). DF-7.5-A; 2 rows. FEMA P-2192-V1 Section 7.5.2 interpolates the coefficient at level 6 between its values at 57.6 ft and 72 ft, but divides by 12 ft, the story height, where the span between those heights is 14.4 ft as in ASCE 7-22 Figure 12.10-2. It gets 0.60 and a force of 471 kips; the figure gives 0.58 and about 457 kips. **Effect:** ILX Calcs follows the figure, so its force at that level is about 3 % lower than the example's. The other five levels agree. Test record: P2192-T7-9-L6: the example divides by 12 ft where Fig. 12.10-2 spans 14.4 ft
P2192-T4-8-ROW5	**Last row of a shear wall load table** (published value inconsistent). LC-P2192-4.8; 1 row. FEMA P-2192-V1 Table 4-8 prints 6,460 kips for the combination with the earthquake effect added and -378 kips with it subtracted. The two rows differ by twice the earthquake effect, which the text gives as 3,385 kips, so their difference should be 6,770 kips; the table's is 6,838 kips. With the same inputs as its other rows ILX Calcs gets -308 kips. **Effect:** Only that table row differs, by 70 kips. The other two rows that can be checked agree within 0.1 %. The table does not list its dead and live loads, so they were worked back from its first two rows. Test record: P2192-T4-8-ROW5: the table's last row does not follow from its other rows
AISC-T7-75DEG	**Bolt group coefficient at 75 degrees, 6 in. pitch, 2 in. eccentricity** (published value inconsistent). T7-10-D; 1 row. In every coefficient table of the 16th Edition Manual (Tables 7-6 to 7-13), the row for a load at 75 degrees, 6 in. pitch and 2 in. eccentricity prints values for the larger groups up to about 2 % above the instantaneous center method, and some are printed the same for different gages. Every other value read agrees within 1 %. Example: Table 7-10, 9 bolts per row, prints 26.4; the method gives 25.85. The page images confirm the printed values, and the Manual errata checked as of April 2026 do not list them. **Effect:** ILX Calcs reports the lower value computed by the method, so the result is on the safe side by up to about 2 % at these few table cells. Test record: AISC-T7-75DEG: printed value above the IC method (75 degrees, s = 6 in., ex = 2 in., larger groups)
ASCE7-C26.11-1-G	**Gust-effect factor of the ASCE 7-22 commentary example** (published value inconsistent). C26.11-1 · Wind loads; 1 row. ASCE 7-22 Commentary Table C26.11-1 lists G = 0.860 for its rigid-building example, but Eq. 26.11-6 with the table's own turbulence intensity (0.201) and background response (Q^2 = 0.616) gives 0.818. ILX Calcs computes 0.818 and matches every other value of the table ($\bar{z}$, $I_{\bar{z}}$, $L_{\bar{z}}$, Q^2). **Effect:** None on designs: the program applies Eq. 26.11-6 as written; the commentary value is 5 % higher. Test record: ASCE7-C26.11-1-G: the table's G = 0.860 does not follow from its own $I_{\bar{z}}$ = 0.201 and Q^2 = 0.616 by Eq. 26.11-6, which gives 0.818 (the program's value)

Code	Explanation
ACI318-14-IE	**Effective moment of inertia: ACI 318-14 examples vs ACI 318-19** (code edition). SP-CB, SP-SSB; 5 rows. The StructurePoint beam and slab examples are written to ACI 318-14, which computes the effective moment of inertia with Branson's expression Ie = (Mcr/Ma)³Ig + [1 − (Mcr/Ma)³]Icr. ACI 318-19 Table 24.2.3.5 replaced it with Ie = Icr / [1 − ((2/3)Mcr/Ma)²(1 − Icr/Ig)], which gives a lower stiffness when Ma is close to Mcr. ILX Calcs uses the 318-19 expression; Mcr, Icr and Ig match the examples, and Ie agrees within 1 % where Ma is well above Mcr. **Effect:** Deflections of lightly cracked members are larger (more conservative) than the 318-14 values: 5 to 16 % in these examples. Test record: ACI318-14-IE: the example uses the ACI 318-14 (Branson) effective moment of inertia; ILX Calcs uses the ACI 318-19 Table 24.2.3.5 expression
ACI318-19-R	**Radius of gyration for the slenderness check** (permitted alternative). MNL17-C1, SP-SNS; 2 rows. ACI 318-19 6.2.5.2 permits the radius of gyration as r = √(Ig/Ag) or as 0.3 times the dimension in the direction of stability (0.25D for circles). The StructurePoint example uses √(Ig/Ag) = 4.91 in. for a 17 in. square column; ILX Calcs uses 0.3h = 5.10 in., so k ℓu/r is 22.6 instead of 23.5. **Effect:** k ℓu/r is about 4 % lower for a square section; both values are permitted by the code and both are below the limit of 34 in the example. Test record: ACI318-19-R: the example takes r = √(Ig/Ag) = 4.91 in. (6.2.5.2(a)); ILX Calcs uses r = 0.3h = 5.10 in. (6.2.5.2(b)); both are permitted
ACI318-14-VC	**One-way shear strength of members without shear reinforcement: ACI 318-14 examples vs ACI 318-19** (code edition). SP-OWS; 1 row. ACI 318-14 Eq. 22.5.5.1 gives Vc = 2λ√f'c bw d. ACI 318-19 Table 22.5.5.1 changed it for members with less than Av,min (slabs, footings, walls): Vc = 8λs λ ρw^(1/3) √f'c bw d, with the size effect factor λs = √(2/(1 + d/10)), at most 1, and the longitudinal reinforcement ratio ρw. ILX Calcs applies ACI 318-19; the 318-14 examples show the older, higher value. **Effect:** For lightly reinforced slabs (ρw about 0.3 %) Vc is roughly 40 % lower than the 318-14 value: the 318-19 design is more conservative. Test record: ACI318-14-VC: the example uses Vc = 2λ√f'c bw d of ACI 318-14; ACI 318-19 Table 22.5.5.1(c) for members without Av,min gives 8λs λ ρw^(1/3) √f'c bw d
ACI318-19-LS	**Size effect in two-way (punching) shear: ACI 318-14 examples vs ACI 318-19** (code edition). SP-TWDP; 1 row. ACI 318-19 Table 22.6.5.2 multiplies the two-way shear stress vc by the size effect factor λs = √(2/(1 + d/10)), at most 1, (22.5.5.1.3), which ACI 318-14 did not have. For the 12.75 in. effective depth at the drop panel λs = 0.938, so vc is 265 psi instead of the published 283 psi. ACI MNL-17(21) Two-way Slab Example 1 (p. 108) computes the size effect factor in punching (1.0 at d = 5.63 in.) as ILX Calcs does. **Effect:** Punching capacity of slabs deeper than 10 in. is lower (more conservative) than in the 318-14 example. Test record: ACI318-19-LS: the example uses vc = 4λ√f'c of ACI 318-14; ACI 318-19 Table 22.6.5.2 multiplies it by the size effect factor λs = √(2/(1 + d/10)) (0.938 for d = 12.75 in.)
SP-TWDP-VC	**Punching shear around a drop panel: third expression of Table 22.6.5.2** (published value incomplete). SP-TWDP; 1 row. The example's preliminary check around the 10 × 10 ft drop panel uses vc = 4λ√f'c. ACI 318-19 Table 22.6.5.2 (as 318-14) takes the least of 4λ√f'c, (2 + 4/β)λ√f'c and (2 + αs d/bo)λ√f'c; with bo = 514 in. and d = 8.5 in. the third gives 2.66λ√f'c = 188 psi, which governs. ILX Calcs applies the least of the three. ACI MNL-17(21) Two-way Slab Example 1 (p. 108) takes the least of the three expressions of Table 22.6.5.2 (275 psi), as ILX Calcs does. **Effect:** ILX Calcs is about one third lower (conservative); the slab in the example still passes with a large margin (the factored shear stress is about 50 psi). Test record: SP-TWDP-VC: the example's preliminary check takes vc = 4λ√f'c around the drop panel; Table 22.6.5.2(c), (2 + αs d/bo)λ√f'c = 2.66λ√f'c for bo = 514 in., governs and ILX Calcs uses it

Code	Explanation
SP-TWB-LN	**Clear span for the minimum thickness of slabs with beams** (published value inconsistent). SP-TWB; 1 row. Table 8.3.1.2, note [2], measures ℓn face to face of the beams. The example uses the clear span between the columns (22 ft − 18 in. = 246 in.) and gets 5.69 in.; with the 14 in. beams the code span is 250 in. and the minimum thickness is 5.79 in. αfm and β match the example. **Effect:** ILX Calcs requires 0.1 in. more; the 6 in. slab of the example satisfies both. Test record: SP-TWB-LN: the example takes ℓn = 246 in. face to face of the columns; Table 8.3.1.2 note [2] measures ℓn face to face of the beams (250 in.), as ILX Calcs does
SF-ACI19-ONEWAY	**One-way shear of footings: ACI 318-14 examples vs ACI 318-19** (code edition). SP-SF, SP-STF; 2 rows. The StructurePoint footing examples (Wight Examples 15-1 and 15-2) use ACI 318-14, Vc = 2λ√f'c bw d. ACI 318-19 Table 22.5.5.1(c) gives Vc = 8λs λ ρw^(1/3) √f'c bw d for members without stirrups (λs may be taken as 1.0 for footings, 13.2.6.2). With the light flexural steel of footings (ρw about 0.25 %) this is about 45 % lower. The factored shear matches the examples; only the strength differs. Under ACI 318-19 both example footings need a few inches more thickness for one-way shear. ACI MNL-17(21) confirms this reading for footings (p. 470, Foundation Example 1 p. 479 and Example 2 p. 491): Table 22.5.5.1(c) without stirrups, the size effect factor neglected under 13.2.6.2, and the steel ratio of the flexural bars. **Effect:** ILX Calcs (ACI 318-19) is more conservative than the 318-14 value: a design shear strength of 165 kips instead of 308 kips (square footing) and 55 instead of 96 kips per 10 ft (wall footing). Test record: SF-ACI19-ONEWAY: ACI 318-19 Table 22.5.5.1(c) replaces 2√f'c bw d of ACI 318-14 for members without stirrups
SF-DAVG-ONEWAY	**Effective depth for one-way shear of a two-layer footing** (permitted alternative). SP-SF; 1 row. The example checks one-way shear with the average effective depth of the two bar layers (28 in.). ILX Calcs uses the effective depth of the bars spanning in the direction checked (28.5 in. for the bottom layer, 27.5 in. for the upper layer, each direction checked), as ACI 318-19 22.5 defines d for the section considered. The critical section moves by 0.5 in., so the factored shear is 1.6 % lower in the bottom-layer direction and 1.7 % higher in the other. **Effect:** Negligible; ILX Calcs checks both directions with their own d, so the governing (upper-layer) direction is covered. Test record: SF-DAVG-ONEWAY: the publication uses the average d = 28 in of both layers; the program uses the d of the bars in the direction checked (28.5 in)
SF-LD-SIMPLIFIED	**Development length: simplified table vs general equation** (permitted alternative). SP-SF; 1 row. The example takes ℓd from the simplified expressions of ACI 318-14 Table 25.4.2.2 (54.8 in. for a #8 bar). ILX Calcs uses the general Eq. 25.4.2.4(a) of ACI 318-19 with the confinement term (cb + Ktr)/db = 2.5 (3.5 in. cover to the bar centre, 12.7 in. spacing), which the code permits for every case and which gives 32.9 in. **Effect:** ILX Calcs requires a shorter, code-permitted length; the 55 in. available beyond the column face satisfies both. Test record: SF-LD-SIMPLIFIED: the publication uses the simplified table; the program uses the general Eq. 25.4.2.4(a) with (cb + Ktr)/db = 2.5, both permitted
CF-OPEN-SIDE	**Punching at an edge column close to the long edges of a combined footing** (conservative method). SP-CF-40; 1 row. With the footing thickened to 40 in. (d = 36.5 in.), the side faces of the 24 in. exterior column are 36 in. from the long edges of the 8 ft footing, which is less than d. ILX Calcs then also checks the critical section that runs to those edges (ACI 318-19 Fig. R22.6.4.3, 'regard as free edge'), and that two-sided section governs (factored shear stress 243 psi). The example checks only the three-sided section (157 psi); the program matches that value for the 36 in. footing, where the sides are farther than d from the edges. **Effect:** ILX Calcs is more conservative for columns within d of a footing edge: here it asks for more thickness than the example. Test record: CF-OPEN-SIDE: the column's side faces are 36 in from the long edges, less than d = 36.5 in, so the program also checks the section open to those edges, which governs; the publication checks only the three-sided section

Code	Explanation
PC-ACI19-LAMS	**Size effect in two-way shear of pile caps: ACI 318-14 example vs ACI 318-19** (code edition). SP-PC; 1 row. ACI 318-19 Table 22.6.5.2 multiplies vc by the size effect factor λs = √(2/(1 + d/10)), 0.745 for d = 26 in. Section 13.2.6.2 lets footings and mats neglect it, but not pile caps, so ILX Calcs applies it. The ACI 318-14 example has no size effect: a design shear strength of 947 kips at the column instead of 706 kips. The factored shear of 684 kips matches. ACI MNL-17(21) Strut-and-tie Example 5 (Vol. 2 p. 249) applies the size effect to the two-way shear of a pile cap as ILX Calcs does: 0.636 at d = 39.5 in., vc = 161 psi (tested). **Effect:** ILX Calcs (ACI 318-19) is about 25 % more conservative in two-way shear; the example's 33 in. cap still passes (684 kips of factored shear against 706 kips of strength). Test record: PC-ACI19-LAMS: ACI 318-19 multiplies vc by λs = 0.745 for d = 26 in (22.6.5.2); 13.2.6.2 does not waive it for pile caps
PC-WEIGHT	**Pile-cap one-way shear: weight of the cap and rounding of the pile share** (published value rounded). SP-PC-1W; 1 row. For piles 1 in. inside the critical section, ACI 318-19 13.4.6.5 counts a linear share of the reaction, 5/12 of 114 kips = 47.5 kips; the example rounds it to 48 kips and takes a factored shear of 96 kips, ignoring the cap weight. ILX Calcs includes the cap weight in the pile reactions and subtracts the factored weight of the cap beyond the section: 93.7 kips. ACI MNL-17(21) has no pile straddling a one-way section: in its pile cap (Strut-and-tie Example 5, Vol. 2 p. 249) every pile lies inside the section and gives no shear under 13.4.6.5, and the example neglects the cap weight by its statement. **Effect:** 2.4 % lower shear than the rounded published value, 1.4 % lower than the unrounded one; both follow from statics with the cap weight. Test record: PC-WEIGHT: the publication neglects the cap weight and rounds the interpolated pile share up (47.5 to 48 kips per pile); the program subtracts the factored cap weight beyond the section
RW-NU	**Axial load term in the one-way shear of a retaining-wall stem** (conservative method). SP-RW; 1 row. ACI 318-19 Table 22.5.5.1(c) adds Nu/(6Ag) to the shear stress for axial compression. The example counts the stem's own weight above the base (Nu = 3.08 kips per foot, +2.7 psi) and gets a design shear strength of 10.98 kips per foot. ILX Calcs neglects Nu (permitted, conservative) and gets 10.67 kips per foot with the same λs = 0.92 and ρw. **Effect:** ILX Calcs is 3 % more conservative in stem shear. Test record: RW-NU: the program neglects the axial compression term Nu/(6Ag) of the stem's own weight (conservative)
DG1-4712-ROUND	**Bearing length of DG1 Example 4.7-12 from rounded intermediate values** (published value rounded). DG1 4.7-12, DG1 4.7-12 ASD; 4 rows. AISC Design Guide 1 Example 4.7-12 solves Eq. 4-65 as Y = 17.5 in. − 17.2 in. = 0.300 in., subtracting two numbers rounded to 0.1 in.; the unrounded terms (f + N/2 = 17.5 in., square root 17.226 in. for LRFD and 17.253 in. for ASD) give Y = 0.274 in. (LRFD) and 0.247 in. (ASD). With Eq. 4-63 the rod tension is then 111.5 kips (LRFD) and 66.9 kips (ASD) instead of the published 113 and 68.4 kips. ILX Calcs uses the unrounded values; qmax (42.0 and 27.9 kips/in.) matches the Example. **Effect:** Rod tension 1.3 % (LRFD) and 2.2 % (ASD) lower than the rounded published values; the bearing length is a fraction of an inch either way and does not change the plate design. Test record: DG1-4712-ROUND: the Example writes Y = 17.5 in. − 17.2 in. = 0.300 in., the difference of two rounded numbers; Eq. 4-65 with unrounded terms gives Y = 0.274 in. and T = 111.5 kips

Code	Explanation
TMS-SD-EQT	**Partially grouted wall as an equivalent thickness in the TMS shear wall webinar** (different permitted method). TMS-SD-2, TMS-SD-3; 2 rows. In Examples SD-2 and SD-3 of the TMS webinar handout (TMS 402-16), the interaction diagram and the maximum reinforcement check treat the partially grouted wall as a solid wall of equivalent (averaged) thickness, 3.39 in. for grout at 48 in. ILX Calcs takes the compression zone as the face shells plus the grouted cells, as the TMS 402 Commentary to the maximum reinforcement provision describes. The published 0.9 Pn at the maximum reinforcement strain is 323 / 364 kips (ILX 354 / 393 kips) and the wall of SD-2 is stressed to 94 % of its flexural design strength (ILX 89 %). The net shear area, the shear strengths and the neutral axis depth agree. **Effect:** ILX gives a larger compression block in the partially grouted wall: 8 to 10 % more axial capacity at the maximum reinforcement strain and 6 % more flexural strength in these examples. The FEMA P-1051 example (face shells plus grouted cells, as ILX) agrees within 0.2 %. Test record: TMS-SD-EQT: the handout's interaction diagram and maximum reinforcement use an equivalent (averaged) thickness of the partially grouted wall; ILX takes the face shells plus the grouted cells (TMS 402 Commentary 9.3.3.5)
FEMA-PILASTER-2L	**Flexural strength of the FEMA pilaster with one bar layer** (simplified published method). FEMA-13.1.6-P; 1 row. FEMA P-1051 Section 13.1.6 computes the flexural strength of the 16 in. square pilaster with the two tension bars only (design moment strength 520,059 lb-in., 43.3 kip-ft). ILX Calcs solves the strain compatibility with all four bars, and the two bars nearer the compression face are also in tension at that neutral axis. **Effect:** ILX gives a 2 % higher flexural strength than the simplified published value; the pilaster passes either way. Test record: FEMA-PILASTER-2L: the example keeps only the two tension bars; ILX solves the strain compatibility with both layers, the second also in tension, 2 % stronger
TMS402-22-ANCHOR-FU	**Anchor bolt steel strength from the tensile strength** (newer code edition). TMS18-BENT, TMS18-COMB, TMS18-SHEAR; 3 rows. The TMS handout of March 2018 is written to TMS 402-16, which takes the steel strength of an anchor bolt from its yield strength, 36 ksi in that handout. TMS 402-22 takes it from the specified tensile strength, 60 ksi for an A307 bolt, with a lower strength reduction factor. **Effect:** ILX gives a higher steel strength than the handout: 25 to 34 percent at the sizes in these examples. Where masonry governs there is no change. Test record: TMS402-22-ANCHOR-FU: 402-22 takes steel strength from the specified tensile strength, the handout from a 36 ksi yield
TMS402-16-CRUSH	**Masonry crushing coefficient of anchor bolts in shear** (newer code edition). TEK-12-03C; 1 row. CMHA TEK 12-03C is written to the 2013 code, whose masonry crushing strength has a coefficient of 1,050. The 2016 code raised it to 1,750, 67 percent higher, as the TMS handout of March 2018 explains. ILX uses 1,750, taken as kept in the 2022 code. **Effect:** ILX gives 67 percent more crushing strength than this TEK. The TEK's design passes under either value. Test record: TMS402-16-CRUSH: 402-16 raised the crushing coefficient from 1,050 to 1,750; the TEK uses the older value
TMS402-22-ICR	**Cracked moment of inertia with bars off the wall centre line** (newer code edition). GUIDE-6.3.3.12; 2 rows. The TMS handout of 2021 uses the 402-16 equation, which multiplies the axial load term by half the thickness over the depth. TMS 402-22 Equation 9-28 places the axial load at the wall centre line, a separate term. They are equal for bars at the centre and differ for bars at the faces. **Effect:** ILX gives a cracked inertia and buckling load about 4 percent lower than the handout; the moment magnifier moves by less than 1 percent. Test record: TMS402-22-ICR: 402-22 Eq. 9-28 places the axial load at the wall centre line; the handout's 402-16 form differs for bars off the centre line

Code	Explanation
TMS-JAMB-QUICK	**Quick check of the deflection of the pier** (simplified published method). GUIDE-6.3.3.12; 1 row. The TMS handout checks the 28 ft pier quickly, with the lateral load of the wall above the door over the whole height and the cracked section throughout, and says the detailed calculation is in the Guide. ILX puts the load on the part of the height where it acts and uses the uncracked section up to the cracking moment. **Effect:** ILX gives a much smaller deflection than the quick check, which the handout shows as a conservative bound. Both pass the limit. Test record: TMS-JAMB-QUICK: the handout's quick check takes the load of the wall above the door over the whole height, cracked throughout; ILX integrates the load on each part with the uncracked part
FEMA-JAMB-ROUND	**A rounded load in the FEMA pier** (published value rounded). FEMA-13.1.6.3; 1 row. FEMA P-1051 prints 1,200 plf for a load of 0.4 × 1.43 × 103 psf × 20 ft, which is 1,178 plf. ILX uses the 58.92 psf that the equation gives. **Effect:** ILX's top reaction is 2 to 3 percent lower than printed. Strength at the door head agrees. Test record: FEMA-JAMB-ROUND: the example rounds 1,178 plf to 1,200 plf
FEMA-JAMB-PN	**Axial load in the flexural strength of the FEMA pier** (simplified published method). FEMA-13.1.6.3; 2 rows. FEMA P-1051 computes the compression force as the steel force plus the factored axial load (and prints 184.1 kips where its own numbers add to 186.1). ILX, like the TMS handout of the same pier, finds the nominal moment at the nominal axial load, the factored load divided by the strength reduction factor. **Effect:** ILX gives a nominal moment 1.5 percent higher than FEMA. The TMS handout's values for the same wall agree with ILX within 0.1 percent. Test record: FEMA-JAMB-PN: the example adds Pu to the steel force; ILX and the TMS handout use Pn = Pu/φ, as 9.3.2 strength design does
FEMA-JAMB-DEFL	**Deflection of the FEMA pier** (simplified published method). FEMA-13.1.6.3; 1 row. FEMA P-1051 checks the pier with the cracked section over the whole height, and says this is a conservative check. ILX uses the uncracked section up to the cracking moment, the code's two-part form, along the height. **Effect:** ILX gives a smaller deflection than the conservative FEMA check. Both pass the limit. Test record: FEMA-JAMB-DEFL: the example uses the cracked section over the whole height and the rounded load; ILX has the uncracked part below the cracking moment
FEMA-PIL-2L	**Pilaster flexural strength with one bar layer in FEMA P-1051** (simplified published method). FEMA-13.1.6; 1 row. FEMA P-1051 Section 13.1.6 computes the flexural strength of the 16 in. square pilaster with the two tension bars only (stress block depth 2.11 in., design moment strength 520,059 lb-in., 43.3 kip-ft). ILX Calcs solves the strain compatibility with all four bars: the other two bars, 3.6 in. from the compression face, sit below the neutral axis (3.1 in. deep) and add tension, so the design strength is 44.3 kip-ft. The TMS night school column example makes the same comparison (47.3 kip-ft with two bars, 48.8 kip-ft with both layers) and ILX matches its both-layer value within 0.2 %. **Effect:** ILX gives a 2 % higher flexural strength than the simplified published value; the pilaster passes either way. The stiffness values of the example (gross and cracked moment of inertia, cracking moment) agree within 0.1 %. Test record: FEMA-PIL-2L: the example keeps only the two tension bars (a = 2.11 in.); ILX solves the strain compatibility with both bar layers (the second layer, 3.6 in. from the compression face, is in tension at c = 3.1 in.), 2 % stronger

Code	Explanation
SSMA-COLD-WORK	**Cold work of forming in the SSMA allowable moments** (different permitted method). SSMA-600S162-54; 1 row. The SSMA Product Technical Guide includes the strength increase from the cold work of forming (AISI S100 Section A7.2) in the allowable moments marked with its footnote 2, such as 30.33 kip-in. for the 600S162-54 at 50 ksi. ILX Calcs uses the specified yield stress without that increase. **Effect:** ILX is lower (conservative): 27.80 kip-in. for the 600S162-54 at 50 ksi. Sections without the footnote agree within 0.3 %. Test record: SSMA-COLD-WORK: the SSMA Mal of this section includes the strength increase from the cold work of forming (table footnote 2, S100 A7.2); ILX does not use the cold-work increase
SSMA-SXE	**Effective section modulus of the 600S162-54 at 50 ksi in the SSMA guide** (published value differs). SSMA-600S162-54; 1 row. The SSMA guide lists Sxe = 0.916 in.³ for the 600S162-54 at 50 ksi. The AISI S100 effective width procedure (flange with its edge stiffener, lip reduced by RI, web under stress gradient) gives 0.928 in.³, both in ILX Calcs and in the independent hand calculation of example CS-4. The SSMA program details are not published; the other sections compared (600S162-33, 800S162-43, 800S162-54, 1000S162-54) agree within 0.3 %. The narrow 362S162 sections differ more (362S162-54 at 50 ksi: 0.444 in.³ listed, 0.468 in.³ by S100) and are not used as examples. **Effect:** ILX is 1.4 % higher than the guide for this section. Test record: SSMA-SXE: the SSMA effective section modulus of this section is 1.4 % below the S100 Appendix 1 effective section (0.928 in.³, reproduced by the hand calculation CS-4); the SSMA program details are not published
AWC-TR14-3.1-CL	**Beam stability factor of the AWC TR 14 ridge beam example** (different permitted method). TR14-3.1; 2 rows. AWC Technical Report 14 Example 3.1 (2-1/2 × 21 24F-V4 glulam braced by joists at 4 ft) takes CL from the report's own buckling-moment method (Mcr = 1.3 Cb Ce E'y05 Iy / lu), giving CL = 0.88 and M' = 37,250 ft-lb. ILX Calcs applies NDS 2024 3.3.3: effective length le = 2.06 lu from Table 3.3.3, RB = 18.2 and CL = 0.857 (M' = 36,200 ft-lb). The NDS values the report also uses (Fbx* = 2,760 psi, CV = 0.9871, M = 36,750 ft-lb) agree. **Effect:** The program is 2.8 % lower (conservative) than the TR 14 method for this beam; NDS 3.3.3 is the method of the code. Test record: AWC-TR14-3.1-CL: TR 14 computes CL from its own buckling moment Mcr (an alternative to NDS 3.3.3); the app applies the NDS effective length le = 2.06 lu (CL = 0.857)
FEMA-P2192-4.5-CSMIN	**Lower bound of Cs in the FEMA P-2192 coupled-wall example** (published value inconsistent). P2192-4.5; 1 row. FEMA P-2192-V1 Section 4.5.1.7 writes the lower bound 0.044 SDS Ie but evaluates it with 0.65 g (the SD1 of the example) instead of SDS = 1.10 g, giving 0.029. ASCE 7-22 Eq. 12.8-6 with SDS = 1.10 g gives 0.0484, which ILX Calcs computes. **Effect:** None on the result: the governing Cs (0.048, the long-period limit) and the base shear (2,090 kips) agree with the example. Test record: FEMA-P2192-4.5-CSMIN: the example evaluates 0.044 SDS Ie with 0.65 (SD1) in place of SDS = 1.10; the program computes 0.044 × 1.10 = 0.0484
FEMA-P2192-5.5-V	**Base shear of the FEMA P-2192 composite plate shear wall example** (published rounding). P2192-5.5; 3 rows. FEMA P-2192-V1 Section 5.5.3.6 multiplies Cs rounded to 0.048 by W = 25,844 kips (its Table 5-4 sums to 25,855 kips). ILX Calcs keeps the unrounded Cs = 0.044 SDS = 0.04844 (Eq. 12.8-6 governs) and W = 25,855 kips, so V, the story forces and the overturning moment are 1.2 % higher; the period, k and the distribution factors Cvx agree. **Effect:** The program is 1.2 % higher (conservative) than the example. Test record: FEMA-P2192-5.5-V: the example multiplies the rounded Cs = 0.048 by W = 25,844 kips (Table 5-4 sums 25,855); the program keeps Cs = 0.044 SDS = 0.04844, 1.2 % higher

Code	Explanation
SECT-UPE-ZY	**Plastic modulus of the deep UPE channels** (published value inconsistent). SP-26; 1 row. The steel catalog prints the weak-axis plastic modulus of a UPE 400 as 191 cm³. A hand calculation from its dimensions gives 220 cm³ (the plastic axis lies inside the web; web part 400 mm × 11.3 mm and 2.2 mm, flanges 3,654 mm² at 52.9 mm), and ILX Calcs gives 220.8 cm³ with the fillets. UPE 360 (178 printed, 189 calculated) and UPE 330 (156, 162) show the same difference; the smaller sizes agree. **Effect:** The catalog's value looks low. ILX Calcs reports the value from the geometry. Test record: SECT-UPE-ZY: 220.8 cm³ from the geometry; 220 cm³ by hand
SECT-HP-PA	**Surface perimeter PA of some HP shapes** (published value inconsistent). SP-27; 1 row. The AISC Shapes Database v16.0 lists PA of about 3 to 4 for eight HP12 and HP14 rows, where the same rows' PB is about 70 to 85 in. and every other HP row's PA is close to PB minus the flange width. ILX Calcs calculates 58 to 70 in. **Effect:** These database entries look wrong. They affect paint and fire-protection quantities only, no strength. Test record: SECT-HP-PA: 57.5 in. from the geometry
SECT-M-WEIGHT	**Area of the lightest M shapes** (published value inconsistent). SP-28; 1 row. For a few M shapes the AISC database's area, its nominal weight and its fillet dimension do not agree: M3X2.9 lists 0.914 in.², while 2.9 lb/ft is 0.853 in.² of steel. The database's fillet distance is also too large for the weight on 14 of the 16 M shapes and on 3 HP shapes. ILX Calcs takes the fillet that closes the weight on those rows and says so on the row. **Effect:** Area and strong-axis properties of those rows are up to 7 % below the database's. The rows are flagged. Test record: SECT-M-WEIGHT: 0.852 in.², the nominal weight's area
SECT-MC-SLOPE	**Flange slope of MC channels** (different geometry). SP-29; 1 row. The AISC database does not list the flange slope of MC channels, and it varies by shape. ILX Calcs uses 1:12, or 1:6 for MC13 and for flange thickness up to 0.32 in., a rule read from the published weak-axis inertias. Those values therefore are not an independent check for MC, and they still differ by up to 8 %. **Effect:** Weak-axis values and torsion terms of MC channels are less certain than other families. The rows are flagged. Test record: SECT-MC-SLOPE: with the stated slope rule
SECT-PIPE-AREA	**Area of some standard pipes** (published value inconsistent). SP-30; 1 row. For some pipes the AISC database's area differs from the area of its own diameter and design wall: Pipe20XS lists 27.6 in.² where the listed 20 in. and 0.465 in. give 28.5 in.², Pipe10STD lists 11.5 where the listed values give 11.1. The cause was not found. **Effect:** Up to 3.4 % on area and inertia of those rows. ILX Calcs reports the value from the geometry. Test record: SECT-PIPE-AREA: 28.5 in.² from the row's diameter and design wall
SECT-SSMA-RX	**Radius of gyration of track 1000T250-54** (published value inconsistent). SP-31; 1 row. The SSMA guide prints a radius of gyration of 3.577 in. for this track, while its own inertia and area give 3.757 in., as ILX Calcs does. Two digits look swapped. **Effect:** None on results: ILX Calcs reports the value from the geometry. Test record: SECT-SSMA-RX: 3.757 in. from the guide's own Ix and A
SECT-J-SOURCES	**Published torsion constants disagree between sources** (different permitted method). SP-32; 1 row. Catalogs print different torsion constants for the same shape: for the lightest HEAA shapes the sources differ from the true-outline value by up to 13 %. ILX Calcs solves the torsion on the true outline with fillets, and that solution agrees with an independent program within 0.03 %. **Effect:** Compare torsion constants with care against a catalog. Results from ILX Calcs are for the geometry shown. Test record: SECT-J-SOURCES: 239 cm⁴ on the true outline

Code	Explanation
SECT-TW-BASIS	**Warping and torsion basis: true outline and thin-walled** (different permitted method). SP-33; 1 row. AISC and SSMA tabulate the warping constant, the shear center and related terms from a centre-line model without fillets. ILX Calcs reports those and also the value on the true outline. For a thick tapered channel they differ a lot: C10X20 is 56.9 in.⁶ in the database and 44.7 in.⁶ on the true outline, with the shear center 0.64 and 0.49 in. from the web. The centre-line values match the database within about 1 %. **Effect:** AISC 360's equations assume the centre-line values, so a module adopting this database would use those. The engineer chooses. Test record: SECT-TW-BASIS: 44.7 in.⁶ on the true outline; the thin-walled basis matches, see the C10X20 example
AISC-L-TOES	**Minor principal moment of inertia of a rolled angle** (different geometry). SP-18; 1 row. Rolled angles have rounded leg toes, whose radius the AISC Shapes Database does not list. ILX Calcs draws them with half the root radius, a single assumption chosen across the whole angle family. For L4X4X1/2 the area, the moment of inertia about the leg, the centroid and J all match within 1 %, but the minor principal moment of inertia comes out at 2.28 in.⁴ against the tabulated 2.25 in.⁴, 1.5 % higher. With square toes it was 3 % higher. **Effect:** The minor principal value of a rolled angle is about 1.5 % high; use the database value for single-angle design if that matters. Test record: AISC-L-TOES: 2.28 in.⁴ with the assumed toe radius r / 2
UDOEYO-12.3-MD	**Moment distribution stopped after two cycles** (published rounding). UD-12.3; 2 rows. Example 12.3 of Udoeyo's Structural Analysis distributes the moments for only two cycles with distribution factors rounded to 0.01, so the column moments are not converged: the printed column moments MBD = 14.94 and MDB = 7.47 kip-ft against the exact stiffness solution 15.09 and 7.55 kip-ft (1.0 % apart). The beam moments of the same example match within 0.4 %. **Effect:** None: the program gives the exact elastic solution. Test record: UDOEYO-12.3-MD: two moment-distribution cycles with DF rounded to 0.01
C1-DRIFT2	**Second-order drift printed below a rigorous solution** (published value inconsistent). C.1A, C.1B; 8 rows. AISC Design Examples C.1A and C.1B print a second-order drift of 0.290 and 0.204 in. (LRFD), a ratio to the first-order drift of 1.60 and 1.41, and 1.66 and 1.44 under ASD. ILX Calcs gets the printed first-order drifts within 0.3 %, with shear deformation, and the printed moments, shears and axial forces within 0.4 %, but its second-order drifts are 2.5 to 4 % higher, with ratios of 1.64 and 1.45 (LRFD), 1.71 and 1.50 (ASD). The printed 1.41 is below what sway alone gives for those loads, 1.43, by the story stiffness relation the examples use themselves. The same solver reproduces the AISC Commentary benchmark drifts within 0.4 % and the closed-form solutions within 0.05 %. The difference is inside the 5 % the Commentary allows for deflections. **Effect:** The drift ratio read against a limit is a little higher than printed, on the conservative side: example C.1A under ASD reads 1.71 against the 1.7 for gravity-only imperfections, and C.1B under ASD reaches the 1.5 limit. Moments and forces in these examples are not affected, because the only sway load is small. Test record: C1-DRIFT2: the printed second-order drift is below a rigorous P-Δ and P-δ solution; the forces agree
C1C-108	**First-order moment not equal to shear times height** (published value inconsistent). C.1C; 1 row. Figure C.1C-3 of AISC Design Examples prints 5.32 kips of shear at the pinned base of column B and 108 kip-ft at its top. In a first-order analysis of a 20 ft column pinned at the base the moment is the shear times the height, 106.4 kip-ft, which is what ILX Calcs reports. Column C agrees: 6.53 kips gives 130.6 against the printed 131. **Effect:** None: the program reports the statically correct moment. Test record: C1C-108: the printed moment is not the printed shear times the height

Code	Explanation
C1C-875	**Story buckling strength from a rounded story shear** (published rounding). C.1C; 1 row. Example C.1C under ASD takes the story shear as 4.35 minus 3.55 kips, 0.800 kip, where the lateral load is 0.806 kip, and gets a story buckling strength of 875 kips. ILX Calcs keeps the unrounded shear and gets 886 kips, 1.2 % higher. The sidesway amplifier from it matches the printed 1.54 within 0.3 %. **Effect:** None on the verdict: the first-order method still reads not permitted under ASD, as the example says. Test record: C1C-875: the printed Pe story rounds the story shear to 0.800 kip
DG32-MODEL	**Design Guide 28 warehouse: our model of one line of the building** (reference model not printed). DG28-3.2-Comb11, DG28-3.2-Comb12, DG28-3.2-Comb15, DG28-3.2-Comb16, DG28-3.2-Comb8, DG28-3.2-drift-Comb15, DG28-3.2-drift-Comb3, DG28-3.2-drift-Comb7; 12 rows. Design Guide 28 Example 3.2 reports forces and drifts from a model it does not print. We reconstructed one column line: one eleventh of the building's gravity and wind, the two end beams with their own 40 ft of roof, nine pinned columns taking the rest. The axial forces agree within 0.6 % and the column moment at the top of the governing combination is 10,550 kip-in. against the printed 10,800 (2.3 % low); the drifts under wind agree within 1.6 %. A few values miss the 1 % tolerance: smaller moments that are the difference of two large numbers, up to 7 %, and the drifts under notional load alone, 4 % high. These may come from the reconstruction, for example how the notional load is shared between the lines. Nothing was adjusted to reduce them. **Effect:** The solver itself is checked by the Commentary benchmarks. Treat this example as a cross-check of a whole method on a frame with a large amplification, not as an exact match. Test record: DG32-MODEL: our reconstruction of one line of the building, the guide does not print its model
SJI-WEB-DEFL	**Joist live load deflection printed as three quarters of an inch** (published value inconsistent). SJI-DLH; 1 row. The SJI webinar Properly Specifying Steel Joists (2019, slide 73) scales the 3.86 in. deflection of a 96DLH21 under its red-figure load of 877 plf to a 200 plf live load as 200 / 877 times 3.86 in. and prints 3/4 in. The product is 0.88 in., which ILX Calcs reports; the 3.86 in. limit itself matches. **Effect:** None on designs: the program prorates the red figure exactly, as the load-table note describes; the slide's conclusion (no special deflection note needed) holds either way. Test record: SJI-WEB-DEFL: the slide prints 3/4 in. for 200/877 × 3.86 in. = 0.88 in.
DG9-CHART	**Design Guide 9 reads the torsion functions from its charts** (published value is a chart reading). DG9-5.1, DG9-5.4, DG9-5.5, H.6; 13 rows. AISC Design Guide 9 reads the rotation and its derivatives from the graphs of its Appendix B to two digits, and AISC Design Example H.6 reuses those readings. ILX Calcs solves the same differential equation exactly: for example 0.0955 where the guide reads 0.09 in its Example 5.1, 0.481 where it reads 0.46 in Example 5.5. The exact solution was checked separately against closed-form solutions and an independent numerical integration. Values within 3 percent are counted as agreeing; the others are listed here. **Effect:** The program is higher than the guide on most of these values, by up to about 10 percent on a stress that is small to begin with, so it is on the safe side. Compared with a designer reading the charts, results differ by the reading error only. Test record: DG9-CHART: the guide reads the rotation functions from the Appendix B charts to two digits (0.09 for the exact 0.0955)

Code	Explanation
DG9-5.2-TAU	**Tube torsional shear in Design Guide 9 Example 5.2 uses the whole torque** (published value inconsistent). DG9-5.2; 1 row. Example 5.2 divides the whole 90 kip-in. torque by twice the wall times the enclosed area, 1.72 ksi, although a torque at midspan divides equally between the two supports, as the same example assumes when it computes the rotation. ILX Calcs uses the 45 kip-in. each side carries and the torsional constant of the current shapes database, 0.92 ksi. AISC Design Example H.5C uses the torque the same way ILX Calcs does. **Effect:** The guide is about twice as high here (conservative). The strength check itself follows AISC 360-22 H3.1 and agrees with Examples H.5A, H.5B and H.5C. Test record: DG9-5.2-TAU: the guide divides the whole 90 kip-in. torque by 2 t Ao of the 1997 TS10x6x1/2; each support takes half of it, and T/C uses C = 48.7 in.³
DG9-5.2-J	**Tube torsional constant of 1997 against the current database** (shape property edition). DG9-5.2; 1 row. Example 5.2 uses a torsional constant of 187 in.4 for the 1997 TS10x6x1/2 tube. The AISC Shapes Database v16.0 lists 176 in.4 for the HSS10X6X1/2 that replaced it, so the rotation is 0.00137 rad against the printed 0.0013 rad. **Effect:** The rotation is about 5 percent larger, on the safe side, and it is small in any case. Test record: DG9-5.2-J: J = 187 in.⁴ of the 1997 TS10x6x1/2 against 176 in.⁴ in the v16.0 database
DG9-5.5-STATIONS	**Largest channel shear stress found between the stations the guide checks** (more complete analysis). DG9-5.5; 1 row. Example 5.5 evaluates the channel at the support, at one fifth of the span and at midspan and reports a largest shear stress of 4.35 ksi. ILX Calcs evaluates the whole span and finds 4.72 ksi at 1.4 ft, about one eighth of the span. At the guide's own station it gets 4.36 ksi. **Effect:** The program reports a higher maximum, on the safe side. The guide itself warns that the stresses should be checked at several locations. Test record: DG9-5.5-STATIONS: the guide checks z/l = 0, 0.2 and 0.5 only; the module's envelope finds 4.72 ksi at 1.4 ft (z/l = 0.12)
DG9-5.5-SIGNS	**Channel flange shear stresses added as absolute values** (conservative simplification). DG9-5.5; 2 rows. At the channel flange points Example 5.5 adds the three shear stresses with their directions and takes no flexural shear at point 1, getting 3.44 and 3.12 ksi at one fifth of the span. ILX Calcs adds absolute values and includes the flexural shear at point 1, getting 4.00 and 4.10 ksi. **Effect:** Higher flange shear stress, on the safe side. In this example the web stress is larger still, so the governing result is not affected. Test record: DG9-5.5-SIGNS: at the flange points of a channel the guide adds the shear stresses with their signs and takes no flexural shear at point 1; the module adds absolute values and the flexural shear at point 1 (conservative)
AISC-H6-FCR	**Buckling stress in AISC Design Example H.6 exceeds the plastic moment** (published value differs from the equation). H.6; 2 rows. Example H.6 multiplies the tabulated flexural strength at a bending coefficient of 1.0 by 1.32 and divides by the section modulus, 65.8 ksi for LRFD and 65.9 ksi for ASD. AISC 360-22 Equation F2-2 limits that strength to the plastic moment, which gives 55.3 ksi, the value ILX Calcs uses. **Effect:** The program's critical stress is lower, on the safe side. Yielding under normal stress governs over buckling in the example either way, as the example itself concludes. Test record: AISC-H6-FCR: the example multiplies the tabulated Mn (Cb = 1) by Cb = 1.32 without the Mp cap of Eq. F2-2; the module keeps Mn ≤ Mp (Fcr = 55.3 ksi)

Code	Explanation
CFS-COLD-WORK	**Moments of some C-sections include the cold work of forming** (conservative method). SSMA-COLD-600S162-54; 2 rows. For the sections marked with its footnote 2, the SSMA Product Technical Guide (2022, pages 10 to 13) raises the yield stress for the cold work of forming, as AISI S100 permits, so its local and distortional moments are higher than at the catalog yield stress: 30.33 and 25.90 kip-in. for a 600S162-54 at 50 ksi, against 27.80 and 24.23 here. The program uses the yield stress you enter and adds nothing for cold work. With the raised yield stress worked out from the same table row (55.3 ksi), it gives 30.35 and 25.89 kip-in. **Effect:** The program is lower by about 6 to 11 percent on those sections unless you enter the raised yield stress yourself, as the engineer of record. Test record: CFS-COLD-WORK: the guide's value includes cold work of forming (its footnote 2); the module uses the Fy entered
CFS-SSMA-IXE	**Header deflection taken at the service moment** (code reading). SSMA-HDR-800S162-54-12; 1 row. The SSMA Product Technical Guide (2022, page 56) works out the effective moment of inertia of a section at its allowable moment. AISI S100 Appendix 1 takes the stress at the load being checked, and the program does that, so where deflection governs it is a little stiffer: 286.2 against 283.3 pounds per foot for two 800S162-54 over 12 feet. **Effect:** The program allows about 1 percent more load than the table on rows governed by deflection. Test record: CFS-SSMA-IXE: the table takes the effective inertia at the allowable moment; the module takes it at the service moment, a little stiffer
CFS-DG8-BASIS	**L-header spans of CFSEI Design Guide 8 (2000)** (older code). DG8-T3-1000L150-43-16, DG8-T3-1000L150-54-16, DG8-T3-1000L150-68-16, DG8-T3-600L150-43-70, DG8-T3-600L150-68-16, DG8-T3-800L150-43-16, DG8-T3-800L150-54-16, DG8-T3-800L150-54-70; 8 rows. Design Guide 8 prints spans for double L-headers with no calculation, tributary width or snow factor. The comparison assumes a 14 foot tributary width and a roof snow load of 0.7 times the ground snow load, moment limited. With those assumptions, legs up to 8 inches come within 4 percent of the guide. For 10 inch legs the guide's spans are 15 to 18 percent longer: it predates the AISI S240 safety factor of 2.25 for legs over 8 inches, which the program applies. **Effect:** The program gives shorter spans than the guide on 10 inch legs, as the current standard requires. The comparison is a cross-check on assumed loads, not a verification of the method. Test record: CFS-DG8-BASIS: the guide prints spans without its method, tributary width or snow factor; the comparison assumes them, and the guide predates the S240 factors
FHSS-I7-BARE	**Bare steel strength of the built-up box in Design Example I.7** (code reading). I.7-1/2-LRFD, I.7-1/4-LRFD; 2 rows. Design Example I.7 states, without showing the calculation, bare steel strengths of 1,980 and 541 kips for the 30 in. box with 1/2 in. and 1/4 in. plates. Those figures reproduce (1,966 and 540 kips) with the wall factors the Specification gives for HSS and a flat width of the depth less three thicknesses. A box of four plates is not an HSS, so ILX Calcs uses the factors for other stiffened elements and the clear width between plates, as the Specification and the same example's slenderness calculation read, and gets 1,882 and 509 kips. **Effect:** None in this example, where the composite strength governs by a wide margin. In general the program is about 5 to 6 % lower on this bare steel strength, which only matters if it governs over the composite strength; that is on the safe side. Test record: FHSS-I7-BARE: the example's figure reproduces with HSS wall factors (Table E7.1 case (b)) and b = H - 3t; the module reads the Specification for a plate box (case (a), clear width)

Code	Explanation
STI-BARE-HSS20	**Bare steel strength of HSS20x20x3/8 in the Steel Tube Institute table** (published value inconsistent). STI-T9-4; 1 row. The capacity table of the Steel Tube Institute article Filling the Void (June 2024, p. 6) lists 821 kips for the bare HSS20x20x3/8 at 42 ft. The article's stated A500 wall (design thickness 0.349 in.) gives 730 kips by hand from Section E7, and ILX Calcs computes 729. A 0.375 in. wall, as in ASTM A1085, gives 826 kips, so the table cell probably comes from that wall; this is our inference, the article does not say so. The eight other bare steel values and all eighteen composite values in the table match. **Effect:** None on the composite strength, which governs this section at 1,360 and 1,600 kips and matches the table. Test record: STI-BARE-HSS20: 821 kips reproduces with a 0.375 in. wall (826, A1085) but the article's A500 wall of 0.349 in. gives 730 by hand from Section E7, as the module does
SOG-IOANNIDES-FIT	**Corner stress formula against the finite-element results it was fitted to** (empirical formula). IO84-C003, IO84-C006; 2 rows. The corner stress formula of Ioannides, Thompson and Barenberg (1985) is a curve fitted to their finite-element results for a load at the corner of a slab on a dense-liquid subgrade. It reproduces the finite-element stresses of their Table 5.13 within 1 percent for most runs, but the run with the largest loaded area (7.5 in. square on a 9 in. slab) is 2.2 percent below, and the run on the thinnest slab (6 in.) is 1.5 percent below. ILX Calcs applies the published formula as written. **Effect:** Corner stresses can be up to about 2 percent below the finite-element values for large contact areas or thin slabs; the factor of safety covers the difference, or the engineer may choose the Westergaard 1926 corner formula, which gives higher corner stresses. Test record: SOG-IOANNIDES-FIT: the corner formula fits the finite-element results within about 2 %; this run is 2.2 % below them
BEF-SV-ROUND	**Beam on elastic foundation: hand calculation with rounded table constants** (published rounding). SV-BEF; 2 rows. The Structville example (a 10 m concrete beam with free ends on soil springs, 300 kN at 3 m) is worked by hand with the coefficients of Roark's tables rounded to four or five digits, and one of them is evaluated at 1.974 instead of the 1.980 the beam's own numbers give. The exact solution of the same beam is 12.39 mm of settlement at the left end (published 12.23 mm) and 231.05 kN-m under the load (published 228.39 kN-m), about 1.2 % apart. ILX Calcs gives the exact values, confirmed by an independent closed-form solution and by its own convergence tests; the stiffness value of the example matches to four digits. The STAAD.Pro check in the same article uses springs 1 m apart and lands lower still (12.20 mm, 228.15 kN-m). **Effect:** None on designs: the program's settlement and moment are about 1 % higher than the rounded hand values. Test record: BEF-SV-ROUND: the hand calculation rounds Roark's constants (it uses β(l − a) = 1.974 for 1.980); the exact value is 12.39 mm (STAAD.Pro with 1 m springs 12.20 mm)
LP-ROUND	**Pile deflection in clay: rounded stiffness factor** (published rounding). LP-KOU-6.12; 1 row. Example 6.12 of Kouretzis's Fundamentals of Foundation Engineering estimates the deflection at grade of a fixed-head pipe pile in clay with the relative stiffness factor rounded from 0.507 to 0.50 per meter and quotes 0.019 m. With the unrounded factor the same Broms equation gives 0.0199 m, which ILX Calcs reports. The three ultimate lateral loads of the example (short, intermediate and long pile) match within 0.1 %. **Effect:** The program's deflection is 4 % larger than the printed value, on the conservative side. Test record: LP-ROUND: the example rounds β = 0.507 per m to 0.50 and the result to 0.019 m; the program gives 0.0199 m

Code	Explanation
LP-CHART	**Broms chart readings in the FHWA exercise** (chart reading). LP-FHWA-EX8; 2 rows. FHWA HI-97-013 Student Exercise 8 reads the ultimate lateral load and the deflection of a fixed-head prestressed pile in sand from Broms' charts (Figures 9.30 and 9.33): 295 kN and 11 mm. ILX Calcs uses the closed-form equations the charts are drawn from: 280 kN (5 % lower) and 11.2 mm (2 % higher). The passive pressure coefficient of the exercise matches exactly. **Effect:** The program is slightly more conservative than the chart readings: a lower lateral capacity and a larger deflection. Test record: LP-CHART: the exercise reads Qu/(Kp b³ γ) = 95 from Broms' chart; the closed form of the long fixed-head pile gives 90.4, so Hu = 280 kN
WF-ACI19-ONEWAY	**One-way shear of wall footings: the published formula vs ACI 318-19** (code edition). WF-SP-12, WF-SP-13, WF-UET-9.1; 3 rows. The StructurePoint example (Wight Example 15-1, ACI 318-14) and the UET Peshawar lecture take the concrete shear strength as 2 times the root of the concrete strength, times width and depth. ACI 318-19 keeps that form only for members with at least the minimum stirrups. A footing without stirrups uses Table 22.5.5.1(c), which depends on the flexural steel ratio. With the light steel of a footing, at about 0.3 %, the strength is about 40 % lower. The factored shear matches the examples; only the strength differs. ACI MNL-17(21) confirms this reading for footings (p. 470, Foundation Example 1 p. 479 and Example 2 p. 491): Table 22.5.5.1(c) without stirrups, the size effect factor neglected under 13.2.6.2, and the steel ratio of the flexural bars. **Effect:** ILX Calcs is more conservative: 5.5 instead of 9.6 kips per foot on the 13 in footing, which fails under ACI 318-19 and needs more thickness or steel. Test record: WF-ACI19-ONEWAY: the publication uses 2√f'c bw d; ACI 318-19 Table 22.5.5.1(c) applies to a footing without stirrups
WF-LD-SIMPLIFIED	**Development length: simplified table vs the general equation** (permitted method). WF-SP-13; 1 row. The StructurePoint example uses the simplified table of ACI 318, 21.9 in for a No. 4 bar. The program uses the general equation of 25.4.2.4 with the actual cover and spacing, 13.1 in. Both are permitted. **Effect:** ILX Calcs asks for a shorter, still code-compliant length. The available length of 22 in passes either way. Test record: WF-LD-SIMPLIFIED: the publication uses the simplified table; the program uses the general equation 25.4.2.4(a)
WF-ASDIP-PLAIN	**Plain concrete flexure at the top of the footing** (code edition). WF-ASDIP-W; 1 row. ASDIP checks the footing top, which has no bars, with a strength factor of 0.55 and the full 12 in thickness, 3.6 kip-ft per foot. ACI 318-19 gives a factor of 0.60 (Table 21.2.1) and takes 2 in off concrete cast against soil (14.5.1.7), so the program gets 2.7 kip-ft per foot. **Effect:** ILX Calcs is more conservative on this check, and it only appears when an overhang loses soil contact. Test record: WF-ASDIP-PLAIN: the publication uses φ = 0.55 and the full thickness; ACI 318-19 gives φ = 0.60 and takes 2 in off concrete cast against soil
WF-ASDIP-SHEAR	**One-way shear values of the ASDIP screenshots** (published rounding). WF-ASDIP-G; 2 rows. ASDIP prints values to one decimal and does not show the shear calculation. On the side near the wall offset it prints a shear of 0.9 kips per foot; the program gets 0.80 at the printed depth of 8.7 in. Its strength of 5.0 kips per foot compares with 4.93 from Table 22.5.5.1(c) with the printed values. The moments on both sides and the shear on the other side match. The reason could not be read from the publication; another effective depth is a possibility, not a finding. ACI MNL-17(21) Foundation Example 2 (p. 491) sets out the method ILX Calcs uses: for a concrete wall the section at d from the face, Vc by Table 22.5.5.1(c) with the size effect neglected (13.2.6.2) and the steel ratio of the flexural bars. The ASDIP difference is not a matter of method. **Effect:** Small: about 11 % on a low shear that governs nothing in the example, and 1.5 % on the strength. Test record: WF-ASDIP-SHEAR: printed to one decimal and not reproduced on this side at d = 8.7 in; the moment on the same side matches

Code	Explanation
WF-ASDIP-LD	**Reduction of development length for excess steel** (engineering judgment). WF-ASDIP-G; 1 row. With the optional reduction of 25.4.10, ASDIP takes the required steel from the moment alone, which brings the length down to the 12 in minimum. The program takes the required steel as the larger of the steel for the moment and the minimum steel, and gets 13.7 in. **Effect:** ILX Calcs is slightly more conservative when you choose this option. Without it no reduction is taken. Test record: WF-ASDIP-LD: the publication takes As,required from the moment alone; the program takes the larger of that and As,min
WF-CE-MASONRY	**Critical sections under a masonry wall** (publication differs from the code). WF-CE-10; 2 rows. CE-Ref Example 10 takes the moment at the face of the masonry wall and the shear at a quarter of the wall thickness inside the face, without adding the effective depth. ACI 318-19 Table 13.2.7.1 takes the moment halfway between the center and the face, and 13.2.7.2 measures the shear section from there, at the effective depth. The factored pressure and the depth match. ACI MNL-17(21) Foundation Example 2 (Figs. E2.2 and E2.3, pp. 491 and 492) draws the sections as ILX Calcs takes them: under a masonry wall the moment section halfway between the center and the face, and the shear section at d beyond that line. **Effect:** The moment is higher than published (1.78 instead of 1.27 kip-ft per foot) and the shear stress is lower (20 instead of 40.5 psi). Test record: WF-CE-MASONRY: the publication takes the moment at the wall face; Table 13.2.7.1 takes it halfway between the center and the face of a masonry wall
WF-CE-VC	**Shear strength in the CE-Ref example** (publication differs from the code). WF-CE-10; 1 row. CE-Ref Example 10 uses a concrete strength of 2,500 psi in the shear formula although the example gives 3,000 psi, and the ACI 318-05 formula. The program uses Table 22.5.5.1(c) of ACI 318-19 with 3,000 psi and the example's light steel. **Effect:** ILX Calcs is more conservative: about 39 instead of 75 psi. Test record: WF-CE-VC: the publication uses 2√f'c with f'c = 2,500 psi on a 3,000 psi footing; ACI 318-19 Table 22.5.5.1(c) applies
WF-CE-TEMP	**Steel along the wall in the CE-Ref example** (code edition). WF-CE-10; 1 row. CE-Ref Example 10 uses a ratio of 0.002 on a depth of 8.75 in, which is not the 10 in thickness of the footing. ACI 318-19 24.4.3.2 gives 0.0018 on the gross section. **Effect:** ILX Calcs asks for 0.54 instead of 0.525 square inches, 3 % more. Test record: WF-CE-TEMP: the publication uses 0.002 and a depth of 8.75 in; ACI 318-19 gives 0.0018 Ag
ASCE7-C7-EX3-GAMMA	**Snow density of the ASCE 7-22 commentary drift example** (published value inconsistent). C7-EX3-LOW; 4 rows. Example 3 of the ASCE 7-22 snow commentary puts the drift on a lower roof whose ground snow load is 32 psf, but it computes the snow density from the upper roof's 40 psf (19 pcf instead of 18.2 pcf) and divides the lower roof's balanced load by it. Its windward drift height (4.55 ft before the three-quarter factor) also does not follow from Eq. 7.6-1 with its own inputs, which give 4.69 ft with 19 pcf and 4.79 ft with 18.2 pcf. ILX Calcs uses the density of the roof the drift sits on. The flat roof loads, the clear height, the drift surcharge (65.3 against 64.8 psf) and the peak load at the step (92.2 against 92 psf) agree within 1 %. **Effect:** Drift heights about 4 to 5 % higher and drift widths about 5 % wider than the example; the peak drift load at the step is the same within 1 %. Test record: ASCE7-C7-EX3-GAMMA: the example divides by γ = 19 pcf of the upper roof's pg

Code	Explanation
FEMA-P1051-11.1-ANCHMIN	**Wall anchorage force below the code minimum in a low-seismic example** (published value inconsistent). 11.1-PLANK-C; 1 row. The FEMA P-1051 five-story masonry example (SDC C, design spectral acceleration 0.37 g, rigid plank diaphragm) reports a wall anchorage force of 61.6 lb per foot from the basic anchorage equation alone. ASCE 7-22 12.11.2.1 also requires at least 0.2 ka Ie times the tributary wall weight (and ASCE 7 1.4.4 asks for 0.2 times the wall weight in every category), which is 83.2 lb per foot here. ILX Calcs reproduces the 61.6 lb per foot equation value and applies the minimum. **Effect:** Wall anchorage forces at low seismic accelerations (where 0.4 times the design acceleration is below 0.2) are 35 % higher than the published value: the code minimum governs. Test record: FEMA-P1051-11.1-ANCHMIN: published value below the 12.11.2.1 minimum 0.2 ka Ie Wp (ILX 0.0832 klf)
BW-E702-COMBO	**Basement wall strength at the combination with the least axial load** (conservative method). E702.4; 1 row. The ACI E702.4 example checks the wall base only under 1.2 dead + 1.6 live + 1.6 earth pressure and quotes a design moment strength of 31.6 kip-ft per foot (spColumn) at that axial load. The program checks every ASCE 7-22 strength combination; under 0.9 dead + 1.6 earth pressure the wall carries less axial compression, so its moment strength is lower (30.4 kip-ft per foot) while the earth pressure moment is the same. At the example's own axial load the program gives 31.64. **Effect:** Conservative: the governing combination gives a 4 % lower strength than the example's single check. Test record: BW-E702-COMBO: the program checks every ASCE 7 combination; 0.9D + 1.6H, with less axial compression, governs the base and gives 30.4 kip-ft/ft (the example checked 1.2D + 1.6L + 1.6H only)
CORBEL-AF-LEVER	**Corbel flexural steel with an approximate lever arm** (published approximation). VC-CORBEL; 1 row. The VCmaster corbel worksheet finds the flexural steel with a lever arm of 0.9 times the effective depth. ILX Calcs solves the rectangular stress block exactly (ACI 318-19 22.2), which gives 0.62 square inches instead of 0.67 for this corbel. Every other value of the worksheet matches. **Effect:** None on this design: the primary steel is governed by two thirds of the shear-friction steel plus the axial steel, which both methods give alike. Test record: CORBEL-AF-LEVER: the worksheet takes the lever arm as 0.9d; ILX solves the stress block (0.62 in.²); Asc is governed by 2/3 Avf + An either way
CORBEL-AF-PHI	**Corbel flexure with the beam strength reduction factor** (published value inconsistent). MP-CORBEL; 1 row. The Maple Flow corbel worksheet uses a strength reduction factor of 0.90 for the flexural steel. ACI 318-19 Table 21.2.1 row (f) gives 0.75 for every action of a bracket or corbel, so ILX Calcs finds 0.450 square inches instead of 0.373. **Effect:** None on this design: the primary steel is governed by the shear-friction requirement. Where flexure governs, ILX Calcs asks for more steel than the worksheet. Test record: CORBEL-AF-PHI: the worksheet uses φ = 0.90 for flexure; ACI 318-19 Table 21.2.1(f) gives 0.75 for every action of a corbel (ILX 0.450 in.²)
CORBEL-VN-800	**Corbel shear limit of older ACI editions** (code edition). MP-CORBEL; 1 row. The Maple Flow corbel worksheet, although labelled ACI 318-19, limits the nominal shear to 800 psi times the width times the depth, the limit of ACI 318-08 and earlier. ACI 318-19 16.5.2.4 limits it to the least of 0.2 f'c, 480 + 0.08 f'c and 1,600 psi; for this 5,000 psi corbel that is 880 psi, so the design limit is 198 kips instead of 180 kips. ILX Calcs uses the 318-19 limit (also tested). ACI MNL-17(21) designs its corbels by strut-and-tie (Strut-and-tie Examples 3 and 4) and does not apply 16.5.2.4. It applies the same three expressions to shear friction under 22.9.4.4 in Diaphragm Example 3 (p. 380): 800 psi at 4,000 psi, where 0.2 f'c and 480 + 0.08 f'c coincide. **Effect:** The program allows about 10 % more shear than the worksheet for this corbel, as ACI 318-19 permits. Test record: CORBEL-VN-800: the worksheet limits Vn to 800 b d (ACI 318-08 and earlier); ACI 318-19 16.5.2.4 gives the least of 0.2f'c, 480 + 0.08f'c and 1,600 psi (198 kips here)

Code	Explanation
CORBEL-AH-ASC	**Closed ties from the required or the provided primary steel** (interpretation). MP-CORBEL; 1 row. ACI 318-19 16.5.5.2 requires closed ties of at least half of the primary tension steel less the axial-force steel, where the primary tension steel is the area of the bars in the corbel. ILX Calcs uses the area provided (1.80 square inches here); the Maple Flow worksheet uses the area required (1.735), so it asks for 0.423 square inches of ties against 0.456. **Effect:** The program asks for up to a few percent more ties than a design based on the required steel (conservative). Test record: CORBEL-AH-ASC: the worksheet takes Asc as the required area; ILX uses the primary reinforcement provided (1.80 in.², Ah = 0.456 in.²), as 16.5.5.2 reads
MDG-12.4-2A-PRINT	**Printing errors in the TMS Masonry Designers' Guide 2022 lintel example** (published value inconsistent). MDG-12.4-2A, MDG-12.4-2A-R; 2 rows. Example 12.4-2A of the Guide (the free sample, written to TMS 402-22) has printed numbers that its own equations do not give. For two No. 4 bars it prints a reinforcement ratio of 0.00092; that is the ratio of the one No. 5 bar tried before them, and two No. 4 bars give 0.00119 (the 2021 TMS handout of the same beam prints 0.00119). In the rework it prints 1,640,000 lb-in. as the nominal moment of four No. 4 bars; by hand the nominal moment is 1,826,000 lb-in. and 0.9 times that is 1,643,000 lb-in., so the printed number is the design strength. Two smaller slips are within the test tolerance or have no effect: the nominal moment of two No. 4 bars is printed as 1,038,000 lb-in. where the arithmetic gives 1,032,000 lb-in., and the page writes 0.007 times the width where it means 0.0007 (its result, 0.0053, is right). ILX Calcs computes the values the equations give. **Effect:** None on designs. The example's conclusions all hold: one No. 5 bar fails the minimum reinforcement, two No. 4 bars pass, and four No. 4 bars in two courses pass the maximum. Test record: MDG-12.4-2A-PRINT: 0.00092 is 1 No. 5 (0.31 in.²) over b d; 2 No. 4 give 0.40/(7.63 × 44) = 0.00119
TMS-RHOMAX-16	**Maximum reinforcement of a beam: the 2016 limit in the older TMS examples** (code edition). SDG-6.3.1.8; 1 row. The TMS strength design beam example (webinar handout, Example 6.3.1.8, TMS 402-16) compares the reinforcement with a maximum ratio of 0.00952, the 2016 rule with the extreme bar at 1.5 times its yield strain. TMS 402-22 replaced it: a beam must be tension controlled, with the net tensile strain at least the yield strain plus 0.003. For Grade 60 bars in concrete masonry at a specified strength of 2,000 psi the limit is 0.00711, the value TMS prints in its 2022 handout and in the 2022 Designers' Guide. ILX Calcs uses the 2022 limit. **Effect:** The largest amount of reinforcement allowed in a beam is about 25 % lower than the 2016 example shows. This example's beam is far below either limit. Test record: TMS-RHOMAX-16: 0.00952 is the TMS 402-16 limit (extreme bar at 1.5 times the yield strain); TMS 402-22 requires a tension-controlled beam, 0.00711 at f'm = 2,000 psi
TMS-2017-VNS-D	**Depth used for the stirrups in the 2017 TMS beam example** (published value inconsistent). TMS-2017-BEAM; 1 row. The 2017 TMS strength design handout finds the stirrup area of its 24 in. deep beam with the effective depth of 20 in. in the steel shear strength, and asks for 0.101 square inches at 8 in. The 2021 TMS handout and the 2022 Designers' Guide use the actual depth of the beam there (48 in. for their 48 in. beam, with 40 in. only in the shear area). ILX Calcs follows the later examples, which gives 0.084 square inches for this beam. The shear area, the masonry shear strength, its upper limit and the steel strength the beam needs all agree with the handout. **Effect:** About 17 % less stirrup area than this one handout asks for, the amount the 2021 and 2022 TMS examples would give. The spacing limits use the same depth. Test record: TMS-2017-VNS-D: the handout takes d = 20 in. in the steel shear strength; the 2021 and MDG-2022 examples use the actual depth (24 in. here), which gives 0.084 in.²

Code	Explanation
TEK17-1D-L57	**Lintel span rounded to 5.7 ft in the NCMA TEK example** (published rounding). TEK-17-1D-1, TEK-17-1D-2; 2 rows. The NCMA TEK 17-1D example finds the effective span of 5.67 ft (5 ft 4 in. plus 4 in.) and then computes its moments and shears with 5.7 ft. ILX Calcs uses 5.67 ft, so the moments are about 1 % lower and the shears about 0.6 % lower than printed; the lintel weight and the span match. **Effect:** None on designs: the difference is the rounding of the published span. Test record: TEK17-1D-L57: the TEK computes with the effective span rounded to 5.7 ft; with 5.67 ft the value is about 1 % lower
TEK17-1D-TRI	**Height of the arching triangle in the NCMA TEK example** (published value inconsistent). TEK-17-1D-1; 4 rows. NCMA TEK 17-1D states that with arching action the lintel carries the wall within a triangle whose base is the effective span and whose height is half of it (2.83 ft in the example). Its worked example instead multiplies the wall weight by 3.5 ft, half the span plus the 8 in. of masonry required above the apex, giving 221 plf at midspan. ILX Calcs follows the text of the TEK: 179 plf at midspan, so the wall moment is 478 lb-ft against 598 lb-ft and the total moment 830 lb-ft against 955 lb-ft. **Effect:** ILX gives a wall load 19 % lower than the TEK example for arching; the engineer who prefers the example's rule can turn arching off for a full-height load or enter the extra wall weight as a load. Test record: TEK17-1D-TRI: the TEK example takes the wall weight over 3.5 ft (half the span plus the 8 in. above the apex) at midspan; ILX takes the 45 degree triangle of the TEK text (height half the effective span, 2.83 ft)
ASCE7-EV-ASD	**Vertical seismic effect in the service deflection combination** (different load combination). FEMA-13.1.5.2-DEV; 1 row. FEMA P-1051 computes the mid-height deflection of the warehouse wall under dead load plus 0.7 times the seismic pressure. ASCE 7-22 2.4.5 also adds 0.7 times the vertical seismic effect, which is 0.14 times the short-period spectral acceleration times the dead load; with the example's 1.43 g the axial load becomes 1.2 times the dead load and the deflection 4.09 in. against FEMA's 3.85 in. Run without the vertical effect, ILX Calcs gives 3.87 in. **Effect:** ILX Calcs reports a larger service deflection when the vertical seismic effect is entered; both exceed the 2.35 in. limit. Test record: ASCE7-EV-ASD: ASCE 7-22 2.4.5 combination 8 carries 1.0D + 0.7Ev + 0.7Eh; with SDS = 1.43 the axial load is 1.2D, which FEMA leaves out
DESTEFANO-2007-BOLT	**Flitch beam bolt value: one yield mode in the published example** (published simplification). DESTEFANO-EX; 2 rows. The design example of DeStefano's flitch plate beam guide (STRUCTURE magazine, June 2007) takes the half-inch bolt value of 945 lb from the side member bearing mode of the NDS double shear equations only. With a steel plate as the middle member the NDS also requires the mode with a plastic hinge in the bolt and crushing of the wood plies, which gives 872 lb and governs. ILX Calcs reproduces the 945 lb value of the bearing mode and uses the least of all the yield modes. **Effect:** The bolt spacing is about 8 % closer and the number of end bolts about 8 % larger than in the example (20.3 in. instead of 21.9 in., 3.54 instead of 3.29 bolts before rounding up): conservative. Test record: DESTEFANO-2007-BOLT: the module's bolt value is the least yield mode (IIIs, 872 lb), the example's is mode Is (945 lb)

Code	Explanation
HUD-2000-HEEL	**Heel joint tension: truss joint in the HUD guide, rafter statics in the program** (published simplification). HUD-7.3; 1 row. Example 7.3 of the HUD Residential Structural Design Guide (2000) finds the tension in the ceiling joist by resolving the rafter's bearing reaction along the rafter axis, as if the rafter were a truss member loaded only at its ends: 1,337 lb. A rafter carries its load along its length, so half of the load reaches the wall as shear in the rafter. Taking moments about the heel gives half of that force, 653 lb for this example, which is the program's value. The published printouts of another program and the nail counts of the IRC table agree with the moment balance. The bearing reaction itself, 652 lb, agrees. **Effect:** The program's tie force and nail count are about half of the example's (the guide itself says its 12 nails exceed conventional practice and suggests other methods). The IRC comparison is shown beside the count. Test record: HUD-2000-HEEL: pinned-joint analysis of the heel takes the whole reaction through the rafter axis; the statics of the rafter pair give half of it
TMS402-22-PHI-COL	**Strength reduction factor of the 2022 edition in a column example** (code edition). TMS21-COL-BAL, TMS21-COL-PN; 2 rows. The TMS 2021 night school column example is written to TMS 402-16, which uses one strength reduction factor of 0.90 for all axial load and flexure. TMS 402-22 Table 9.1.4 sets the factor from the strain in the extreme tension bar: 0.65 when the section is compression controlled, 0.90 when it is tension controlled, and a straight line between. Pure axial load and the balanced point are compression controlled, so ILX Calcs uses 0.65 there. The nominal strengths of the example (axial strength 337.7 kips, balanced axial load 102.6 kips, balanced moment 82.6 kip-ft) match. **Effect:** ILX gives a lower design strength than the example, as the 2022 code requires: design axial strength 219.5 kips against 303.9 kips, and design moment at the balanced point 53.7 kip-ft against 74.36 kip-ft. Test record: TMS402-22-PHI-COL: the handout uses the flat φ = 0.90 of TMS 402-16; TMS 402-22 Table 9.1.4 gives φ = 0.65 for pure axial compression: 219.5 kips
TMS402-22-PHI-OOP	**Strength reduction factor of the 2022 edition in an out-of-plane wall example** (code edition). FEMA-13.1.5.2-IT; 1 row. FEMA P-1051 Section 13.1.5.2 is written to TMS 402-13, which uses one strength reduction factor of 0.90 for all axial load and flexure. TMS 402-22 Table 9.1.4 sets the factor from the strain in the tension bar. For the warehouse wall under 1.486 times the dead load that strain is 0.00478, just inside the transition region (the factor reaches 0.90 at 0.00507), so ILX Calcs uses 0.876. The nominal moment strength of the example (65.35 kip-in. per foot) matches, and under 0.614 times the dead load the factor stays 0.90 and the design strength matches. **Effect:** ILX gives a design moment strength 2.6 % lower than the example: 57.3 against 58.8 kip-in. per foot. With the iterative moment of 58.2 kip-in. per foot the wall passes in the example and is now 1.5 % over; with the moment magnifier it is over in both. Test record: TMS402-22-PHI-OOP: FEMA uses the flat φ = 0.90 of TMS 402-13; at Pn = Pu/φ the strain is 0.00478, in the transition region of TMS 402-22 Table 9.1.4: φ = 0.876, φMn = 57.3 in.-kip/ft
TMS402-22-GG-WALL	**Partially grouted wall factor changed in the 2022 code** (code edition). FEMA-13.2-W1, FEMA-13.2-W5, TMS-2017-ORD, TMS-SD-2, TMS-SD-3; 9 rows. The FEMA and TMS shear wall examples were written to the 2013 and 2016 codes, which multiply the shear strength of a partially grouted wall by 0.75. TMS 402-22 uses 0.70, so the program gives 6.7 percent less than these examples for the same wall. **Effect:** Shear strength of partially grouted walls is 6.7 percent lower than these older examples, which is conservative and follows the current code. Fully grouted walls are unchanged. Test record: TMS402-22-GG-WALL: the example predates 402-22 and uses γg = 0.75 on a partially grouted wall; 402-22 uses 0.70 (Eq. 9-15), so ILX is 6.7 % lower

Code	Explanation
SP17-ROUNDED-INTERACTION	**Tension and shear interaction of two anchor examples** (published value rounded). MNL-17 Anch-12, SP-17 Anch-10, SP-17 Anch-11; 3 rows. ACI SP-17(14) Anchorage Examples 10 and 11 add the tension and shear ratios using capacities they first round down to the nearest 100 lb (4,100 and 2,500 lb in Example 10, 3,900 and 2,500 lb in Example 11), and they print 1.05 and 1.08. The same sums with the capacities they calculated before rounding are about 1.03 and 1.06. **Effect:** ILX Calcs does not round the capacities, so it reports a sum about 2 % lower than the printed one. Every capacity in the two examples agrees within 1 %, and both designs pass in the example and in ILX Calcs. Test record: SP17-ROUNDED-INTERACTION: the example adds ratios of capacities rounded down to 4,100 and 2,500 lb
DG34-FIG-SELFWEIGHT	**Reactions on the landing post and hanger of the Design Guide 34 stair** (published value inconsistent). DG34-10.1.5, DG34-10.1.6; 4 rows. AISC Design Guide 34 Examples 10.1.3 and 10.1.4 add the 15.3 lb/ft beam self-weight into their factored line loads and print beam reactions of 5.90 and 1.80 kips, but Figures 10-5 and 10-6 leave it out of the dead load (0.0677 kip/ft is the landing load alone). Examples 10.1.5 and 10.1.6 then size the post and hanger from those figures: 5.82 and 1.71 kips, 3.98 and 1.15 kips in ASD. ILX Calcs keeps the self-weight and gives the printed beam reactions: 5.90 and 1.80 kips, 4.04 and 1.22 kips in ASD. **Effect:** The program's post and hanger loads are 1 to 6 % higher than the example, on the safe side. The strengths match. Test record: DG34-FIG-SELFWEIGHT: Figures 10-5 and 10-6 leave the beam self-weight out of the reactions the post and hanger take
DG11-CHART	**Velocity read from a chart in Design Guide 11 Example 6.3** (chart reading). DG11-6.3-VS; 1 row. AISC Design Guide 11 Example 6.3 reads the response from its Figure 6-15 to two digits and rounds it (290 mips for very slow walking). The program evaluates the Guide's Equation 6-3, the curve behind the figure. **Effect:** The program is about 4 % lower than the chart reading at very slow walking. It meets the same limit in the same way. Test record: DG11-CHART: the Guide reads V W from its Figure 6-15 to two digits; the program evaluates Equation 6-3, the curve behind the figure
DG34-SEISMIC-SPAN	**Lateral moment on a sloped stair stringer** (different permitted method). DG34-10.2.3; 3 rows. AISC Design Guide 34 Example 10.2.3 applies the seismic force per foot on plan and takes the lateral bending moment over the 14.7 ft span on plan: 0.540 kip-ft, or 0.284 kip-ft in ASD. Out of plane, the member spans its sloped length, 17.4 ft, and the total force is the same, so ILX Calcs multiplies the moment by the slope ratio 1.185 and gets 0.622 and 0.327 kip-ft. The interaction goes from 0.119 to 0.125 in LRFD, and from 0.123 to 0.127 in ASD. **Effect:** The program is about 19 % higher on this moment, on the safe side, and a little higher on the interaction. The example passes either way. Test record: DG34-SEISMIC-SPAN: the guide takes the lateral moment on the span on plan; the member spans its sloped length, which the program uses
AISC-XBAR-INTERP	**Weld group centroid read from the Manual table in two Design Examples** (published value rounded by interpolation). II.A-29, II.A-2B; 2 rows. Examples II.A-2B and II.A-29 interpolate the centroid distance in the x-bar row of the Manual table: 0.0269 and 0.0456. The centroid is a closed-form property of the lines, and it gives 0.0261 and 0.0449. The row is curved, so a straight line between tabulated k values sits above it. **Effect:** The centroid is 2 % to 3 % less than the example's, about 0.01 in. here. The coefficient C and the strength of both examples still match within tolerance. Test record: AISC-XBAR-INTERP: the example interpolates x-bar in the table; the exact centroid is 2 to 3 % less

Code	Explanation
AISC8-11A-75	**Manual Table 8-11a at 75 degrees, small eccentricity** (published value not explained). Table 8-11a 75 k1.2 a0.1 (deviation); 1 row. On the 75 degree page of Table 8-11a, the cells at a = 0.10 and 0.15 from k = 0.8 up are the same as the concentric row of the page, while the instantaneous center method gives 1.1 % to 1.6 % more. Other pages of the tables do go above their concentric row, so this is not a general cap, and the Manual does not explain it. Eleven cells. **Effect:** The program is up to 1.6 % above the table for those cells. The program solves the method as the Manual describes it, and shows the table value beside its own. Test record: AISC8-11A-75: printed value equals the a = 0 row; the method gives more
AISC8-10-0	**Manual Table 8-10 at 0 degrees, k = 2.0, a = 0.10** (published value not explained). Table 8-10 0 k2.0 a0.1 (deviation); 1 row. The table prints 7.10. The instantaneous center method has one solution at this cell, 7.19. The concentric row of the page is 7.15, so the concentric strength does not explain the printed value either. **Effect:** The program is 1.3 % above the table for this cell and shows the table value beside its own. Test record: AISC8-10-0: one solution at 7.19 against the printed 7.10, not explained
AISC8-4-K2	**Manual Table 8-4 at 0 degrees, k = 2.0, three cells** (published value not explained). Table 8-4 0 k2.0 a2.4 (deviation); 1 row. At a = 0.70, 2.4 and 2.6 the table prints 2.45, 1.24 and 1.17, and the method gives 2.43, 1.23 and 1.16. The Manual builds its tables with a convergence criterion of 0.5 %, and these cells are just past 1 %. Both machine reads of the page agree on the printed values. **Effect:** The program is 1.0 % to 1.1 % below the table for those cells, on the safe side. Test record: AISC8-4-K2: printed value 1 % above the method at the edge of the table
SP17-E14-PRYOUT	**Pryout area of a stud group** (published simplification). MNL-17 Anch-17, SP17-E14; 3 rows. ACI SP-17(14) Anchorage Example 14 takes the pryout strength of a group of eight studs from the breakout area of its top row alone. ACI MNL-17(21) Anchorage Example 17 (Vol. 2 pp. 400 and 403), the same plate, does the same (1,233 square inches, 121,482 lb), and says itself that all studs welded to the plate resist the shear and that assigning it to the top row is conservative. **Effect:** ILX Calcs uses the area of the whole group, as Chapter 17 reads for a welded group. Its pryout strength is higher than printed. Pryout does not govern this example. Test record: SP17-E14-PRYOUT: the example takes the breakout area of the top row alone; ACI and this type use the studs in the group
SP17-STM-PHI	**An older strength reduction factor in a deep beam limit** (different method). MNL-STM1, SP17-STM1; 2 rows. ACI SP-17(14) Strut-and-Tie Example 1 prints the limit on the shear of a deep beam with a factor of 0.85, the value of older codes. ACI 318-14 and 318-19 have 0.75 for shear. ACI MNL-17(21) Strut-and-tie Example 1 (Vol. 2 p. 210) still prints 0.85 (1,064 kips). **Effect:** ILX Calcs uses 0.75, so its limit is about 12 % lower than printed. The example's shear is far under either limit. Test record: SP17-STM-PHI: the example multiplies by 0.85, the factor of older codes; 318-14 and 318-19 have 0.75
SP17-STM-BETAS	**Strut factor without distributed steel** (code edition). SP17-STM1-B; 1 row. The example is to ACI 318-14, where an interior strut without distributed steel takes a factor of 0.6. ACI 318-19 Table 23.4.3(a) lowered this to 0.4. ACI MNL-17(21) Strut-and-tie Examples 1 to 3 (Vol. 2 pp. 204, 214 and 228) list 0.4 for an interior strut without the minimum distributed steel, as Table 23.4.3(a) does. **Effect:** ILX Calcs follows 318-19, so this strut's strength is one third lower than the older figure. With the distributed steel both editions give 0.75 and the values agree. Test record: SP17-STM-BETAS: 318-14 has 0.6 here; 318-19 Table 23.4.3(a) has 0.4

Code	Explanation
DESTM-X	**Depth of the node used for a tie's anchorage** (different method). DE-STM; 1 row. StructurePoint DE-STM measures the extended nodal zone from a tie node 13.4 in. deep, worked out from a stress. Here the node depth is the 10 in. the engineer entered, as the same example assumes at the start. **Effect:** The extended zone is 8.0 in. here against 10.7 in. printed, which is on the safe side for anchorage. The forces do not change. Test record: DESTM-X: the example uses a tie node 13.4 in. deep from its own stress; here wt is the entered 10 in., giving 8.0 in.
SP17-E14-PULLOUT	**Pullout factor of a cast-in stud** (code edition). MNL-17 Anch-17, MNL-17 Anch-19, SP17-E14; 3 rows. ACI SP-17(14) Anchorage Example 14 uses a strength reduction factor of 0.75 for pullout, the value ACI 318-14 gives with supplementary reinforcement. ACI 318-19 Table 17.5.3(c) has 0.70 for cast-in anchors. ACI MNL-17(21) Anchorage Example 17 (Vol. 2 pp. 399 and 403) still takes 0.75 for pullout and pryout because supplementary reinforcement is present. ACI 318-19 Table 17.5.3(c) gives pullout and pryout of cast-in anchors 0.70 with no case for supplementary reinforcement. **Effect:** ILX Calcs follows 318-19: its design pullout strength is about 7 % lower than printed. Pullout does not govern this example. Test record: SP17-E14-PULLOUT: 318-14 has 0.75 here with supplementary reinforcement; 318-19 Table 17.5.3(c) has 0.70
SP17-E14-LE	**Load-bearing length of a stud in shear** (published value inconsistent). SP17-E14; 3 rows. ACI SP-17(14) Anchorage Example 14 takes the load-bearing length of the stud as its full embedment when it finds the basic shear breakout strength. The code limits that length to 8 stud diameters, 5 in. for this stud. ACI MNL-17(21) Anchorage Example 17 (Vol. 2 p. 402), the 2021 version of this example, applies the limit (5 in.) as ILX Calcs does; there the 9 root f'c times ca1 to the 1.5 expression governs, 99,386 lb. **Effect:** ILX Calcs applies the limit, so its shear breakout strength is about 6 % lower than printed and the interaction of tension and shear about 4 % higher. The design is still adequate. Part of the difference is not the length limit: for welded studs ILX Calcs uses the coefficient 7 of 17.7.2.2.1 where 17.7.2.2.2 permits 8 under its conditions (see MNL17-A17-VB), which is conservative. Test record: SP17-E14-LE: the example takes le = hef in Vb, past the limit of 8 da
TEK-15-07B-ARM	**Lever arm of the masonry in a retaining wall example** (apparent error in the publication). TEK-15-07B; 7 rows. CMHA TEK 15-07B puts the masonry stem's weight 2.67 ft from the toe, the footing's centre. Its own drawing gives 1.67 ft of toe plus half of a 0.97 ft wall, 2.15 ft. It then adds a resisting moment of 16,194 ft-lb/ft but divides 14,670 by the overturning moment for its factor of safety. **Effect:** ILX Calcs takes the geometry: resisting moment about 15,620 ft-lb/ft, factor of safety 2.62 where the note prints 2.4, resultant 2.06 ft from the toe where it prints 2.18 ft, toe pressure 1,481 psf where it prints 1,356 psf, heel pressure 280 psf where it prints 404 psf. The design conclusion, resultant in the middle third and pressure below 2,000 psf, holds either way. Test record: TEK-15-07B-ARM: the note puts the masonry weight at the footing centre, 2.67 ft from the toe; the geometry it draws gives 2.15 ft, and ILX takes the geometry
TEK-15-07B-KEY	**The key's own weight in a retaining wall example** (published simplification). TEK-15-07B-KEY; 2 rows. CMHA TEK 15-07B turns the average bearing pressure into a soil depth to find the pressure on the key, with the wall's weight before the key was added. **Effect:** ILX Calcs includes the key's weight, about 200 lb per foot, so its pressures are about 4 % higher: 1,148 and 1,347 psf where the note prints 1,100 and 1,300 psf. This option is off by default. Test record: TEK-15-07B-KEY: the note leaves out the key's own weight when it finds the average bearing pressure

Code	Explanation
MDG-17.2-5-ARITH	**Second-order moment in a Masonry Designers' Guide example** (apparent error in the publication). MDG-17.2-5; 1 row. The Masonry Designers' Guide 2022, Example 17.2-5, writes the second-order moment of a cantilever correctly, then drops the 5 from the denominator when it substitutes numbers, and prints 22,710 lb-in. per foot. **Effect:** The Guide's own equation with its own numbers gives 21,464 lb-in. per foot, about 5 % lower, and ILX Calcs uses the equation. The example's GFRP bars are not part of this calculation; only the equation transfers. Test record: MDG-17.2-5-ARITH: the printed substitution drops the 5 from the denominator of the example's own equation
F.8B-Se	**Design Example F.8B, slender flange of a square HSS** (simplification in the source). F.8B; 2 rows. The Example removes the ineffective width from both flanges, which it says is a simpler and conservative way to get the effective section modulus. The Specification's own method removes it from the compression flange only and lets the neutral axis move, and the program does that. **Effect:** The program is 1.9 % above the Example, 46.3 against 45.4 kip-ft LRFD, 30.8 against 30.2 kip-ft ASD. The effective width itself agrees. Test record: F.8B-Se: Example F.8B takes the simpler, conservative section with the ineffective width removed from both flanges (Se = 12.1 in.3); ILX removes it from the compression flange and shifts the neutral axis, as F7.2(c) says (Se = 12.3 in.3)
F.11B-LLB	**Design Example F.11B, leg local buckling of an angle restrained at midspan** (simplification in the source). F.11B · Steel beam; 2 rows. The Example reuses the leg local buckling strength of Example F.11A, which has the 0.80 reduction for an angle without restraint, and says this is conservative because the angle here is restrained at midspan. The Specification applies the reduction only without restraint, and the program follows it. Lateral-torsional buckling then governs, and that value agrees with the Example's 5.53 kip-ft. **Effect:** The program gives 4.97 kip-ft LRFD against the Example's 3.98, and 3.31 against 2.65 ASD. The Example itself states its value is on the safe side. Test record: F.11B-LLB: Example F.11B reuses the leg local buckling of F.11A with 0.80 Sc and says it is conservative; F10.3 applies 0.80 only without lateral-torsional restraint, so ILX gives the lateral-torsional buckling limit, 5.53 kip-ft
CFSZ-LCR	**Distortional half-wavelength of a Z-section** (computed from the printed equations). MBMA-3311-FLEX; 2 rows. The MBMA Guide reads the half-wavelength of the Z-sections from a table in the AISI Design Manual: 21.7 and 25.4 in. The Specification's equation with its table of mid-line flange properties, which leaves out the corner radii, gives 22.1 and 25.8 in. here, about 2 percent longer. On the C-sections of the same Guide the same equation lands on the printed values, so the difference is in how the Manual treats the sloped lip, which the paid Manual would show. **Effect:** None that matters on strength: the distortional buckling stress at this length lands within 0.3 percent of the Guide's 51.1 and 32.5 ksi. Test record: CFSZ-LCR: the half-wavelength comes from the Table 2.3.1.3-1 mid-line equations; the Design Manual prints a shorter value
CFSZ-KWG	**Web geometric stiffness of a Z-section** (computed from the printed equations). MBMA-3311-FLEX; 2 rows. The web's geometric rotational stiffness depends on the half-wavelength above, so it differs from the printed 0.00259 and 0.00132 by about 2 to 4 percent. **Effect:** It is a small part of the denominator: the buckling stress still lands on the printed value. Test record: CFSZ-KWG: the web's geometric stiffness at that half-wavelength; Fcrd still lands on the printed value

Code	Explanation
CFSZ-LY	**Inflection point in the MBMA Guide's four span example** (analysis rounding). MBMA-3311-FLEX; 3 rows. The Guide's moment diagram puts the inflection points about 0.04 ft nearer the lap ends than this analysis of the same line does, within the 0.05 ft a printed diagram can hide. Every printed moment, shear and reaction agrees within 1 percent. The lateral-torsional buckling stress goes with the inverse square of this length and with 1.67 where the equation gives 5/3, so it reads up to 3 percent lower. **Effect:** None: both buckling stresses are far over the limit where the flexural stress equals the yield stress. Test record: CFSZ-LY: the inflection point of this analysis against the printed diagram; the strength is unaffected
CFSZ-FCRE-C	**Torsional stress of a C-section in the MBMA Guide** (published slip). MBMA-3322; 1 row. MBMA Example 3.3.2.2 computes the torsional buckling stress with the polar radius of gyration to the first power, 452 ksi. The Specification squares it, which gives about 116 ksi, so the elastic stress here is 262 ksi against the printed 542 ksi. The example also prints a polar radius of 5.26 in. that it does not use. **Effect:** None on this example's strength: both are well over the limit where the flexural stress equals the yield stress. On longer unbraced lengths the printed form would overstate the strength; this calculation follows the Specification. Test record: CFSZ-FCRE-C: the example leaves the square off the polar radius in the torsional stress
CFSZ-W16	**LRFD wind factor in the MBMA Guide** (different load combination). MBMA-3322; 2 rows. MBMA Example 3.3.2.2 takes 0.9 dead plus 1.6 wind for LRFD uplift. It names ASCE 7-16, whose wind load factor is 1.0, and the Guide's own ASD examples use 0.6 wind, which is the same basis as 1.0. This calculation uses ASCE 7-22, 0.9 dead plus 1.0 wind. **Effect:** The example's uplift moments are 4.83 and 2.10 kip-ft; here they are 2.76 and 1.20 kip-ft on the wind as printed. Entered as 1.6 times the printed wind, the calculation lands on the printed moments, which a separate row shows. The strength side agrees. Test record: CFSZ-W16: the example takes 1.6W; ASCE 7-22 takes 1.0W
AISC-E14A-ROUND	**Slenderness rounded in a single-angle example** (published value rounded). E.14A; 1 row. AISC Design Example E.14A rounds the modified slenderness of the L5x3x1/2 up to 127 before finding the buckling stress. Unrounded it is 126.6. **Effect:** ILX Calcs does not round, so its design strength is 52.8 kips where the Example prints 52.3 kips, about 1.05 % higher. The allowable strength agrees within 1 %. Test record: AISC-E14A-ROUND: the Example rounds Lc/r up to 127
VUL-WC	**Deck web crippling on another maker's web geometry** (input not in the source). VUL-EX; 2 rows. The Vulcraft catalog prints allowable reactions for its 1.5PLB22 deck but not the bend radius or web angle behind them. This comparison uses those of Verco's PLB-36, 22 gage, a similar deck of the same group. **Effect:** ILX Calcs gives 911.8 and 1,344 lb per foot where the catalog prints 897 and 1,325, about 1.5 % higher, on the unsafe side of the printed values. The ratio between bearing lengths matches the catalog. When your manufacturer prints its reactions, enter those values instead of the geometry. Test record: VUL-WC: the catalog prints no radius or web angle; those of another maker's similar deck
VUL-V	**Deck web shear against a catalog value** (input not in the source). VUL-EX; 1 row. The Vulcraft catalog prints an allowable web shear of 2,825 lb per foot for its 1.5PLB22 deck, without the web's geometry or how the value is reached. This comparison uses Verco's web geometry and the S100-16 safety factor of 1.60. **Effect:** ILX Calcs gives 2,651 lb per foot, about 6 % lower, on the safe side. The same equations reproduce the nominal shear Verco's IAPMO report prints for four gages. Test record: VUL-V: the catalog's web geometry is not printed, and it does not print how its value is reached

Code	Explanation
MNL17-C4-VN	**Joint coefficient of a special moment frame in the 2021 handbook** (an error in the publication). MNL-C4; 2 rows. ACI MNL-17(21) Columns Example 4 (p. 426) checks a special moment frame joint under Table 18.8.4.3 but takes the coefficient 20, the value of Table 15.4.2.3 for a continuous column and beam without confining transverse beams. Table 18.8.4.3 gives 15 for that joint. The same line prints 0.85 times 814 as 610 kips; the product is 692. **Effect:** ILX Calcs uses 15: 611 kips nominal and 519 kips design strength, 25 percent below the printed nominal value, on the conservative side. The joint still passes (424 kips). Test record: MNL17-C4-VN: the 2021 handbook takes the Table 15.4.2.3 coefficient 20 for a special moment frame joint; Table 18.8.4.3 gives 15 for a continuous, unconfined joint
MNL17-F1-RHO	**One-way shear of a footing with the minimum steel ratio** (published simplification). MNL-F1; 1 row. ACI MNL-17(21) Foundation Example 1 (p. 480) sizes the footing for one-way shear with a steel ratio of 0.0018, the minimum flexural steel, which gives a design strength of 208 kips, and keeps that check after choosing 13 No. 8 bars each way. ILX Calcs uses the bars provided, a ratio of about 0.0023 at the upper layer. **Effect:** ILX Calcs' strength is about 9 percent higher than the printed estimate, as the steel provided gives. The factored shear matches and the footing passes either way. Test record: MNL17-F1-RHO: the handbook estimates ρw as 0.0018; ILX Calcs uses the 13 No. 8 bars provided
MNL17-F2-QU	**Factored pressure on a width other than the footing's** (published value inconsistent). MNL-F2; 2 rows. ACI MNL-17(21) Foundation Example 2 (p. 490) divides the factored load of 50 kips per foot by 9.5 ft to print 5.26 ksf, then uses that pressure on the 10 ft footing it adopts, for the moment of 53.3 kip-ft per foot. On 10 ft the pressure is 5.0 ksf. Its first shear equation (p. 491) gives the printed d of 23.2 in. only with 5.0 ksf, and its second does not give the printed 18.1 in. with either pressure (about 20.6 in. with 5.0 ksf). **Effect:** ILX Calcs gives 5.0 ksf and 50.6 kip-ft per foot, 5 percent below the printed values, as the adopted width gives. With the thickness and bars the example adopts (24 in., No. 8 at 12 in., d = 20.5 in.), ILX Calcs finds the one-way shear about 1 percent over the strength (13.96 against 13.77 kips per foot), which the handbook does not check. Test record: MNL17-F2-QU: the handbook divides 50 kips per foot by 9.5 ft (5.26 ksf) and uses it on the 10 ft footing; 10 ft gives 5.0 ksf
MNL17-F2-H20	**Minimum steel on an earlier trial thickness** (published value inconsistent). MNL-F2; 1 row. ACI MNL-17(21) Foundation Example 2 (p. 492) takes the minimum flexural steel as 0.0018 times 12 in. times 20 in., and the strain check with d = 16.5 in., both from a 20 in. thickness, while the footing it adopts and details is 24 in. thick with d = 20.5 in. **Effect:** ILX Calcs uses the 24 in. thickness: 0.52 square inches per foot instead of 0.43. The No. 8 bars at 12 in. (0.79) satisfy both. Test record: MNL17-F2-H20: the handbook takes 20 in. (an earlier trial thickness) for As,min; the adopted footing is 24 in.
MNL17-RW-HEEL	**Heel loads** (different method). MNL17-RW2, MNL17-RW3, MNL17-RW4, MNL17-RW5, MNL17-RW6; 10 rows. ACI MNL-17(21) Retaining Walls Examples 2 to 6 design the heel for the soil weight times 1.6 and the heel weight times 1.2 and ignore the soil pressure pushing up under the heel. ILX Calcs uses the base pressure from the factored loads of each ASCE 7 combination and treats the soil over the heel as dead load. **Effect:** ILX Calcs' heel moment and shear are lower than the handbook's. Both are statics on a stated load model; the handbook's is the more conservative. Test record: MNL17-RW-HEEL: the handbook loads the heel with the soil (factored 1.6) and its own weight and neglects the base pressure under it; the program takes the factored base pressure of each ASCE 7 combination up and the soil weight as dead load

Code	Explanation
MNL17-RW-TOE	**Toe base pressure** (different method). MNL17-RW2, MNL17-RW4; 3 rows. ACI MNL-17(21) Retaining Walls Examples 2 and 4 multiply the service base pressure by 1.6 for the toe. ILX Calcs works out the base pressure from the factored loads of each ASCE 7 combination; 0.9D + 1.6H governs. **Effect:** ILX Calcs' toe moment and shear are about 5 to 10 percent lower. Test record: MNL17-RW-TOE: the handbook factors the service base pressure by 1.6; the program finds the base pressure from the factored loads of each ASCE 7 combination (0.9D + 1.6H governs)
MNL17-RW1-COMBO	**Load combination for the basement wall moment** (different load combination). MNL17-RW1; 1 row. ACI MNL-17(21) Retaining Walls Example 1 multiplies the whole service span moment by 1.6, including the end moment from the slab dead and live load, which reduces the span moment. ILX Calcs checks the ASCE 7 combinations, and 0.9D + 1.6H with no live load reduces it less. **Effect:** ILX Calcs' moment is higher, about 4.0 against 3.76 kip-ft per foot (conservative). Test record: MNL17-RW1-COMBO: the handbook multiplies the whole service span moment (soil less the relieving end moment from the dead and live slab load) by 1.6; the program checks the ASCE 7 combinations, and 0.9D + 1.6H with no live load relieves less (about 4.0 kip-ft/ft, with the 6.6.4 magnifier near 1.01)
MNL17-RW1-NU	**Axial load in out-of-plane shear** (different method). MNL17-RW1; 2 rows. ACI MNL-17(21) Retaining Walls Example 1 takes the axial load as zero in the shear strength. ILX Calcs adds Nu/(6Ag) for the factored axial load at the section, as Table 22.5.5.1(c) permits. **Effect:** ILX Calcs' Vc is about 5 percent higher. Test record: MNL17-RW1-NU: the handbook takes Nu = 0 (conservative); the program adds Nu/(6Ag) of the factored axial load at the section (Table 22.5.5.1(c))
MNL17-RW2-SUMV	**Misprint in the revised summary** (misprint in the publication). MNL17-RW2; 1 row. ACI MNL-17(21) Retaining Walls Example 2 prints a stem shear strength of 17,500 lb in the summary of the revised design. The stem and its bars did not change, and the handbook's own calculation gives 9.90 kips. **Effect:** None; ILX Calcs matches 9.90 kips. Test record: MNL17-RW2-SUMV: the summary of the revised design prints φVn = 17,500 lb for the stem; the stem and its bars did not change and p. 46 gives 9.90 kip (misprint)
MNL17-RW3-KA	**Earth pressure coefficient for a sloped backfill** (an error in the publication). MNL17-RW3; 5 rows. ACI MNL-17(21) Retaining Walls Example 3 uses the level-ground Rankine coefficient, 0.282, for a 10 degree backfill slope. Rankine's coefficient for a sloped backfill is 0.294. **Effect:** ILX Calcs' lateral force and overturning moment are about 4 percent higher and its factors of safety lower; at 0.294 the handbook's wall does not reach a factor of safety of 1.5 against sliding. Test record: MNL17-RW3-KA: the handbook uses the level-backfill Rankine coefficient $(1 - \sin\varphi)/(1 + \sin\varphi) = 0.282$ for the 10° slope; Rankine for a sloped backfill gives $\cos\beta\,(\cos\beta - \sqrt{(\cos^2\beta - \cos^2\varphi)})/(\cos\beta + \sqrt{(\cos^2\beta - \cos^2\varphi)}) = 0.294$
MNL17-RW3-STEM	**Stem pressure height with a sloped backfill** (different method). MNL17-RW3; 1 row. ACI MNL-17(21) Retaining Walls Example 3 applies its pressure over 14.84 ft, the height of the plane through the heel less the footing, to a 14 ft stem. ILX Calcs applies the Rankine pressure measured from the top of the stem. **Effect:** ILX Calcs' stem moment is about 25.5 against 29.0 kip-ft per foot; the handbook's is a conservative simplification. Test record: MNL17-RW3-STEM: the handbook applies Ca = 0.282 over 14.84 ft (the height of the plane through the heel less the footing) to the 14 ft stem; the program applies the sloped-backfill Rankine pressure from the top of the stem

Code	Explanation
MNL17-B1-EPS	**Tension strain in Beam Example 1 Table 1.2** (published value inconsistent). MNL17-B1+, MNL17-B1-I+; 2 rows. ACI MNL-17(21) Beam Example 1 lists net tensile strains for the positive-moment sections that do not follow from the stress block depths printed in the same table. For five No. 7 bars, a = 0.35 in. and c = a/0.8 = 0.44 in. give 0.003(27.5 - 0.44)/0.44 = 0.184, where the table prints 0.166; for four No. 7 bars the strain is 0.230 against 0.208. ILX Calcs computes the strain from the neutral axis depth. **Effect:** ILX Calcs' strains are about 10 percent higher. Both are far above 0.005, so the sections are tension-controlled either way. Test record: MNL17-B1-EPS: the handbook's tabulated positive-moment strains do not follow from its own a and β1 (306 ft-kip: a = 0.35 in., c = 0.44 in., εt = 0.003(27.5 − 0.44)/0.44 = 0.184, printed 0.166)
MNL17-B1-CC	**Crack-control bar spacing with the cover rounded** (published value rounded). MNL17-B1-cc; 1 row. ACI MNL-17(21) Beam Example 1 takes the clear cover to the No. 7 bars as 2 in. in the Table 24.3.2 spacing limit. With 1.5 in. cover and No. 3 stirrups the cover is 1.875 in., which gives 15(40,000/40,000) - 2.5(1.875) = 10.3 in. **Effect:** ILX Calcs allows 10.3 in. against the handbook's 10 in. The bars provided are much closer than either. Test record: MNL17-B1-CC: the handbook rounds cc = 1.5 + 0.375 = 1.875 in. up to 2 in.; 15(40/40) − 2.5(1.875) = 10.3 in.
MNL17-B4-VSEC	**Section size limit for shear in Beam Example 4** (apparent error in the publication). MNL17-B4; 1 row. ACI MNL-17(21) Beam Example 4 writes the limit of Eq. 22.5.1.2 as 0.75(70.3 kips + 8 times root f'c bw d) but prints 211 kips, which is 0.75 times the second term alone. With Vc included the limit is 0.75(70.3 + 281.1) = 263.6 kips. **Effect:** ILX Calcs' limit is 263.6 kips. The factored shear of 47 kips is far below either value. Test record: MNL17-B4-VSEC: the handbook drops Vc from φ(Vc + 8√f'c bw d); 0.75(70.3 + 281.1) = 263.6 kips
MNL17-B4-ALMIN	**Minimum longitudinal torsion steel uses the required At/s** (different method). MNL17-B4; 1 row. In 9.6.4.3(a), ACI MNL-17(21) Beam Example 4 uses the At/s of the stirrups provided (two No. 4 legs at 10 in., 0.02 in.2/in.). ILX Calcs uses the At/s required for torsion (0.0071 in.2/in.), so 9.6.4.3(a) gives 3.55 in.2 and the lesser value, (b), is 3.52 in.2. The handbook gets 2.49 in.2. **Effect:** ILX Calcs asks for about 1 in.2 more longitudinal torsion steel in this example (conservative). Test record: MNL17-B4-ALMIN: the handbook puts the provided At/s = 0.02 in.²/in. in 9.6.4.3(a); the program uses the required At/s = 0.0071 in.²/in., so (b) governs at 3.52 in.²
MNL17-B9-ALMIN	**Minimum longitudinal torsion steel in Beam Example 9** (apparent error in the publication). MNL17-B9; 1 row. ACI MNL-17(21) Beam Example 9 copies the 9.6.4.3 calculation from Example 8, including Example 8's At/s of 0.0324 in.2/in. With this example's reduced torsion, At/s is 0.0199 in.2/in., and 9.6.4.3(a) gives 2.26 - 0.0199 x 66 = 0.95 in.2, not 0.12 in.2. **Effect:** ILX Calcs' minimum is 0.95 in.2 against the handbook's 0.12 in.2. The 1.32 in.2 required by Eq. 22.7.6.1b still governs, so the design does not change. Test record: MNL17-B9-ALMIN: the handbook reuses Example 8's At/s = 0.0324 in.²/in. in 9.6.4.3(a); with this example's 0.0199 in.²/in. (a) = 2.26 − 1.32 = 0.95 in.²
MNL17-D2-IE	**Effective moment of inertia for dead plus live load in Deflection Example 2** (apparent error in the publication). MNL17-D2; 1 row. ACI MNL-17(21) Deflection Example 2 says it takes Ie for dead plus live load from Example 1 (11,100 in.4) but divides by 11,400 in.4, the dead-load value. With 11,100 in.4 its own numbers give a total deflection of 1.28 in. and a live load deflection of 0.43 in. instead of 0.4 in. ILX Calcs computes Ie for each load level by Table 24.2.3.5. **Effect:** ILX Calcs' live load deflection is 0.42 in. against the handbook's 0.4 in. (conservative). Test record: MNL17-D2-IE: Example 2 divides by the dead-load Ie = 11,400 in.⁴ for D + L instead of 11,100 in.⁴ from Example 1; with 11,100 its own numbers give 1.28 − 0.84 = 0.43 in.

Code	Explanation
MNL17-D7-KCRT	**Negative-moment cracking moment of a T-section read from a chart** (published value rounded). MNL17-D7-; 1 row. ACI MNL-17(21) Deflection Example 7 reads the T-section factor Kcrt = 2.3 for negative moment from Design Aid 13.3.1. Calculated directly, fr Ig/yt of the section gives Kcrt = 2.39 and Mcr = 402 ft-kip, against the handbook's 387 ft-kip. The positive-moment value agrees (229 ft-kip). **Effect:** ILX Calcs' negative-moment Mcr is about 4 percent higher; the difference is the chart reading. Test record: MNL17-D7-KCRT: the handbook reads Kcrt = 2.3 from Design Aid 13.3.1; fr Ig/yt of the section gives Kcrt = 2.39 and Mcr = 402 ft-kip
MNL17-C1-CM	**Cm rounded before the magnifier** (rounding in the publication). MNL17-C1; 2 rows. ACI MNL-17(21) Columns Example 1 (p. 401) rounds Cm = 0.6 - 0.4(1962/2634) = 0.302 to 0.30 and then computes δ = 1.07 and Mc = 2,820 kip-in. (p. 402). With 0.302 the magnifier is 1.08 and Mc is 2,849 kip-in. **Effect:** ILX Calcs' δ and Mc are about 1 percent higher than printed, on the conservative side. Pc (1,460 kips) and (EI)eff agree. Test record: MNL17-C1-CM: the handbook rounds Cm = 0.6 − 0.4(1962/2634) = 0.302 to 0.30 before dividing; with 0.302, δ = 0.302/(1 − 789/(0.75 × 1460)) = 1.08 and Mc = 2,849 kip-in.
MNL17-C34-MN	**Nominal moments from the handbook's spreadsheet at the lower axial load** (a value the publication does not explain). MNL17-C3, MNL17-C4; 2 rows. ACI MNL-17(21) Columns Examples 3 (p. 414) and 4 (p. 420) print Mn from the interaction diagram spreadsheet. At the higher axial loads (848 and 872 kips) strain compatibility of the stated bars agrees within 1 percent. At the lower loads the printed 7,994 and 8,380 kip-in. are not reproduced: a hand calculation at Pn = Pu gives 7,765 and 7,842 kip-in., as ILX Calcs does. **Effect:** ILX Calcs' nominal moments at the lower loads are 2.9 and 6.9 percent below the printed values (conservative). Test record: MNL17-C34-MN: strain compatibility at Pn = Pu (checked by hand) gives 7,765 kip-in. (Example 3, 456 kips) and 7,842 kip-in. (Example 4, 432 kips); the example's spreadsheet values at the lower axial load are 2.9 and 6.9 percent higher and are not reproduced with the stated bars, while its values at the higher load (848 and 872 kips) agree within 1 percent
MNL17-W-LAYOUT	**Distributed wall bars placed from s/2 at each end** (different geometry). MNL17-W1, MNL17-W2-PM; 2 rows. The ACI MNL-17(21) shear wall spreadsheet puts the first pair of bars 3 in. and the second 12 in. from each end, then every 12 in. (29 positions in 28 ft). ILX Calcs spaces the distributed bars at s, starting s/2 from each end (28 positions). **Effect:** Design flexural strength at Pu = 1,015 kips is 1.9 percent lower in Example 1 (24,130 against 24,600 kip-ft) and 2.9 percent lower in Example 2 (39,050 against 40,200 kip-ft). Concentrated end bars can be entered to model bars near the ends. Test record: MNL17-W-LAYOUT: the example's spreadsheet places the first bar pair 3 in. and the second 12 in. from each end (29 positions); ILX Calcs spaces the distributed bars at s from s/2 at each end (28 positions): φMn = 24,130 kip-ft
MNL17-W1-RHOL	**Minimum vertical wall steel not taken below 0.0025** (conservative method). MNL17-W1; 1 row. ACI MNL-17(21) Shear Wall Example 1 (p. 448) reads 11.6.2(a) literally: the vertical ratio need not exceed the horizontal ratio required for strength, which is zero there, so it sets the minimum to zero. ILX Calcs does not go below 0.0025, because the horizontal ratio itself must be at least 0.0025 by 11.6.2(b). The example's Eq. 11.6.2 line also uses hw/lw = 2 where the wall has 3.3; the result would be 0.0025 either way. **Effect:** ILX Calcs asks for 0.36 in.2 per foot of vertical steel where the example asks for none. The No. 5 at 12 in. each face provided passes either way. Test record: MNL17-W1-RHOL: the example lets ρℓ fall to the ρt required for strength (zero); ILX Calcs does not take ρℓ below 0.0025 (ρt is at least 0.0025 by 11.6.2(b)): 0.36 in.²/ft

Code	Explanation
MNL17-W2-PHI	**Shear strength reduction factor of a wall designed by the displacement method** (an error in the publication). MNL17-W2; 1 row. ACI MNL-17(21) Shear Wall Example 2 (p. 457) uses φ = 0.60 for shear because Vn is less than the shear that develops the nominal moment (21.2.4.1). ACI 318-19 18.10.4.6 (p. 323) states that 21.2.4.1 does not apply to walls or wall piers designed according to 18.10.6.2, as this one is; R18.10.4.6 explains that such walls are controlled by flexural yielding and their shear is already amplified. ILX Calcs uses φ = 0.75 for them, and 0.60 under 21.2.4.1 for other special walls. **Effect:** Design shear strength is 1,537 kips against the printed 1,227 kips. Both exceed Ve = 1,107 kips. Vn itself agrees (2,049 against 2,045 kips). Test record: MNL17-W2-PHI: the example applies φ = 0.60 of 21.2.4.1; 18.10.4.6 exempts walls designed by 18.10.6.2, as this one is, so ILX Calcs keeps φ = 0.75 (1,537 kips)
MNL17-W2-C	**Neutral axis depth for the boundary element check** (input not in the source). MNL17-W2; 2 rows. ACI MNL-17(21) Shear Wall Example 2 (p. 458) takes c = 67.9 in. from its software, with its own bar layout (bars 3 in. from each end). With No. 8 at 12 in. each face placed from s/2, ILX Calcs computes c = 65.3 in. at Pu = 1,015 kips. **Effect:** The required width by the square-root expression is 23.4 in. against 23.9 in. Special boundary elements are required either way, and the 12 in. wall fails both alternatives in both. Test record: MNL17-W2-C: the example takes c = 67.9 in. from its software, with its own bar layout (bars 3 in. from each end); ILX Calcs computes c = 65.3 in. at Pu = 1,015 kips with No. 8 at 12 in. from s/2, and so b required = 23.4 in.; special boundary elements are required either way
MNL17-W2-DC	**Drift capacity reported at its 0.015 floor** (code reading). MNL17-W2; 1 row. Eq. 18.10.6.2b need not be taken below 0.015. ACI MNL-17(21) Shear Wall Example 2 (p. 459) prints the raw value 0.0035 for b = 12 in.; ILX Calcs reports 0.015. **Effect:** Both are below 1.5 δu/hwcs = 0.0163, so the wall fails at b = 12 in. either way, as the example concludes. Test record: MNL17-W2-DC: ILX Calcs reports δc/hwcs at the 0.015 that Eq. 18.10.6.2b need not be taken below; the example prints the raw value 0.0035. Both are below 1.5δu/hwcs = 0.0163, so the boundary still fails at b = 12 in.
MNL17-P3-GV	**Shear fraction of the transferred moment at an edge column** (published value rounded). MNL17-TW3-EDGE; 3 rows. ACI MNL-17(21) Two-way Slab Example 3 (p. 136) takes γv = 0.4 at the edge column. With b1 = 28.5 in. and b2 = 33 in., Eq. 8.4.2.2.2 gives γf = 0.617 and γv = 0.383. **Effect:** The moment stress is 75.9 psi against 79 psi, and vu is 146 psi against 149 psi, 2 percent lower. Both are well below φvc = 212 psi. Test record: MNL17-P3-GV: the example takes γv = 0.4 at the edge column; Eq. 8.4.2.2.2 with b1 = 28.5 in. and b2 = 33 in. gives γf = 0.617, γv = 0.383 (ILX Calcs)
MNL17-P3-AS	**The αs term of the third vc expression** (published value inconsistent). MNL17-TW3-EDGE, MNL17-TW3-INT; 2 rows. ACI MNL-17(21) Two-way Slab Example 3 (p. 137) uses αs d/bo = 2.73 at the edge column and 2.5 at the interior column. With αs = 30 and 40, d = 9 in. and bo = 90 and 132 in., the terms are 3.0 and 2.73; the printed values look swapped. **Effect:** The third expression is 354 and 334 psi against the printed 334 and 318 psi. It does not govern: 4λ√f'c = 283 psi governs in both. Test record: MNL17-P3-AS: the example's third expression of Table 22.6.5.2 uses αs d/bo = 2.73 at the edge column and 2.5 at the interior column; with αs = 30 and 40, d = 9 in., bo = 90 and 132 in. the terms are 3.0 and 2.73. The expression does not govern
MNL17-LD-O1	**Development length rounded up** (published rounding). MNL17-LD-OW1; 2 rows. ACI MNL-17(21) One-way Slab Example 1 (p. 55) prints ℓd = 19 in. for a No. 5 bar with (cb + Ktr)/db = 1.7; the equation gives 18.7 in. The lap of 1.3 x 19 = 24.7 in. (p. 56) carries the rounding. **Effect:** ILX Calcs gives 18.7 in. and a 24.3 in. Class B lap, 1.5 percent below the printed values. Test record: MNL17-LD-O1: the example prints ℓd = 19 in. for 18.7 in. (rounded up) and laps 1.3 × 19 = 24.7 in. (ours 24.3 in.)

Code	Explanation
MNL17-LD-C5	**Simplified development length with the other-cases coefficient** (an error in the publication). MNL17-LD-C5; 1 row. ACI MNL-17(21) Columns Example 5 (p. 429) states that the No. 8 bars have clear spacing of at least 2db and clear cover of at least db, which is the first row of Table 25.4.2.3. It then uses the other-cases expression 3fy/(40λ√f'c) db, giving 63.6 in. The first row gives fy/(20λ√f'c) db = 42.4 in. **Effect:** ILX Calcs gives 42.4 in. The printed 63.6 in. is conservative, and its 1.25ℓd check against ℓu/2 passes either way. Test record: MNL17-LD-C5: the example states clear spacing ≥ 2db and cover ≥ db, the first row of Table 25.4.2.3 (fy ψ/(20λ√f'c) db = 42.4 in.), then applies the 'other cases' coefficient 3/40
MNL17-LDH-W2	**Hook length of a No. 6 bar computed with the No. 5 diameter** (an error in the publication). MNL17-LDH-W2; 1 row. ACI MNL-17(21) Shear Wall Example 2 (p. 463) checks the hook of the No. 6 horizontal bars with db = 0.625 in., the No. 5 diameter, and gets 7.1 in. With db = 0.75 in. the same factors give 9.4 in. **Effect:** ILX Calcs' hook length is 31 percent longer than printed, on the safe side; the 26.5 in. available still suffices. Test record: MNL17-LDH-W2: the example checks a No. 6 bar with the No. 5 diameter (0.625 in.); with db = 0.75 in. ℓdh = 9.4 in. (26.5 in. available)
MNL17-A4-NSA	**Screw anchor steel strength in the summary** (an error in the publication). MNL-17 Anch-4; 1 row. ACI MNL-17(21) Anchorage Example 4 (Vol. 2 p. 286) lists a design steel strength of 12,700 lb for the 3/4 in. screw anchor in its summary table. That is the value of the 5/8 in. expansion anchor of Example 3. The book's Table E.2 (p. 487) gives the 3/4 in. screw anchor an effective area of 0.403 in.2 and futa of 75,000 psi, and the example takes φ = 0.65 for brittle steel, so φNsa = 0.65 × 0.403 × 75,000 = 19,646 lb. **Effect:** ILX Calcs gives 19,646 lb from the table data. Steel does not govern: concrete breakout at 7,235 lb controls in both, and that value matches. Test record: MNL17-A4-NSA: the summary repeats Example 3's 12,700 lb; Table E.2 gives 0.65 × 0.403 × 75,000 = 19,646 lb
MNL17-A5B-TAU	**Bond stress of the 1/2 in. adhesive anchor** (an error in the publication). MNL-17 Anch-5B; 3 rows. ACI MNL-17(21) Anchorage Example 5, Part B (Vol. 2 p. 296), says it takes τcr from Table E.3 and prints 1,120 psi, giving Nba = 6,157 lb, φNa = 2,770 lb and a sustained strength of 1,500 lb. Table E.3 (p. 488) gives 1,030 psi in cracked concrete and 2,240 psi in uncracked concrete for the 1/2 in. anchor; 1,120 psi is not in it. The example's own summary table prints φNa = 2,500 lb, which follows from 1,030 psi (2,548 lb). **Effect:** ILX Calcs uses the table value of 1,030 psi and gives Nba = 5,663 lb, φNa = 2,548 lb and a sustained strength of 1,401 lb, about 8 percent below the printed values, on the safe side. The anchor still passes the 880 lb demand. Test record: MNL17-A5B-TAU: the example takes τcr = 1,120 psi; Table E.3 gives 1,030 psi for the 1/2 in. anchor
MNL17-A9-PSICP	**Splitting factor of an adhesive anchor in cracked concrete** (an error in the publication). MNL-17 Anch-14, MNL-17 Anch-9; 4 rows. ACI MNL-17(21) Anchorage Examples 9 and 14 (Vol. 2 pp. 325 and 373) apply ψcp,Na below 1.0 to an adhesive anchor in concrete taken as cracked. ACI 318-19 17.6.5.5.1 applies this factor only to anchors designed for uncracked concrete, and 17.6.5.5.2 makes it 1.0 in all other cases. In Example 9 the printed Na of 5,216 lb is in fact computed without the factor; in Example 14 it lowers Na to 5,277 lb. **Effect:** ILX Calcs takes ψcp,Na = 1.0 in cracked concrete. It matches Example 9's Na and gives 5,997 lb for Example 14 (φNa 3.90 against 3.43 kips, interaction 1.06 against 1.15), following the code. Test record: MNL17-A9-PSICP: the example applies ψcp,Na in cracked concrete; 17.6.5.5.2 makes it 1.0, and its Na line does not use it

Code	Explanation
MNL17-A9-PHI	**Strength reduction factor for pryout of an adhesive anchor** (an error in the publication). MNL-17 Anch-9; 1 row. ACI MNL-17(21) Anchorage Example 9 (Vol. 2 p. 325) takes φ = 0.65 for concrete pryout, the factor of the adhesive's Category 1, and prints φVcp = 6,780 lb. ACI 318-19 Table 17.5.3(c) gives 0.70 for pryout of cast-in and post-installed anchors alike; the category factors in that table apply to pullout only. The book's Examples 7 and 8 use 0.70 for the same check. **Effect:** ILX Calcs gives 0.70 × 10,432 lb = 7,302 lb, about 8 percent above the printed 6,780 lb, as the code requires. Shear breakout at 1,495 lb governs the anchor in both. Test record: MNL17-A9-PHI: the example takes φ = 0.65 of the adhesive's category; Table 17.5.3(c) gives 0.70 for pryout of every anchor
MNL17-A10-INTERACTION	**Tension and shear interaction of a cast-in bolt at a beam end** (rounding in the publication). MNL-17 Anch-10; 1 row. ACI MNL-17(21) Anchorage Example 10 (Vol. 2 p. 335) adds 1,935 lb over 6,300 lb and 1,440 lb over 2,500 lb, capacities it first rounds down from 6,363 and 2,573 lb, and prints 0.89. Those two ratios add to 0.88; with the unrounded capacities the sum is 0.87. **Effect:** ILX Calcs does not round the capacities and gives 0.87, about 2 percent below the printed value. Every capacity in the example agrees within 1 percent, and the anchor passes in both. Test record: MNL17-A10-INTERACTION: the example adds ratios of capacities rounded down to 6,300 and 2,500 lb and prints 0.89 for 0.88
MNL17-A11-INTERACTION	**Tension and shear interaction of a hooked bolt** (an error in the publication). MNL-17 Anch-11; 1 row. ACI MNL-17(21) Anchorage Example 11 (Vol. 2 p. 345) finds that pullout governs tension at φNpn = 3,308 lb (3,300 lb in its summary), then divides Nua = 1,935 lb by 4,400 lb in the interaction and prints 1.02. No 4,400 lb strength appears in the example. With the governing 3,300 and 2,500 lb the sum is 1.16; with the unrounded strengths it is 1.15. **Effect:** ILX Calcs uses the governing tension strength and gives 1.15, higher than the printed 1.02 and on the safe side. The anchor still passes the 1.2 limit. Test record: MNL17-A11-INTERACTION: the example divides Nua by 4,400 lb, not by the governing pullout strength of 3,300 lb
MNL17-A13-VCB	**Shear breakout of the screw anchor multiplied by the wrong value** (arithmetic in the publication). MNL-17 Anch-13; 2 rows. ACI MNL-17(21) Anchorage Example 13 (Vol. 2 p. 364) computes Vcb = 3,675 lb and then prints φVcb = 0.7 times 3,515 lb = 2,460 lb. With its own Vcb, φVcb is 2,570 lb, as in Examples 12 and 14 on the same beam. Its interaction (p. 365) adds 1,935/4,100 and 1,440/2,400, which is 1.07, and prints 1.05. **Effect:** ILX Calcs gives φVcb = 2.57 kips and an interaction of 1.02. The publication is the more conservative by about 4 percent on breakout; the anchor passes either way. Test record: MNL17-A13-VCB: the example multiplies 0.7 by 3,515 lb, not by its Vcb of 3,675 lb
MNL17-A14-NA	**Bond strength used in the adhesive anchor pryout** (arithmetic in the publication). MNL-17 Anch-14; 1 row. ACI MNL-17(21) Anchorage Example 14 (Vol. 2 p. 376) takes Na = 5,692 lb in the pryout check. Its bond step (p. 373) gives Na = 5,277 lb with ψcp,Na = 0.88, and ACI 318-19 gives 5,997 lb (ψcp,Na = 1.0 in cracked concrete). The value 5,692 lb follows from neither. **Effect:** ILX Calcs gives φVcp = 0.70 times 2 times 5,997 lb = 8.40 kips against the printed 7.97 kips, 5 percent higher, following the code. Pryout does not govern this anchor. Test record: MNL17-A14-NA: the pryout takes Na = 5,692 lb, which is neither the example's 5,277 lb nor the code's value

Code	Explanation
MNL17-A17-VB	**Basic shear breakout strength of studs welded to a plate** (conservative simplification). MNL-17 Anch-17; 4 rows. ACI MNL-17(21) Anchorage Example 17 (Vol. 2 p. 402) has 5/8 in. studs welded to a 1-1/2 in. plate. It takes Vb as the lesser of 9 λa √f'c ca1^1.5 and the expression of 17.7.2.2.2 with the coefficient 8, which ACI 318-19 permits for studs continuously welded to an attachment at least da/2 and 3/8 in. thick under further conditions; the 9 √f'c expression governs at 99,386 lb. ILX Calcs uses the general expression of 17.7.2.2.1 with the coefficient 7 for welded studs as well, which governs at about 92,600 lb. **Effect:** ILX Calcs gives a basic and group shear breakout strength about 7 percent lower than printed (Vcbg about 46,100 lb against 49,253 lb), and a tension and shear interaction about 4 percent higher. This is on the safe side; the design is still adequate. Test record: MNL17-A17-VB: ILX takes Vb from Eq. 17.7.2.2.1a with 7 and le = 8 da; for studs welded to a plate at least da/2 thick, 17.7.2.2.2 permits 8, and then 9 λa √f'c ca1^1.5 governs as printed (ILX lower, conservative)
MNL17-A20-PHI	**Tension φ without the credit for supplementary reinforcement** (a conservative choice in the publication). MNL-17 Anch-20, MNL-17 Anch-22; 3 rows. ACI MNL-17(21) Anchorage Examples 20 and 22 state that supplementary reinforcement is detailed, yet take φ for adhesive bond (and in Example 20 also for concrete breakout) from the product data table, 0.65 for Category 1 and 0.55 for Category 2. Those are the ACI 318-19 Table 17.5.3(b) values without supplementary reinforcement. With it, the table gives 0.75 and 0.65. Example 16 uses 0.75 for breakout in the same situation, and Example 22 uses 0.65 (Category 2) for its breakout. **Effect:** ILX Calcs applies Table 17.5.3(b) as stated: Example 20 gives φNcbg = 22.07 and φNag = 16.57 kips against 19.14 and 14.36, and Example 22 gives φNag = 23.8 against 20.3 kips. The publication is more conservative; the engineer can enter no supplementary reinforcement to get its values. Test record: MNL17-A20-PHI: the example takes the φ of the product table (0.65), the Table 17.5.3(b) value without supplementary reinforcement, although it states supplementary reinforcement; ILX applies the Table 17.5.3(b) value with it
MNL17-A21-PRYOUT	**Pryout area of a base plate rod group** (a different method in the publication). MNL-17 Anch-21b; 2 rows. ACI MNL-17(21) Anchorage Example 21 (Vol. 2 p. 462) takes the pryout strength of four rods from the breakout area of one row of two (512 square inches, Ncpg = 39,628 lb, Vcpg = 79,256 lb) and takes φ as 0.75. ACI 318-19 17.7.3 takes Ncpg as the breakout strength of the anchor group, and Table 17.5.3(c) gives φ = 0.70 for cast-in anchors in pryout. **Effect:** ILX Calcs uses the whole group (1,024 square inches, Vcpg = 158.5 kips, φVcpg = 110.9 kips), higher than printed. Pryout does not govern this example. Test record: MNL17-A21-PRYOUT: the example takes the breakout area of one row of two rods; ACI 17.7.3 and ILX use the group
MNL17-A22-PRYOUT	**Pryout of the base plate group from the back row only** (a different method in the publication). MNL-17 Anch-22; 1 row. ACI MNL-17(21) Anchorage Example 22 (Vol. 2 p. 478) computes pryout from the breakout of the back two anchors only (ANc = 392 square inches, Ncbg = 19,900 lb) with φ = 0.75. It also uses 4.5 cNa squared for ANao in that step. ACI 318-19 17.7.3 takes Ncpg of the group, here the four anchors, the lesser of breakout (39.8 kips) and bond (36.7 kips), and Table 17.5.3(c) gives φ = 0.70 for pryout. **Effect:** ILX Calcs gives φVcpg = 0.70 times 2 times 36.7 = 51.3 kips against the printed 29.85 kips. This is higher because the whole group is used, as in the code; the same choice is recorded for the embed plate (SP17-E14-PRYOUT). Test record: MNL17-A22-PRYOUT: the example takes the breakout of the back row only (ANc = 392 in.²) and φ = 0.75; ACI uses the group (Ncpg of all four anchors) and Table 17.5.3(c) gives 0.70
BC-CWG-ROUND	**Groundwater factor rounded in the published example** (rounding in the publication). GEC6-B1; 1 row. The FHWA shallow foundations circular works the bearing capacity of an interior pier and rounds the groundwater correction factor of the unit weight term to 0.9. Its own equation gives 0.878 for the 6 meter width used. **Effect:** ILX Calcs keeps the equation's value, so the unit weight term is about 2 percent lower than printed (1,487 against 1,524 kPa). The surcharge term and every factor match. Test record: BC-CWG-ROUND: the example rounds Cwy to 0.9; Eq. 5-9 gives 0.878 for Bf = 6 m, which ILX keeps (1,487 kPa)

Code	Explanation
C26.11-1-G	**Rigid gust factor in the commentary table does not follow from its own inputs** (a value the publication does not explain). C26.11-1 · Gust-effect factor; 1 row. The ASCE 7-22 commentary table of gust factors lists a turbulence intensity of 0.201 and a background response squared of 0.616 for its 600 foot building, and prints a calculated rigid gust factor of 0.860. The standard's equation with those two values gives 0.818. Every other value in the table, including the flexible factor of 1.162, is reproduced. **Effect:** ILX Calcs gives 0.818, the equation's value, about 5 percent below the printed number. The flexible factor, which this building must use, matches. Test record: C26.11-1-G: the table's 0.860 does not follow from its own Iz and Q² by Eq. 26.11-6, which gives 0.818
C26.11-2-SIGMA	**Commentary acceleration uses the resonant response of the design wind speed** (a value the publication does not explain). C26.11-2; 2 rows. The commentary example of along-wind acceleration works the acceleration at a 76 mph serviceability wind but lists the resonant response factor 1.123, which is the value at the 115 mph design wind. The resonant response depends on the wind speed, and at 76 mph the standard's equation gives about 0.74. **Effect:** ILX Calcs evaluates the resonant response at the serviceability speed, so its acceleration is about 0.126 instead of 0.176 feet per second squared, and its peak about 0.48 instead of 0.668. The displacement and the peak factor match the example. Test record: C26.11-2-SIGMA: the table uses R = 1.123 of the 115 mph case; R at the 76 mph service speed gives about 0.126 ft/s²

Method notes

From docs/VERIFICATION_MANUAL.md. Sections 4 to 6 of the manual are the tables above, regenerated from the tests.

1. Purpose and scope

This manual shows how each ILX Calcs calculation compares with published examples and code tables where they exist, and with hand calculations from the code equations where they do not, value by value, for LRFD and ASD where the code has both. Every number on the Verification page and in the Verification Report is produced by the test code; none is typed by hand.

What is verified

For each calculation type, the quantities a published example computes, so far as the module implements them: required strengths from the load combinations, nominal and available strengths per limit state, intermediate values the example prints (section properties, slenderness limits, factors such as Cb, Cv or adjustment factors) and serviceability values (deflections against the engineer's limits).

What is not verified, and why

Where no published worked example is available for a limit state, the module ships hand-verifiable tests (closed form values) instead, and the gap is listed in the module's chapter of the user manual (its Verification section) and in `project.md`. Inputs outside a module's scope are reported as NOT FEASIBLE with a reason; they are never silently computed.

Intended use

ILX Calcs is a design aid. The engineer of record remains responsible for the design and for judging whether these comparisons are adequate.

2. Method

1. **Benchmark comparison.** Each published example is entered as the module's input (the `EXAMPLES` of the type's `test_verify_<type>.py`, built with `tests/golden.py` `Example` and `Value`). Each published value is read from the design result: a check's available strength or demand, or a named calculation step.
2. **One source for the tests and the page.** pytest runs one case per published value; `tools/export_verification.py` imports the same `EXAMPLES`, so the Verification page shows exactly what the tests assert, with each row's pytest node id and outcome.
3. **Internal units.** Values are compared in the app's internal US units (kips, kip-ft, in., ksi, psf, ...). Every module is also exercised in SI by its behaviour tests; the conversion is checked to match the US result.
4. **Robustness.** Property-based fuzzing (Hypothesis) of every registered type: no input reaches a server error.

Acceptance criteria

A value passes when the ILX value is within the tolerance of its kind: a relative tolerance (1 % for strengths, moments, lengths and stresses; 2 % for ratios) with an absolute floor for small numbers. The table of tolerances is printed in the Verification Report.

Status codes

Status	Meaning
Pass	Within tolerance.
Documented deviation	Outside tolerance for a known reason (a method the code permits, an error or edition difference in the source). The test is a strict expected failure, so it fails the moment the behaviour changes. Each has a plain-language entry in `docs/verification/deviations.json`.
Not checked	The example computes it; the module does not (a coverage gap).
Fail	Outside tolerance without a documented cause. A release has none.

7. SI / US consistency

Inputs are saved in display units with their unit system and converted to internal US units before the design (`calcs.common.to_internal`). The behaviour tests of each module design the same member in US and SI and compare the results; the unit labels and factors are in `backend/app/engine/units.py`.

8. Fuzz robustness summary

`backend/tests/test_backend_fuzz.py` generates inputs for every registered calculation type from its input model (within and outside the field bounds) and asserts that the API never answers with a server error: a design either succeeds or reports field errors (422).

9. Known deviations and coverage gaps

The documented deviations are listed in the Verification Report with their plain-language explanation and effect. Coverage gaps (limit states a published example checks and the module does not) are listed in each module's manual chapter, Verification section.

10. How to rerun

```
cd backend
.venv/Scripts/python -m pytest -q tests/test_verify_*.py
.venv/Scripts/python ../tools/export_verification.py
```

The export runs the golden files, writes `docs/verification/results.json` and prints the counts. A release has no failures and `tests/test_docs_api.py` confirms the shipped JSON is current.

11. References

The published examples of each module are cited in its golden file and its manual chapter: AISC Design Examples v16.0 and Design Guides; ACI, PCA, CRSI and ACI SP-17 examples; AWC / NDS examples; TMS and the Masonry Designers' Guide; AISI design examples; ASCE, SEAOC and FEMA P-1051 examples; textbooks with complete worked examples.

ILX Calcs is a design aid. The engineer of record remains responsible for the design and for judging whether these comparisons are adequate. All values are generated by the verification tests at release time; none are typed by hand.