OpenPT

Verification Manual

102 verified PASS cases across 12 chapters

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How to read this manual

This manual compares numbers computed by OpenPT with numbers from an independent reference: commercial structural software, published engineering literature, or the BIM/CAD program that receives an exported file. Each comparison is a **case** with an identifier such as `V-301`.

Layout of a case

Each case presents its engineering perspective, reference source, **model** description, **method** of comparison, quantitative comparison table with explicit acceptance tolerances, and provenance (OpenPT build, command, and input/output files). Every verified check in this manual meets its acceptance tolerance (**PASS**). Where informational context rows without a separate gate tolerance appear inside a passing case, they are marked `INFO`.

Summary

102 verified PASS cases in 12 chapters.

Cases by reference category

Reference category	PASS cases
Competing software 1	73
Competing software 2	7
Revit	3
AutoCAD	3
other	16
Total	102

All verified cases

The column "Largest |diff| %" is the largest absolute percentage difference among all gated rows of the case.

Id	Title	Perspective	Reference	Largest |diff| %	Status
V-201	OSI_typ_v2: tendon force before and after seating, elongation	Tendon friction, seating and elongation	Competing software 1, friction module results of the project (TendonStressHistory, summary)	–	PASS
V-202	B1CC4_TDH: tendon force before and after seating, elongation	Tendon friction, seating and elongation	Competing software 1, friction module results of the project (TendonStressHistory, summary)	–	PASS
V-203	H1HH1_F9-12: tendon force before and after seating, elongation	Tendon friction, seating and elongation	Competing software 1, friction module results of the project (TendonStressHistory, summary)	–	PASS
V-206	OSI_typ_v2: long-term losses of the tendon force	Tendon long-term losses	Competing software 1, long-term loss results (TendonSegStress) of the project	–	PASS
V-207	H1HH1_F9-12: long-term losses of the tendon force	Tendon long-term losses	Competing software 1, long-term loss results (TendonSegStress) of the project	–	PASS
V-208	B1CC4_TDH: long-term losses of the tendon force	Tendon long-term losses	Competing software 1, long-term loss results (TendonSegStress) of the project	–	PASS
V-210	OSI_typ_v2: tendon profile geometry against Competing software 1's tendon polylines	Tendon profile geometry	Competing software 1, tendon polylines (TendonSeg) generated from the exchange INP	–	PASS
V-211	H1HH1_F9-12: tendon profile geometry against Competing software 1's tendon polylines	Tendon profile geometry	Competing software 1, tendon polylines (TendonSeg) generated from the exchange INP	–	PASS
V-212	B10 (synthetic PT floor): tendon profile geometry against Competing software 1's tendon polylines	Tendon profile geometry	Competing software 1, tendon polylines (TendonSeg) generated from the exchange INP	–	PASS
V-213	OSI_typ_v2: balanced loads of the tendons	Balanced loads (equivalent loads)	Competing software 1, finite-element tendons of the project (_original.adi, PRESTRESSING.ADO) and exact equilibrium	–	PASS
V-214	H1HH1_F9-12: balanced loads of the tendons	Balanced loads (equivalent loads)	Competing software 1, finite-element tendons of the project (_original.adi, PRESTRESSING.ADO) and exact equilibrium	–	PASS
V-215	B1CC4_TDH: balanced loads of the tendons	Balanced loads (equivalent loads)	Competing software 1, finite-element tendons of the project (_original.adi, PRESTRESSING.ADO) and exact equilibrium	–	PASS
V-216	B3CC1_F10-19: balanced loads of the tendons	Balanced loads (equivalent loads)	Competing software 1, finite-element tendons of the project (_original.adi, PRESTRESSING.ADO) and exact equilibrium	–	PASS
V-301	B01 RC flat plate: deflection and cracking	Deflection, cracked and long-term	Competing software 1, EC2	1.17	PASS
V-302	B01 RC flat plate: calculated rebar	Calculated rebar: provided area, steel mass, bar counts	Competing software 1, EC2	0.44	PASS
V-303	B01 RC flat plate: punching shear	Punching shear	Competing software 1, EC2	0.00	PASS
V-304	B02 PT flat plate: deflection and cracking	Deflection, cracked and long-term	Competing software 1, EC2	4.16	PASS
V-305	B02 PT flat plate: calculated rebar	Calculated rebar: provided area, steel mass, bar counts	Competing software 1, EC2	1.53	PASS
V-306	B02 PT flat plate: punching shear	Punching shear	Competing software 1, EC2	0.00	PASS
V-307	B03 PT flat plate with drop panels: deflection and cracking	Deflection, cracked and long-term	Competing software 1, EC2	0.96	PASS
V-308	B03 PT flat plate with drop panels: calculated rebar	Calculated rebar: provided area, steel mass, bar counts	Competing software 1, EC2	1.27	PASS
V-309	B03 PT flat plate with drop panels: punching shear	Punching shear	Competing software 1, EC2	0.00	PASS
V-310	B04 RC slab with perimeter beams and a wall: deflection and cracking	Deflection, cracked and long-term	Competing software 1, EC2	0.21	PASS
V-311	B04 RC slab with perimeter beams and a wall: calculated rebar	Calculated rebar: provided area, steel mass, bar counts	Competing software 1, EC2	0.31	PASS
V-312	B04 RC slab with perimeter beams and a wall: punching shear	Punching shear	Competing software 1, EC2	0.00	PASS
V-313	B05 PT slab with cantilevers: deflection and cracking	Deflection, cracked and long-term	Competing software 1, EC2	1.08	PASS
V-314	B05 PT slab with cantilevers: calculated rebar	Calculated rebar: provided area, steel mass, bar counts	Competing software 1, EC2	1.20	PASS
V-315	B05 PT slab with cantilevers: punching shear	Punching shear	Competing software 1, EC2	0.00	PASS
V-316	B06 PT slab with openings: deflection and cracking	Deflection, cracked and long-term	Competing software 1, EC2	1.98	PASS
V-317	B06 PT slab with openings: calculated rebar	Calculated rebar: provided area, steel mass, bar counts	Competing software 1, EC2	1.00	PASS
V-318	B06 PT slab with openings: punching shear	Punching shear	Competing software 1, EC2	0.00	PASS
V-319	B07 PT long-span slab with band regions: deflection and cracking	Deflection, cracked and long-term	Competing software 1, EC2	1.28	PASS
V-320	B07 PT long-span slab with band regions: calculated rebar	Calculated rebar: provided area, steel mass, bar counts	Competing software 1, EC2	1.38	PASS
V-321	B07 PT long-span slab with band regions: punching shear	Punching shear	Competing software 1, EC2	0.00	PASS
V-322	B08 RC slab with a transfer beam: deflection and cracking	Deflection, cracked and long-term	Competing software 1, EC2	0.72	PASS
V-323	B08 RC slab with a transfer beam: calculated rebar	Calculated rebar: provided area, steel mass, bar counts	Competing software 1, EC2	4.35	PASS
V-324	B08 RC slab with a transfer beam: punching shear	Punching shear	Competing software 1, EC2	0.00	PASS
V-325	B09 RC irregular slab (L shape): deflection and cracking	Deflection, cracked and long-term	Competing software 1, EC2	0.42	PASS
V-326	B09 RC irregular slab (L shape): calculated rebar	Calculated rebar: provided area, steel mass, bar counts	Competing software 1, EC2	0.54	PASS

Id	Title	Perspective	Reference	Largest |diff| %	Status
V-327	B09 RC irregular slab (L shape): punching shear	Punching shear	Competing software 1, EC2	0.00	PASS
V-328	B10 PT large floor with core walls: deflection and cracking	Deflection, cracked and long-term	Competing software 1, EC2	0.99	PASS
V-329	B10 PT large floor with core walls: calculated rebar	Calculated rebar: provided area, steel mass, bar counts	Competing software 1, EC2	1.13	PASS
V-330	B10 PT large floor with core walls: punching shear	Punching shear	Competing software 1, EC2	0.00	PASS
V-331	B10F PT large floor with core walls, fine mesh: accuracy	Large floor, fine mesh: deflection, rebar and punching	Competing software 1, EC2	1.11	PASS
V-401	M01 multi-level building, three storeys: counts, reactions, displacements, column forces	Multi-level building: counts, reactions, displacements, column forces	Competing software 1, multi-level analysis (ADO results and analyser deck of the project)	0.09	PASS
V-402	M02 multi-level building, three storeys: counts, reactions, displacements, column forces	Multi-level building: counts, reactions, displacements, column forces	Competing software 1, multi-level analysis (ADO results and analyser deck of the project)	0.08	PASS
V-404	M04 multi-level building, three storeys: counts, reactions, displacements, column forces	Multi-level building: counts, reactions, displacements, column forces	Competing software 1, multi-level analysis (ADO results and analyser deck of the project)	0.08	PASS
V-501	HongNgoc L10 T8: deflection and cracking	Deflection, cracked and long-term (real project)	Competing software 1, EC2	4.81	PASS
V-502	XuanLa F 7-16: deflection and cracking	Deflection, cracked and long-term (real project)	Competing software 1, EC2	0.81	PASS
V-503	EMASI T1 half 02 180: deflection and cracking	Deflection, cracked and long-term (real project)	Competing software 1, EC2	0.84	PASS
V-504	B3CC1 F10-19: deflection and cracking	Deflection, cracked and long-term (real project)	Competing software 1, EC2	0.18	PASS
V-505	H1HH1 F9-12: deflection and cracking	Deflection, cracked and long-term (real project)	Competing software 1, EC2	0.48	PASS
V-506	HongNgoc L10 T8: calculated rebar	Calculated rebar (real project)	Competing software 1, EC2	4.17	PASS
V-507	XuanLa F 7-16: calculated rebar	Calculated rebar (real project)	Competing software 1, EC2	0.00	PASS
V-508	EMASI T1 half 02 180: calculated rebar	Calculated rebar (real project)	Competing software 1, EC2	1.44	PASS
V-509	B3CC1 F10-19: calculated rebar	Calculated rebar (real project)	Competing software 1, EC2	5.81	PASS
V-510	H1HH1 F9-12: calculated rebar	Calculated rebar (real project)	Competing software 1, EC2	0.00	PASS
V-511	HongNgoc L10 T8: punching shear	Punching shear (real project)	Competing software 1, EC2	0.00	PASS
V-512	XuanLa F 7-16: punching shear	Punching shear (real project)	Competing software 1, EC2	0.00	PASS
V-601	B3CC1_F10-19: cracked section properties, cracking pattern and cracked deflection	Cracked sections and deflection	Competing software 1, cracked-deflection results of the project (.dfl, .dfm, CRACKED_SUSTAINED_LOAD.ADO)	0.00	PASS
V-602	XuanLa_F_7-16_2024: cracked section properties, cracking pattern and cracked deflection	Cracked sections and deflection	Competing software 1, cracked-deflection results of the project (.dfl, .dfm, CRACKED_SUSTAINED_LOAD.ADO)	0.00	PASS
V-603	H1HH1_F9-12: cracked section properties, cracking pattern and cracked deflection	Cracked sections and deflection	Competing software 1, cracked-deflection results of the project (.dfl, .dfm, CRACKED_SUSTAINED_LOAD.ADO)	0.00	PASS
V-604	OSI_typ_v2: cracked section properties, cracking pattern and cracked deflection	Cracked sections and deflection	Competing software 1, cracked-deflection results of the project (.dfl, .dfm, CRACKED_SUSTAINED_LOAD.ADO)	0.00	PASS
V-606	EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180: strip design against Competing software 1's designer output	Strip design (required reinforcement)	Competing software 1, designer output of the project (.DSO), strip model PR.dat	–	PASS
V-607	H1HH1_F9-12: strip design against Competing software 1's designer output	Strip design (required reinforcement)	Competing software 1, designer output of the project (.DSO), strip model PR.dat	–	PASS
V-608	Punching shear against Competing software 1's punching program: 90 reference cases (EC2, ACI 318-14, ACI 318-08)	Punching shear	Competing software 1, punching program output (.PUO) for the same input (.PUI)	–	PASS
V-610	.adm reader against Competing software 1's own exchange INP: 7 saves of two projects	Data exchange: reading .adm model files	Competing software 1, exchange INP written by Competing software 1 for the same save as the .ADM	–	PASS
V-611	OSI_typ_v2: OpenPT's FE solver against Competing software 1's analyser on Competing software 1's own input deck	FE solver, same mesh and same deck	Competing software 1 analyser FRAME.exe, run on 2026-11-18	–	PASS
V-612	OSI_typ_v2: prestress loads and the deflection they cause	Prestress as load, FE result	Competing software 1: PRESTRESSING.ADO and the analysis deck of the project	5.18	PASS
V-613	OSI_typ_v2: hyperstatic (secondary) effects of prestress	Hyperstatic case	Competing software 1: HYPERSTATIC.ADO of the project; analyser FRAME.exe for row H4	1.82	PASS
V-701	Gravity: self weight (SWL)	Building floor imported from Competing software 2: gravity load	Competing software 2 (full-precision result tables)	–	PASS
V-702	Gravity: superimposed dead loads (FNS, MRS)	Building floor imported from Competing software 2: gravity load	Competing software 2 (full-precision result tables)	–	PASS
V-703	Gravity: live-load cases (11 cases LLa to LLi)	Building floor imported from Competing software 2: gravity load	Competing software 2 (full-precision result tables)	–	PASS
V-704	Wind in X (Wx)	Building floor imported from Competing software 2: wind load	Competing software 2 (full-precision result tables)	–	PASS

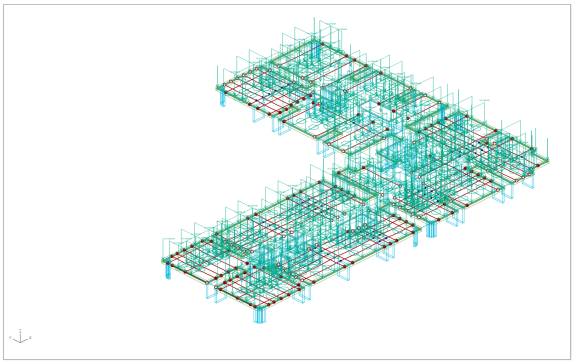
Id	Title	Perspective	Reference	Largest |diff| %	Status
V-705	Wind in Y (Wy)	Building floor imported from Competing software 2: wind load	Competing software 2 (full-precision result tables)	–	PASS
V-706	Modes 1 to 12	Building floor imported from Competing software 2: modal analysis (mode shapes imported from ETABS)	Competing software 2 (full-precision result tables)	–	PASS
V-711	OpenPT's own mesh (cell 1200) against Competing software 2: self weight	Building floor imported from Competing software 2: OpenPT's own mesh	Competing software 2 (full-precision result tables)	–	PASS
V-801	B01 RC flat plate: sustained and long-term deflection, Competing software 1, Competing software 2 and OpenPT	Long-term deflection: sustained and EC2 long-term values, uncracked linear values	Competing software 1 (EC2) and Competing software 2 (linear uncracked)	1.17	PASS
V-804	B09 RC irregular floor: sustained and long-term deflection, Competing software 1, Competing software 2 and OpenPT	Long-term deflection: sustained and EC2 long-term values, uncracked linear values	Competing software 1 (EC2) and Competing software 2 (linear uncracked)	0.42	PASS
V-807	Xuan La real floor: sustained and long-term deflection, Competing software 1, Competing software 2 and OpenPT	Long-term deflection: sustained and EC2 long-term values, uncracked linear values	Competing software 1 (EC2) and Competing software 2 (linear uncracked)	0.43	PASS
V-901	M01: model exported as IFC and opened in Revit 2024	Data exchange, Revit	Revit 2024 (build 24.0.4.427)	0.00	PASS
V-902	M03: model exported as IFC and opened in Revit 2024	Data exchange, Revit	Revit 2024 (build 24.0.4.427)	0.00	PASS
V-903	B10: model exported as IFC and opened in Revit 2024	Data exchange, Revit	Revit 2024 (build 24.0.4.427)	0.00	PASS
V-904	B04: structural plan exported as DXF and opened in AutoCAD 2024	Data exchange, AutoCAD	AutoCAD 2024 (core console)	0.00	PASS
V-905	B05: structural plan exported as DXF and opened in AutoCAD 2024	Data exchange, AutoCAD	AutoCAD 2024 (core console)	0.00	PASS
V-906	B10: structural plan exported as DXF and opened in AutoCAD 2024	Data exchange, AutoCAD	AutoCAD 2024 (core console)	0.00	PASS
V-1103	Competing software 1 TN T9-04 5.3: box girder bridge, friction at the second support	Post-tensioning formulas, losses	Technical Note of Competing software 1 T9-04 (2004), 5.3, p.13	0.43	PASS
V-1105	midas EN 1992 verification: anchorage slip and friction of two cables	Post-tensioning formulas, losses (EN 1992-1-1 5.10.4, 5.10.5.2)	midas, Prestress Tension Loss Verification as per EN 1992, 3.1.4 A and B, pp.15 to 22	0.75	PASS
V-1301	Competing software 2 ACI 318-19 RC-SL-001 and RC-PN-001: slab strip flexure and punching shear	Slab section, flexure and punching (ACI)	Software Verification manual of Competing software 2, ACI 318-19 RC-SL EXAMPLE 001 (pp.2-3) and RC-PN EXAMPLE 001 (pp.2-6)	0.29	PASS
V-1306	SOFiSTiK DCE-EN31: punching of a flat slab, DIN EN 1992-1-1	Punching shear (EC2)	SOFiSTiK Verification Manual, Benchmark No. 31 DCE-EN31 (pp.8-14)	0.17	PASS
V-1310	StructurePoint flat plate: strip flexure for the document's moments	Slab section, flexure (ACI)	StructurePoint, Two-Way Flat Plate Concrete Floor System Analysis and Design (ACI 318-14), spSlab v10.00, Tables 3, 4, 7 and 8 (printed pp.13-29)	0.64	PASS
V-1402	Plate with clamped edges (Competing software 2 example 2)	Plate FE against tabulated exact deflections and Competing software 2	Software Verification manual of Competing software 2, Analysis Example 2 (vendor of Competing software 2), Table 2-1, pages 3 and 4; the exact value is the document's, Competing software 2 (thin plate) is ref2	1.70	PASS
V-1403	Plate with mixed boundary: two simply supported edges, one clamped, one free (Competing software 2 example 3)	Plate FE against the Levy solution and Competing software 2	Software Verification manual of Competing software 2, Analysis Example 3 (vendor of Competing software 2), Table 3-1, page 3; the exact value is the document's, Competing software 2 (thin plate) is ref2	1.43	PASS
V-1404	Plate on elastic edge beams (Competing software 2 example 4)	Plate with beams against Timoshenko and ACI DDM	Software Verification manual of Competing software 2, Analysis Example 4 (vendor of Competing software 2), Tables 4-1 to 4-3, pages 5 to 7; the exact value is the document's, Competing software 2 (thin plate) is ref2	3.50	PASS
V-1410	University of Illinois two-way slab test T1 (Competing software 2 example 13)	Two-way slab with beams against a test, EFM and Competing software 2	Software Verification manual of Competing software 2, Analysis Example 13 (vendor of Competing software 2), Table 13-1, page 5; the exact value is the document's, Competing software 2 (thin plate) is ref2 (test T1 and EFM from Corley and Jirsa 1970)	8.71	PASS
V-1504	Flat slab punching, 3 x 24 ft spans, ACI 318-14 (Competing software 2 RC-PN-001)	Punching, end to end	Software Verification manual of Competing software 2, ACI 318-14 RC-PN Example 001, pages 1 to 6	3.69	PASS
V-1505	Flat slab punching, 3 x 24 ft spans, ACI 318-19 (Competing software 2 RC-PN-001)	Punching, end to end	Software Verification manual of Competing software 2, ACI 318-19 RC-PN Example 001, pages 1 to 6	3.10	PASS
V-1506	Flat slab punching at a circular column, ACI 318-19 (Competing software 2 RC-PN-002)	Punching, end to end	Software Verification manual of Competing software 2, ACI 318-19 RC-PN Example 002, pages 1 to 6	4.80	PASS
V-1507	Flat slab punching, 3 x 8 m spans, EN 1992-1-1 (Competing software 2 RC-PN-001)	Punching, end to end	Software Verification manual of Competing software 2, EN 2-2004 RC-PN Example 001, pages 1 to 7	8.86	PASS
V-1508	One-way simple-span slab, strip flexure, ACI 318-14 (Competing software 2 RC-SL-001)	Strip design, end to end	Software Verification manual of Competing software 2, ACI 318-14 RC-SL Example 001, pages 1 to 3 (the ACI 318-19 version, `cs2_ACI19_RCSL001_B2`, has the same numbers)	7.56	PASS
V-1509	One-way simple-span slab, strip flexure, EN 1992-1-1 (Competing software 2 RC-SL-001)	Strip design, end to end	Software Verification manual of Competing software 2, EN 2-2004 RC-SL Example 001, pages 1 to 4	3.15	PASS
V-1510	One-way PT slab strip, moments, mild steel and concrete stresses, ACI 318-14 (Competing software 2 PT-SL-001)	PT strip, end to end	Software Verification manual of Competing software 2, ACI 318-14 PT-SL Example 001, pages 1 to 7 (the ACI 318-19 version, `cs2_ACI19_PTSL001_B2`, has the same stresses and 2.251 in2 of steel)	3.15	PASS

1 Tendons: friction, seating, elongation, profiles and balanced loads against Competing software 1

This chapter compares OpenPT's tendon modules with the result files that Competing software 1 wrote into the `Databases` folder of a project: the friction and seating forces and elongations, the long-term losses, the tendon profiles and the equivalent (balanced) loads. Competing software 1 was not started for this manual; every reference number is read from those stored files. OpenPT was run again with the installed build (`OpenPT.Regress`, Release build of commit 7d86603).

1.1 V-201 OSI_typ_v2: tendon force before and after seating, elongation

Perspective: Tendon friction, seating and elongation · **Reference:** Competing software 1, friction module results of the project (TendonStressHistory, summary) · **Status:** PASS



Structure: OSI_typ_v2

MODEL

OSI_typ_v2: Competing software 1 project with 100 tendons (groups Group_1). The tendon polylines cover 74.1 x 60.5 m in plan. Tendon system in the segment data: unbonded; tendon areas 280, 700 mm2; E = 200000 MPa, fpu = 1860 MPa, fpy = 1700 MPa; friction coefficient 0.07, wobble coefficient K = 3.28e-06 per mm; jacking ratio 0.8 of fpu, seating 6 mm (stage 1 of TendonOperation). Reference files from NDC_san\OSI_typ_v2 (Competing software 1 run of 2026-10-27).

METHOD

Every tendon is run through OpenPT's friction and seating solver with the stressing operations Competing software 1 stored (TendonOperation). The force of every node before and after seating is compared with TendonStressHistory (relative error), and the elongation of each stressed end with the summary of TendonSegStress (ends with |reference elongation| < 1 mm are not compared: 15 here). Errors are |OpenPT - Competing software 1| / Competing software 1 in percent, pooled over all nodes; the tool's own targets are the tolerances (spec 01 section 8.2).

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
tendons compared, of the tendons in the Competing software 1 files (skipped 0)	–	100	100	+0.00	all compared	INFO
force error before seating, median (n = 2545 nodes)	%	–	0.072	–	<= 0.6 %	PASS
force error before seating, 95th percentile	%	–	0.372	–	<= 1 %	PASS
force error after seating, median (n = 2545 nodes)	%	–	0.053	–	<= 0.6 %	PASS
force error after seating, 95th percentile	%	–	0.123	–	<= 1 %	PASS
force error before and after seating pooled, maximum (n = 5090)	%	–	0.49	–	<= 1 %	PASS
elongation error per end, median (n = 100 ends)	%	–	0.034	–	<= 0.15 %	PASS
elongation error per end, 95th percentile	%	–	0.156	–	<= 0.5 %	PASS
force error before seating, maximum	%	–	0.49	–	no target printed	INFO
force error after seating, maximum	%	–	0.144	–	no target printed	INFO
elongation error per end, maximum	%	–	0.433	–	no target printed	INFO
tendons with a force error above 1 % (from the 10-worst list of the tool)	–	–	0	–	none expected	INFO

OpenPT build: 7d86603 Release (tag installed-20261118-1237), run 2026-11-18
Command: `OpenPT.Regress.exe D:\NETtool\NDC_san\OSI_typ_v2\Databases (cwd openpt-build\ver-run\B\out\final)`
Sources: `NDC_san\OSI_typ_v2\Databases\TendonSeg_OSI_typ_v2.dat`
`NDC_san\OSI_typ_v2\Databases\TendonOperation_OSI_typ_v2.dat`
`NDC_san\OSI_typ_v2\Databases\TendonStressHistory_OSI_typ_v2.dat`
`NDC_san\OSI_typ_v2\Databases\TendonSegStress_OSI_typ_v2.dat`
`openpt-build\ver-run\B\out\final\ch2_friction_OSI_typ_v2.txt`

1.2 V-202 B1CC4_TDH: tendon force before and after seating, elongation

Perspective: Tendon friction, seating and elongation · **Reference:** Competing software 1, friction module results of the project (TendonStressHistory, summary) · **Status:** PASS

MODEL

B1CC4_TDH: Competing software 1 project with 94 tendons (groups CAPX, CAPY). The tendon polylines cover 75.7 x 38.7 m in plan. Tendon system in the segment data: bonded; tendon areas 280, 700 mm2; E = 200000 MPa, fpu = 1860 MPa, fpy = 1700 MPa; friction coefficient 0.2, wobble coefficient K = 5e-06 per mm; jacking ratio 0.8 of fpu, seating 6 mm (stage 1 of TendonOperation). Reference files from bench\work\real\B1CC4_TDH (Competing software 1 run of 2026-11-03).

METHOD

Every tendon is run through OpenPT's friction and seating solver with the stressing operations Competing software 1 stored (TendonOperation). The force of every node before and after seating is compared with TendonStressHistory (relative error), and the elongation of each stressed end with the summary of TendonSegStress (ends with |reference elongation| < 1 mm are not compared: 0 here). Errors are |OpenPT - Competing software 1| / Competing software 1 in percent, pooled over all nodes; the tool's own targets are the tolerances (spec 01 section 8.2).

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
tendons compared, of the tendons in the Competing software 1 files (skipped 0)	–	94	94	+0.00	all compared	INFO
force error before seating, median (n = 6196 nodes)	%	–	0.067	–	<= 0.6 %	PASS
force error before seating, 95th percentile	%	–	0.241	–	<= 1 %	PASS
force error after seating, median (n = 6196 nodes)	%	–	0.06	–	<= 0.6 %	PASS
force error after seating, 95th percentile	%	–	0.163	–	<= 1 %	PASS
force error before and after seating pooled, maximum (n = 12392)	%	–	0.492	–	<= 1 %	PASS
elongation error per end, median (n = 114 ends)	%	–	0.024	–	<= 0.15 %	PASS
elongation error per end, 95th percentile	%	–	0.134	–	<= 0.5 %	PASS
force error before seating, maximum	%	–	0.492	–	no target printed	INFO
force error after seating, maximum	%	–	0.254	–	no target printed	INFO
elongation error per end, maximum	%	–	0.168	–	no target printed	INFO
tendons with a force error above 1 % (from the 10-worst list of the tool)	–	–	0	–	none expected	INFO

OpenPT build: 7d86603 Release (tag installed-20261118-1237), run 2026-11-18
Command: `OpenPT.Regress.exe D:\NETtool\OpenPT\bench\work\real\B1CC4_TDH\B1CC4_TDH\Databases (cwd openpt-build\ver-run\B\out\final)`
Sources: `OpenPT\bench\work\real\B1CC4_TDH\B1CC4_TDH\Databases\TendonSeg_B1CC4_TDH.dat`
`OpenPT\bench\work\real\B1CC4_TDH\B1CC4_TDH\Databases\TendonOperation_B1CC4_TDH.dat`
`OpenPT\bench\work\real\B1CC4_TDH\B1CC4_TDH\Databases\TendonStressHistory_B1CC4_TDH.dat`
`OpenPT\bench\work\real\B1CC4_TDH\B1CC4_TDH\Databases\TendonSegStress_B1CC4_TDH.dat`
`openpt-build\ver-run\B\out\final\ch2_friction_B1CC4_TDH.txt`

1.3 V-203 H1HH1_F9-12: tendon force before and after seating, elongation

Perspective: Tendon friction, seating and elongation · **Reference:** Competing software 1, friction module results of the project (TendonStressHistory, summary) · **Status:** PASS

MODEL

H1HH1_F9-12: Competing software 1 project with 48 tendons (groups TendonY). The tendon polylines cover 45.9 x 27.0 m in plan. Tendon system in the segment data: bonded; tendon areas 280, 700 mm2; E = 195000 MPa, fpu = 1860 MPa, fpy = 1670 MPa; friction coefficient 0.2, wobble coefficient K = 5e-05 per mm; jacking ratio 0.8 of fpu, seating 6 mm (stage 1 of TendonOperation). Reference files from bench\work\real\H1HH1_F9-12 (Competing software 1 run of 2026-11-03).

METHOD

Every tendon is run through OpenPT's friction and seating solver with the stressing operations Competing software 1 stored (TendonOperation). The force of every node before and after seating is compared with TendonStressHistory (relative error), and the elongation of each stressed end with the summary of TendonSegStress (ends with |reference elongation| < 1 mm are not compared: 0 here). Errors are |OpenPT - Competing software 1| / Competing software 1 in percent, pooled over all nodes; the tool's own targets are the tolerances (spec 01 section 8.2).

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
tendons compared, of the tendons in the Competing software 1 files (skipped 0)	–	48	48	+0.00	all compared	INFO
force error before seating, median (n = 1581 nodes)	%	–	0.069	–	<= 0.6 %	PASS
force error before seating, 95th percentile	%	–	0.293	–	<= 1 %	PASS
force error after seating, median (n = 1581 nodes)	%	–	0.112	–	<= 0.6 %	PASS
force error after seating, 95th percentile	%	–	0.487	–	<= 1 %	PASS
force error before and after seating pooled, maximum (n = 3162)	%	–	0.69	–	<= 1 %	PASS
elongation error per end, median (n = 48 ends)	%	–	0.033	–	<= 0.15 %	PASS
elongation error per end, 95th percentile	%	–	0.421	–	<= 0.5 %	PASS
force error before seating, maximum	%	–	0.469	–	no target printed	INFO
force error after seating, maximum	%	–	0.69	–	no target printed	INFO
elongation error per end, maximum	%	–	0.442	–	no target printed	INFO
tendons with a force error above 1 % (from the 10-worst list of the tool)	–	–	0	–	none expected	INFO

OpenPT build: 7d86603 Release (tag installed-20261118-1237), run 2026-11-18
Command: `OpenPT.Regress.exe D:\NETtool\OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases (cwd openpt-build\ver-run\B\out\final)`
Sources: `OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\TendonSeg_H1HH1_F9-12.dat`
`OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\TendonOperation_H1HH1_F9-12.dat`
`OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\TendonStressHistory_H1HH1_F9-12.dat`
`OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\TendonSegStress_H1HH1_F9-12.dat`
`openpt-build\ver-run\B\out\final\ch2_friction_H1HH1_F9-12.txt`

1.4 V-206 OSI_typ_v2: long-term losses of the tendon force

Perspective: Tendon long-term losses · **Reference:** Competing software 1, long-term loss results (TendonSegStress) of the project · **Status:** PASS

MODEL

OSI_typ_v2: Competing software 1 project with 100 tendons (groups Group_1). The tendon polylines cover 74.1 x 60.5 m in plan. Tendon system in the segment data: unbonded; tendon areas 280, 700 mm2; E = 200000 MPa, fpu = 1860 MPa, fpy = 1700 MPa; friction coefficient 0.07, wobble coefficient K = 3.28e-06 per mm; jacking ratio 0.8 of fpu, seating 6 mm (stage 1 of TendonOperation). The project's long-term loss is the lump-sum method of the regression (spec 03 section 8.2): 100 tendons, 2220 segments.

METHOD

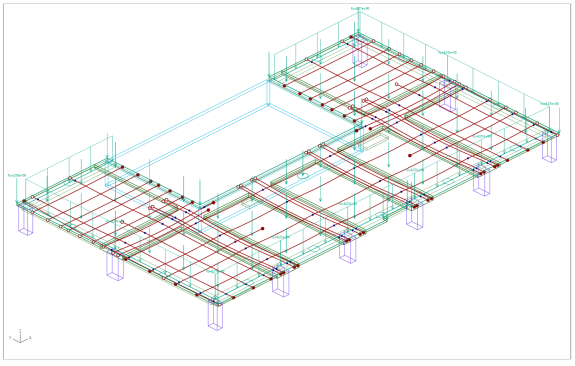
Module check: OpenPT's long-term loss module is fed with Competing software 1's own stresses at the segment ends and must reproduce Competing software 1's loss at every segment to the 4 significant digits Competing software 1 prints. End to end: OpenPT's own friction and seating forces go through the loss module and the final force at every node is compared with Competing software 1's (relative error). Targets are those the tool prints (spec 03 section 8.2).

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
module check: segments whose long-term loss equals Competing software 1's (4 significant digits), of 2220	–	–	2220	–	100 %	PASS
end-to-end force error after long-term losses, median (n = 4440 nodes)	%	–	0.019	–	<= 0.6 %	PASS
end-to-end force error, 95th percentile	%	–	0.042	–	<= 1 %	PASS
end-to-end force error, maximum	%	–	0.055	–	<= 1.5 %	PASS
tendons skipped	–	–	0	–	none expected	INFO

OpenPT build: 7d86603 Release (tag installed-20261118-1237), run 2026-11-18
Command: `OpenPT.Regress.exe losses D:\NETtool\NDC_san\OSI_typ_v2\Databases (cwd openpt-build\ver-run\B\out\final)`
Sources: `NDC_san\OSI_typ_v2\Databases\TendonSeg_OSI_typ_v2.dat`
`NDC_san\OSI_typ_v2\Databases\TendonOperation_OSI_typ_v2.dat`
`NDC_san\OSI_typ_v2\Databases\TendonStressHistory_OSI_typ_v2.dat`
`NDC_san\OSI_typ_v2\Databases\TendonSegStress_OSI_typ_v2.dat`
`openpt-build\ver-run\B\out\final\ch2_losses_OSI_typ_v2.txt`

1.5 V-207 H1HH1_F9-12: long-term losses of the tendon force

Perspective: Tendon long-term losses · **Reference:** Competing software 1, long-term loss results (TendonSegStress) of the project · **Status:** PASS



Structure: H1HH1_F9-12

MODEL

H1HH1_F9-12: Competing software 1 project with 48 tendons (groups TendonY). The tendon polylines cover 45.9 x 27.0 m in plan. Tendon system in the segment data: bonded; tendon areas 280, 700 mm2; E = 195000 MPa, fpu = 1860 MPa, fpy = 1670 MPa; friction coefficient 0.2, wobble coefficient K = 5e-05 per mm; jacking ratio 0.8 of fpu, seating 6 mm (stage 1 of TendonOperation). The project's long-term loss is the lump-sum method of the regression (spec 03 section 8.2): 48 tendons, 1533 segments.

METHOD

Module check: OpenPT's long-term loss module is fed with Competing software 1's own stresses at the segment ends and must reproduce Competing software 1's loss at every segment to the 4 significant digits Competing software 1 prints. End to end: OpenPT's own friction and seating forces go through the loss module and the final force at every node is compared with Competing software 1's (relative error). Targets are those the tool prints (spec 03 section 8.2).

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
module check: segments whose long-term loss equals Competing software 1's (4 significant digits), of 1533	–	–	1533	–	100 %	PASS
end-to-end force error after long-term losses, median (n = 2934 nodes)	%	–	0.009	–	<= 0.6 %	PASS
end-to-end force error, 95th percentile	%	–	0.532	–	<= 1 %	PASS
end-to-end force error, maximum	%	–	0.624	–	<= 1.5 %	PASS
tendons skipped	–	–	0	–	none expected	INFO

OpenPT build: 7d86603 Release (tag installed-20261118-1237), run 2026-11-18
Command: `OpenPT.Regress.exe losses D:\NETtool\OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases (cwd openpt-build\ver-run\B\out\final)`
Sources: `OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\TendonSeg_H1HH1_F9-12.dat`
`OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\TendonOperation_H1HH1_F9-12.dat`
`OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\TendonStressHistory_H1HH1_F9-12.dat`
`OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\TendonSegStress_H1HH1_F9-12.dat`
`openpt-build\ver-run\B\out\final\ch2_losses_H1HH1_F9-12.txt`

1.6 V-208 B1CC4_TDH: long-term losses of the tendon force

Perspective: Tendon long-term losses · **Reference:** Competing software 1, long-term loss results (TendonSegStress) of the project · **Status:** PASS

MODEL

B1CC4_TDH: Competing software 1 project with 94 tendons (groups CAPX, CAPY). The tendon polylines cover 75.7 x 38.7 m in plan. Tendon system in the segment data: bonded; tendon areas 280, 700 mm2; E = 200000 MPa, fpu = 1860 MPa, fpy = 1700 MPa; friction coefficient 0.2, wobble coefficient K = 5e-06 per mm; jacking ratio 0.8 of fpu, seating 6 mm (stage 1 of TendonOperation). The project's long-term loss is the lump-sum method of the regression (spec 03 section 8.2): 94 tendons, 3666 segments.

METHOD

Module check: OpenPT's long-term loss module is fed with Competing software 1's own stresses at the segment ends and must reproduce Competing software 1's loss at every segment to the 4 significant digits Competing software 1 prints. End to end: OpenPT's own friction and seating forces go through the loss module and the final force at every node is compared with Competing software 1's (relative error). Targets are those the tool prints (spec 03 section 8.2).

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
module check: segments whose long-term loss equals Competing software 1's (4 significant digits), of 3666	–	–	3666	–	100 %	PASS
end-to-end force error after long-term losses, median (n = 7332 nodes)	%	–	0.019	–	<= 0.6 %	PASS
end-to-end force error, 95th percentile	%	–	0.045	–	<= 1 %	PASS
end-to-end force error, maximum	%	–	0.069	–	<= 1.5 %	PASS
tendons skipped	–	–	0	–	none expected	INFO

OpenPT build: 7d86603 Release (tag installed-20261118-1237), run 2026-11-18
Command: `OpenPT.Regress.exe losses D:\NETtool\OpenPT\bench\work\real\B1CC4_TDH\B1CC4_TDH\Databases (cwd openpt-build\ver-run\B\out\final)`
Sources: `OpenPT\bench\work\real\B1CC4_TDH\B1CC4_TDH\Databases\TendonSeg_B1CC4_TDH.dat`
`OpenPT\bench\work\real\B1CC4_TDH\B1CC4_TDH\Databases\TendonOperation_B1CC4_TDH.dat`
`OpenPT\bench\work\real\B1CC4_TDH\B1CC4_TDH\Databases\TendonStressHistory_B1CC4_TDH.dat`
`OpenPT\bench\work\real\B1CC4_TDH\B1CC4_TDH\Databases\TendonSegStress_B1CC4_TDH.dat`
`openpt-build\ver-run\B\out\final\ch2_losses_B1CC4_TDH.txt`

1.7 V-210 OSI_typ_v2: tendon profile geometry against Competing software 1's tendon polylines

Perspective: Tendon profile geometry · **Reference:** Competing software 1, tendon polylines (TendonSeg) generated from the exchange INP · **Status:** PASS

MODEL

OSI_typ_v2: exchange file `NDC_san\OSI_typ_v2\backup\osi_typ_v2_002.INP` (exchange file written by Competing software 1, backup 002), 86 tendons; Competing software 1's TendonSeg of the same project holds 100 tendon polylines. Implied slab thickness at the low point (code 0 spans, rounded to 10 mm): 220 mm x120, 400 mm x2. The tendons cover 74.1 x 60.5 m in plan; E = 200000 MPa, fpu = 1860 MPa.

METHOD

The tendons of the INP are matched with the tendons of TendonSeg by plan geometry (sum of the two end-point distances <= 50 mm, nodes within 5 mm of the chord). OpenPT evaluates the INP profile (parabolas, reversed parabolas, straight lines; codes shown in the rows) at every node of Competing software 1's polyline and the largest vertical difference per span is compared with 0.1 mm. Gate of the tool (spec 02 section 7.2): at least 95 % of the supported spans within 0.1 mm (the tool gates the pooled spans of all pairs; the share is shown here for this pair alone). The end-to-end check (built polyline, spec 01 solver, TendonStressHistory) is reported only.

Quantity	Unit	Reference	OpenPT	Difference %
INP tendons matched with a Competing software 1 tendon by plan geometry, of 86 INP tendons (100 tendons in Competing software 1's TendonSeg)	–	–	86	–
supported spans within 0.1 mm of Competing software 1's polyline nodes, of 139	–	–	139	–
largest span deviation, profile code 0 (122 spans; median 0.007 mm, 95th 0.029 mm)	mm	–	0.037	–
largest span deviation, profile code 7 (17 spans; median 0 mm, 95th 0.002 mm)	mm	–	0.009	–
end-to-end node force error, median (n = 3490 nodes; report only)	%	–	0.221	–
end-to-end node force error, 95th percentile	%	–	0.605	–
end-to-end node force error, maximum	%	–	0.823	–
end-to-end elongation error per end, median (n = 71 ends)	%	–	0.181	–
end-to-end elongation error per end, 95th percentile	%	–	0.367	–
end-to-end elongation error per end, maximum	%	–	0.68	–

NOTES

End-to-end: 59 tendons keep the segment count of the run, 12 have a different one (their forces are compared after interpolation to the run's nodes; the tool counts both together in the rows above).

OpenPT build: 7d86603 Release (tag installed-20261118-1237), run 2026-11-18
Command: `OpenPT.Regress.exe profiles D:\NETtool\NDC_san\OSI_typ_v2\backup\osi_typ_v2_002.INP D:\NETtool\NDC_san\OSI_typ_v2\Databases (cwd openpt-build\ver-run\B\out\final)`
Sources: `NDC_san\OSI_typ_v2\backup\osi_typ_v2_002.INP`
`NDC_san\OSI_typ_v2\Databases\TendonSeg_OSI_typ_v2.dat`
`NDC_san\OSI_typ_v2\Databases\TendonOperation_OSI_typ_v2.dat`
`NDC_san\OSI_typ_v2\Databases\TendonStressHistory_OSI_typ_v2.dat`
`NDC_san\OSI_typ_v2\Databases\TendonSegStress_OSI_typ_v2.dat`
`openpt-build\ver-run\B\out\final\ch2_profiles_OSI_typ_v2.txt`

1.8 V-211 H1HH1_F9-12: tendon profile geometry against Competing software 1's tendon polylines

Perspective: Tendon profile geometry · **Reference:** Competing software 1, tendon polylines (TendonSeg) generated from the exchange INP · **Status:** PASS

MODEL

H1HH1_F9-12: exchange file `NDC_san\H1HH1_F9-12\backup\h1hh1_f9-12_001.INP` (exchange file written by Competing software 1, backup 001), 48 tendons; Competing software 1's TendonSeg of the same project holds 48 tendon polylines. Implied slab thickness at the low point (code 0 spans, rounded to 10 mm): 230 mm x44, 400 mm x26. The tendons cover 45.9 x 27.0 m in plan; E = 195000 MPa, fpu = 1860 MPa.

METHOD

The tendons of the INP are matched with the tendons of TendonSeg by plan geometry (sum of the two end-point distances <= 50 mm, nodes within 5 mm of the chord). OpenPT evaluates the INP profile (parabolas, reversed parabolas, straight lines; codes shown in the rows) at every node of Competing software 1's polyline and the largest vertical difference per span is compared with 0.1 mm. Gate of the tool (spec 02 section 7.2): at least 95 % of the supported spans within 0.1 mm (the tool gates the pooled spans of all pairs; the share is shown here for this pair alone). The end-to-end check (built polyline, spec 01 solver, TendonStressHistory) is reported only.

Quantity	Unit	Reference	OpenPT	Difference %	T
INP tendons matched with a Competing software 1 tendon by plan geometry, of 48 INP tendons (48 tendons in Competing software 1's TendonSeg)	–	–	48	–	n p
supported spans within 0.1 mm of Competing software 1's polyline nodes, of 120	–	–	120	–	> o sp
largest span deviation, profile code 0 (70 spans; median 0.001 mm, 95th 0.004 mm)	mm	–	0.004	–	0 p
largest span deviation, profile code 7 (50 spans; median 0 mm, 95th 0.004 mm)	mm	–	0.004	–	0 p
end-to-end node force error, median (n = 3162 nodes; report only)	%	–	0.104	–	re o
end-to-end node force error, 95th percentile	%	–	0.362	–	re o
end-to-end node force error, maximum	%	–	0.585	–	re o
end-to-end elongation error per end, median (n = 48 ends)	%	–	0.113	–	re o
end-to-end elongation error per end, 95th percentile	%	–	0.442	–	re o
end-to-end elongation error per end, maximum	%	–	0.442	–	re o

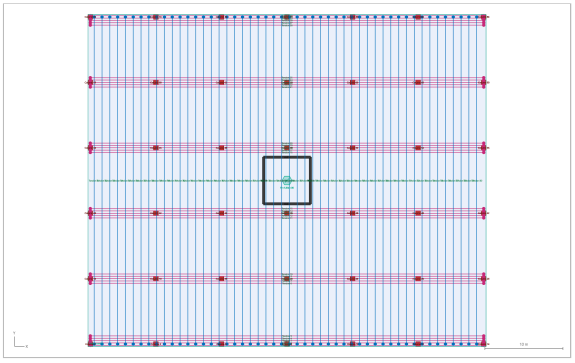
NOTES

End-to-end: 39 tendons keep the segment count of the run, 9 have a different one (their forces are compared after interpolation to the run's nodes; the tool counts both together in the rows above).

OpenPT build: 7d86603 Release (tag installed-20261118-1237), run 2026-11-18
Command: `OpenPT.Regress.exe profiles D:\NETtool\NDC_san\H1HH1_F9-12\backup\h1hh1_f9-12_001.INP D:\NETtool\OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases (cwd openpt-build\ver-run\B\out\final)`
Sources: `NDC_san\H1HH1_F9-12\backup\h1hh1_f9-12_001.INP`
`OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\TendonSeg_H1HH1_F9-12.dat`
`OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\TendonOperation_H1HH1_F9-12.dat`
`OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\TendonStressHistory_H1HH1_F9-12.dat`
`OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\TendonSegStress_H1HH1_F9-12.dat`
`openpt-build\ver-run\B\out\final\ch2_profiles_H1HH1_F9-12.txt`

1.9 V-212 B10 (synthetic PT floor): tendon profile geometry against Competing software 1's tendon polylines

Perspective: Tendon profile geometry · **Reference:** Competing software 1, tendon polylines (TendonSeg) generated from the exchange INP · **Status:** PASS



Structure: B10

MODEL

B10 (synthetic PT floor): exchange file `OpenPT\bench\cases\B10\B10.INP` (benchmark input file that was imported into Competing software 1), 80 tendons; Competing software 1's TendonSeg of the same project holds 80 tendon polylines. Implied slab thickness at the low point (code 0 spans, rounded to 10 mm): 230 mm x430. The tendons cover 50.4 x 42.3 m in plan; E = 200000 MPa, fpu = 1860 MPa.

METHOD

The tendons of the INP are matched with the tendons of TendonSeg by plan geometry (sum of the two end-point distances <= 50 mm, nodes within 5 mm of the chord). OpenPT evaluates the INP profile (parabolas, reversed parabolas, straight lines; codes shown in the rows) at every node of Competing software 1's polyline and the largest vertical difference per span is compared with 0.1 mm. Gate of the tool (spec 02 section 7.2): at least 95 % of the supported spans within 0.1 mm (the tool gates the pooled spans of all pairs; the share is shown here for this pair alone). The end-to-end check (built polyline, spec 01 solver, TendonStressHistory) is reported only.

Quantity	Unit	Reference	OpenPT	Difference %	T
INP tendons matched with a Competing software 1 tendon by plan geometry, of 80 INP tendons (80 tendons in Competing software 1's TendonSeg)	–	–	80	–	n p
supported spans within 0.1 mm of Competing software 1's polyline nodes, of 430	–	–	430	–	> o sp
largest span deviation, profile code 0 (430 spans; median 0.003 mm, 95th 0.005 mm)	mm	–	0.005	–	0 p
end-to-end node force error, median (n = 27840 nodes; report only)	%	–	0.082	–	re o
end-to-end node force error, 95th percentile	%	–	0.175	–	re o
end-to-end node force error, maximum	%	–	0.231	–	re o
end-to-end elongation error per end, median (n = 160 ends)	%	–	0.065	–	re o
end-to-end elongation error per end, 95th percentile	%	–	0.196	–	re o
end-to-end elongation error per end, maximum	%	–	0.196	–	re o

NOTES

End-to-end: 80 tendons keep the segment count of the run, 0 have a different one (their forces are compared after interpolation to the run's nodes; the tool counts both together in the rows above).

OpenPT build: 7d86603 Release (tag installed-20261118-1237), run 2026-11-18
Command: `OpenPT.Regress.exe profiles D:\NETtool\OpenPT\bench\cases\B10\B10.INP D:\NETtool\OpenPT\bench\work\B10\B10\Databases (cwd openpt-build\ver-run\B\out\final)`
Sources: `OpenPT\bench\cases\B10\B10.INP`
`OpenPT\bench\work\B10\B10\Databases\TendonSeg_B10.dat`
`OpenPT\bench\work\B10\B10\Databases\TendonOperation_B10.dat`
`OpenPT\bench\work\B10\B10\Databases\TendonStressHistory_B10.dat`
`OpenPT\bench\work\B10\B10\Databases\TendonSegStress_B10.dat`
`openpt-build\ver-run\B\out\final\ch2_profiles_B10.txt`

1.10 V-213 OSI_typ_v2: balanced loads of the tendons

Perspective: Balanced loads (equivalent loads) · **Reference:** Competing software 1, finite-element tendons of the project (_original.adi, PRESTRESSING.ADO) and exact equilibrium · **Status:** PASS

MODEL

OSI_typ_v2: Competing software 1 project with 100 tendons (groups Group_1). The tendon polylines cover 74.1 x 60.5 m in plan. Tendon system in the segment data: unbonded; tendon areas 280, 700 mm2; E = 200000 MPa, fpu = 1860 MPa, fpy = 1700 MPa; friction coefficient 0.07, wobble coefficient K = 3.28e-06 per mm; jacking ratio 0.8 of fpu, seating 6 mm (stage 1 of TendonOperation). The Competing software 1 analysis model holds 100 finite-element tendons.

METHOD

Gate (spec 04 section 8.2): for every tendon OpenPT builds the 3D equivalent loads of the force after long-term losses; the resultant force and moment of the loads and the anchors must vanish (relative residual <= 1E-9), also after moving the loads to a reference surface 50 mm above the highest node, and each anchor load must have the size of the segment force. This is a check of OpenPT's own loads, not a number from Competing software 1. Report (section 8.3): Competing software 1's finite-element tendons are matched with OpenPT's tendons (plan box prefilter 100 mm, nearest mean 3D distance, unmatched above 5 mm); the geometry is compared point by point and the stress after long-term losses with the FEM chord force / area at the chord midpoint. Section 8.3 has no tolerance, so the rows are information.

Quantity	Unit	Reference	OpenPT	Diffe
equilibrium of the tendon loads, force residual, worst of 100 tendons	relative	–	0.00000000000000000649	
equilibrium, moment residual	relative	–	0.00000000000000000739	
equilibrium after moving to the reference surface, moment residual	relative	–	0.00000000000000644	
anchor load size against the segment force, worst relative error	relative	–	0.00000000000000267	
Competing software 1 FEM tendons matched with an OpenPT tendon, of 100 (25 unmatched above 5 mm, 1 with a different chord count)	–	–	75	
tendon geometry: distance of Competing software 1's FEM points to OpenPT's polyline, median (n = 1333)	mm	–	0.064	
geometry distance, 95th percentile	mm	–	0.432	
geometry distance, maximum	mm	–	77.65	
stress difference, calculated-force tendons, median (n = 1049 chords)	%	–	0.226	
stress difference, 95th percentile	%	–	0.731	
stress difference, maximum	%	–	1.539	
effective-force FEM tendons (12 tendons, one constant force): difference to OpenPT's friction-based stress, median (n = 148)	%	–	36.63	

NOTES

12 tendons of this project are effective-force tendons in Competing software 1 (one constant chord force). OpenPT's friction-based stress, which these tendons do not use, differs from that constant by a median of 36.6 %, as the tool's own text says; the row is information only.

OpenPT build: 7d86603 Release (tag installed-20261118-1237), run 2026-11-18
Command: `OpenPT.Regress.exe loads D:\NETtool\NDC_san\OSI_typ_v2\Databases (cwd openpt-build\ver-run\B\out\final) (the final 'INP EFFECTIVE FORCE' block of the tool reads D:\NDC_OSI\... which does not exist on this PC; it is not used)`
Sources: `NDC_san\OSI_typ_v2\Databases\TendonSeg_OSI_typ_v2.dat`
`NDC_san\OSI_typ_v2\Databases\TendonOperation_OSI_typ_v2.dat`
`NDC_san\OSI_typ_v2\Databases\TendonStressHistory_OSI_typ_v2.dat`
`NDC_san\OSI_typ_v2\Databases\TendonSegStress_OSI_typ_v2.dat`
`NDC_san\OSI_typ_v2\Databases\OSI_TYP_V2_original.adi`
`openpt-build\ver-run\B\out\final\ch2_loads_OSI_typ_v2.txt`

1.11 V-214 H1HH1_F9-12: balanced loads of the tendons

Perspective: Balanced loads (equivalent loads) · **Reference:** Competing software 1, finite-element tendons of the project (_original.adi, PRESTRESSING.ADO) and exact equilibrium · **Status:** PASS

MODEL

H1HH1_F9-12: Competing software 1 project with 48 tendons (groups TendonY). The tendon polylines cover 45.9 x 27.0 m in plan. Tendon system in the segment data: bonded; tendon areas 280, 700 mm2; E = 195000 MPa, fpu = 1860 MPa, fpy = 1670 MPa; friction coefficient 0.2, wobble coefficient K = 5e-05 per mm; jacking ratio 0.8 of fpu, seating 6 mm (stage 1 of TendonOperation). The Competing software 1 analysis model holds 48 finite-element tendons.

METHOD

Gate (spec 04 section 8.2): for every tendon OpenPT builds the 3D equivalent loads of the force after long-term losses; the resultant force and moment of the loads and the anchors must vanish (relative residual <= 1E-9), also after moving the loads to a reference surface 50 mm above the highest node, and each anchor load must have the size of the segment force. This is a check of OpenPT's own loads, not a number from Competing software 1. Report (section 8.3): Competing software 1's finite-element tendons are matched with OpenPT's tendons (plan box prefilter 100 mm, nearest mean 3D distance, unmatched above 5 mm); the geometry is compared point by point and the stress after long-term losses with the FEM chord force / area at the chord midpoint. Section 8.3 has no tolerance, so the rows are information.

Quantity	Unit	Reference	OpenPT	Differ
equilibrium of the tendon loads, force residual, worst of 48 tendons	relative	–	0.00000000000000000713	
equilibrium, moment residual	relative	–	0.00000000000000000416	
equilibrium after moving to the reference surface, moment residual	relative	–	0.00000000000000075	
anchor load size against the segment force, worst relative error	relative	–	0.00000000000000277	
sum of the upward balanced loads f_z+ of all tendons (information)	kN	–	2004	
Competing software 1 FEM tendons matched with an OpenPT tendon, of 48 (17 unmatched above 5 mm, 0 with a different chord count)	–	–	31	
tendon geometry: distance of Competing software 1's FEM points to OpenPT's polyline, median (n = 1418)	mm	–	0.023	
geometry distance, 95th percentile	mm	–	0.044	
geometry distance, maximum	mm	–	71.67	
stress difference, calculated-force tendons, median (n = 1308 chords)	%	–	0.139	
stress difference, 95th percentile	%	–	0.883	
stress difference, maximum	%	–	27.32	

OpenPT build: 7d86603 Release (tag installed-20261118-1237), run 2026-11-18
Command: `OpenPT.Regress.exe loads D:\NETtool\OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases (cwd openpt-build\ver-run\B\out\final) (the final 'INP EFFECTIVE FORCE' block of the tool reads D:\NDC_OSI\... which does not exist on this PC; it is not used)`
Sources: `OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\TendonSeg_H1HH1_F9-12.dat`
`OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\TendonOperation_H1HH1_F9-12.dat`
`OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\TendonStressHistory_H1HH1_F9-12.dat`
`OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\TendonSegStress_H1HH1_F9-12.dat`
`OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\H1HH1_F9-12_original.adi`
`openpt-build\ver-run\B\out\final\ch2_loads_H1HH1_F9-12.txt`

1.12 V-215 B1CC4_TDH: balanced loads of the tendons

Perspective: Balanced loads (equivalent loads) · **Reference:** Competing software 1, finite-element tendons of the project (_original.adi, PRESTRESSING.ADO) and exact equilibrium · **Status:** PASS

MODEL

B1CC4_TDH: Competing software 1 project with 94 tendons (groups CAPX, CAPY). The tendon polylines cover 75.7 x 38.7 m in plan. Tendon system in the segment data: bonded; tendon areas 280, 700 mm2; E = 200000 MPa, fpu = 1860 MPa, fpy = 1700 MPa; friction coefficient 0.2, wobble coefficient K = 5e-06 per mm; jacking ratio 0.8 of fpu, seating 6 mm (stage 1 of TendonOperation). The Competing software 1 analysis model holds 94 finite-element tendons.

METHOD

Gate (spec 04 section 8.2): for every tendon OpenPT builds the 3D equivalent loads of the force after long-term losses; the resultant force and moment of the loads and the anchors must vanish (relative residual <= 1E-9), also after moving the loads to a reference surface 50 mm above the highest node, and each anchor load must have the size of the segment force. This is a check of OpenPT's own loads, not a number from Competing software 1. Report (section 8.3): Competing software 1's finite-element tendons are matched with OpenPT's tendons (plan box prefilter 100 mm, nearest mean 3D distance, unmatched above 5 mm); the geometry is compared point by point and the stress after long-term losses with the FEM chord force / area at the chord midpoint. Section 8.3 has no tolerance, so the rows are information.

Quantity	Unit	Reference	OpenPT	Differe
equilibrium of the tendon loads, force residual, worst of 94 tendons	relative	–	0.00000000000000000841	
equilibrium, moment residual	relative	–	0.00000000000000000089	
equilibrium after moving to the reference surface, moment residual	relative	–	0.00000000000000388	
anchor load size against the segment force, worst relative error	relative	–	0.00000000000000193	
sum of the upward balanced loads f_z+ of all tendons (information)	kN	–	10390	
Competing software 1 FEM tendons matched with an OpenPT tendon, of 94 (8 unmatched above 5 mm, 0 with a different chord count)	–	–	86	
tendon geometry: distance of Competing software 1's FEM points to OpenPT's polyline, median (n = 2096)	mm	–	0.005	
geometry distance, 95th percentile	mm	–	0.027	
geometry distance, maximum	mm	–	0.056	
stress difference, calculated-force tendons, median (n = 1868 chords)	%	–	0.345	
stress difference, 95th percentile	%	–	2.368	
stress difference, maximum	%	–	4.846	

OpenPT build: 7d86603 Release (tag installed-20261118-1237), run 2026-11-18
Command: `OpenPT.Regress.exe loads D:\NETtool\OpenPT\bench\work\real\B1CC4_TDH\B1CC4_TDH\Databases (cwd openpt-build\ver-run\B\out\final) (the final 'INP EFFECTIVE FORCE' block of the tool reads D:\NDC_OSI\... which does not exist on this PC; it is not used)`
Sources: `OpenPT\bench\work\real\B1CC4_TDH\B1CC4_TDH\Databases\TendonSeg_B1CC4_TDH.dat`
`OpenPT\bench\work\real\B1CC4_TDH\B1CC4_TDH\Databases\TendonOperation_B1CC4_TDH.dat`
`OpenPT\bench\work\real\B1CC4_TDH\B1CC4_TDH\Databases\TendonStressHistory_B1CC4_TDH.dat`
`OpenPT\bench\work\real\B1CC4_TDH\B1CC4_TDH\Databases\TendonSegStress_B1CC4_TDH.dat`
`OpenPT\bench\work\real\B1CC4_TDH\B1CC4_TDH\Databases\B1CC4_TDH_original.adi`
`openpt-build\ver-run\B\out\final\ch2_loads_B1CC4_TDH.txt`

1.13 V-216 B3CC1_F10-19: balanced loads of the tendons

Perspective: Balanced loads (equivalent loads) · **Reference:** Competing software 1, finite-element tendons of the project (_original.adi, PRESTRESSING.ADO) and exact equilibrium · **Status:** PASS

MODEL

B3CC1_F10-19: Competing software 1 project with 118 tendons (groups Group_X, Group_Y). The tendon polylines cover 62.1 x 30.9 m in plan. Tendon system in the segment data: bonded; tendon areas 280, 700 mm2; E = 200000 MPa, fpu = 1860 MPa, fpy = 1700 MPa; friction coefficient 0.2, wobble coefficient K = 5e-07 per mm; jacking ratio 0.8 of fpu, seating 6 mm (stage 1 of TendonOperation). The Competing software 1 analysis model holds 118 finite-element tendons.

METHOD

Gate (spec 04 section 8.2): for every tendon OpenPT builds the 3D equivalent loads of the force after long-term losses; the resultant force and moment of the loads and the anchors must vanish (relative residual <= 1E-9), also after moving the loads to a reference surface 50 mm above the highest node, and each anchor load must have the size of the segment force. This is a check of OpenPT's own loads, not a number from Competing software 1. Report (section 8.3): Competing software 1's finite-element tendons are matched with OpenPT's tendons (plan box prefilter 100 mm, nearest mean 3D distance, unmatched above 5 mm); the geometry is compared point by point and the stress after long-term losses with the FEM chord force / area at the chord midpoint. Section 8.3 has no tolerance, so the rows are information.

Quantity	Unit	Reference	OpenPT	Differ
equilibrium of the tendon loads, force residual, worst of 118 tendons	relative	–	0.00000000000000000985	
equilibrium, moment residual	relative	–	0.00000000000000000154	
equilibrium after moving to the reference surface, moment residual	relative	–	0.00000000000000409	
anchor load size against the segment force, worst relative error	relative	–	0.00000000000000000351	
sum of the upward balanced loads f_z+ of all tendons (information)	kN	–	12550	
Competing software 1 FEM tendons matched with an OpenPT tendon, of 118 (8 unmatched above 5 mm, 0 with a different chord count)	–	–	110	
tendon geometry: distance of Competing software 1's FEM points to OpenPT's polyline, median (n = 2917)	mm	–	0.05	
geometry distance, 95th percentile	mm	–	0.467	
geometry distance, maximum	mm	–	80.11	
stress difference, calculated-force tendons, median (n = 2682 chords)	%	–	0.263	
stress difference, 95th percentile	%	–	1.863	
stress difference, maximum	%	–	385.2	

NOTES

The maximum stress difference of 385.2 % is the tool's largest value over 2682 chords; the tool does not print which tendon it belongs to. The friction case of this project (V-204) has two tendons whose force after seating is far from Competing software 1's; a link is not established.

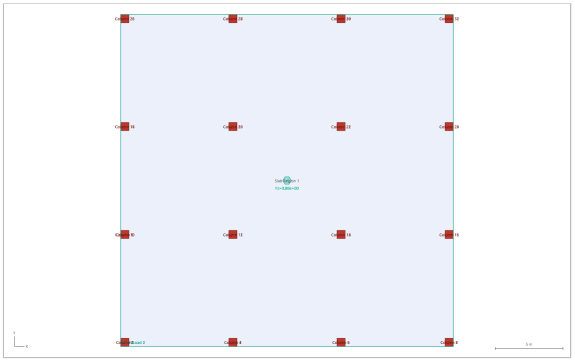
OpenPT build: 7d86603 Release (tag installed-20261118-1237), run 2026-11-18
Command: `OpenPT.Regress.exe loads D:\NETtool\NDC_san\B3CC1_F10-19\Databases (cwd openpt-build\ver-run\B\out\final) (the final 'INP EFFECTIVE FORCE' block of the tool reads D:\NDC_OSI\... which does not exist on this PC; it is not used)`
Sources: `NDC_san\B3CC1_F10-19\Databases\TendonSeg_B3CC1_F10-19.dat`
`NDC_san\B3CC1_F10-19\Databases\TendonOperation_B3CC1_F10-19.dat`
`NDC_san\B3CC1_F10-19\Databases\TendonStressHistory_B3CC1_F10-19.dat`
`NDC_san\B3CC1_F10-19\Databases\TendonSegStress_B3CC1_F10-19.dat`
`NDC_san\B3CC1_F10-19\Databases\B3CC1_F10-19_original.adi`
`openpt-build\ver-run\B\out\final\ch2_loads_B3CC1_F10-19.txt`

2 Floors against Competing software 1: ten synthetic cases

Ten synthetic floors, B01 to B10, and the fine-mesh variant B10F, each built so that one feature is exercised: drop panels, beams and a wall, cantilevers, openings, long spans, a transfer beam, an irregular outline, a large floor (PLAN.md section 2.2). Each model is one floor of an INP file generated by `tools/OpenPT.BenchGen`; the same INP, support lines, covers and mesh values went into both programs.

2.1 V-301 B01 RC flat plate: deflection and cracking

Perspective: Deflection, cracked and long-term · **Reference:** Competing software 1, EC2 · **Status:** PASS



Structure: B01

MODEL

Reinforced concrete floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 605.2 m2; patch dead load 907.7 kN, patch live load 1815.5 kN. baseline RC flat plate 3 x 3 bays of 8.0 m, t 250; 16 columns 600 x 600: 4 interior, 8 edge, 4 corner punching cases. 16 columns, 0 walls, 0 beams, 0 openings; 8 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 296 nodes, 227 shells, 32 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M1: maximum |uz| of the cracked long-term deflection (Competing software 1 cracked_Long_Term; OpenPT `CrackedDeflectionResult.MaxCrackedLongTerm`), relative difference, tolerance 10 % or 1.0 mm when Competing software 1 is below 10 mm. U0 and K = cracked / uncracked sustained (M2, tolerance 10 %). Cracked state: the two programs use the same design sections; a section is cracked when Ie/Ig < 1; at least 85 % of the sections must agree. Probes: the inverse-distance mean of the four nearest slab nodes within 1000 mm, report only.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
max |uz|, cracked long-term (M1)	mm	24.95	24.66	-1.17 -0.291 mm	<= 10 % or <= 1 mm if A < 10 mm	PASS
max |uz|, uncracked sustained (U0, diagnostic)	mm	8.133	8.068	-0.80	soft target +/-5 %, diagnostic only	INFO
max |uz|, cracked sustained	mm	8.318	8.221	-1.17	report only	INFO
K = cracked / uncracked sustained (M2)	-	1.023	1.019	-0.37	+/-10 %	PASS
sections with the same cracked state as Competing software 1 (of 312; 100.0 %)	sections	–	312	–	>= 85 %	PASS
cracked sections among the paired (Competing software 1 / OpenPT)	sections	15	15	+0.00	report only	INFO
distance between the two max |uz| locations	mm	–	23780	–	report only	INFO
largest probe difference: bay_3_1 (of 7 probes compared, 9 defined), uz cracked long-term	mm	-24.53	-24.18	+1.42 +0.3494 mm	report only	INFO

NOTES

The mesh of OpenPT is its own, so deflections are compared at the maximum and at the probe points, not node by node (PLAN.md section 6, item 4).

OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case B01 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B01 --inp ver-run\A\work\B01\export\B01_export.INP --adm ver-run\A\work\B01\B01.adm --run-json ver-run\A\work\B01\cs1_run.json --out ver-run\A\results\B01 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

Sources: `bench\results\B01\cs1.jsonl`

`bench\results\B01\cs1_uz.csv`

`openpt-build\ver-run\A\results\B01\openpt.jsonl`

`openpt-build\ver-run\A\results\compare.csv`

`openpt-build\ver-run\A\work\B01\cs1_run.json`

`bench\cases\B01\B01.case.json`

2.2 V-302 B01 RC flat plate: calculated rebar

Perspective: Calculated rebar: provided area, steel mass, bar counts · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Reinforced concrete floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 605.2 m2; patch dead load 907.7 kN, patch live load 1815.5 kN. baseline RC flat plate 3 x 3 bays of 8.0 m, t 250; 16 columns 600 x 600: 4 interior, 8 edge, 4 corner punching cases. 16 columns, 0 walls, 0 beams, 0 openings; 8 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 296 nodes, 227 shells, 32 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M3b: provided As per design section and face (at least 90 % of section-faces must match). M3c: total steel mass per face of the Calculated Rebar Plan, tolerance 10 %. Bar counts and the multiset of bars (spec 27 G2) and the required-As envelope (M3a) are report only. Provided As: Competing software 1's value in the .adm section record against OpenPT's Calculated Rebar Plan. Steel mass: bars with Source = 1 in the Competing software 1 export against OpenPT's plan. A section-face matches when |difference| <= max(10 % of Competing software 1, one bar area of that face).

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
provided As section-faces matching Competing software 1 (of 624; 99.8 %)	faces	–	623	–	>= 90 % of faces; face tol max(10 % of A, 1 bar)	PASS
calculated-rebar steel mass, top face	kg	3522	3537	+0.44	+/-10 %	PASS
calculated-rebar steel mass, bottom face	kg	5566	5566	+0.00	+/-10 %	PASS
bar count, top face	bars	32	32	+0.00	report only	INFO
bar count, bottom face	bars	24	24	+0.00	report only	INFO
bars identical to Competing software 1's (same length and diameter), top face (of 32; 90.6 %)	bars	–	29	–	report only	INFO
bars identical to Competing software 1's (same length and diameter), bottom face (of 24; 100.0 %)	bars	–	24	–	report only	INFO
required As envelope, |difference| median over section-faces	%	–	0.03275	–	report only	INFO
required As envelope, |difference| maximum	%	–	5.375	–	report only	INFO

NOTES

Report-only rows are not judged. The steel mass of the whole plan is compared; the bar multiset differs from Competing software 1 in some cases because whole-bar rounding and splice positions differ (spec 27 G2).

OpenPT build: 7d86603 Release, run 2026-11-18
Command: `tools\run_openpt.ps1 -Case B01 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B01 --inp ver-run\A\work\B01\export\B01_export.INP --adm ver-run\A\work\B01\B01.adm --run-json ver-run\A\work\B01\cs1_run.json --out ver-run\A\results\B01 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`
Sources: `bench\results\B01\cs1.jsonl`
`bench\results\B01\cs1_uz.csv`
`openpt-build\ver-run\A\results\B01\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B01\cs1_run.json`
`bench\cases\B01\B01.case.json`

2.3 V-303 B01 RC flat plate: punching shear

Perspective: Punching shear · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Reinforced concrete floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 605.2 m2; patch dead load 907.7 kN, patch live load 1815.5 kN. baseline RC flat plate 3 x 3 bays of 8.0 m, t 250; 16 columns 600 x 600: 4 interior, 8 edge, 4 corner punching cases. 16 columns, 0 walls, 0 beams, 0 openings; 8 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 296 nodes, 227 shells, 32 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M4: Competing software 1's `.PUO` after Execute Shear Check against OpenPT's `PunchingCheck` (precompression mode and compatibility switches set to match Competing software 1), matched by support label. Tolerances: the set of checked supports identical; stress ratio within 10 % on at least 90 % of the supports; verdict class equal on at least 90 %. Every column and short wall of the level is checked by both programs.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
supports checked (Competing software 1 / OpenPT)	supports	16	16	+0.00	identical	PASS
supports with the stress ratio within +/-10 % of Competing software 1's (of 16; 100.0 %)	supports	–	16	–	>= 90 %	PASS
supports with the same verdict class as Competing software 1 (of 16; 100.0 %)	supports	–	16	–	>= 90 %	PASS
largest stress-ratio difference: Column 1 (of 16 supports checked by both)	ratio	1.667	1.66	-0.39 -0.0066 ratio	report only	INFO
stress-ratio |difference|, median of 16 supports	%	–	0.184	–	report only	INFO
stress-ratio |difference|, 90th percentile (nearest rank)	%	–	0.285	–	report only	INFO

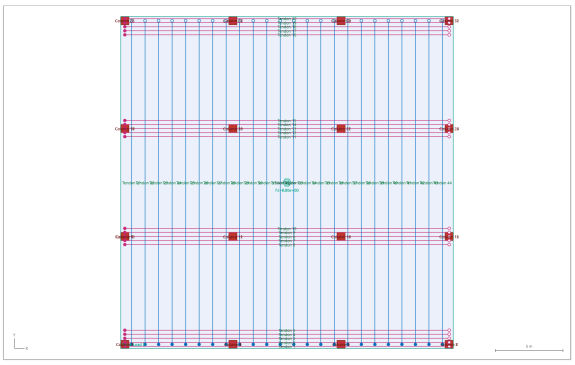
NOTES

Under EC2 Competing software 1 ignores the moment transfer (constant beta), so the ratio scales with the column force.

OpenPT build: 7d86603 Release, run 2026-11-18
Command: `tools\run_openpt.ps1 -Case B01 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B01 --inp ver-run\A\work\B01\export\B01_export.INP --adm ver-run\A\work\B01\B01.adm --run-json ver-run\A\work\B01\cs1_run.json --out ver-run\A\results\B01 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`
Sources: `bench\results\B01\cs1.jsonl`
`bench\results\B01\cs1_uz.csv`
`openpt-build\ver-run\A\results\B01\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B01\cs1_run.json`
`bench\cases\B01\B01.case.json`

2.4 V-304 B02 PT flat plate: deflection and cracking

Perspective: Deflection, cracked and long-term · **Reference:** Competing software 1, EC2 · **Status:** PASS



Structure: B02

MODEL

Post-tensioned floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 605.2 m2; patch dead load 4538.7 kN, patch live load 3631.0 kN. baseline PT flat plate 3 x 3 bays of 8.0 m, t 220; PT standard layout: X banded 5 x 3 strands on the column lines, Y distributed at 1.0 m with 2 strands; SDL 7.5 (finishes, fill and partitions), LL 6: the case cracks. 16 columns, 0 walls, 0 beams, 0 openings, 44 tendons; 8 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 296 nodes, 227 shells, 32 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M1: maximum |uz| of the cracked long-term deflection (Competing software 1 cracked_Long_Term; OpenPT `CrackedDeflectionResult.MaxCrackedLongTerm`), relative difference, tolerance 10 % or 1.0 mm when Competing software 1 is below 10 mm. U0 and K = cracked / uncracked sustained (M2, tolerance 10 %). Cracked state: the two programs use the same design sections; a section is cracked when Ie/Ig < 1; at least 85 % of the sections must agree. Probes: the inverse-distance mean of the four nearest slab nodes within 1000 mm, report only.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
max |uz|, cracked long-term (M1)	mm	65.68	67.73	+3.11 +2.045 mm	<= 10 % or <= 1 mm if A < 10 mm	PASS
max |uz|, uncracked sustained (U0, diagnostic)	mm	16.74	16.57	-1.01	soft target +/-5 %, diagnostic only	INFO
max |uz|, cracked sustained	mm	21.89	22.58	+3.11	report only	INFO
K = cracked / uncracked sustained (M2)	-	1.308	1.362	+4.16	+/-10 %	PASS
sections with the same cracked state as Competing software 1 (of 312; 100.0 %)	sections	–	312	–	>= 85 %	PASS
cracked sections among the paired (Competing software 1 / OpenPT)	sections	82	82	+0.00	report only	INFO
distance between the two max |uz| locations	mm	–	0.0000003893	–	report only	INFO
largest probe difference: bay_2_3 (of 7 probes compared, 9 defined), uz cracked long-term	mm	-46.06	-49.53	-7.54 -3.475 mm	report only	INFO

NOTES

The mesh of OpenPT is its own, so deflections are compared at the maximum and at the probe points, not node by node (PLAN.md section 6, item 4).

OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case B02 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B02 --inp ver-run\A\work\B02\export\B02_export.INP --adm ver-run\A\work\B02\B02.adm --run-json ver-run\A\work\B02\cs1_run.json --out ver-run\A\results\B02 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

Sources: `bench\results\B02\cs1.jsonl`
`bench\results\B02\cs1_uz.csv`
`openpt-build\ver-run\A\results\B02\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B02\cs1_run.json`
`bench\cases\B02\B02.case.json`

2.5 V-305 B02 PT flat plate: calculated rebar

Perspective: Calculated rebar: provided area, steel mass, bar counts · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Post-tensioned floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 605.2 m2; patch dead load 4538.7 kN, patch live load 3631.0 kN. baseline PT flat plate 3 x 3 bays of 8.0 m, t 220; PT standard layout: X banded 5 x 3 strands on the column lines, Y distributed at 1.0 m with 2 strands; SDL 7.5 (finishes, fill and partitions), LL 6: the case cracks. 16 columns, 0 walls, 0 beams, 0 openings, 44 tendons; 8 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 296 nodes, 227 shells, 32 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M3b: provided As per design section and face (at least 90 % of section-faces must match). M3c: total steel mass per face of the Calculated Rebar Plan, tolerance 10 %. Bar counts and the multiset of bars (spec 27 G2) and the required-As envelope (M3a) are report only. Provided As: Competing software 1's value in the .adm section record against OpenPT's Calculated Rebar Plan. Steel mass: bars with Source = 1 in the Competing software 1 export against OpenPT's plan. A section-face matches when |difference| <= max(10 % of Competing software 1, one bar area of that face).

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
provided As section-faces matching Competing software 1 (of 624; 97.9 %)	faces	–	611	–	>= 90 % of faces; face tol max(10 % of A, 1 bar)	PASS
calculated-rebar steel mass, top face	kg	3519	3547	+0.80	+/-10 %	PASS
calculated-rebar steel mass, bottom face	kg	5581	5496	-1.53	+/-10 %	PASS
bar count, top face	bars	19	21	+10.53	report only	INFO
bar count, bottom face	bars	22	22	+0.00	report only	INFO
bars identical to Competing software 1's (same length and diameter), top face (of 19; 52.6 %)	bars	–	10	–	report only	INFO
bars identical to Competing software 1's (same length and diameter), bottom face (of 22; 86.4 %)	bars	–	19	–	report only	INFO
required As envelope, |difference| median over section-faces	%	–	2.075	–	report only	INFO
required As envelope, |difference| maximum	%	–	100	–	report only	INFO

NOTES

Report-only rows are not judged. The steel mass of the whole plan is compared; the bar multiset differs from Competing software 1 in some cases because whole-bar rounding and splice positions differ (spec 27 G2).

OpenPT build: 7d86603 Release, run 2026-11-18
Command: `tools\run_openpt.ps1 -Case B02 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B02 --inp ver-run\A\work\B02\export\B02_export.INP --adm ver-run\A\work\B02\B02.adm --run-json ver-run\A\work\B02\cs1_run.json --out ver-run\A\results\B02 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`
Sources: `bench\results\B02\cs1.jsonl`
`bench\results\B02\cs1_uz.csv`
`openpt-build\ver-run\A\results\B02\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B02\cs1_run.json`
`bench\cases\B02\B02.case.json`

2.6 V-306 B02 PT flat plate: punching shear

Perspective: Punching shear · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Post-tensioned floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 605.2 m2; patch dead load 4538.7 kN, patch live load 3631.0 kN. baseline PT flat plate 3 x 3 bays of 8.0 m, t 220; PT standard layout: X banded 5 x 3 strands on the column lines, Y distributed at 1.0 m with 2 strands; SDL 7.5 (finishes, fill and partitions), LL 6: the case cracks. 16 columns, 0 walls, 0 beams, 0 openings, 44 tendons; 8 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 296 nodes, 227 shells, 32 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M4: Competing software 1's `.PUO` after Execute Shear Check against OpenPT's `PunchingCheck` (precompression mode and compatibility switches set to match Competing software 1), matched by support label. Tolerances: the set of checked supports identical; stress ratio within 10 % on at least 90 % of the supports; verdict class equal on at least 90 %. Every column and short wall of the level is checked by both programs.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
supports checked (Competing software 1 / OpenPT)	supports	16	16	+0.00	identical	PASS
supports with the stress ratio within +/-10 % of Competing software 1's (of 16; 100.0 %)	supports	–	16	–	>= 90 %	PASS
supports with the same verdict class as Competing software 1 (of 16; 100.0 %)	supports	–	16	–	>= 90 %	PASS
largest stress-ratio difference: Column 15 (of 16 supports checked by both)	ratio	3.607	3.597	-0.28 -0.01 ratio	report only	INFO
stress-ratio |difference|, median of 16 supports	%	–	0.147	–	report only	INFO
stress-ratio |difference|, 90th percentile (nearest rank)	%	–	0.266	–	report only	INFO

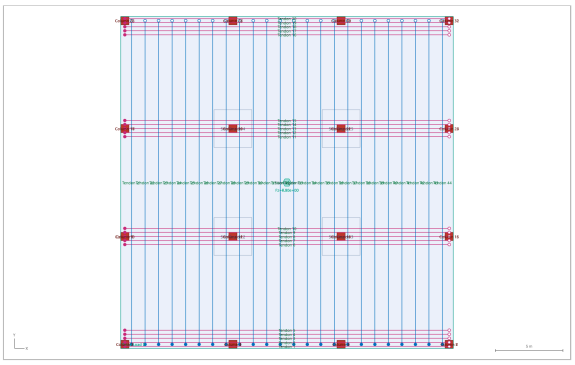
NOTES

Under EC2 Competing software 1 ignores the moment transfer (constant beta), so the ratio scales with the column force.

OpenPT build: 7d86603 Release, run 2026-11-18
Command: `tools\run_openpt.ps1 -Case B02 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B02 --inp ver-run\A\work\B02\export\B02_export.INP --adm ver-run\A\work\B02\B02.adm --run-json ver-run\A\work\B02\cs1_run.json --out ver-run\A\results\B02 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`
Sources: `bench\results\B02\cs1.jsonl`
`bench\results\B02\cs1_uz.csv`
`openpt-build\ver-run\A\results\B02\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B02\cs1_run.json`
`bench\cases\B02\B02.case.json`

2.7 V-307 B03 PT flat plate with drop panels: deflection and cracking

Perspective: Deflection, cracked and long-term · **Reference:** Competing software 1, EC2 · **Status:** PASS



Structure: B03

MODEL

Post-tensioned floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 605.2 m2; patch dead load 4538.7 kN, patch live load 3631.0 kN. B02 (same loads and tendons) plus 4 drop panels 2800 x 2800 (total depth 420, top flush) at the interior columns, as slab regions (no DROP_CAP rows); multi-region clipping, punching with a head, cracking at the drop edge. 16 columns, 0 walls, 0 beams, 0 openings, 44 tendons; 8 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 439 nodes, 370 shells, 32 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M1: maximum |uz| of the cracked long-term deflection (Competing software 1 cracked_Long_Term; OpenPT `CrackedDeflectionResult.MaxCrackedLongTerm`), relative difference, tolerance 10 % or 1.0 mm when Competing software 1 is below 10 mm. U0 and K = cracked / uncracked sustained (M2, tolerance 10 %). Cracked state: the two programs use the same design sections; a section is cracked when Ie/Ig < 1; at least 85 % of the sections must agree. Probes: the inverse-distance mean of the four nearest slab nodes within 1000 mm, report only.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
max |uz|, cracked long-term (M1)	mm	49.19	49.29	+0.22 +0.1062 mm	<= 10 % or <= 1 mm if A < 10 mm	PASS
max |uz|, uncracked sustained (U0, diagnostic)	mm	14.63	14.52	-0.74	soft target +/-5 %, diagnostic only	INFO
max |uz|, cracked sustained	mm	16.39	16.43	+0.22	report only	INFO
K = cracked / uncracked sustained (M2)	-	1.121	1.132	+0.96	+/-10 %	PASS
sections with the same cracked state as Competing software 1 (of 312; 98.4 %)	sections	–	307	–	>= 85 %	PASS
cracked sections among the paired (Competing software 1 / OpenPT)	sections	51	50	-1.96	report only	INFO
distance between the two max |uz| locations	mm	–	61.06	–	report only	INFO
largest probe difference: bay_2_3 (of 9 probes compared, 9 defined), uz cracked long-term	mm	-21.64	-17.9	+17.30 +3.743 mm	report only	INFO

NOTES

The mesh of OpenPT is its own, so deflections are compared at the maximum and at the probe points, not node by node (PLAN.md section 6, item 4).

OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case B03 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B03 --inp ver-run\A\work\B03\export\B03_export.INP --adm ver-run\A\work\B03\B03.adm --run-json ver-run\A\work\B03\cs1_run.json --out ver-run\A\results\B03 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

Sources: `bench\results\B03\cs1.jsonl`
`bench\results\B03\cs1_uz.csv`
`openpt-build\ver-run\A\results\B03\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B03\cs1_run.json`
`bench\cases\B03\B03.case.json`

2.8 V-308 B03 PT flat plate with drop panels: calculated rebar

Perspective: Calculated rebar: provided area, steel mass, bar counts · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Post-tensioned floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 605.2 m2; patch dead load 4538.7 kN, patch live load 3631.0 kN. B02 (same loads and tendons) plus 4 drop panels 2800 x 2800 (total depth 420, top flush) at the interior columns, as slab regions (no DROP_CAP rows); multi-region clipping, punching with a head, cracking at the drop edge. 16 columns, 0 walls, 0 beams, 0 openings, 44 tendons; 8 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 439 nodes, 370 shells, 32 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M3b: provided As per design section and face (at least 90 % of section-faces must match). M3c: total steel mass per face of the Calculated Rebar Plan, tolerance 10 %. Bar counts and the multiset of bars (spec 27 G2) and the required-As envelope (M3a) are report only. Provided As: Competing software 1's value in the .adm section record against OpenPT's Calculated Rebar Plan. Steel mass: bars with Source = 1 in the Competing software 1 export against OpenPT's plan. A section-face matches when |difference| <= max(10 % of Competing software 1, one bar area of that face).

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
provided As section-faces matching Competing software 1 (of 624; 99.4 %)	faces	–	620	–	>= 90 % of faces; face tol max(10 % of A, 1 bar)	PASS
calculated-rebar steel mass, top face	kg	2705	2671	-1.27	+/-10 %	PASS
calculated-rebar steel mass, bottom face	kg	4318	4303	-0.36	+/-10 %	PASS
bar count, top face	bars	32	16	-50.00	report only	INFO
bar count, bottom face	bars	18	18	+0.00	report only	INFO
bars identical to Competing software 1's (same length and diameter), top face (of 32; 15.6 %)	bars	–	5	–	report only	INFO
bars identical to Competing software 1's (same length and diameter), bottom face (of 18; 66.7 %)	bars	–	12	–	report only	INFO
required As envelope, |difference| median over section-faces	%	–	2.218	–	report only	INFO
required As envelope, |difference| maximum	%	–	104.2	–	report only	INFO

NOTES

Report-only rows are not judged. The steel mass of the whole plan is compared; the bar multiset differs from Competing software 1 in some cases because whole-bar rounding and splice positions differ (spec 27 G2).

OpenPT build: 7d86603 Release, run 2026-11-18
Command: `tools\run_openpt.ps1 -Case B03 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B03 --inp ver-run\A\work\B03\export\B03_export.INP --adm ver-run\A\work\B03\B03.adm --run-json ver-run\A\work\B03\cs1_run.json --out ver-run\A\results\B03 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`
Sources: `bench\results\B03\cs1.jsonl`
`bench\results\B03\cs1_uz.csv`
`openpt-build\ver-run\A\results\B03\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B03\cs1_run.json`
`bench\cases\B03\B03.case.json`

2.9 V-309 B03 PT flat plate with drop panels: punching shear

Perspective: Punching shear · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Post-tensioned floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 605.2 m2; patch dead load 4538.7 kN, patch live load 3631.0 kN. B02 (same loads and tendons) plus 4 drop panels 2800 x 2800 (total depth 420, top flush) at the interior columns, as slab regions (no DROP_CAP rows); multi-region clipping, punching with a head, cracking at the drop edge. 16 columns, 0 walls, 0 beams, 0 openings, 44 tendons; 8 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 439 nodes, 370 shells, 32 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M4: Competing software 1's `.PUO` after Execute Shear Check against OpenPT's `PunchingCheck` (precompression mode and compatibility switches set to match Competing software 1), matched by support label. Tolerances: the set of checked supports identical; stress ratio within 10 % on at least 90 % of the supports; verdict class equal on at least 90 %. Every column and short wall of the level is checked by both programs.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
supports checked (Competing software 1 / OpenPT)	supports	16	16	+0.00	identical	PASS
supports with the stress ratio within +/-10 % of Competing software 1's (of 16; 100.0 %)	supports	–	16	–	>= 90 %	PASS
supports with the same verdict class as Competing software 1 (of 16; 100.0 %)	supports	–	16	–	>= 90 %	PASS
largest stress-ratio difference: Column 12 (of 16 supports checked by both)	ratio	3.256	3.269	+0.40 +0.0131 ratio	report only	INFO
stress-ratio |difference|, median of 16 supports	%	–	0.138	–	report only	INFO
stress-ratio |difference|, 90th percentile (nearest rank)	%	–	0.356	–	report only	INFO

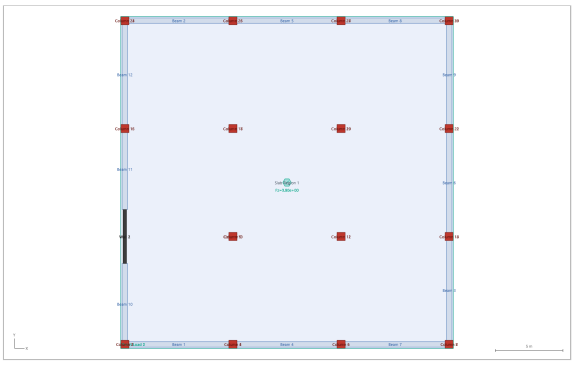
NOTES

Under EC2 Competing software 1 ignores the moment transfer (constant beta), so the ratio scales with the column force.

OpenPT build: 7d86603 Release, run 2026-11-18
Command: `tools\run_openpt.ps1 -Case B03 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B03 --inp ver-run\A\work\B03\export\B03_export.INP --adm ver-run\A\work\B03\B03.adm --run-json ver-run\A\work\B03\cs1_run.json --out ver-run\A\results\B03 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`
Sources: `bench\results\B03\cs1.jsonl`
`bench\results\B03\cs1_uz.csv`
`openpt-build\ver-run\A\results\B03\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B03\cs1_run.json`
`bench\cases\B03\B03.case.json`

2.10 V-310 B04 RC slab with perimeter beams and a wall: deflection and cracking

Perspective: Deflection, cracked and long-term · **Reference:** Competing software 1, EC2 · **Status:** PASS



Structure: B04

MODEL

Reinforced concrete floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 605.2 m2; patch dead load 907.7 kN, patch live load 1815.5 kN. B01 plus perimeter beams 400 x 700 (one per bay); wall 250 x 4000 (0,6000)-(0,10000) replaces the column at (0,8000); edge columns not checked for punching (a beam touches them); wall support. 15 columns, 1 wall, 12 beams, 0 openings; 8 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 326 nodes, 257 shells, 99 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M1: maximum |uz| of the cracked long-term deflection (Competing software 1 cracked_Long_Term; OpenPT `CrackedDeflectionResult.MaxCrackedLongTerm`), relative difference, tolerance 10 % or 1.0 mm when Competing software 1 is below 10 mm. U0 and K = cracked / uncracked sustained (M2, tolerance 10 %). Cracked state: the two programs use the same design sections; a section is cracked when Ie/Ig < 1; at least 85 % of the sections must agree. Probes: the inverse-distance mean of the four nearest slab nodes within 1000 mm, report only.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
max |uz|, cracked long-term (M1)	mm	19.17	19.17	-0.00 -0.0001 mm	<= 10 % or <= 1 mm if A < 10 mm	PASS
max |uz|, uncracked sustained (U0, diagnostic)	mm	5.656	5.668	+0.21	soft target +/-5 %, diagnostic only	INFO
max |uz|, cracked sustained	mm	6.389	6.39	+0.00	report only	INFO
K = cracked / uncracked sustained (M2)	-	1.13	1.127	-0.21	+/-10 %	PASS
sections with the same cracked state as Competing software 1 (of 329; 99.4 %)	sections	–	327	–	>= 85 %	PASS
cracked sections among the paired (Competing software 1 / OpenPT)	sections	46	46	+0.00	report only	INFO
distance between the two max |uz| locations	mm	–	0.2755	–	report only	INFO
largest probe difference: bay_1_1 (of 9 probes compared, 9 defined), uz cracked long-term	mm	-17.9	-17.73	+0.92 +0.1654 mm	report only	INFO

NOTES

The mesh of OpenPT is its own, so deflections are compared at the maximum and at the probe points, not node by node (PLAN.md section 6, item 4).

OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case B04 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B04 --inp ver-run\A\work\B04\export\B04_export.INP --adm ver-run\A\work\B04\B04.adm --run-json ver-run\A\work\B04\cs1_run.json --out ver-run\A\results\B04 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

Sources: `bench\results\B04\cs1.jsonl`
`bench\results\B04\cs1_uz.csv`
`openpt-build\ver-run\A\results\B04\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B04\cs1_run.json`
`bench\cases\B04\B04.case.json`

2.11 V-311 B04 RC slab with perimeter beams and a wall: calculated rebar

Perspective: Calculated rebar: provided area, steel mass, bar counts · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Reinforced concrete floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 605.2 m2; patch dead load 907.7 kN, patch live load 1815.5 kN. B01 plus perimeter beams 400 x 700 (one per bay); wall 250 x 4000 (0,6000)-(0,10000) replaces the column at (0,8000); edge columns not checked for punching (a beam touches them); wall support. 15 columns, 1 wall, 12 beams, 0 openings; 8 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 326 nodes, 257 shells, 99 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M3b: provided As per design section and face (at least 90 % of section-faces must match). M3c: total steel mass per face of the Calculated Rebar Plan, tolerance 10 %. Bar counts and the multiset of bars (spec 27 G2) and the required-As envelope (M3a) are report only. Provided As: Competing software 1's value in the .adm section record against OpenPT's Calculated Rebar Plan. Steel mass: bars with Source = 1 in the Competing software 1 export against OpenPT's plan. A section-face matches when |difference| <= max(10 % of Competing software 1, one bar area of that face). The 318 beam section-faces of this case are excluded from the 90 % rule (beam layout rule, spec 19 D3, declared in PLAN.md section 2.2) and listed in a separate row; the mass rows with the beam lines left out on both sides are report only.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
provided As section-faces matching Competing software 1 (of 340; 100.0 %)	faces	–	340	–	>= 90 % of faces; face tol max(10 % of A, 1 bar)	PASS
calculated-rebar steel mass, top face	kg	2845	2842	-0.10	+/-10 %	PASS
calculated-rebar steel mass, bottom face	kg	4670	4656	-0.31	+/-10 %	PASS
beam section-faces (excluded from the M3b verdict, spec 19 D3), matching (of 318; 100.0 %)	faces	–	318	–	report only	INFO
steel mass, top face, beam lines left out on both sides	kg	2278	2288	+0.43	report only (no verdict)	INFO
steel mass, bottom face, beam lines left out on both sides	kg	3400	3400	+0.00	report only (no verdict)	INFO
bar count, top face	bars	26	24	-7.69	report only	INFO
bar count, bottom face	bars	25	23	-8.00	report only	INFO
bars identical to Competing software 1's (same length and diameter), top face (of 26; 84.6 %)	bars	–	22	–	report only	INFO
bars identical to Competing software 1's (same length and diameter), bottom face (of 25; 88.0 %)	bars	–	22	–	report only	INFO
required As envelope, |difference| median over section-faces	%	–	0.02504	–	report only	INFO
required As envelope, |difference| maximum	%	–	103.2	–	report only	INFO

NOTES

Report-only rows are not judged. The steel mass of the whole plan is compared; the bar multiset differs from Competing software 1 in some cases because whole-bar rounding and splice positions differ (spec 27 G2). Beam section-faces: see the method.

OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case B04 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B04 --inp ver-run\A\work\B04\export\B04_export.INP --adm ver-run\A\work\B04\B04.adm --run-json ver-run\A\work\B04\cs1_run.json --out ver-run\A\results\B04 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

Sources: `bench\results\B04\cs1.jsonl`
`bench\results\B04\cs1_uz.csv`
`openpt-build\ver-run\A\results\B04\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B04\cs1_run.json`
`bench\cases\B04\B04.case.json`

2.12 V-312 B04 RC slab with perimeter beams and a wall: punching shear

Perspective: Punching shear · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Reinforced concrete floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 605.2 m2; patch dead load 907.7 kN, patch live load 1815.5 kN. B01 plus perimeter beams 400 x 700 (one per bay); wall 250 x 4000 (0,6000)-(0,10000) replaces the column at (0,8000); edge columns not checked for punching (a beam touches them); wall support. 15 columns, 1 wall, 12 beams, 0 openings; 8 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 326 nodes, 257 shells, 99 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M4: Competing software 1's `.PUO` after Execute Shear Check against OpenPT's `PunchingCheck` (precompression mode and compatibility switches set to match Competing software 1), matched by support label. Tolerances: the set of checked supports identical; stress ratio within 10 % on at least 90 % of the supports; verdict class equal on at least 90 %. Supports with a beam touching them are not checked in either program (PLAN.md section 1, M4).

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
supports checked (Competing software 1 / OpenPT)	supports	4	4	+0.00	identical	PASS
supports with the stress ratio within +/-10 % of Competing software 1's (of 4; 100.0 %)	supports	–	4	–	>= 90 %	PASS
supports with the same verdict class as Competing software 1 (of 4; 100.0 %)	supports	–	4	–	>= 90 %	PASS
largest stress-ratio difference: Column 6 (of 4 supports checked by both)	ratio	2.164	2.158	-0.27 -0.0057 ratio	report only	INFO
stress-ratio |difference|, median of 4 supports	%	–	0.11	–	report only	INFO
stress-ratio |difference|, 90th percentile (nearest rank)	%	–	0.266	–	report only	INFO

NOTES

Under EC2 Competing software 1 ignores the moment transfer (constant beta), so the ratio scales with the column force. The beams of this case are deep, so spec 94c (shallow-beam columns are checked) does not change the checked set.

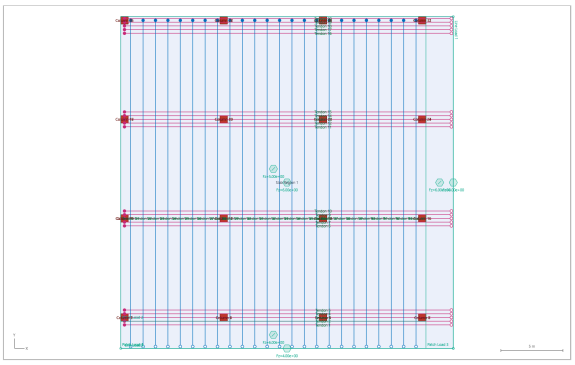
OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case B04 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B04 --inp ver-run\A\work\B04\export\B04_export.INP --adm ver-run\A\work\B04\B04.adm --run-json ver-run\A\work\B04\cs1_run.json --out ver-run\A\results\B04 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

Sources: `bench\results\B04\cs1.jsonl`
`bench\results\B04\cs1_uz.csv`
`openpt-build\ver-run\A\results\B04\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B04\cs1_run.json`
`bench\cases\B04\B04.case.json`

2.13 V-313 B05 PT slab with cantilevers: deflection and cracking

Perspective: Deflection, cracked and long-term · **Reference:** Competing software 1, EC2 · **Status:** PASS



Structure: B05

MODEL

Post-tensioned floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 718.2 m2; patch dead load 4309.4 kN, patch live load 3704.3 kN, line loads 214.4 kN. B02 plus cantilevers 2.5 m (from the column line) on the east and south sides; tendons run into the cantilevers: cantilever profile code 6, covers 50/135 (as in t5_001.INP); SDL 6, LL 5 on the main plate, LL 6 on the cantilevers; facade line load 4 kN/m (dead) at the tips. 16 columns, 0 walls, 0 beams, 0 openings, 44 tendons; 8 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 316 nodes, 245 shells, 32 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M1: maximum |uz| of the cracked long-term deflection (Competing software 1 cracked_Long_Term; OpenPT `CrackedDeflectionResult.MaxCrackedLongTerm`), relative difference, tolerance 10 % or 1.0 mm when Competing software 1 is below 10 mm. U0 and K = cracked / uncracked sustained (M2, tolerance 10 %). Cracked state: the two programs use the same design sections; a section is cracked when Ie/Ig < 1; at least 85 % of the sections must agree. Probes: the inverse-distance mean of the four nearest slab nodes within 1000 mm, report only.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
max |uz|, cracked long-term (M1)	mm	46.42	46.88	+0.99 +0.4594 mm	<= 10 % or <= 1 mm if A < 10 mm	PASS
max |uz|, uncracked sustained (U0, diagnostic)	mm	14.1	14.08	-0.09	soft target +/-5 %, diagnostic only	INFO
max |uz|, cracked sustained	mm	15.47	15.63	+0.99	report only	INFO
K = cracked / uncracked sustained (M2)	-	1.098	1.11	+1.08	+/-10 %	PASS
sections with the same cracked state as Competing software 1 (of 352; 99.4 %)	sections	–	350	–	>= 85 %	PASS
cracked sections among the paired (Competing software 1 / OpenPT)	sections	43	45	+4.65	report only	INFO
distance between the two max |uz| locations	mm	–	53.24	–	report only	INFO
largest probe difference: tip_east (of 7 probes compared, 11 defined), uz cracked long-term	mm	-21.43	-20.08	+6.30 +1.35 mm	report only	INFO

NOTES

The mesh of OpenPT is its own, so deflections are compared at the maximum and at the probe points, not node by node (PLAN.md section 6, item 4).

OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case B05 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B05 --inp ver-run\A\work\B05\export\B05_export.INP --adm ver-run\A\work\B05\B05.adm --run-json ver-run\A\work\B05\cs1_run.json --out ver-run\A\results\B05 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

Sources: `bench\results\B05\cs1.jsonl`
`bench\results\B05\cs1_uz.csv`
`openpt-build\ver-run\A\results\B05\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B05\cs1_run.json`
`bench\cases\B05\B05.case.json`

2.14 V-314 B05 PT slab with cantilevers: calculated rebar

Perspective: Calculated rebar: provided area, steel mass, bar counts · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Post-tensioned floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 718.2 m2; patch dead load 4309.4 kN, patch live load 3704.3 kN, line loads 214.4 kN. B02 plus cantilevers 2.5 m (from the column line) on the east and south sides; tendons run into the cantilevers: cantilever profile code 6, covers 50/135 (as in t5_001.INP); SDL 6, LL 5 on the main plate, LL 6 on the cantilevers; facade line load 4 kN/m (dead) at the tips. 16 columns, 0 walls, 0 beams, 0 openings, 44 tendons; 8 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 316 nodes, 245 shells, 32 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M3b: provided As per design section and face (at least 90 % of section-faces must match). M3c: total steel mass per face of the Calculated Rebar Plan, tolerance 10 %. Bar counts and the multiset of bars (spec 27 G2) and the required-As envelope (M3a) are report only. Provided As: Competing software 1's value in the .adm section record against OpenPT's Calculated Rebar Plan. Steel mass: bars with Source = 1 in the Competing software 1 export against OpenPT's plan. A section-face matches when |difference| <= max(10 % of Competing software 1, one bar area of that face).

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
provided As section-faces matching Competing software 1 (of 704; 98.9 %)	faces	–	696	–	>= 90 % of faces; face tol max(10 % of A, 1 bar)	PASS
calculated-rebar steel mass, top face	kg	3618	3619	+0.02	+/-10 %	PASS
calculated-rebar steel mass, bottom face	kg	3717	3673	-1.20	+/-10 %	PASS
bar count, top face	bars	23	24	+4.35	report only	INFO
bar count, bottom face	bars	22	22	+0.00	report only	INFO
bars identical to Competing software 1's (same length and diameter), top face (of 23; 69.6 %)	bars	–	16	–	report only	INFO
bars identical to Competing software 1's (same length and diameter), bottom face (of 22; 77.3 %)	bars	–	17	–	report only	INFO
required As envelope, |difference| median over section-faces	%	–	2.543	–	report only	INFO
required As envelope, |difference| maximum	%	–	1510	–	report only	INFO

NOTES

Report-only rows are not judged. The steel mass of the whole plan is compared; the bar multiset differs from Competing software 1 in some cases because whole-bar rounding and splice positions differ (spec 27 G2).

OpenPT build: 7d86603 Release, run 2026-11-18
Command: `tools\run_openpt.ps1 -Case B05 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B05 --inp ver-run\A\work\B05\export\B05_export.INP --adm ver-run\A\work\B05\B05.adm --run-json ver-run\A\work\B05\cs1_run.json --out ver-run\A\results\B05 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`
Sources: `bench\results\B05\cs1.jsonl`
`bench\results\B05\cs1_uz.csv`
`openpt-build\ver-run\A\results\B05\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B05\cs1_run.json`
`bench\cases\B05\B05.case.json`

2.15 V-315 B05 PT slab with cantilevers: punching shear

Perspective: Punching shear · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Post-tensioned floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 718.2 m2; patch dead load 4309.4 kN, patch live load 3704.3 kN, line loads 214.4 kN. B02 plus cantilevers 2.5 m (from the column line) on the east and south sides; tendons run into the cantilevers: cantilever profile code 6, covers 50/135 (as in t5_001.INP); SDL 6, LL 5 on the main plate, LL 6 on the cantilevers; facade line load 4 kN/m (dead) at the tips. 16 columns, 0 walls, 0 beams, 0 openings, 44 tendons; 8 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 316 nodes, 245 shells, 32 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M4: Competing software 1's `.PUO` after Execute Shear Check against OpenPT's `PunchingCheck` (precompression mode and compatibility switches set to match Competing software 1), matched by support label. Tolerances: the set of checked supports identical; stress ratio within 10 % on at least 90 % of the supports; verdict class equal on at least 90 %. Every column and short wall of the level is checked by both programs.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
supports checked (Competing software 1 / OpenPT)	supports	16	16	+0.00	identical	PASS
supports with the stress ratio within +/-10 % of Competing software 1's (of 16; 100.0 %)	supports	–	16	–	>= 90 %	PASS
supports with the same verdict class as Competing software 1 (of 16; 100.0 %)	supports	–	16	–	>= 90 %	PASS
largest stress-ratio difference: Column 14 (of 16 supports checked by both)	ratio	3.153	3.142	-0.34 -0.0107 ratio	report only	INFO
stress-ratio |difference|, median of 16 supports	%	–	0.098	–	report only	INFO
stress-ratio |difference|, 90th percentile (nearest rank)	%	–	0.299	–	report only	INFO

NOTES

Under EC2 Competing software 1 ignores the moment transfer (constant beta), so the ratio scales with the column force.

OpenPT build: 7d86603 Release, run 2026-11-18
Command: `tools\run_openpt.ps1 -Case B05 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B05 --inp ver-run\A\work\B05\export\B05_export.INP --adm ver-run\A\work\B05\B05.adm --run-json ver-run\A\work\B05\cs1_run.json --out ver-run\A\results\B05 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`
Sources: `bench\results\B05\cs1.jsonl`
`bench\results\B05\cs1_uz.csv`
`openpt-build\ver-run\A\results\B05\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B05\cs1_run.json`
`bench\cases\B05\B05.case.json`

2.16 V-316 B06 PT slab with openings: deflection and cracking

Perspective: Deflection, cracked and long-term · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Post-tensioned floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 592.2 m2; patch dead load 3553.0 kN, patch live load 2960.8 kN. B02 (loads SDL 6.0, LL 5.0; 3 strands per Y tendon because dropped tendons lower the precompression) plus a stair opening 2400 x 5000 (x 8900..11300, y 8900..13900) and a shaft 1000 x 1000 (x 16600..17600, y 16600..17600); tendons within 150 mm of an opening are dropped; openings inside the punching perimeters, tributary cuts, mesh around voids. 16 columns, 0 walls, 0 beams, 2 openings, 39 tendons; 8 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 420 nodes, 344 shells, 32 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M1: maximum |uz| of the cracked long-term deflection (Competing software 1 cracked_Long_Term; OpenPT `CrackedDeflectionResult.MaxCrackedLongTerm`), relative difference, tolerance 10 % or 1.0 mm when Competing software 1 is below 10 mm. U0 and K = cracked / uncracked sustained (M2, tolerance 10 %). Cracked state: the two programs use the same design sections; a section is cracked when Ie/Ig < 1; at least 85 % of the sections must agree. Probes: the inverse-distance mean of the four nearest slab nodes within 1000 mm, report only.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
max |uz|, cracked long-term (M1)	mm	50.85	51.83	+1.94 +0.9847 mm	<= 10 % or <= 1 mm if A < 10 mm	PASS
max |uz|, uncracked sustained (U0, diagnostic)	mm	14.77	14.76	-0.04	soft target +/-5 %, diagnostic only	INFO
max |uz|, cracked sustained	mm	16.95	17.28	+1.94	report only	INFO
K = cracked / uncracked sustained (M2)	-	1.148	1.171	+1.98	+/-10 %	PASS
sections with the same cracked state as Competing software 1 (of 312; 100.0 %)	sections	–	312	–	>= 85 %	PASS
cracked sections among the paired (Competing software 1 / OpenPT)	sections	42	42	+0.00	report only	INFO
distance between the two max |uz| locations	mm	–	0.7625	–	report only	INFO
largest probe difference: bay_3_3 (of 15 probes compared, 17 defined), uz cracked long-term	mm	-49.96	-50.95	-1.99 -0.9953 mm	report only	INFO

NOTES

The mesh of OpenPT is its own, so deflections are compared at the maximum and at the probe points, not node by node (PLAN.md section 6, item 4).

OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case B06 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B06 --inp ver-run\A\work\B06\export\B06_export.INP --adm ver-run\A\work\B06\B06.adm --run-json ver-run\A\work\B06\cs1_run.json --out ver-run\A\results\B06 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

Sources: `bench\results\B06\cs1.jsonl`
`bench\results\B06\cs1_uz.csv`
`openpt-build\ver-run\A\results\B06\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B06\cs1_run.json`
`bench\cases\B06\B06.case.json`

2.17 V-317 B06 PT slab with openings: calculated rebar

Perspective: Calculated rebar: provided area, steel mass, bar counts · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Post-tensioned floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 592.2 m2; patch dead load 3553.0 kN, patch live load 2960.8 kN. B02 (loads SDL 6.0, LL 5.0; 3 strands per Y tendon because dropped tendons lower the precompression) plus a stair opening 2400 x 5000 (x 8900..11300, y 8900..13900) and a shaft 1000 x 1000 (x 16600..17600, y 16600..17600); tendons within 150 mm of an opening are dropped; openings inside the punching perimeters, tributary cuts, mesh around voids. 16 columns, 0 walls, 0 beams, 2 openings, 39 tendons; 8 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 420 nodes, 344 shells, 32 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M3b: provided As per design section and face (at least 90 % of section-faces must match). M3c: total steel mass per face of the Calculated Rebar Plan, tolerance 10 %. Bar counts and the multiset of bars (spec 27 G2) and the required-As envelope (M3a) are report only. Provided As: Competing software 1's value in the .adm section record against OpenPT's Calculated Rebar Plan. Steel mass: bars with Source = 1 in the Competing software 1 export against OpenPT's plan. A section-face matches when |difference| <= max(10 % of Competing software 1, one bar area of that face).

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
provided As section-faces matching Competing software 1 (of 624; 100.0 %)	faces	–	624	–	>= 90 % of faces; face tol max(10 % of A, 1 bar)	PASS
calculated-rebar steel mass, top face	kg	2066	2071	+0.25	+/-10 %	PASS
calculated-rebar steel mass, bottom face	kg	3827	3865	+1.00	+/-10 %	PASS
bar count, top face	bars	16	16	+0.00	report only	INFO
bar count, bottom face	bars	18	18	+0.00	report only	INFO
bars identical to Competing software 1's (same length and diameter), top face (of 16; 68.8 %)	bars	–	11	–	report only	INFO
bars identical to Competing software 1's (same length and diameter), bottom face (of 18; 88.9 %)	bars	–	16	–	report only	INFO
required As envelope, |difference| median over section-faces	%	–	1.506	–	report only	INFO
required As envelope, |difference| maximum	%	–	100	–	report only	INFO

NOTES

Report-only rows are not judged. The steel mass of the whole plan is compared; the bar multiset differs from Competing software 1 in some cases because whole-bar rounding and splice positions differ (spec 27 G2).

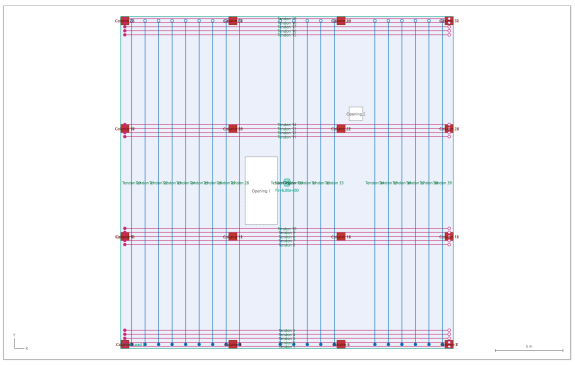
OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case B06 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B06 --inp ver-run\A\work\B06\export\B06_export.INP --adm ver-run\A\work\B06\B06.adm --run-json ver-run\A\work\B06\cs1_run.json --out ver-run\A\results\B06 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

Sources: `bench\results\B06\cs1.jsonl`
`bench\results\B06\cs1_uz.csv`
`openpt-build\ver-run\A\results\B06\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B06\cs1_run.json`
`bench\cases\B06\B06.case.json`

2.18 V-318 B06 PT slab with openings: punching shear

Perspective: Punching shear · **Reference:** Competing software 1, EC2 · **Status:** PASS



Structure: B06

MODEL

Post-tensioned floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 592.2 m2; patch dead load 3553.0 kN, patch live load 2960.8 kN. B02 (loads SDL 6.0, LL 5.0; 3 strands per Y tendon because dropped tendons lower the precompression) plus a stair opening 2400 x 5000 (x 8900..11300, y 8900..13900) and a shaft 1000 x 1000 (x 16600..17600, y 16600..17600); tendons within 150 mm of an opening are dropped; openings inside the punching perimeters, tributary cuts, mesh around voids. 16 columns, 0 walls, 0 beams, 2 openings, 39 tendons; 8 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 420 nodes, 344 shells, 32 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M4: Competing software 1's `.PUO` after Execute Shear Check against OpenPT's `PunchingCheck` (precompression mode and compatibility switches set to match Competing software 1), matched by support label. Tolerances: the set of checked supports identical; stress ratio within 10 % on at least 90 % of the supports; verdict class equal on at least 90 %. Every column and short wall of the level is checked by both programs.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
supports checked (Competing software 1 / OpenPT)	supports	16	16	+0.00	identical	PASS
supports with the stress ratio within +/-10 % of Competing software 1's (of 16; 100.0 %)	supports	–	16	–	>= 90 %	PASS
supports with the same verdict class as Competing software 1 (of 16; 93.8 %)	supports	–	15	–	>= 90 %	PASS
largest stress-ratio difference: Column 16 (of 16 supports checked by both)	ratio	2.501	2.494	-0.25 -0.0063 ratio	report only	INFO
stress-ratio |difference|, median of 16 supports	%	–	0.078	–	report only	INFO
stress-ratio |difference|, 90th percentile (nearest rank)	%	–	0.24	–	report only	INFO

NOTES

Under EC2 Competing software 1 ignores the moment transfer (constant beta), so the ratio scales with the column force.

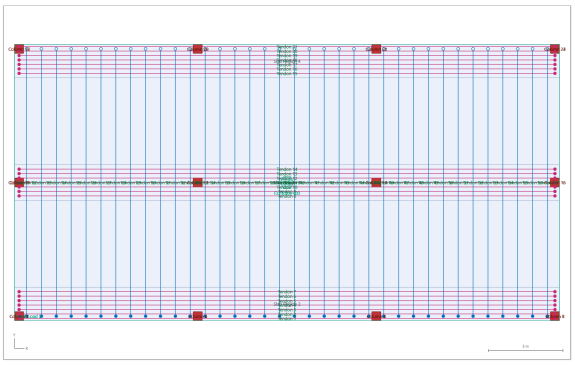
OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case B06 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B06 --inp ver-run\A\work\B06\export\B06_export.INP --adm ver-run\A\work\B06\B06.adm --run-json ver-run\A\work\B06\cs1_run.json --out ver-run\A\results\B06 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

Sources: `bench\results\B06\cs1.jsonl`
`bench\results\B06\cs1_uz.csv`
`openpt-build\ver-run\A\results\B06\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B06\cs1_run.json`
`bench\cases\B06\B06.case.json`

2.19 V-319 B07 PT long-span slab with band regions: deflection and cracking

Perspective: Deflection, cracked and long-term · **Reference:** Competing software 1, EC2 · **Status:** PASS



Structure: B07

MODEL

Post-tensioned floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 680.8 m2; patch dead load 3063.4 kN, patch live load 3403.8 kN. 3 x 2 bays of 12.0 m (X) x 9.0 m (Y), t 250; band slab regions 2400 wide (clipped at the slab edge), total depth 500, on the X column lines; X tendons banded 7 x 3 strands inside the bands, Y distributed at 1.0 m with 2 strands; SDL 4.5, LL 5.0. 12 columns, 0 walls, 0 beams, 0 openings, 57 tendons; 7 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 424 nodes, 358 shells, 24 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M1: maximum |uz| of the cracked long-term deflection (Competing software 1 cracked_Long_Term; OpenPT `CrackedDeflectionResult.MaxCrackedLongTerm`), relative difference, tolerance 10 % or 1.0 mm when Competing software 1 is below 10 mm. U0 and K = cracked / uncracked sustained (M2, tolerance 10 %). Cracked state: the two programs use the same design sections; a section is cracked when Ie/Ig < 1; at least 85 % of the sections must agree. Probes: the inverse-distance mean of the four nearest slab nodes within 1000 mm, report only.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
max |uz|, cracked long-term (M1)	mm	36.18	35.72	-1.28 -0.4624 mm	<= 10 % or <= 1 mm if A < 10 mm	PASS
max |uz|, uncracked sustained (U0, diagnostic)	mm	10.3	10.23	-0.71	soft target +/-5 %, diagnostic only	INFO
max |uz|, cracked sustained	mm	12.06	11.91	-1.28	report only	INFO
K = cracked / uncracked sustained (M2)	-	1.171	1.164	-0.57	+/-10 %	PASS
sections with the same cracked state as Competing software 1 (of 291; 100.0 %)	sections	–	291	–	>= 85 %	PASS
cracked sections among the paired (Competing software 1 / OpenPT)	sections	24	24	+0.00	report only	INFO
distance between the two max |uz| locations	mm	–	27649	–	report only	INFO
largest probe difference: bay_1_1 (of 6 probes compared, 6 defined), uz cracked long-term	mm	-35.99	-35.46	+1.48 +0.5324 mm	report only	INFO

NOTES

The mesh of OpenPT is its own, so deflections are compared at the maximum and at the probe points, not node by node (PLAN.md section 6, item 4).

OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case B07 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B07 --inp ver-run\A\work\B07\export\B07_export.INP --adm ver-run\A\work\B07\B07.adm --run-json ver-run\A\work\B07\cs1_run.json --out ver-run\A\results\B07 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

Sources: `bench\results\B07\cs1.jsonl`
`bench\results\B07\cs1_uz.csv`
`openpt-build\ver-run\A\results\B07\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B07\cs1_run.json`
`bench\cases\B07\B07.case.json`

2.20 V-320 B07 PT long-span slab with band regions: calculated rebar

Perspective: Calculated rebar: provided area, steel mass, bar counts · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Post-tensioned floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 680.8 m2; patch dead load 3063.4 kN, patch live load 3403.8 kN. 3 x 2 bays of 12.0 m (X) x 9.0 m (Y), t 250; band slab regions 2400 wide (clipped at the slab edge), total depth 500, on the X column lines; X tendons banded 7 x 3 strands inside the bands, Y distributed at 1.0 m with 2 strands; SDL 4.5, LL 5.0. 12 columns, 0 walls, 0 beams, 0 openings, 57 tendons; 7 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 424 nodes, 358 shells, 24 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M3b: provided As per design section and face (at least 90 % of section-faces must match). M3c: total steel mass per face of the Calculated Rebar Plan, tolerance 10 %. Bar counts and the multiset of bars (spec 27 G2) and the required-As envelope (M3a) are report only. Provided As: Competing software 1's value in the .adm section record against OpenPT's Calculated Rebar Plan. Steel mass: bars with Source = 1 in the Competing software 1 export against OpenPT's plan. A section-face matches when |difference| <= max(10 % of Competing software 1, one bar area of that face).

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
provided As section-faces matching Competing software 1 (of 582; 99.7 %)	faces	–	580	–	>= 90 % of faces; face tol max(10 % of A, 1 bar)	PASS
calculated-rebar steel mass, top face	kg	1657	1647	-0.64	+/-10 %	PASS
calculated-rebar steel mass, bottom face	kg	4425	4364	-1.38	+/-10 %	PASS
bar count, top face	bars	16	8	-50.00	report only	INFO
bar count, bottom face	bars	23	15	-34.78	report only	INFO
bars identical to Competing software 1's (same length and diameter), top face (of 16; 18.8 %)	bars	–	3	–	report only	INFO
bars identical to Competing software 1's (same length and diameter), bottom face (of 23; 30.4 %)	bars	–	7	–	report only	INFO
required As envelope, |difference| median over section-faces	%	–	1.254	–	report only	INFO
required As envelope, |difference| maximum	%	–	101.7	–	report only	INFO

NOTES

Report-only rows are not judged. The steel mass of the whole plan is compared; the bar multiset differs from Competing software 1 in some cases because whole-bar rounding and splice positions differ (spec 27 G2).

OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case B07 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B07 --inp ver-run\A\work\B07\export\B07_export.INP --adm ver-run\A\work\B07\B07.adm --run-json ver-run\A\work\B07\cs1_run.json --out ver-run\A\results\B07 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

Sources: `bench\results\B07\cs1.jsonl`
`bench\results\B07\cs1_uz.csv`
`openpt-build\ver-run\A\results\B07\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B07\cs1_run.json`
`bench\cases\B07\B07.case.json`

2.21 V-321 B07 PT long-span slab with band regions: punching shear

Perspective: Punching shear · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Post-tensioned floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 680.8 m2; patch dead load 3063.4 kN, patch live load 3403.8 kN. 3 x 2 bays of 12.0 m (X) x 9.0 m (Y), t 250; band slab regions 2400 wide (clipped at the slab edge), total depth 500, on the X column lines; X tendons banded 7 x 3 strands inside the bands, Y distributed at 1.0 m with 2 strands; SDL 4.5, LL 5.0. 12 columns, 0 walls, 0 beams, 0 openings, 57 tendons; 7 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 424 nodes, 358 shells, 24 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M4: Competing software 1's `.PUO` after Execute Shear Check against OpenPT's `PunchingCheck` (precompression mode and compatibility switches set to match Competing software 1), matched by support label. Tolerances: the set of checked supports identical; stress ratio within 10 % on at least 90 % of the supports; verdict class equal on at least 90 %. Every column and short wall of the level is checked by both programs.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
supports checked (Competing software 1 / OpenPT)	supports	12	12	+0.00	identical	PASS
supports with the stress ratio within +/-10 % of Competing software 1's (of 12; 100.0 %)	supports	–	12	–	>= 90 %	PASS
supports with the same verdict class as Competing software 1 (of 12; 100.0 %)	supports	–	12	–	>= 90 %	PASS
largest stress-ratio difference: Column 3 (of 12 supports checked by both)	ratio	1.673	1.67	-0.18 -0.003 ratio	report only	INFO
stress-ratio |difference|, median of 12 supports	%	–	0.072	–	report only	INFO
stress-ratio |difference|, 90th percentile (nearest rank)	%	–	0.136	–	report only	INFO

NOTES

Under EC2 Competing software 1 ignores the moment transfer (constant beta), so the ratio scales with the column force.

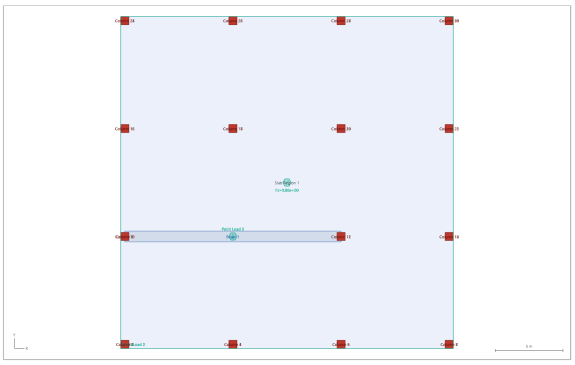
OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case B07 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B07 --inp ver-run\A\work\B07\export\B07_export.INP --adm ver-run\A\work\B07\B07.adm --run-json ver-run\A\work\B07\cs1_run.json --out ver-run\A\results\B07 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

Sources: `bench\results\B07\cs1.jsonl`
`bench\results\B07\cs1_uz.csv`
`openpt-build\ver-run\A\results\B07\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B07\cs1_run.json`
`bench\cases\B07\B07.case.json`

2.22 V-322 B08 RC slab with a transfer beam: deflection and cracking

Perspective: Deflection, cracked and long-term · **Reference:** Competing software 1, EC2 · **Status:** PASS



Structure: B08

MODEL

Reinforced concrete floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 605.2 m2; patch dead load 907.7 kN, patch live load 1815.5 kN, point loads 2200 kN. B01 without the column at (8000,8000) (none below, none above); transfer beam 800 x 1100 on y = 8000 from x = 0 to 16000; point load 1800 kN dead + 400 kN live at (8000,8000) standing in for a planted column. 15 columns, 0 walls, 1 beam, 0 openings; 8 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 323 nodes, 256 shells, 41 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M1: maximum |uz| of the cracked long-term deflection (Competing software 1 cracked_Long_Term; OpenPT `CrackedDeflectionResult.MaxCrackedLongTerm`), relative difference, tolerance 10 % or 1.0 mm when Competing software 1 is below 10 mm. U0 and K = cracked / uncracked sustained (M2, tolerance 10 %). Cracked state: the two programs use the same design sections; a section is cracked when Ie/Ig < 1; at least 85 % of the sections must agree. Probes: the inverse-distance mean of the four nearest slab nodes within 1000 mm, report only.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
max |uz|, cracked long-term (M1)	mm	95.9	95.21	-0.72 -0.6943 mm	<= 10 % or <= 1 mm if A < 10 mm	PASS
max |uz|, uncracked sustained (U0, diagnostic)	mm	28.49	28.49	-0.01	soft target +/-5 %, diagnostic only	INFO
max |uz|, cracked sustained	mm	31.97	31.74	-0.72	report only	INFO
K = cracked / uncracked sustained (M2)	-	1.122	1.114	-0.71	+/-10 %	PASS
sections with the same cracked state as Competing software 1 (of 313; 99.4 %)	sections	–	311	–	>= 85 %	PASS
cracked sections among the paired (Competing software 1 / OpenPT)	sections	66	66	+0.00	report only	INFO
distance between the two max |uz| locations	mm	–	0.000000572	–	report only	INFO
largest probe difference: bay_1_1 (of 9 probes compared, 9 defined), uz cracked long-term	mm	-62.54	-61.94	+0.95 +0.5953 mm	report only	INFO

NOTES

The mesh of OpenPT is its own, so deflections are compared at the maximum and at the probe points, not node by node (PLAN.md section 6, item 4).

OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case B08 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B08 --inp ver-run\A\work\B08\export\B08_export.INP --adm ver-run\A\work\B08\B08.adm --run-json ver-run\A\work\B08\cs1_run.json --out ver-run\A\results\B08 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

Sources: `bench\results\B08\cs1.jsonl`
`bench\results\B08\cs1_uz.csv`
`openpt-build\ver-run\A\results\B08\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B08\cs1_run.json`
`bench\cases\B08\B08.case.json`

2.23 V-323 B08 RC slab with a transfer beam: calculated rebar

Perspective: Calculated rebar: provided area, steel mass, bar counts · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Reinforced concrete floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 605.2 m2; patch dead load 907.7 kN, patch live load 1815.5 kN, point loads 2200 kN. B01 without the column at (8000,8000) (none below, none above); transfer beam 800 x 1100 on y = 8000 from x = 0 to 16000; point load 1800 kN dead + 400 kN live at (8000,8000) standing in for a planted column. 15 columns, 0 walls, 1 beam, 0 openings; 8 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 323 nodes, 256 shells, 41 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M3b: provided As per design section and face (at least 90 % of section-faces must match). M3c: total steel mass per face of the Calculated Rebar Plan, tolerance 10 %. Bar counts and the multiset of bars (spec 27 G2) and the required-As envelope (M3a) are report only. Provided As: Competing software 1's value in the .adm section record against OpenPT's Calculated Rebar Plan. Steel mass: bars with Source = 1 in the Competing software 1 export against OpenPT's plan. A section-face matches when |difference| <= max(10 % of Competing software 1, one bar area of that face). The 80 beam section-faces of this case are excluded from the 90 % rule (beam layout rule, spec 19 D3, declared in PLAN.md section 2.2) and listed in a separate row; the mass rows with the beam lines left out on both sides are report only.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
provided As section-faces matching Competing software 1 (of 546; 90.7 %)	faces	–	495	–	>= 90 % of faces; face tol max(10 % of A, 1 bar)	PASS
calculated-rebar steel mass, top face	kg	4572	4394	-3.90	+/-10 %	PASS
calculated-rebar steel mass, bottom face	kg	10518	10060	-4.35	+/-10 %	PASS
beam section-faces (excluded from the M3b verdict, spec 19 D3), matching (of 80; 100.0 %)	faces	–	80	–	report only	INFO
steel mass, top face, beam lines left out on both sides	kg	3669	3476	-5.26	report only (no verdict)	INFO
steel mass, bottom face, beam lines left out on both sides	kg	6322	5865	-7.24	report only (no verdict)	INFO
bar count, top face	bars	32	31	-3.12	report only	INFO
bar count, bottom face	bars	22	22	+0.00	report only	INFO
bars identical to Competing software 1's (same length and diameter), top face (of 32; 81.2 %)	bars	–	26	–	report only	INFO
bars identical to Competing software 1's (same length and diameter), bottom face (of 22; 77.3 %)	bars	–	17	–	report only	INFO
required As envelope, |difference| median over section-faces	%	–	0.1524	–	report only	INFO
required As envelope, |difference| maximum	%	–	100	–	report only	INFO

NOTES

Report-only rows are not judged. The steel mass of the whole plan is compared; the bar multiset differs from Competing software 1 in some cases because whole-bar rounding and splice positions differ (spec 27 G2). Beam section-faces: see the method.

OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case B08 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B08 --inp ver-run\A\work\B08\export\B08_export.INP --adm ver-run\A\work\B08\B08.adm --run-json ver-run\A\work\B08\cs1_run.json --out ver-run\A\results\B08 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

Sources: `bench\results\B08\cs1.jsonl`
`bench\results\B08\cs1_uz.csv`
`openpt-build\ver-run\A\results\B08\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B08\cs1_run.json`
`bench\cases\B08\B08.case.json`

2.24 V-324 B08 RC slab with a transfer beam: punching shear

Perspective: Punching shear · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Reinforced concrete floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 605.2 m2; patch dead load 907.7 kN, patch live load 1815.5 kN, point loads 2200 kN. B01 without the column at (8000,8000) (none below, none above); transfer beam 800 x 1100 on y = 8000 from x = 0 to 16000; point load 1800 kN dead + 400 kN live at (8000,8000) standing in for a planted column. 15 columns, 0 walls, 1 beam, 0 openings; 8 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 323 nodes, 256 shells, 41 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M4: Competing software 1's `.PUO` after Execute Shear Check against OpenPT's `PunchingCheck` (precompression mode and compatibility switches set to match Competing software 1), matched by support label. Tolerances: the set of checked supports identical; stress ratio within 10 % on at least 90 % of the supports; verdict class equal on at least 90 %. Supports with a beam touching them are not checked in either program (PLAN.md section 1, M4).

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
supports checked (Competing software 1 / OpenPT)	supports	13	13	+0.00	identical	PASS
supports with the stress ratio within +/-10 % of Competing software 1's (of 13; 100.0 %)	supports	–	13	–	>= 90 %	PASS
supports with the same verdict class as Competing software 1 (of 13; 100.0 %)	supports	–	13	–	>= 90 %	PASS
largest stress-ratio difference: Column 8 (of 13 supports checked by both)	ratio	1.852	1.86	+0.44 +0.0082 ratio	report only	INFO
stress-ratio |difference|, median of 13 supports	%	–	0.073	–	report only	INFO
stress-ratio |difference|, 90th percentile (nearest rank)	%	–	0.346	–	report only	INFO

NOTES

Under EC2 Competing software 1 ignores the moment transfer (constant beta), so the ratio scales with the column force. The beams of this case are deep, so spec 94c (shallow-beam columns are checked) does not change the checked set.

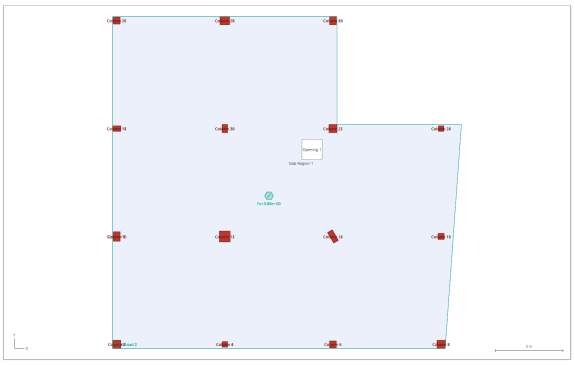
OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case B08 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B08 --inp ver-run\A\work\B08\export\B08_export.INP --adm ver-run\A\work\B08\B08.adm --run-json ver-run\A\work\B08\cs1_run.json --out ver-run\A\results\B08 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

Sources: `bench\results\B08\cs1.jsonl`
`bench\results\B08\cs1_uz.csv`
`openpt-build\ver-run\A\results\B08\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B08\cs1_run.json`
`bench\cases\B08\B08.case.json`

2.25 V-325 B09 RC irregular slab (L shape): deflection and cracking

Perspective: Deflection, cracked and long-term · **Reference:** Competing software 1, EC2 · **Status:** PASS



Structure: B09

MODEL

Reinforced concrete floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 548.9 m2; patch dead load 823.3 kN, patch live load 1646.6 kN. L-shaped plate (NE bay removed), t 250; east edge skewed from (24300,-300) to (25500,16300); column 400 x 900 rotated 30 deg at (16000,8000); other columns 400..800; opening 1500 x 1500 at the re-entrant corner, 500 mm clear of the column faces; support lines clipped to the L. 15 columns, 0 walls, 0 beams, 1 opening; 8 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 366 nodes, 295 shells, 30 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M1: maximum |uz| of the cracked long-term deflection (Competing software 1 cracked_Long_Term; OpenPT `CrackedDeflectionResult.MaxCrackedLongTerm`), relative difference, tolerance 10 % or 1.0 mm when Competing software 1 is below 10 mm. U0 and K = cracked / uncracked sustained (M2, tolerance 10 %). Cracked state: the two programs use the same design sections; a section is cracked when Ie/Ig < 1; at least 85 % of the sections must agree. Probes: the inverse-distance mean of the four nearest slab nodes within 1000 mm, report only.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
max |uz|, cracked long-term (M1)	mm	24.76	24.65	-0.42 -0.1032 mm	<= 10 % or <= 1 mm if A < 10 mm	PASS
max |uz|, uncracked sustained (U0, diagnostic)	mm	8.14	8.121	-0.23	soft target +/-5 %, diagnostic only	INFO
max |uz|, cracked sustained	mm	8.252	8.218	-0.42	report only	INFO
K = cracked / uncracked sustained (M2)	-	1.014	1.012	-0.18	+/-10 %	PASS
sections with the same cracked state as Competing software 1 (of 312; 100.0 %)	sections	–	312	–	>= 85 %	PASS
cracked sections among the paired (Competing software 1 / OpenPT)	sections	13	13	+0.00	report only	INFO
distance between the two max |uz| locations	mm	–	3.51	–	report only	INFO
largest probe difference: bay_3_2 (of 12 probes compared, 12 defined), uz cracked long-term	mm	-22.67	-22.43	+1.06 +0.2414 mm	report only	INFO

NOTES

The mesh of OpenPT is its own, so deflections are compared at the maximum and at the probe points, not node by node (PLAN.md section 6, item 4).

OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case B09 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B09 --inp ver-run\A\work\B09\export\B09_export.INP --adm ver-run\A\work\B09\B09.adm --run-json ver-run\A\work\B09\cs1_run.json --out ver-run\A\results\B09 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

Sources: `bench\results\B09\cs1.jsonl`
`bench\results\B09\cs1_uz.csv`
`openpt-build\ver-run\A\results\B09\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B09\cs1_run.json`
`bench\cases\B09\B09.case.json`

2.26 V-326 B09 RC irregular slab (L shape): calculated rebar

Perspective: Calculated rebar: provided area, steel mass, bar counts · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Reinforced concrete floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 548.9 m2; patch dead load 823.3 kN, patch live load 1646.6 kN. L-shaped plate (NE bay removed), t 250; east edge skewed from (24300,-300) to (25500,16300); column 400 x 900 rotated 30 deg at (16000,8000); other columns 400..800; opening 1500 x 1500 at the re-entrant corner, 500 mm clear of the column faces; support lines clipped to the L. 15 columns, 0 walls, 0 beams, 1 opening; 8 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 366 nodes, 295 shells, 30 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M3b: provided As per design section and face (at least 90 % of section-faces must match). M3c: total steel mass per face of the Calculated Rebar Plan, tolerance 10 %. Bar counts and the multiset of bars (spec 27 G2) and the required-As envelope (M3a) are report only. Provided As: Competing software 1's value in the .adm section record against OpenPT's Calculated Rebar Plan. Steel mass: bars with Source = 1 in the Competing software 1 export against OpenPT's plan. A section-face matches when |difference| <= max(10 % of Competing software 1, one bar area of that face).

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
provided As section-faces matching Competing software 1 (of 624; 100.0 %)	faces	–	624	–	>= 90 % of faces; face tol max(10 % of A, 1 bar)	PASS
calculated-rebar steel mass, top face	kg	3087	3087	-0.00	+/-10 %	PASS
calculated-rebar steel mass, bottom face	kg	5342	5371	+0.54	+/-10 %	PASS
bar count, top face	bars	30	30	+0.00	report only	INFO
bar count, bottom face	bars	22	22	+0.00	report only	INFO
bars identical to Competing software 1's (same length and diameter), top face (of 30; 93.3 %)	bars	–	28	–	report only	INFO
bars identical to Competing software 1's (same length and diameter), bottom face (of 22; 95.5 %)	bars	–	21	–	report only	INFO
required As envelope, |difference| median over section-faces	%	–	0.02966	–	report only	INFO
required As envelope, |difference| maximum	%	–	19.32	–	report only	INFO

NOTES

Report-only rows are not judged. The steel mass of the whole plan is compared; the bar multiset differs from Competing software 1 in some cases because whole-bar rounding and splice positions differ (spec 27 G2).

OpenPT build: 7d86603 Release, run 2026-11-18
Command: `tools\run_openpt.ps1 -Case B09 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B09 --inp ver-run\A\work\B09\export\B09_export.INP --adm ver-run\A\work\B09\B09.adm --run-json ver-run\A\work\B09\cs1_run.json --out ver-run\A\results\B09 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`
Sources: `bench\results\B09\cs1.jsonl`
`bench\results\B09\cs1_uz.csv`
`openpt-build\ver-run\A\results\B09\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B09\cs1_run.json`
`bench\cases\B09\B09.case.json`

2.27 V-327 B09 RC irregular slab (L shape): punching shear

Perspective: Punching shear · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Reinforced concrete floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 548.9 m2; patch dead load 823.3 kN, patch live load 1646.6 kN. L-shaped plate (NE bay removed), t 250; east edge skewed from (24300,-300) to (25500,16300); column 400 x 900 rotated 30 deg at (16000,8000); other columns 400..800; opening 1500 x 1500 at the re-entrant corner, 500 mm clear of the column faces; support lines clipped to the L. 15 columns, 0 walls, 0 beams, 1 opening; 8 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 366 nodes, 295 shells, 30 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M4: Competing software 1's `.PUO` after Execute Shear Check against OpenPT's `PunchingCheck` (precompression mode and compatibility switches set to match Competing software 1), matched by support label. Tolerances: the set of checked supports identical; stress ratio within 10 % on at least 90 % of the supports; verdict class equal on at least 90 %. Every column and short wall of the level is checked by both programs.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
supports checked (Competing software 1 / OpenPT)	supports	15	15	+0.00	identical	PASS
supports with the stress ratio within +/-10 % of Competing software 1's (of 15; 100.0 %)	supports	–	15	–	>= 90 %	PASS
supports with the same verdict class as Competing software 1 (of 15; 100.0 %)	supports	–	15	–	>= 90 %	PASS
largest stress-ratio difference: Column 3 (of 15 supports checked by both)	ratio	2.063	2.056	-0.36 -0.0074 ratio	report only	INFO
stress-ratio |difference|, median of 15 supports	%	–	0.074	–	report only	INFO
stress-ratio |difference|, 90th percentile (nearest rank)	%	–	0.335	–	report only	INFO

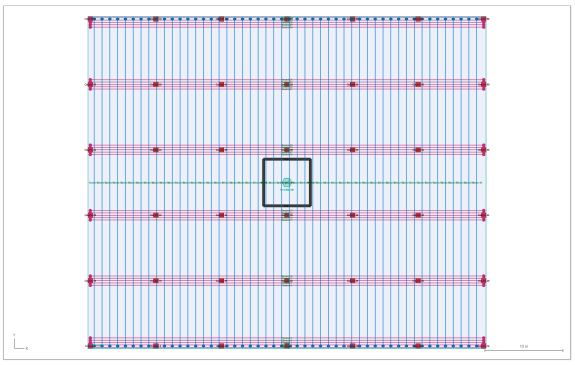
NOTES

Under EC2 Competing software 1 ignores the moment transfer (constant beta), so the ratio scales with the column force.

OpenPT build: 7d86603 Release, run 2026-11-18
Command: `tools\run_openpt.ps1 -Case B09 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B09 --inp ver-run\A\work\B09\export\B09_export.INP --adm ver-run\A\work\B09\B09.adm --run-json ver-run\A\work\B09\cs1_run.json --out ver-run\A\results\B09 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`
Sources: `bench\results\B09\cs1.jsonl`
`bench\results\B09\cs1_uz.csv`
`openpt-build\ver-run\A\results\B09\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B09\cs1_run.json`
`bench\cases\B09\B09.case.json`

2.28 V-328 B10 PT large floor with core walls: deflection and cracking

Perspective: Deflection, cracked and long-term · **Reference:** Competing software 1, EC2 · **Status:** PASS



Structure: B10

MODEL

Post-tensioned floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 2172.6 m2; patch dead load 11949.3 kN, patch live load 10863.0 kN. 6 x 5 bays of 8.4 m (50.4 x 42 m), t 230, 42 columns; central core of 4 walls 300 thick, 6 x 6 m, centred at (25200,21000); scale case for time and memory. 42 columns, 4 walls, 0 beams, 0 openings, 80 tendons; 13 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 914 nodes, 763 shells, 84 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M1: maximum |uz| of the cracked long-term deflection (Competing software 1 cracked_Long_Term; OpenPT `CrackedDeflectionResult.MaxCrackedLongTerm`), relative difference, tolerance 10 % or 1.0 mm when Competing software 1 is below 10 mm. U0 and K = cracked / uncracked sustained (M2, tolerance 10 %). Cracked state: the two programs use the same design sections; a section is cracked when Ie/Ig < 1; at least 85 % of the sections must agree. Probes: the inverse-distance mean of the four nearest slab nodes within 1000 mm, report only.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
max |uz|, cracked long-term (M1)	mm	48.84	48.36	-0.99 -0.4836 mm	<= 10 % or <= 1 mm if A < 10 mm	PASS
max |uz|, uncracked sustained (U0, diagnostic)	mm	14.91	14.83	-0.48	soft target +/-5 %, diagnostic only	INFO
max |uz|, cracked sustained	mm	16.28	16.12	-0.99	report only	INFO
K = cracked / uncracked sustained (M2)	-	1.092	1.087	-0.52	+/-10 %	PASS
sections with the same cracked state as Competing software 1 (of 1015; 99.9 %)	sections	–	1014	–	>= 85 %	PASS
cracked sections among the paired (Competing software 1 / OpenPT)	sections	129	128	-0.78	report only	INFO
distance between the two max |uz| locations	mm	–	34780	–	report only	INFO
largest probe difference: bay_5_2 (of 28 probes compared, 30 defined), uz cracked long-term	mm	-22.43	-23.23	-3.56 -0.7974 mm	report only	INFO

NOTES

The mesh of OpenPT is its own, so deflections are compared at the maximum and at the probe points, not node by node (PLAN.md section 6, item 4).

OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case B10 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B10 --inp ver-run\A\work\B10\export\B10_export.INP --adm ver-run\A\work\B10\B10.adm --run-json ver-run\A\work\B10\cs1_run.json --out ver-run\A\results\B10 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

Sources: `bench\results\B10\cs1.jsonl`
`bench\results\B10\cs1_uz.csv`
`openpt-build\ver-run\A\results\B10\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B10\cs1_run.json`
`bench\cases\B10\B10.case.json`

2.29 V-329 B10 PT large floor with core walls: calculated rebar

Perspective: Calculated rebar: provided area, steel mass, bar counts · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Post-tensioned floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 2172.6 m2; patch dead load 11949.3 kN, patch live load 10863.0 kN. 6 x 5 bays of 8.4 m (50.4 x 42 m), t 230, 42 columns; central core of 4 walls 300 thick, 6 x 6 m, centred at (25200,21000); scale case for time and memory. 42 columns, 4 walls, 0 beams, 0 openings, 80 tendons; 13 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 914 nodes, 763 shells, 84 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M3b: provided As per design section and face (at least 90 % of section-faces must match). M3c: total steel mass per face of the Calculated Rebar Plan, tolerance 10 %. Bar counts and the multiset of bars (spec 27 G2) and the required-As envelope (M3a) are report only. Provided As: Competing software 1's value in the .adm section record against OpenPT's Calculated Rebar Plan. Steel mass: bars with Source = 1 in the Competing software 1 export against OpenPT's plan. A section-face matches when |difference| <= max(10 % of Competing software 1, one bar area of that face).

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
provided As section-faces matching Competing software 1 (of 2030; 94.8 %)	faces	–	1925	–	>= 90 % of faces; face tol max(10 % of A, 1 bar)	PASS
calculated-rebar steel mass, top face	kg	10230	10111	-1.13	+/-10 %	PASS
calculated-rebar steel mass, bottom face	kg	12310	12260	-0.39	+/-10 %	PASS
bar count, top face	bars	63	57	-9.52	report only	INFO
bar count, bottom face	bars	67	62	-7.46	report only	INFO
bars identical to Competing software 1's (same length and diameter), top face (of 63; 69.8 %)	bars	–	44	–	report only	INFO
bars identical to Competing software 1's (same length and diameter), bottom face (of 67; 76.1 %)	bars	–	51	–	report only	INFO
required As envelope, |difference| median over section-faces	%	–	2.56	–	report only	INFO
required As envelope, |difference| maximum	%	–	841.9	–	report only	INFO

NOTES

Report-only rows are not judged. The steel mass of the whole plan is compared; the bar multiset differs from Competing software 1 in some cases because whole-bar rounding and splice positions differ (spec 27 G2).

OpenPT build: 7d86603 Release, run 2026-11-18
Command: `tools\run_openpt.ps1 -Case B10 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B10 --inp ver-run\A\work\B10\export\B10_export.INP --adm ver-run\A\work\B10\B10.adm --run-json ver-run\A\work\B10\cs1_run.json --out ver-run\A\results\B10 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`
Sources: `bench\results\B10\cs1.jsonl`
`bench\results\B10\cs1_uz.csv`
`openpt-build\ver-run\A\results\B10\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B10\cs1_run.json`
`bench\cases\B10\B10.case.json`

2.30 V-330 B10 PT large floor with core walls: punching shear

Perspective: Punching shear · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Post-tensioned floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 2172.6 m2; patch dead load 11949.3 kN, patch live load 10863.0 kN. 6 x 5 bays of 8.4 m (50.4 x 42 m), t 230, 42 columns; central core of 4 walls 300 thick, 6 x 6 m, centred at (25200,21000); scale case for time and memory. 42 columns, 4 walls, 0 beams, 0 openings, 80 tendons; 13 support lines. Mesh used for both programs: cell 1500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 914 nodes, 763 shells, 84 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

M4: Competing software 1's `.PUO` after Execute Shear Check against OpenPT's `PunchingCheck` (precompression mode and compatibility switches set to match Competing software 1), matched by support label. Tolerances: the set of checked supports identical; stress ratio within 10 % on at least 90 % of the supports; verdict class equal on at least 90 %. Every column and short wall of the level is checked by both programs.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
supports checked (Competing software 1 / OpenPT)	supports	42	42	+0.00	identical	PASS
supports with the stress ratio within +/-10 % of Competing software 1's (of 42; 100.0 %)	supports	–	42	–	>= 90 %	PASS
supports with the same verdict class as Competing software 1 (of 42; 100.0 %)	supports	–	42	–	>= 90 %	PASS
largest stress-ratio difference: Column 18 (of 42 supports checked by both)	ratio	1.723	1.716	-0.44 -0.0076 ratio	report only	INFO
stress-ratio |difference|, median of 42 supports	%	–	0.104	–	report only	INFO
stress-ratio |difference|, 90th percentile (nearest rank)	%	–	0.218	–	report only	INFO

NOTES

Under EC2 Competing software 1 ignores the moment transfer (constant beta), so the ratio scales with the column force.

OpenPT build: 7d86603 Release, run 2026-11-18
Command: `tools\run_openpt.ps1 -Case B10 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B10 --inp ver-run\A\work\B10\export\B10_export.INP --adm ver-run\A\work\B10\B10.adm --run-json ver-run\A\work\B10\cs1_run.json --out ver-run\A\results\B10 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`
Sources: `bench\results\B10\cs1.jsonl`
`bench\results\B10\cs1_uz.csv`
`openpt-build\ver-run\A\results\B10\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B10\cs1_run.json`
`bench\cases\B10\B10.case.json`

2.31 V-331 B10F PT large floor with core walls, fine mesh: accuracy

Perspective: Large floor, fine mesh: deflection, rebar and punching · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Post-tensioned floor, EC2, N-mm; one floor between two levels (story height 3300 mm). Net slab area 2172.6 m2; patch dead load 11949.3 kN, patch live load 10863.0 kN. 6 x 5 bays of 8.4 m (50.4 x 42 m), t 230, 42 columns; central core of 4 walls 300 thick, 6 x 6 m, centred at (25200,21000); scale case for time and memory; fine mesh (cell 500) of the B10 model. 42 columns, 4 walls, 0 beams, 0 openings, 80 tendons; 13 support lines. Mesh used for both programs: cell 500 mm, node shift 500 mm (the values of Competing software 1's mesh dialog, cs1_run.json); OpenPT mesh 5202 nodes, 4926 shells, 84 frames. Covers 15/15 mm, bars 18/28 mm (top/bottom), strip covers 24/29 mm: as in force in Competing software 1.

METHOD

The same model as B10, meshed at cell 500 mm. The benchmark gives B10F no accuracy gate (time and memory case, PLAN.md section 2.2); the gate tolerances of PLAN.md section 1 are applied to its numbers here as `report.py` computed them, and its rows are marked not gated. Rows: M1 and M2 (deflection, K, cracked state), M3b and M3c (provided As, steel mass), M4 (checked set, ratio, verdict class).

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
max |uz|, cracked long-term (M1)	mm	64.51	64.78	+0.42 +0.2719 mm	<= 10 % or <= 1 mm if A < 10 mm	PASS
max |uz|, uncracked sustained (U0, diagnostic)	mm	16.89	16.85	-0.21	soft target +/-5 %, diagnostic only	INFO
max |uz|, cracked sustained	mm	21.5	21.59	+0.42	report only	INFO
K = cracked / uncracked sustained (M2)	-	1.273	1.282	+0.64	+/-10 %	PASS
sections with the same cracked state as Competing software 1 (of 1015; 99.8 %)	sections	–	1013	–	>= 85 %	PASS
provided As section-faces matching Competing software 1 (of 2030; 95.7 %)	faces	–	1943	–	>= 90 % of faces; face tol max(10 % of A, 1 bar)	PASS
calculated-rebar steel mass, top face	kg	10450	10330	-1.11	+/-10 %	PASS
calculated-rebar steel mass, bottom face	kg	13370	13360	-0.10	+/-10 %	PASS
supports checked (Competing software 1 / OpenPT)	supports	42	42	+0.00	identical	PASS
supports with the stress ratio within +/-10 % of Competing software 1's (of 42; 100.0 %)	supports	–	42	–	>= 90 %	PASS
supports with the same verdict class as Competing software 1 (of 42; 100.0 %)	supports	–	42	–	>= 90 %	PASS
largest stress-ratio difference: Column 25 (of 42 supports checked by both)	ratio	1.641	1.637	-0.23 -0.0037 ratio	report only	INFO

NOTES

B10F is not part of the benchmark gate (PLAN.md section 2.2: time and memory only, no accuracy gate). The numbers of B10 itself are in V-328 to V-330. Time and memory of both programs are in chapter 10.

OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case B10F -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B10F --inp ver-run\A\work\B10F\export\B10F_export.INP --adm ver-run\A\work\B10F\B10F.adm --run-json ver-run\A\work\B10F\cs1_run.json --out ver-run\A\results\B10F --repeat 1 --tag cold1 --cell 500 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 18 --bar-bottom 28 --strip-cover-top 24 --strip-cover-bottom 29; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

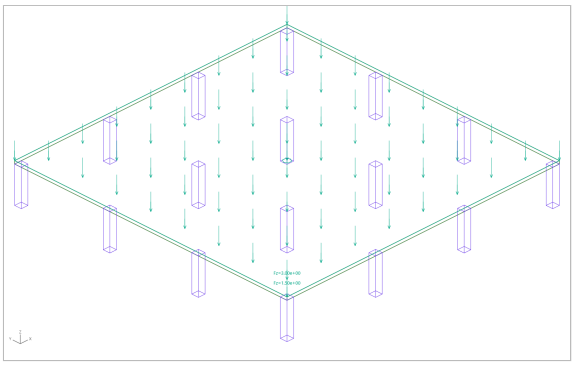
Sources: `bench\results\B10F\cs1.jsonl`
`bench\results\B10F\cs1_uz.csv`
`openpt-build\ver-run\A\results\B10F\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\B10F\cs1_run.json`
`bench\cases\B10F\B10F.case.json`

3 Multi-level buildings against Competing software 1

This chapter compares OpenPT's multi-level analysis (spec 81) with Competing software 1 on four three-storey buildings M01 to M04, which are the single-level benchmark floors B01, B02, B04 and B08 stacked on three slab planes. Competing software 1's multi-level run (Competing software 1, fixed bases) was made earlier and stored in `bench\multistory\<model>\cs1\<model>\Databases` (analyser deck and ADO result files); Competing software 1 was not started for this manual. OpenPT was run again (`OpenPT.Bench multilevel`, then `mldeck` and `mlcmp`, and `mlsummary` for the summary table) with the installed build, at cell 1500 mm, node shift 500 mm, all six freedoms fixed at the base, on copies of the inputs.

3.1 V-401 M01 multi-level building, three storeys: counts, reactions, displacements, column forces

Perspective: Multi-level building: counts, reactions, displacements, column forces · **Reference:** Competing software 1, multi-level analysis (ADO results and analyser deck of the project) · **Status:** PASS



Structure: M01

MODEL

M01: 3 slab planes (z = 3300, 6600, 9900 mm) of the stacked single-level model `B01_src.INP` (bench\PLAN.md section 2.2, B01 RC-FLAT: G3, t 250, 16 columns; loads: SDL 1.5, LL 3.0). Competing software 1's multi-level deck has 856 nodes, 96 frames and 681 shells; 16 supports at the base. OpenPT `multilevel` at cell 1500 mm, node shift 500 mm, base all six freedoms fixed.

METHOD

OpenPT's multi-level model of the exchange file (`M01.INP`) is solved with Selfweight, Dead and Live and compared with Competing software 1's results of the same cases (gates of spec 81, bench\multistory\report_81.md): G1 counts per level and storey; G2b sum of reactions; G3 slab uz at the nodes that exist in both models (matched by x, y, z within 1 mm); G4 column axial force and G5 column end moments of the matched frames (difference as a percentage of the case's largest |value|, worst over levels and the three cases); G6 OpenPT.Fem solving Competing software 1's own deck (all nodes match).

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
nodes, whole building	–	856	856	+0.00	equal	PASS
frames (columns and beams)	–	96	96	+0.00	equal	PASS
shells (slab and wall)	–	681	681	+0.00	equal	PASS
supports (restrained nodes)	–	16	16	+0.00	equal	PASS
G2b: sum of the vertical reactions of the Selfweight case (worst of Selfweight, Dead, Live)	N	12026560	12020000	-0.09	|difference| <= 0.1 %	PASS
G3: slab uz difference per level, p90 of the matched nodes (worst over levels and cases)	% of level max |uz|	–	0.245	–	p90 <= 0.5 %	PASS
G3: slab uz difference, maximum	% of level max |uz|	–	0.457	–	max <= 2 %	PASS
G4: column axial force difference, p90	% of case max	–	0.089	–	p90 <= 0.5 %	PASS
G4: column axial force difference, maximum	% of case max	–	0.131	–	max <= 2 %	PASS
G5: column end moment difference, p90	% of case max	–	0.405	–	p90 <= 2 %	PASS
G5: column end moment difference, maximum	% of case max	–	0.632	–	max <= 5 %	PASS
G6: OpenPT.Fem on Competing software 1's own deck, uz difference, p90 (all nodes match)	% of level max |uz|	–	0.003	–	p90 <= 0.1 %	PASS

NOTES

G6 maximum (deck run): 0.006 % (no target defined). G2a (sum of reactions = applied load): 2.9E-14, tolerance <= 1E-6. **Self-weight** of OpenPT is 0.085 % lighter than Competing software 1's in all four models; G2b passes with a small margin. `mldeck` solves the deck's empty Selfweight case with W = 1.

OpenPT build: 7d86603 Release (tag installed-20261118-1237), run 2026-11-18
Command: `OpenPT.Bench.exe multilevel M01.INP openpt\v1 --cell 1500 --shift 500 --base fixed; mldeck cs1\M01\Databases\M01.INP openpt\deck; mlcmp openpt\v1 cs1\M01\Databases openpt\v1\report.md; mlcmp openpt\deck cs1\M01\Databases openpt\deck\report.md (cwd openpt-build\ver-run\B\ms\M01; inputs copied from bench\multistory)`
Sources: `OpenPT\bench\multistory\M01\cs1\M01\Databases\M01.INP`
`OpenPT\bench\multistory\M01\cs1\M01\Databases\M01ado`
`OpenPT\bench\multistory\M01\M01.INP`
`OpenPT\bench\multistory\report_81.md`
`openpt-build\ver-run\B\ms\M01\openpt\v1\report.md`
`openpt-build\ver-run\B\ms\M01\openpt\v1\report.gates.json`
`openpt-build\ver-run\B\ms\M01\openpt\deck\report.gates.json`
`openpt-build\ver-run\B\out\final\ch4_M01_multilevel.txt`
`openpt-build\ver-run\B\out\final\ch4_M01_mldeck.txt`

3.2 V-402 M02 multi-level building, three storeys: counts, reactions, displacements, column forces

Perspective: Multi-level building: counts, reactions, displacements, column forces · **Reference:** Competing software 1, multi-level analysis (ADO results and analyser deck of the project) · **Status:** PASS

MODEL

M02: 3 slab planes (z = 3300, 6600, 9900 mm) of the stacked single-level model `B02_src.INP` (bench\PLAN.md section 2.2, B02 PT-FLAT: G3, t 220; loads: SDL 1.5, LL 3.0). Competing software 1's multi-level deck has 856 nodes, 96 frames and 681 shells; 16 supports at the base. Prestress: 44 tendons on each of the 3 slab planes. OpenPT `multilevel` at cell 1500 mm, node shift 500 mm, base all six freedoms fixed.

METHOD

OpenPT's multi-level model of the exchange file (`M02.INP`) is solved with Selfweight, Dead and Live and compared with Competing software 1's results of the same cases (gates of spec 81, bench\multistory\report_81.md): G1 counts per level and storey; G2b sum of reactions; G3 slab uz at the nodes that exist in both models (matched by x, y, z within 1 mm); G4 column axial force and G5 column end moments of the matched frames (difference as a percentage of the case's largest |value|, worst over levels and the three cases); G6 OpenPT.Fem solving Competing software 1's own deck (all nodes match).

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
nodes, whole building	–	856	856	+0.00	equal	PASS
frames (columns and beams)	–	96	96	+0.00	equal	PASS
shells (slab and wall)	–	681	681	+0.00	equal	PASS
supports (restrained nodes)	–	16	16	+0.00	equal	PASS
G2b: sum of the vertical reactions of the Selfweight case (worst of Selfweight, Dead, Live)	N	10744350	10740000	-0.08	|difference| <= 0.1 %	PASS
G3: slab uz difference per level, p90 of the matched nodes (worst over levels and cases)	% of level max |uz|	–	0.248	–	p90 <= 0.5 %	PASS
G3: slab uz difference, maximum	% of level max |uz|	–	0.463	–	max <= 2 %	PASS
G4: column axial force difference, p90	% of case max	–	0.09	–	p90 <= 0.5 %	PASS
G4: column axial force difference, maximum	% of case max	–	0.134	–	max <= 2 %	PASS
G5: column end moment difference, p90	% of case max	–	0.418	–	p90 <= 2 %	PASS
G5: column end moment difference, maximum	% of case max	–	0.666	–	max <= 5 %	PASS
G6: OpenPT.Fem on Competing software 1's own deck, uz difference, p90 (all nodes match)	% of level max |uz|	–	0.002	–	p90 <= 0.1 %	PASS

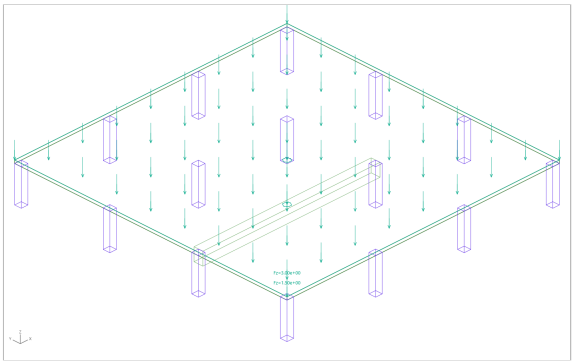
NOTES

G6 maximum (deck run): 0.005 % (no target defined). G2a (sum of reactions = applied load): 1.9E-13, tolerance <= 1E-6. **Self-weight** of OpenPT is 0.085 % lighter than Competing software 1's in all four models; G2b passes with a small margin. `mldeck` solves the deck's empty Selfweight case with W = 1.

OpenPT build: 7d86603 Release (tag installed-20261118-1237), run 2026-11-18
Command: `OpenPT.Bench.exe multilevel M02.INP openpt\v1 --cell 1500 --shift 500 --base fixed; mldeck cs1\M02\Databases\M02.INP openpt\deck; mlcmp openpt\v1 cs1\M02\Databases openpt\v1\report.md; mlcmp openpt\deck cs1\M02\Databases openpt\deck\report.md (cwd openpt-build\ver-run\B\ms\M02; inputs copied from bench\multistory)`
Sources: `OpenPT\bench\multistory\M02\cs1\M02\Databases\M02.INP`
`OpenPT\bench\multistory\M02\cs1\M02\Databases\M02ado`
`OpenPT\bench\multistory\M02\M02.INP`
`OpenPT\bench\multistory\report_81.md`
`openpt-build\ver-run\B\ms\M02\openpt\v1\report.md`
`openpt-build\ver-run\B\ms\M02\openpt\v1\report.gates.json`
`openpt-build\ver-run\B\ms\M02\openpt\deck\report.gates.json`
`openpt-build\ver-run\B\out\final\ch4_M02_multilevel.txt`
`openpt-build\ver-run\B\out\final\ch4_M02_mldeck.txt`

3.3 V-404 M04 multi-level building, three storeys: counts, reactions, displacements, column forces

Perspective: Multi-level building: counts, reactions, displacements, column forces · **Reference:** Competing software 1, multi-level analysis (ADO results and analyser deck of the project) · **Status:** PASS



Structure: M04

MODEL

M04: 3 slab planes (z = 3300, 6600, 9900 mm) of the stacked single-level model `B08_src.INP` (bench\PLAN.md section 2.2, B08 RC-TRANSFER: G3, t 250; no column below at (8000, 8000); transfer beam 800 x 1100 on y = 8000 from x = 0 to 16000; point load at (8000, 8000) on the beam; loads: + point load 1800 kN (dead) + 400 kN (live), standing in for a planted column (no column-above object)). Competing software 1's multi-level deck has 939 nodes, 123 frames and 768 shells; 15 supports at the base. OpenPT `multilevel` at cell 1500 mm, node shift 500 mm, base all six freedoms fixed.

METHOD

OpenPT's multi-level model of the exchange file (`M04.INP`) is solved with Selfweight, Dead and Live and compared with Competing software 1's results of the same cases (gates of spec 81, bench\multistory\report_81.md): G1 counts per level and storey; G2b sum of reactions; G3 slab uz at the nodes that exist in both models (matched by x, y, z within 1 mm); G4 column axial force and G5 column end moments of the matched frames (difference as a percentage of the case's largest |value|, worst over levels and the three cases); G6 OpenPT.Fem solving Competing software 1's own deck (all nodes match).

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
nodes, whole building	–	939	939	+0.00	equal	PASS
frames (columns and beams)	–	123	123	+0.00	equal	PASS
shells (slab and wall)	–	768	768	+0.00	equal	PASS
supports (restrained nodes)	–	15	15	+0.00	equal	PASS
G2b: sum of the vertical reactions of the Selfweight case (worst of Selfweight, Dead, Live)	N	12936880	12930000	-0.08	|difference| <= 0.1 %	PASS
G3: slab uz difference per level, p90 of the matched nodes (worst over levels and cases)	% of level max |uz|	–	0.14	–	p90 <= 0.5 %	PASS
G3: slab uz difference, maximum	% of level max |uz|	–	0.288	–	max <= 2 %	PASS
G4: column axial force difference, p90	% of case max	–	0.069	–	p90 <= 0.5 %	PASS
G4: column axial force difference, maximum	% of case max	–	0.081	–	max <= 2 %	PASS
G5: column end moment difference, p90	% of case max	–	0.189	–	p90 <= 2 %	PASS
G5: column end moment difference, maximum	% of case max	–	0.395	–	max <= 5 %	PASS
G6: OpenPT.Fem on Competing software 1's own deck, uz difference, p90 (all nodes match)	% of level max |uz|	–	0.012	–	p90 <= 0.1 %	PASS

NOTES

G6 maximum (deck run): 0.032 % (no target defined). G2a (sum of reactions = applied load): 2.2E-13, tolerance <= 1E-6. **Self-weight** of OpenPT is 0.085 % lighter than Competing software 1's in all four models; G2b passes with a small margin. `mldeck` solves the deck's empty Selfweight case with W = 1.

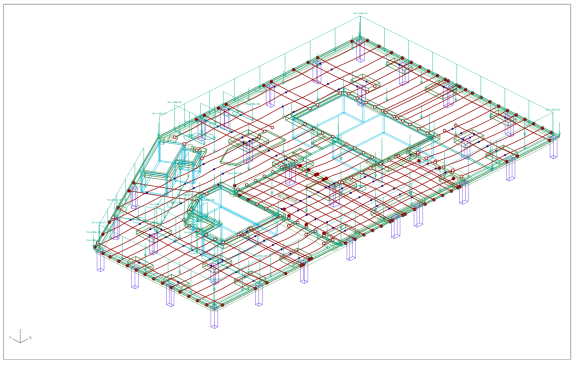
OpenPT build: 7d86603 Release (tag installed-20261118-1237), run 2026-11-18
Command: `OpenPT.Bench.exe multilevel M04.INP openpt\v1 --cell 1500 --shift 500 --base fixed; mldeck cs1\M04\Databases\M04.INP openpt\deck; mlcmp openpt\v1 cs1\M04\Databases openpt\v1\report.md; mlcmp openpt\deck cs1\M04\Databases openpt\deck\report.md (cwd openpt-build\ver-run\B\ms\M04; inputs copied from bench\multistory)`
Sources: `OpenPT\bench\multistory\M04\cs1\M04\Databases\M04.INP`
`OpenPT\bench\multistory\M04\cs1\M04\Databases\M04ado`
`OpenPT\bench\multistory\M04\M04.INP`
`OpenPT\bench\multistory\report_81.md`
`openpt-build\ver-run\B\ms\M04\openpt\v1\report.md`
`openpt-build\ver-run\B\ms\M04\openpt\v1\report.gates.json`
`openpt-build\ver-run\B\ms\M04\openpt\deck\report.gates.json`
`openpt-build\ver-run\B\out\final\ch4_M04_multilevel.txt`
`openpt-build\ver-run\B\out\final\ch4_M04_mldeck.txt`

4 Real projects against Competing software 1

Five real projects, each compared with Competing software 1: HongNgoc L10 T8, XuanLa F 7-16 2024, EMASI T1 half 02 180, B3CC1 F10-19 and H1HH1 F9-12. The Competing software 1 numbers are the stored files of 2026-11-03, produced by running Competing software 1's GUI chain on a copy of each model, set to EC2 where it was not, with the model's own support lines (none were drawn or changed). OpenPT runs on Competing software 1's exported INP and the copied .adm, with Competing software 1's covers and bar sizes. OpenPT was run again on 2026-11-18 with the installed build 7d86603 (Release).

4.1 V-501 HongNgoc L10 T8: deflection and cracking

Perspective: Deflection, cracked and long-term (real project) · **Reference:** Competing software 1, EC2 · **Status:** PASS



Structure: HongNgoc_L10_T8

MODEL

Post-tensioned (94 tendons in the analysed level) floor (level LEVEL_2 of the 3-level exchange file), EC2, N-mm; plan bounding box 59.1 x 34.2 m. 31 slab regions, thickness 200 / 230 / 300 / 470 / 500 mm; 29 columns below; 23 walls below; 19 beams; 10 openings. Mesh used for both programs: cell 256 mm, node shift 150 mm (Competing software 1's mesh dialog values, cs1_run.json); OpenPT mesh 21152 nodes, 20368 shells, 1053 frames. Covers 15/15 mm, bars 10/10 mm (top/bottom), strip covers 20/20 mm: as in force in Competing software 1.

METHOD

M1: maximum |uz| of the cracked long-term deflection against Competing software 1, tolerance 10 % or 1.0 mm below 10 mm. M2: K = cracked / uncracked sustained within 10 %, and the cracked state (Ie/Ig < 1) equal on at least 85 % of the design sections. U0 is diagnostic.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
max |uz|, cracked long-term (M1)	mm	27.78	29.12	+4.81 +1.336 mm	<= 10 % or <= 1 mm if A < 10 mm	PASS
max |uz|, uncracked sustained (U0, diagnostic)	mm	8.11	8.371	+3.21	soft target +/-5 %, diagnostic only	INFO
max |uz|, cracked sustained	mm	9.26	9.706	+4.81	report only	INFO
K = cracked / uncracked sustained (M2)	-	1.142	1.159	+1.55	+/-10 %	PASS
sections with the same cracked state as Competing software 1 (of 1347; 99.6 %)	sections	–	1341	–	>= 85 %	PASS
cracked sections among the paired (Competing software 1 / OpenPT)	sections	20	24	+20.00	report only	INFO
distance between the two max |uz| locations	mm	–	318.1	–	report only	INFO

NOTES

Real models have no probe points; only the maximum is compared. The benchmark ran phase 2 (real models) as report only, with the same tolerances as the synthetic cases.

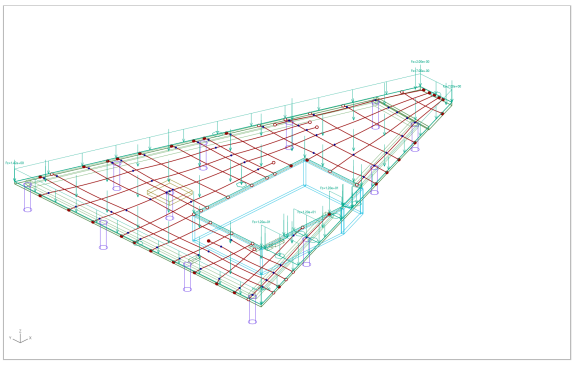
OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case HongNgoc_L10_T8 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case HongNgoc_L10_T8 --inp ver-run\A\work\real\HongNgoc_L10_T8\export\HongNgoc_L10_T8_export.INP --adm ver-run\A\work\real\HongNgoc_L10_T8\HongNgoc_L10_T8.adm --run-json ver-run\A\work\real\HongNgoc_L10_T8\cs1_run.json --out ver-run\A\results\HongNgoc_L10_T8 --repeat 1 --tag cold1 --cell 256 --shift 150 --cover-top 15 --cover-bottom 15 --bar-top 10 --bar-bottom 10 --strip-cover-top 20 --strip-cover-bottom 20; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

Sources: `bench\results\HongNgoc_L10_T8\cs1.jsonl`
`bench\results\HongNgoc_L10_T8\cs1_uz.csv`
`openpt-build\ver-run\A\results\HongNgoc_L10_T8\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\real\HongNgoc_L10_T8\cs1_run.json`

4.2 V-502 XuanLa F 7-16: deflection and cracking

Perspective: Deflection, cracked and long-term (real project) · **Reference:** Competing software 1, EC2 · **Status:** PASS



Structure: XuanLa_F_7-16_2024

MODEL

Post-tensioned (31 tendons in the analysed level) floor (level LEVEL_2 of the 3-level exchange file), EC2, N-mm; plan bounding box 39.8 x 32.9 m. 2 slab regions, thickness 250 / 350 mm; 12 columns below; 5 walls below; 5 beams; 5 openings. Mesh used for both programs: cell 1000 mm, node shift 500 mm (Competing software 1's mesh dialog values, cs1_run.json); OpenPT mesh 987 nodes, 852 shells, 132 frames. Covers 15/15 mm, bars 12/10 mm (top/bottom), strip covers 21/20 mm: as in force in Competing software 1.

METHOD

M1: maximum |uz| of the cracked long-term deflection against Competing software 1, tolerance 10 % or 1.0 mm below 10 mm. M2: K = cracked / uncracked sustained within 10 %, and the cracked state (Ie/Ig < 1) equal on at least 85 % of the design sections. U0 is diagnostic.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
max |uz|, cracked long-term (M1)	mm	23.44	23.25	-0.81 -0.189 mm	<= 10 % or <= 1 mm if A < 10 mm	PASS
max |uz|, uncracked sustained (U0, diagnostic)	mm	7.538	7.511	-0.36	soft target +/-5 %, diagnostic only	INFO
max |uz|, cracked sustained	mm	7.812	7.749	-0.81	report only	INFO
K = cracked / uncracked sustained (M2)	-	1.036	1.032	-0.45	+/-10 %	PASS
sections with the same cracked state as Competing software 1 (of 435; 100.0 %)	sections	–	435	–	>= 85 %	PASS
cracked sections among the paired (Competing software 1 / OpenPT)	sections	24	24	+0.00	report only	INFO
distance between the two max |uz| locations	mm	–	0.0000002084	–	report only	INFO

NOTES

Real models have no probe points; only the maximum is compared. The benchmark ran phase 2 (real models) as report only, with the same tolerances as the synthetic cases.

OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case XuanLa_F_7-16_2024 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case XuanLa_F_7-16_2024 --inp ver-run\A\work\real\XuanLa_F_7-16_2024\export\XuanLa_F_7-16_2024_export.INP --adm ver-run\A\work\real\XuanLa_F_7-16_2024\XuanLa_F_7-16_2024.adm --run-json ver-run\A\work\real\XuanLa_F_7-16_2024\cs1_run.json --out ver-run\A\results\XuanLa_F_7-16_2024 --repeat 1 --tag cold1 --cell 1000 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 12 --bar-bottom 10 --strip-cover-top 21 --strip-cover-bottom 20; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

Sources: `bench\results\XuanLa_F_7-16_2024\cs1.jsonl`
`bench\results\XuanLa_F_7-16_2024\cs1_uz.csv`
`openpt-build\ver-run\A\results\XuanLa_F_7-16_2024\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\real\XuanLa_F_7-16_2024\cs1_run.json`

4.3 V-503 EMASI T1 half 02 180: deflection and cracking

Perspective: Deflection, cracked and long-term (real project) · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Post-tensioned (106 tendons in the analysed level) floor (level LEVEL_2 of the 3-level exchange file), EC2, N-mm; plan bounding box 77.0 x 56.7 m. 40 slab regions, thickness 180 / 230 / 250 / 300 / 500 mm; 66 columns below; 10 walls below; 68 beams; 7 openings. Mesh used for both programs: cell 1500 mm, node shift 500 mm (Competing software 1's mesh dialog values, cs1_run.json); OpenPT mesh 4312 nodes, 3883 shells, 816 frames. Covers 20/20 mm, bars 10/10 mm (top/bottom), strip covers 25/25 mm: as in force in Competing software 1.

METHOD

M1: maximum |uz| of the cracked long-term deflection against Competing software 1, tolerance 10 % or 1.0 mm below 10 mm. M2: K = cracked / uncracked sustained within 10 %, and the cracked state (Ie/Ig < 1) equal on at least 85 % of the design sections. U0 is diagnostic.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
max |uz|, cracked long-term (M1)	mm	37.01	37.33	+0.84 +0.3121 mm	<= 10 % or <= 1 mm if A < 10 mm	PASS
max |uz|, uncracked sustained (U0, diagnostic)	mm	12.34	12.44	+0.84	soft target +/-5 %, diagnostic only	INFO
max |uz|, cracked sustained	mm	12.34	12.44	+0.84	report only	INFO
K = cracked / uncracked sustained (M2)	-	1	1	+0.00	+/-10 % (not judged: the Competing software 1 reference is declared invalid)	INFO
distance between the two max |uz| locations	mm	–	567.1	–	report only	INFO

NOTES

Real models have no probe points; only the maximum is compared. The benchmark ran phase 2 (real models) as report only, with the same tolerances as the synthetic cases. **M2 is not judged for this model.** Declared invalid Competing software 1 reference (`bench\results\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180\invalid_reference.json`, declared before the comparison was looked at): no Competing software 1 cracked-state data: Competing software 1's cracked DFL is empty (0 sections with stiffness; the stored sibling has the same empty DFL), K (Competing software 1) = 1.000 and long term = 3 x sustained, i.e. Competing software 1's cracked run did not crack; reported, not passed or failed

OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180 --inp ver-run\A\work\real\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180\export\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180_export.INP --adm ver-run\A\work\real\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180.adm --run-json ver-run\A\work\real\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180\cs1_run.json --out ver-run\A\results\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 20 --cover-bottom 20 --bar-top 10 --bar-bottom 10 --strip-cover-top 25 --strip-cover-bottom 25; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

Sources: `bench\results\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180\cs1.jsonl`
`bench\results\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180\cs1_uz.csv`
`openpt-build\ver-run\A\results\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\real\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180\cs1_run.json`
`bench\results\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180\invalid_reference.json`

4.4 V-504 B3CC1 F10-19: deflection and cracking

Perspective: Deflection, cracked and long-term (real project) · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Post-tensioned (118 tendons in the analysed level) floor (level LEVEL_2 of the 3-level exchange file), EC2, N-mm; plan bounding box 62.1 x 30.9 m. 5 slab regions, thickness 250 / 450 mm; 18 columns below; 40 walls below; 37 beams; 30 openings. Mesh used for both programs: cell 1500 mm, node shift 300 mm (Competing software 1's mesh dialog values, cs1_run.json); OpenPT mesh 2823 nodes, 2599 shells, 212 frames. Covers 15/15 mm, bars 12/10 mm (top/bottom), strip covers 21/20 mm: as in force in Competing software 1.

METHOD

M1: maximum |uz| of the cracked long-term deflection against Competing software 1, tolerance 10 % or 1.0 mm below 10 mm. M2: K = cracked / uncracked sustained within 10 %, and the cracked state (Ie/Ig < 1) equal on at least 85 % of the design sections. U0 is diagnostic.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
max |uz|, cracked long-term (M1)	mm	35.96	36.03	+0.18 +0.0641 mm	<= 10 % or <= 1 mm if A < 10 mm	PASS
max |uz|, uncracked sustained (U0, diagnostic)	mm	11.25	11.28	+0.25	soft target +/-5 %, diagnostic only	INFO
max |uz|, cracked sustained	mm	11.99	12.01	+0.18	report only	INFO
K = cracked / uncracked sustained (M2)	-	1.066	1.065	-0.07	+/-10 %	PASS
sections with the same cracked state as Competing software 1 (of 1193; 99.8 %)	sections	–	1191	–	>= 85 %	PASS
cracked sections among the paired (Competing software 1 / OpenPT)	sections	148	148	+0.00	report only	INFO
distance between the two max |uz| locations	mm	–	408.7	–	report only	INFO

NOTES

Real models have no probe points; only the maximum is compared. The benchmark ran phase 2 (real models) as report only, with the same tolerances as the synthetic cases.

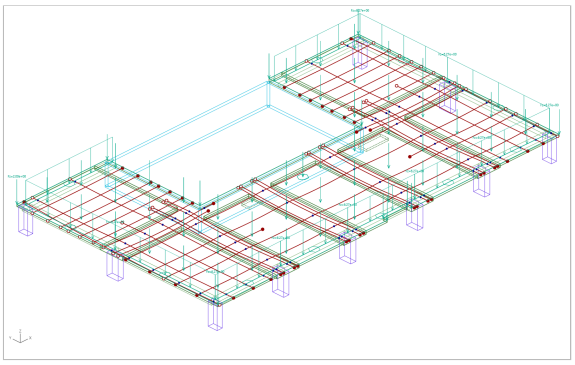
OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case B3CC1_F10-19 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B3CC1_F10-19 --inp ver-run\A\work\real\B3CC1_F10-19\export\B3CC1_F10-19_export.INP --adm ver-run\A\work\real\B3CC1_F10-19\B3CC1_F10-19.adm --run-json ver-run\A\work\real\B3CC1_F10-19\cs1_run.json --out ver-run\A\results\B3CC1_F10-19 --repeat 1 --tag cold1 --cell 1500 --shift 300 --cover-top 15 --cover-bottom 15 --bar-top 12 --bar-bottom 10 --strip-cover-top 21 --strip-cover-bottom 20; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

Sources: `bench\results\B3CC1_F10-19\cs1.jsonl`
`bench\results\B3CC1_F10-19\cs1_uz.csv`
`openpt-build\ver-run\A\results\B3CC1_F10-19\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\real\B3CC1_F10-19\cs1_run.json`

4.5 V-505 H1HH1 F9-12: deflection and cracking

Perspective: Deflection, cracked and long-term (real project) · **Reference:** Competing software 1, EC2 · **Status:** PASS



Structure: H1HH1_F9-12

MODEL

Post-tensioned (48 tendons in the analysed level) floor (level LEVEL_2 of the 3-level exchange file), EC2, N-mm; plan bounding box 45.9 x 27.0 m. 8 slab regions, thickness 230 / 400 mm; 10 columns below; 4 walls below; 11 beams; 2 openings. Mesh used for both programs: cell 500 mm, node shift 300 mm (Competing software 1's mesh dialog values, cs1_run.json); OpenPT mesh 4751 nodes, 4503 shells, 286 frames. Covers 15/15 mm, bars 10/10 mm (top/bottom), strip covers 20/20 mm: as in force in Competing software 1.

METHOD

M1: maximum |uz| of the cracked long-term deflection against Competing software 1, tolerance 10 % or 1.0 mm below 10 mm. M2: K = cracked / uncracked sustained within 10 %, and the cracked state (Ie/Ig < 1) equal on at least 85 % of the design sections. U0 is diagnostic.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
max |uz|, cracked long-term (M1)	mm	54.49	54.59	+0.18 +0.1007 mm	<= 10 % or <= 1 mm if A < 10 mm	PASS
max |uz|, uncracked sustained (U0, diagnostic)	mm	13.56	13.52	-0.30	soft target +/-5 %, diagnostic only	INFO
max |uz|, cracked sustained	mm	18.16	18.2	+0.18	report only	INFO
K = cracked / uncracked sustained (M2)	-	1.339	1.346	+0.48	+/-10 %	PASS
sections with the same cracked state as Competing software 1 (of 502; 100.0 %)	sections	–	502	–	>= 85 %	PASS
cracked sections among the paired (Competing software 1 / OpenPT)	sections	116	116	+0.00	report only	INFO
distance between the two max |uz| locations	mm	–	168.3	–	report only	INFO

NOTES

Real models have no probe points; only the maximum is compared. The benchmark ran phase 2 (real models) as report only, with the same tolerances as the synthetic cases.

OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case H1HH1_F9-12 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Benc h.dll run --case H1HH1_F9-12 --inp ver-run\A\work\real\H1HH1_F9-12\export\H1HH1_F9-12_export.INP --adm ver-run\A\work\real\H1HH1_F9-12\H1HH1_F9-12.adm --run-json ver-run\A\work \real\H1HH1_F9-12\cs1_run.json --out ver-run\A\results\H1HH1_F9-12 --repeat 1 --tag cold1 --cell 500 --shift 300 --cover-top 15 --cover-bottom 15 --bar-top 10 --bar-bottom 10 - -strip-cover-top 20 --strip-cover-bottom 20; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run \A\report --date 2026-11-18`

Sources: `bench\results\H1HH1_F9-12\cs1.jsonl`
`bench\results\H1HH1_F9-12\cs1_uz.csv`
`openpt-build\ver-run\A\results\H1HH1_F9-12\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\real\H1HH1_F9-12\cs1_run.json`

4.6 V-506 HongNgoc L10 T8: calculated rebar

Perspective: Calculated rebar (real project) · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Post-tensioned (94 tendons in the analysed level) floor (level LEVEL_2 of the 3-level exchange file), EC2, N-mm; plan bounding box 59.1 x 34.2 m. 31 slab regions, thickness 200 / 230 / 300 / 470 / 500 mm; 29 columns below; 23 walls below; 19 beams; 10 openings. Mesh used for both programs: cell 256 mm, node shift 150 mm (Competing software 1's mesh dialog values, cs1_run.json); OpenPT mesh 21152 nodes, 20368 shells, 1053 frames. Covers 15/15 mm, bars 10/10 mm (top/bottom), strip covers 20/20 mm: as in force in Competing software 1.

METHOD

M3b: provided As per design section and face against the .adm record; M3c: total steel mass per face of the Calculated Rebar Plan; M3a and bar counts report only.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
provided As section-faces matching Competing software 1 (of 2694; 99.2 %)	faces	–	2672	–	>= 90 % of faces; face tol max(10 % of A, 1 bar)	PASS
calculated-rebar steel mass, top face	kg	338.8	324.7	-4.17	+/-10 %	PASS
calculated-rebar steel mass, bottom face	kg	100.2	103.7	+3.48	+/-10 %	PASS
bar count, top face	bars	19	20	+5.26	report only	INFO
bar count, bottom face	bars	9	8	-11.11	report only	INFO
bars identical to Competing software 1's (same length and diameter), top face (of 19; 78.9 %)	bars	–	15	–	report only	INFO
bars identical to Competing software 1's (same length and diameter), bottom face (of 9; 44.4 %)	bars	–	4	–	report only	INFO
required As envelope, |difference| median over section-faces	%	–	0.0168	–	report only	INFO
required As envelope, |difference| maximum	%	–	257.1	–	report only	INFO

NOTES

Provided As and steel mass as in chapter 3 (M3b at least 90 % of section-faces, M3c mass per face within 10 %). The bar-multiset rows are report only (spec 27 G2).

OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case HongNgoc_L10_T8 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case HongNgoc_L10_T8 --inp ver-run\A\work\real\HongNgoc_L10_T8\export\HongNgoc_L10_T8_export.INP --adm ver-run\A\work\real\HongNgoc_L10_T8\HongNgoc_L10_T8.adm --run-json ver-run\A\work\real\HongNgoc_L10_T8\cs1_run.json --out ver-run\A\results\HongNgoc_L10_T8 --repeat 1 --tag cold1 --cell 256 --shift 150 --cover-top 15 --cover-bottom 15 --bar-top 10 --bar-bottom 10 --strip-cover-top 20 --strip-cover-bottom 20; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

Sources: `bench\results\HongNgoc_L10_T8\cs1.jsonl`
`bench\results\HongNgoc_L10_T8\cs1_uz.csv`
`openpt-build\ver-run\A\results\HongNgoc_L10_T8\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\real\HongNgoc_L10_T8\cs1_run.json`

4.7 V-507 XuanLa F 7-16: calculated rebar

Perspective: Calculated rebar (real project) · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Post-tensioned (31 tendons in the analysed level) floor (level LEVEL_2 of the 3-level exchange file), EC2, N-mm; plan bounding box 39.8 x 32.9 m. 2 slab regions, thickness 250 / 350 mm; 12 columns below; 5 walls below; 5 beams; 5 openings. Mesh used for both programs: cell 1000 mm, node shift 500 mm (Competing software 1's mesh dialog values, cs1_run.json); OpenPT mesh 987 nodes, 852 shells, 132 frames. Covers 15/15 mm, bars 12/10 mm (top/bottom), strip covers 21/20 mm: as in force in Competing software 1.

METHOD

M3b: provided As per design section and face against the .adm record; M3c: total steel mass per face of the Calculated Rebar Plan; M3a and bar counts report only.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
provided As section-faces matching Competing software 1 (of 870; 100.0 %)	faces	–	870	–	>= 90 % of faces; face tol max(10 % of A, 1 bar)	PASS
calculated-rebar steel mass, top face	kg	35.81	35.81	+0.00	+/-10 %	PASS
calculated-rebar steel mass, bottom face	kg	5.793	5.793	+0.00	+/-10 %	PASS
bar count, top face	bars	5	5	+0.00	report only	INFO
bar count, bottom face	bars	2	2	+0.00	report only	INFO
bars identical to Competing software 1's (same length and diameter), top face (of 5; 100.0 %)	bars	–	5	–	report only	INFO
bars identical to Competing software 1's (same length and diameter), bottom face (of 2; 100.0 %)	bars	–	2	–	report only	INFO
required As envelope, |difference| median over section-faces	%	–	0.01583	–	report only	INFO
required As envelope, |difference| maximum	%	–	2.914	–	report only	INFO

NOTES

Provided As and steel mass as in chapter 3 (M3b at least 90 % of section-faces, M3c mass per face within 10 %). The bar-multiset rows are report only (spec 27 G2).

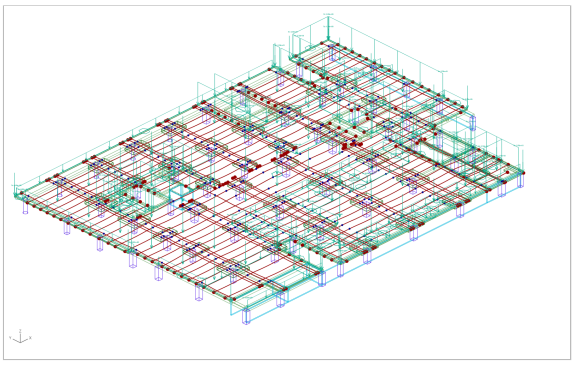
OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case XuanLa_F_7-16_2024 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case XuanLa_F_7-16_2024 --inp ver-run\A\work\real\XuanLa_F_7-16_2024\export\XuanLa_F_7-16_2024_export.INP --adm ver-run\A\work\real\XuanLa_F_7-16_2024\XuanLa_F_7-16_2024.adm --run-json ver-run\A\work\real\XuanLa_F_7-16_2024\cs1_run.json --out ver-run\A\results\XuanLa_F_7-16_2024 --repeat 1 --tag cold1 --cell 1000 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 12 --bar-bottom 10 --strip-cover-top 21 --strip-cover-bottom 20; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

Sources: `bench\results\XuanLa_F_7-16_2024\cs1.jsonl`
`bench\results\XuanLa_F_7-16_2024\cs1_uz.csv`
`openpt-build\ver-run\A\results\XuanLa_F_7-16_2024\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\real\XuanLa_F_7-16_2024\cs1_run.json`

4.8 V-508 EMASI T1 half 02 180: calculated rebar

Perspective: Calculated rebar (real project) · **Reference:** Competing software 1, EC2 · **Status:** PASS



Structure: EMASI_T1 (half)

MODEL

Post-tensioned (106 tendons in the analysed level) floor (level LEVEL_2 of the 3-level exchange file), EC2, N-mm; plan bounding box 77.0 x 56.7 m. 40 slab regions, thickness 180 / 230 / 250 / 300 / 500 mm; 66 columns below; 10 walls below; 68 beams; 7 openings. Mesh used for both programs: cell 1500 mm, node shift 500 mm (Competing software 1's mesh dialog values, cs1_run.json); OpenPT mesh 4312 nodes, 3883 shells, 816 frames. Covers 20/20 mm, bars 10/10 mm (top/bottom), strip covers 25/25 mm: as in force in Competing software 1.

METHOD

M3b: provided As per design section and face against the .adm record; M3c: total steel mass per face of the Calculated Rebar Plan; M3a and bar counts report only.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
provided As section-faces matching Competing software 1 (of 4034; 91.8 %)	faces	–	3704	–	>= 90 % of faces; face tol max(10 % of A, 1 bar)	PASS
calculated-rebar steel mass, top face	kg	8686	8561	-1.44	+/-10 %	PASS
calculated-rebar steel mass, bottom face	kg	7904	7898	-0.08	+/-10 %	PASS
bar count, top face	bars	131	98	-25.19	report only	INFO
bar count, bottom face	bars	71	62	-12.68	report only	INFO
bars identical to Competing software 1's (same length and diameter), top face (of 131; 25.2 %)	bars	–	33	–	report only	INFO
bars identical to Competing software 1's (same length and diameter), bottom face (of 71; 32.4 %)	bars	–	23	–	report only	INFO
required As envelope, |difference| median over section-faces	%	–	3.174	–	report only	INFO
required As envelope, |difference| maximum	%	–	2306	–	report only	INFO

NOTES

Provided As and steel mass as in chapter 3 (M3b at least 90 % of section-faces, M3c mass per face within 10 %). The bar-multiset rows are report only (spec 27 G2).

OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180 --inp ver-run\A\work\real\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180\export\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180_export.INP --adm ver-run\A\work\real\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180.adm --run-json ver-run\A\work\real\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180\cs1_run.json --out ver-run\A\results\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180 --repeat 1 --tag cold1 --cell 1500 --shift 500 --cover-top 20 --cover-bottom 20 --bar-top 10 --bar-bottom 10 --strip-cover-top 25 --strip-cover-bottom 25; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

Sources: `bench\results\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180\cs1.jsonl`
`bench\results\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180\cs1_uz.csv`
`openpt-build\ver-run\A\results\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\real\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180\cs1_run.json`

4.9 V-509 B3CC1 F10-19: calculated rebar

Perspective: Calculated rebar (real project) · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Post-tensioned (118 tendons in the analysed level) floor (level LEVEL_2 of the 3-level exchange file), EC2, N-mm; plan bounding box 62.1 x 30.9 m. 5 slab regions, thickness 250 / 450 mm; 18 columns below; 40 walls below; 37 beams; 30 openings. Mesh used for both programs: cell 1500 mm, node shift 300 mm (Competing software 1's mesh dialog values, cs1_run.json); OpenPT mesh 2823 nodes, 2599 shells, 212 frames. Covers 15/15 mm, bars 12/10 mm (top/bottom), strip covers 21/20 mm: as in force in Competing software 1.

METHOD

M3b: provided As per design section and face against the .adm record; M3c: total steel mass per face of the Calculated Rebar Plan; M3a and bar counts report only.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
provided As section-faces matching Competing software 1 (of 2386; 93.2 %)	faces	–	2223	–	>= 90 % of faces; face tol max(10 % of A, 1 bar)	PASS
calculated-rebar steel mass, top face	kg	2576	2426	-5.81	+/-10 %	PASS
calculated-rebar steel mass, bottom face	kg	951.9	898.3	-5.63	+/-10 %	PASS
bar count, top face	bars	30	20	-33.33	report only	INFO
bar count, bottom face	bars	40	33	-17.50	report only	INFO
bars identical to Competing software 1's (same length and diameter), top face (of 30; 13.3 %)	bars	–	4	–	report only	INFO
bars identical to Competing software 1's (same length and diameter), bottom face (of 40; 35.0 %)	bars	–	14	–	report only	INFO
required As envelope, |difference| median over section-faces	%	–	3.118	–	report only	INFO
required As envelope, |difference| maximum	%	–	247.4	–	report only	INFO

NOTES

Provided As and steel mass as in chapter 3 (M3b at least 90 % of section-faces, M3c mass per face within 10 %). The bar-multiset rows are report only (spec 27 G2).

OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case B3CC1_F10-19 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case B3CC1_F10-19 --inp ver-run\A\work\real\B3CC1_F10-19\export\B3CC1_F10-19_export.INP --adm ver-run\A\work\real\B3CC1_F10-19\B3CC1_F10-19.adm --run-json ver-run\A\work\real\B3CC1_F10-19\cs1_run.json --out ver-run\A\results\B3CC1_F10-19 --repeat 1 --tag cold1 --cell 1500 --shift 300 --cover-top 15 --cover-bottom 15 --bar-top 12 --bar-bottom 10 --strip-cover-top 21 --strip-cover-bottom 20; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

Sources: `bench\results\B3CC1_F10-19\cs1.jsonl`
`bench\results\B3CC1_F10-19\cs1_uz.csv`
`openpt-build\ver-run\A\results\B3CC1_F10-19\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\real\B3CC1_F10-19\cs1_run.json`

4.10 V-510 H1HH1 F9-12: calculated rebar

Perspective: Calculated rebar (real project) · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Post-tensioned (48 tendons in the analysed level) floor (level LEVEL_2 of the 3-level exchange file), EC2, N-mm; plan bounding box 45.9 x 27.0 m. 8 slab regions, thickness 230 / 400 mm; 10 columns below; 4 walls below; 11 beams; 2 openings. Mesh used for both programs: cell 500 mm, node shift 300 mm (Competing software 1's mesh dialog values, cs1_run.json); OpenPT mesh 4751 nodes, 4503 shells, 286 frames. Covers 15/15 mm, bars 10/10 mm (top/bottom), strip covers 20/20 mm: as in force in Competing software 1.

METHOD

M3b: provided As per design section and face against the .adm record; M3c: total steel mass per face of the Calculated Rebar Plan; M3a and bar counts report only.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
provided As section-faces matching Competing software 1 (of 1004; 100.0 %)	faces	–	1004	–	>= 90 % of faces; face tol max(10 % of A, 1 bar)	PASS
calculated-rebar steel mass, top face	kg	2.958	2.958	+0.00	+/-10 %	PASS
calculated-rebar steel mass, bottom face	kg	0	0	–	+/-10 %	PASS
bar count, top face	bars	2	2	+0.00	report only	INFO
bar count, bottom face	bars	0	0	–	report only	INFO
bars identical to Competing software 1's (same length and diameter), top face (of 2; 100.0 %)	bars	–	2	–	report only	INFO
bars identical to Competing software 1's (same length and diameter), bottom face (of 0)	bars	–	0	–	report only	INFO
required As envelope, |difference| median over section-faces	%	–	78.24	–	report only	INFO
required As envelope, |difference| maximum	%	–	78.24	–	report only	INFO

NOTES

Provided As and steel mass as in chapter 3 (M3b at least 90 % of section-faces, M3c mass per face within 10 %). The bar-multiset rows are report only (spec 27 G2).

OpenPT build: 7d86603 Release, run 2026-11-18

Command: `tools\run_openpt.ps1 -Case H1HH1_F9-12 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case H1HH1_F9-12 --inp ver-run\A\work\real\H1HH1_F9-12\export\H1HH1_F9-12_export.INP --adm ver-run\A\work\real\H1HH1_F9-12\H1HH1_F9-12.adm --run-json ver-run\A\work\real\H1HH1_F9-12\cs1_run.json --out ver-run\A\results\H1HH1_F9-12 --repeat 1 --tag cold1 --cell 500 --shift 300 --cover-top 15 --cover-bottom 15 --bar-top 10 --bar-bottom 10 --strip-cover-top 20 --strip-cover-bottom 20; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`

Sources: `bench\results\H1HH1_F9-12\cs1.jsonl`
`bench\results\H1HH1_F9-12\cs1_uz.csv`
`openpt-build\ver-run\A\results\H1HH1_F9-12\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\real\H1HH1_F9-12\cs1_run.json`

4.11 V-511 HongNgoc L10 T8: punching shear

Perspective: Punching shear (real project) · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Post-tensioned (94 tendons in the analysed level) floor (level LEVEL_2 of the 3-level exchange file), EC2, N-mm; plan bounding box 59.1 x 34.2 m. 31 slab regions, thickness 200 / 230 / 300 / 470 / 500 mm; 29 columns below; 23 walls below; 19 beams; 10 openings. Mesh used for both programs: cell 256 mm, node shift 150 mm (Competing software 1's mesh dialog values, cs1_run.json); OpenPT mesh 21152 nodes, 20368 shells, 1053 frames. Covers 15/15 mm, bars 10/10 mm (top/bottom), strip covers 20/20 mm: as in force in Competing software 1.

METHOD

M4: Competing software 1's .PUO against OpenPT's PunchingCheck, matched by support label; checked set identical, ratio within 10 % on at least 90 %, verdict class equal on at least 90 %.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
supports checked (Competing software 1 / OpenPT)	supports	5	5	+0.00	identical	PASS
supports with the stress ratio within +/-10 % of Competing software 1's (of 5; 100.0 %)	supports	–	5	–	>= 90 %	PASS
supports with the same verdict class as Competing software 1 (of 5; 100.0 %)	supports	–	5	–	>= 90 %	PASS
largest stress-ratio difference: Column 219 (of 5 supports checked by both)	ratio	2.581	2.565	-0.60 -0.0154 ratio	report only	INFO
stress-ratio |difference|, median of 5 supports	%	–	0.045	–	report only	INFO
stress-ratio |difference|, 90th percentile (nearest rank)	%	–	0.598	–	report only	INFO

NOTES

Spec 22: native-chain column force within 5 %; the stress ratio scales with it under EC2.

OpenPT build: 7d86603 Release, run 2026-11-18
Command: `tools\run_openpt.ps1 -Case HongNgoc_L10_T8 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case HongNgoc_L10_T8 --inp ver-run\A\work\real\HongNgoc_L10_T8\export\HongNgoc_L10_T8_export.INP --adm ver-run\A\work\real\HongNgoc_L10_T8\HongNgoc_L10_T8.adm --run-json ver-run\A\work\real\HongNgoc_L10_T8\cs1_run.json --out ver-run\A\results\HongNgoc_L10_T8 --repeat 1 --tag cold1 --cell 256 --shift 150 --cover-top 15 --cover-bottom 15 --bar-top 10 --bar-bottom 10 --strip-cover-top 20 --strip-cover-bottom 20; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`
Sources: `bench\results\HongNgoc_L10_T8\cs1.jsonl`
`bench\results\HongNgoc_L10_T8\cs1_uz.csv`
`openpt-build\ver-run\A\results\HongNgoc_L10_T8\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\real\HongNgoc_L10_T8\cs1_run.json`

4.12 V-512 XuanLa F 7-16: punching shear

Perspective: Punching shear (real project) · **Reference:** Competing software 1, EC2 · **Status:** PASS

MODEL

Post-tensioned (31 tendons in the analysed level) floor (level LEVEL_2 of the 3-level exchange file), EC2, N-mm; plan bounding box 39.8 x 32.9 m. 2 slab regions, thickness 250 / 350 mm; 12 columns below; 5 walls below; 5 beams; 5 openings. Mesh used for both programs: cell 1000 mm, node shift 500 mm (Competing software 1's mesh dialog values, cs1_run.json); OpenPT mesh 987 nodes, 852 shells, 132 frames. Covers 15/15 mm, bars 12/10 mm (top/bottom), strip covers 21/20 mm: as in force in Competing software 1.

METHOD

M4: Competing software 1's .PUO against OpenPT's PunchingCheck, matched by support label; checked set identical, ratio within 10 % on at least 90 %, verdict class equal on at least 90 %.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
supports checked (Competing software 1 / OpenPT)	supports	1	1	+0.00	identical	PASS
supports with the stress ratio within +/-10 % of Competing software 1's (of 1; 100.0 %)	supports	–	1	–	>= 90 %	PASS
supports with the same verdict class as Competing software 1 (of 1; 100.0 %)	supports	–	1	–	>= 90 %	PASS
largest stress-ratio difference: Column 142 (of 1 supports checked by both)	ratio	0.8393	0.8364	-0.34 -0.0029 ratio	report only	INFO
stress-ratio |difference|, median of 1 supports	%	–	0.344	–	report only	INFO
stress-ratio |difference|, 90th percentile (nearest rank)	%	–	0.344	–	report only	INFO

NOTES

Spec 22: native-chain column force within 5 %; the stress ratio scales with it under EC2.

OpenPT build: 7d86603 Release, run 2026-11-18
Command: `tools\run_openpt.ps1 -Case XuanLa_F_7-16_2024 -Build Release -BenchBuildDir D:\NETtool\openpt-build\ver-bench -ColdRuns 1 -SkipWarm -TimeoutSec 300, i.e. dotnet OpenPT.Bench.dll run --case XuanLa_F_7-16_2024 --inp ver-run\A\work\real\XuanLa_F_7-16_2024\export\XuanLa_F_7-16_2024_export.INP --adm ver-run\A\work\real\XuanLa_F_7-16_2024\XuanLa_F_7-16_2024.adm --run-json ver-run\A\work\real\XuanLa_F_7-16_2024\cs1_run.json --out ver-run\A\results\XuanLa_F_7-16_2024 --repeat 1 --tag cold1 --cell 1000 --shift 500 --cover-top 15 --cover-bottom 15 --bar-top 12 --bar-bottom 10 --strip-cover-top 21 --strip-cover-bottom 20; then python -I bench\tools\report.py --results ver-run\A\results --cases ver-run\A\cases --plan ver-run\A\PLAN.md --report ver-run\A\report --date 2026-11-18`
Sources: `bench\results\XuanLa_F_7-16_2024\cs1.jsonl`
`bench\results\XuanLa_F_7-16_2024\cs1_uz.csv`
`openpt-build\ver-run\A\results\XuanLa_F_7-16_2024\openpt.jsonl`
`openpt-build\ver-run\A\results\compare.csv`
`openpt-build\ver-run\A\work\real\XuanLa_F_7-16_2024\cs1_run.json`

5 Module checks against Competing software 1's own solver, designer, punching and mesher programs

This chapter checks the remaining OpenPT modules that have a stored Competing software 1 program result on this PC: the cracked-deflection chain (spec 16), the strip design (spec 19), the punching calculator (spec 22), the quad mesher (spec 09) and the .adm reader (spec 46). The references are files written by Competing software 1 or by its design, punching and mesher programs: `.dfl`/`.dfm`, `CRACKED_SUSTAINED_LOAD.ADO` and the cracked deck, `.DSO` and `PR.dat`, `.PUO`, `.msh`/`.END`, and the exchange `.INP`. None of Competing software 1's programs was started: only modes that read stored files were run (`OpenPT.Regress cracked`, `stripdesign`, `punching calc`, `mesh --multiregion`, `admread`), always with explicit paths. Acceptance rules are the gates the tools print; a number the tool prints without a verdict is INFO.

5.1 V-601 B3CC1_F10-19: cracked section properties, cracking pattern and cracked deflection

Perspective: Cracked sections and deflection · **Reference:** Competing software 1, cracked-deflection results of the project (.dfl, .dfm, CRACKED_SUSTAINED_LOAD.ADO) · **Status:** PASS

MODEL

B3CC1_F10-19: design code EC2, concrete Concrete 1 cyl 28 Ec 32951 fck 28. Competing software 1's cracked deck has 2841 nodes, 2615 shells and 207 frames with CRACK rows on 2411 shells and 171 frames; 1193 design sections (DSI) carry a cracked-deflection row. 118 tendons from the exchange file `B3CC1_F10-19.inp` are put on the deck for C3 and C4.

METHOD

Spec 16 section 9.2. C1: OpenPT computes M_cr, I_cr and I_e of every design section from the DSI and compares them with Competing software 1's .dfl (2 digits) and .dfm (3 digits). C2: OpenPT's cracking ratio and angle of every shell and frame (strips taken from the .adm) against the CRACK block of Competing software 1's cracked deck. C3: the sustained-load case solved with OpenPT.Fem on Competing software 1's deck, with the CRACK rows and OpenPT's tendon loads, against max |uz| of CRACKED_SUSTAINED_LOAD.ADO. C4: the long term, (1 + phi) times the cracked sustained deflection, against the cracked Long_Term result. The tolerances are the limits in the tool's gate table; rows the tool prints as 'report' are INFO.

Quantity	Unit	Reference	OpenPT	Di
C1: sections whose I_e is within +-5 % of Competing software 1's .dfl, of 1193	–	–	1193	
C1: M_cr+ and M_cr- within +-0.6 % of Competing software 1's 3-digit .dfm, of 2386 values	–	–	2386	
C1: largest M_cr error against the .dfm	%	–	0.5	
C1: M_cr within +-1 % of the 2-digit .dfl, of 2386 values (report; the .dfl is too coarse for this test)	–	–	2291	
C2: element slots whose cracking ratio and angle equal Competing software 1's CRACK row, of 5164	–	–	5147	
C2: slab shells and beam frames of the CRACK block found in both models (2 sets)	–	2	2	
C3: max |uz| of the cracked sustained case, OpenPT solved on Competing software 1's deck with OpenPT's cracking ratios and tendons (CRACK block of the deck)	mm	11.99	11.96	
C3: same with OpenPT's own cracking ratios (C2 rows)	mm	11.99	11.96	
C4: max |uz| of the long term, (1 + phi) x cracked sustained (phi = 2.00) against Competing software 1's cracked Long_Term.ADO	mm	35.96	35.89	

NOTES

C3 and C4 are reported by the tool without a verdict (limit text <= 5 % printed). The tool's own result for this project: PASS.

OpenPT build: 7d86603 Release (tag installed-20261118-1237), run 2026-11-18
Command: `OpenPT.Regress.exe cracked "--project=B3CC1_F10-19|D:\NETtool\NDC_san\B3CC1_F10-19|D:\NETtool\NDC_san\B3CC1_F10-19.adm|D:\NETtool\NDC_san\B3CC1_F10-19.inp" (cwd openpt-build\ver-run\B\out\final)`
Sources: `NDC_san\B3CC1_F10-19\Databases\B3CC1_F10-19.cri`
`NDC_san\B3CC1_F10-19\Databases\B3CC1_F10-19.DSI`
`NDC_san\B3CC1_F10-19\Databases\B3CC1_F10-19.MAI`
`NDC_san\B3CC1_F10-19\Databases\cracked_B3CC1_F10-19.dfl`
`NDC_san\B3CC1_F10-19\Databases\cracked_B3CC1_F10-19.dfm`
`NDC_san\B3CC1_F10-19\Databases\cracked_B3CC1_F10-19.inp`
`NDC_san\B3CC1_F10-19\Databases\B3CC1_F10-19ado`
`NDC_san\B3CC1_F10-19.adm`
`NDC_san\B3CC1_F10-19.inp`
`openpt-build\ver-run\B\out\final\ch6_cracked_B3CC1_F10-19.txt`

5.2 V-602 XuanLa_F_7-16_2024: cracked section properties, cracking pattern and cracked deflection

Perspective: Cracked sections and deflection · **Reference:** Competing software 1, cracked-deflection results of the project (.dfl, .dfm, CRACKED_SUSTAINED_LOAD.ADO) · **Status:** PASS

MODEL

XuanLa_F_7-16_2024: design code EC2, concrete B35 cyl 26.36 Ec 32443.1373 fck 26.36. Competing software 1's cracked deck has 1046 nodes, 911 shells and 132 frames with CRACK rows on 875 shells and 108 frames; 435 design sections (DSI) carry a cracked-deflection row. 31 tendons from the exchange file `XuanLa_F_7-16_2024_export.INP` are put on the deck for C3 and C4.

METHOD

Spec 16 section 9.2. C1: OpenPT computes M_cr, I_cr and I_e of every design section from the DSI and compares them with Competing software 1's .dfl (2 digits) and .dfm (3 digits). C2: OpenPT's cracking ratio and angle of every shell and frame (strips taken from the .adm) against the CRACK block of Competing software 1's cracked deck. C3: the sustained-load case solved with OpenPT.Fem on Competing software 1's deck, with the CRACK rows and OpenPT's tendon loads, against max |uz| of CRACKED_SUSTAINED_LOAD.ADO. C4: the long term, (1 + phi) times the cracked sustained deflection, against the cracked Long_Term result. The tolerances are the limits in the tool's gate table; rows the tool prints as 'report' are INFO.

Quantity	Unit	Reference	OpenPT	Di
C1: sections whose I_e is within +-5 % of Competing software 1's .dfl, of 435	–	–	432	
C1: M_cr+ and M_cr- within +-0.6 % of Competing software 1's 3-digit .dfm, of 870 values	–	–	870	
C1: largest M_cr error against the .dfm	%	–	0.41	
C1: M_cr within +-1 % of the 2-digit .dfl, of 870 values (report; the .dfl is too coarse for this test)	–	–	804	
C2: element slots whose cracking ratio and angle equal Competing software 1's CRACK row, of 1966	–	–	1954	
C2: slab shells and beam frames of the CRACK block found in both models (2 sets)	–	2	2	
C3: max |uz| of the cracked sustained case, OpenPT solved on Competing software 1's deck with OpenPT's cracking ratios and tendons (CRACK block of the deck)	mm	7.812	7.788	
C3: same with OpenPT's own cracking ratios (C2 rows)	mm	7.812	7.773	
C4: max |uz| of the long term, (1 + phi) x cracked sustained (phi = 2.00) against Competing software 1's cracked Long_Term.ADO	mm	23.44	23.36	

NOTES

C3 and C4 are reported by the tool without a verdict (limit text <= 5 % printed). The tool's own result for this project: PASS.

OpenPT build: 7d86603 Release (tag installed-20261118-1237), run 2026-11-18
Command: `OpenPT.Regress.exe cracked "--project=XuanLa_F_7-16_2024|D:\NETtool\OpenPT\bench\work\real\XuanLa_F_7-16_2024\XuanLa_F_7-16_2024|D:\NETtool\OpenPT\bench\work\real\XuanLa_F_7-16_2024\XuanLa_F_7-16_2024.adm|D:\NETtool\OpenPT\bench\work\real\XuanLa_F_7-16_2024\export\XuanLa_F_7-16_2024_export.INP" (cwd openpt-build\ver-run\B\out\final)`
Sources: `OpenPT\bench\work\real\XuanLa_F_7-16_2024\XuanLa_F_7-16_2024\Databases\cracked_XuanLa_F_7-16_2024.dfl`
`OpenPT\bench\work\real\XuanLa_F_7-16_2024\XuanLa_F_7-16_2024\Databases\cracked_XuanLa_F_7-16_2024.dfm`
`OpenPT\bench\work\real\XuanLa_F_7-16_2024\XuanLa_F_7-16_2024\Databases\cracked_XUANLA_F_7-16_2024.inp`
`OpenPT\bench\work\real\XuanLa_F_7-16_2024\XuanLa_F_7-16_2024\Databases\XuanLa_F_7-16_2024.cri`
`OpenPT\bench\work\real\XuanLa_F_7-16_2024\XuanLa_F_7-16_2024\Databases\XuanLa_F_7-16_2024.DSI`
`OpenPT\bench\work\real\XuanLa_F_7-16_2024\XuanLa_F_7-16_2024\Databases\XuanLa_F_7-16_2024.MAI`
`OpenPT\bench\work\real\XuanLa_F_7-16_2024\XuanLa_F_7-16_2024\Databases\XuanLa_F_7-16_2024ado`
`OpenPT\bench\work\real\XuanLa_F_7-16_2024\XuanLa_F_7-16_2024.adm`
`OpenPT\bench\work\real\XuanLa_F_7-16_2024\export\XuanLa_F_7-16_2024_export.INP`
`openpt-build\ver-run\B\out\final\ch6_cracked_XuanLa_F_7-16_2024.txt`

5.3 V-603 H1HH1_F9-12: cracked section properties, cracking pattern and cracked deflection

Perspective: Cracked sections and deflection · **Reference:** Competing software 1, cracked-deflection results of the project (.dfl, .dfm, CRACKED_SUSTAINED_LOAD.ADO) · **Status:** PASS

MODEL

H1HH1_F9-12: design code EC2, concrete B35 cyl 28 Ec 32951 fck 28. Competing software 1's cracked deck has 4782 nodes, 4534 shells and 286 frames with CRACK rows on 4382 shells and 246 frames; 502 design sections (DSI) carry a cracked-deflection row. 48 tendons from the exchange file `H1HH1_F9-12_export.INP` are put on the deck for C3 and C4.

METHOD

Spec 16 section 9.2. C1: OpenPT computes M_cr, I_cr and I_e of every design section from the DSI and compares them with Competing software 1's .dfl (2 digits) and .dfm (3 digits). C2: OpenPT's cracking ratio and angle of every shell and frame (strips taken from the .adm) against the CRACK block of Competing software 1's cracked deck. C3: the sustained-load case solved with OpenPT.Fem on Competing software 1's deck, with the CRACK rows and OpenPT's tendon loads, against max |uz| of CRACKED_SUSTAINED_LOAD.ADO. C4: the long term, (1 + phi) times the cracked sustained deflection, against the cracked Long_Term result. The tolerances are the limits in the tool's gate table; rows the tool prints as 'report' are INFO.

Quantity	Unit	Reference	OpenPT	Di
C1: sections whose I_e is within +-5 % of Competing software 1's .dfl, of 502	–	–	501	
C1: M_cr+ and M_cr- within +-0.6 % of Competing software 1's 3-digit .dfm, of 1004 values	–	–	1004	
C1: largest M_cr error against the .dfm	%	–	0.42	
C1: M_cr within +-1 % of the 2-digit .dfl, of 1004 values (report; the .dfl is too coarse for this test)	–	–	966	
C2: element slots whose cracking ratio and angle equal Competing software 1's CRACK row, of 9256	–	–	9250	
C2: slab shells and beam frames of the CRACK block found in both models (2 sets)	–	2	2	
C3: max |uz| of the cracked sustained case, OpenPT solved on Competing software 1's deck with OpenPT's cracking ratios and tendons (CRACK block of the deck)	mm	18.16	18.16	
C3: same with OpenPT's own cracking ratios (C2 rows)	mm	18.16	18.16	
C4: max |uz| of the long term, (1 + phi) x cracked sustained (phi = 2.00) against Competing software 1's cracked Long_Term.ADO	mm	54.49	54.47	

NOTES

C3 and C4 are reported by the tool without a verdict (limit text <= 5 % printed). The tool's own result for this project: PASS.

OpenPT build: 7d86603 Release (tag installed-20261118-1237), run 2026-11-18
Command: `OpenPT.Regress.exe cracked "--project=H1HH1_F9-12|D:\NETtool\OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12|D:\NETtool\OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12.adm|D:\NETtool\OpenPT\bench\work\real\H1HH1_F9-12\export\H1HH1_F9-12_export.INP" (cwd openpt-build\ver-run\B\out\final)`
Sources: `OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\cracked_H1HH1_F9-12.dfl`
`OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\cracked_H1HH1_F9-12.dfm`
`OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\cracked_H1HH1_F9-12.inp`
`OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\H1HH1_F9-12.cri`
`OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\H1HH1_F9-12.DSI`
`OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\H1HH1_F9-12.MAI`
`OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\H1HH1_F9-12ado`
`OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12.adm`
`OpenPT\bench\work\real\H1HH1_F9-12\export\H1HH1_F9-12_export.INP`
`openpt-build\ver-run\B\out\final\ch6_cracked_H1HH1_F9-12.txt`

5.4 V-604 OSI_typ_v2: cracked section properties, cracking pattern and cracked deflection

Perspective: Cracked sections and deflection · **Reference:** Competing software 1, cracked-deflection results of the project (.dfl, .dfm, CRACKED_SUSTAINED_LOAD.ADO) · **Status:** PASS

MODEL

OSI_typ_v2: design code EC2, concrete Concrete 1 cyl 26.36 Ec 32443.1373 fck 26.36; B35 cyl 28 Ec 32951 fck 28. Competing software 1's cracked deck has 5333 nodes, 4702 shells and 485 frames with CRACK rows on 3370 shells and 485 frames; 4374 design sections (DSI) carry a cracked-deflection row. 100 tendons from the exchange file `osi_typ_v2_003.INP` are put on the deck for C3 and C4.

METHOD

Spec 16 section 9.2. C1: OpenPT computes M_cr, I_cr and I_e of every design section from the DSI and compares them with Competing software 1's .dfl (2 digits) and .dfm (3 digits). C2: OpenPT's cracking ratio and angle of every shell and frame (strips taken from the .adm) against the CRACK block of Competing software 1's cracked deck. C3: the sustained-load case solved with OpenPT.Fem on Competing software 1's deck, with the CRACK rows and OpenPT's tendon loads, against max |uz| of CRACKED_SUSTAINED_LOAD.ADO. C4: the long term, (1 + phi) times the cracked sustained deflection, against the cracked Long_Term result. The tolerances are the limits in the tool's gate table; rows the tool prints as 'report' are INFO.

Quantity	Unit	Reference	OpenPT	Di
C1: sections whose I_e is within +-5 % of the 2-digit Competing software 1 .dfl (the .dfl of this project has 0 rows: no data)	–	–	0	
C1: M_cr+ and M_cr- within +-0.6 % of Competing software 1's 3-digit .dfm, of 8748 values	–	–	8748	
C1: largest M_cr error against the .dfm	%	–	0.44	
C2: element slots whose cracking ratio and angle equal Competing software 1's CRACK row, of 7710	–	–	7710	
C2: slab shells and beam frames of the CRACK block found in both models (2 sets)	–	2	2	
C3: max |uz| of the cracked sustained case, OpenPT solved on Competing software 1's deck with OpenPT's cracking ratios and tendons (CRACK block of the deck)	mm	13.92	13.88	
C3: same with OpenPT's own cracking ratios (C2 rows)	mm	13.92	13.88	
C4: max |uz| of the long term, (1 + phi) x cracked sustained (phi = 2.00) against Competing software 1's cracked Long_Term.ADO	mm	41.75	41.64	

NOTES

The 2-digit `cracked_OSI_typ_v2.dfl` of this project is empty (0 rows), so the tool's I_e gate has no data and prints FAIL on 0 of 1; it is not counted as a difference here. The 3-digit `.dfm` has 4374 rows and is compared (row 2). C3 and C4 are reported by the tool without a verdict (limit text <= 5 % printed). The tool's own result for this project: FAIL (caused only by the empty .dfl).

OpenPT build: 7d86603 Release (tag installed-20261118-1237), run 2026-11-18
Command: `OpenPT.Regress.exe cracked "--project=OSI_typ_v2|D:\NETtool\NDC_san\OSI_typ_v2|D:\NETtool\NDC_san\OSI_typ_v2.adm|D:\NETtool\NDC_san\OSI_typ_v2\backup\osi_typ_v2_003.INP" (cwd openpt-build\ver-run\B\out\final)`
Sources: `NDC_san\OSI_typ_v2\Databases\cracked_OSI_typ_v2.dfl`
`NDC_san\OSI_typ_v2\Databases\cracked_OSI_typ_v2.dfm`
`NDC_san\OSI_typ_v2\Databases\cracked_OSI_TYP_V2.inp`
`NDC_san\OSI_typ_v2\Databases\OSI_typ_v2.cri`
`NDC_san\OSI_typ_v2\Databases\OSI_typ_v2.DSI`
`NDC_san\OSI_typ_v2\Databases\OSI_typ_v2.MAI`
`NDC_san\OSI_typ_v2\Databases\OSI_typ_v2ado`
`NDC_san\OSI_typ_v2.adm`
`NDC_san\OSI_typ_v2\backup\osi_typ_v2_003.INP`
`openpt-build\ver-run\B\out\final\ch6_cracked_OSI_typ_v2.txt`

5.5 V-606 EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180: strip design against Competing software 1's designer output

Perspective: Strip design (required reinforcement) · **Reference:** Competing software 1, designer output of the project (.DSO), strip model PR.dat · **Status:** PASS

MODEL

EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180: strip model of the Competing software 1 project with 2018 design sections (DSI/DSO); required steel of the service checks (initial, quasi-permanent, frequent) and of the strength check, and the bar layout of the strip model (PR.dat).

METHOD

Spec 19 section 9.2. OpenPT designs every section of the DSI (same sections and combinations as Competing software 1's designer) and compares the required steel with the DSO: D1 per criterion, face by face (a value matches within the tool's rule); D2 the envelope that Competing software 1 prints as its summed design result; D3 the bar layout against PR.dat. Targets: the thresholds printed by the tool for each gate (D1 INITIAL 99 %, other D1 98 %, D2 97 %, D3 97 %).

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
D1: INITIAL check (service, initial stage), values equal Competing software 1's required steel (face values, of 3562)	–	–	3562	–	>= 99 %	PASS
D1: QUASI-PERMANENT service check (face values, of 4036)	–	–	3994	–	>= 98 %	PASS
D1: FREQUENT service check (face values, of 4036)	–	–	3981	–	>= 98 %	PASS
D1: STRENGTH check (face values, of 3562)	–	–	3534	–	>= 98 %	PASS
D2: envelope of the required top steel (summed design result of Competing software 1) (sections, of 2018)	–	–	1979	–	>= 97 %	PASS
D2: envelope of the required bottom steel (sections, of 2018)	–	–	1995	–	>= 97 %	PASS
D3: layout against PR.dat not applicable (PR.dat has 2017 rows for 2018 sections)	–	–	0	–	tool prints 'not applicable'	INFO

OpenPT build: 7d86603 Release (tag installed-20261118-1237), run 2026-11-18
Command: `OpenPT.Regress.exe stripdesign --project=EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180,D:\NETtool\OpenPT\bench\work\real\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180 --gate (cwd openpt-build\ver-run\B\out\final)`
Sources: `OpenPT\bench\work\real\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180\Databases\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180.cri`
`OpenPT\bench\work\real\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180\Databases\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180.DSI`
`OpenPT\bench\work\real\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180\Databases\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180.DSO`
`OpenPT\bench\work\real\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180\Databases\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180.MAI`
`OpenPT\bench\work\real\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180\EMASI_T1-EMSI-CIPUTRA_v5_v3_half_02_180\STRIP_MODEL\Current_plane\PR.dat`
`openpt-build\ver-run\B\out\final\ch6_stripdesign_EMASI.txt`

5.6 V-607 H1HH1_F9-12: strip design against Competing software 1's designer output

Perspective: Strip design (required reinforcement) · **Reference:** Competing software 1, designer output of the project (.DSO), strip model PR.dat · **Status:** PASS

MODEL

H1HH1_F9-12: strip model of the Competing software 1 project with 502 design sections (DSI/DSO); required steel of the service checks (initial, quasi-permanent, frequent) and of the strength check, and the bar layout of the strip model (PR.dat).

METHOD

Spec 19 section 9.2. OpenPT designs every section of the DSI (same sections and combinations as Competing software 1's designer) and compares the required steel with the DSO: D1 per criterion, face by face (a value matches within the tool's rule); D2 the envelope that Competing software 1 prints as its summed design result; D3 the bar layout against PR.dat. Targets: the thresholds printed by the tool for each gate (D1 INITIAL 99 %, other D1 98 %, D2 97 %, D3 97 %).

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Stat
D1: INITIAL check (service, initial stage), values equal Competing software 1's required steel (face values, of 706)	–	–	706	–	>= 99 %	PASS
D1: QUASI-PERMANENT service check (face values, of 1004)	–	–	1004	–	>= 98 %	PASS
D1: FREQUENT service check (face values, of 1004)	–	–	1004	–	>= 98 %	PASS
D1: STRENGTH check (face values, of 706)	–	–	706	–	>= 98 %	PASS
D2: envelope of the required top steel (summed design result of Competing software 1) (sections, of 502)	–	–	502	–	>= 97 %	PASS
D2: envelope of the required bottom steel (sections, of 502)	–	–	502	–	>= 97 %	PASS
D3: bottom bar layout against Competing software 1's PR.dat: no section needs bottom rebar (0 of 0; the tool prints 0.00 % and FAIL)	–	–	0	–	>= 97 % (no data)	INFO
D3: top bar layout (report only, of 3)	–	–	3	–	report only	INFO

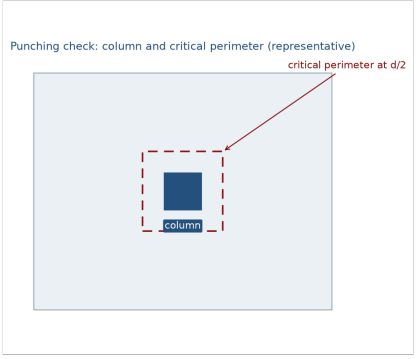
NOTES

The tool's D3 gate prints FAIL (0.00 %) for this project only because no section needs bottom rebar, so its 0 of 0 has no data; it is not counted as a difference here. The tool's own result: 1 gate(s) failed.

OpenPT build: 7d86603 Release (tag installed-20261118-1237), run 2026-11-18
Command: `OpenPT.Regress.exe stripdesign --project=H1HH1_F9-12,D:\NETtool\OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12 --gate (cwd openpt-build\ver-run\B\out\final)`
Sources: `OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\H1HH1_F9-12.cri`
`OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\H1HH1_F9-12.DSI`
`OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\H1HH1_F9-12.DSO`
`OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\Databases\H1HH1_F9-12.MAI`
`OpenPT\bench\work\real\H1HH1_F9-12\H1HH1_F9-12\STRIP_MODEL\Current_plane\PR.dat`
`openpt-build\ver-run\B\out\final\ch6_stripdesign_H1HH1_F9-12.txt`

5.7 V-608 Punching shear against Competing software 1's punching program: 90 reference cases (EC2, ACI 318-14, ACI 318-08)

Perspective: Punching shear · **Reference:** Competing software 1, punching program output (.PUO) for the same input (.PUI) · **Status:** PASS



Structure: Punching (representative column)

MODEL

90 punching reference cases of `OpenPT-ref\punching` (each a folder with case.PUI, case.PUO, case.MAI and case.cri written by Competing software 1's punching program): 49 with EC2, 40 with ACI 318-14, 1 with ACI 318-08; 5426 support combinations in all. Shear reinforcement: studs and stirrups with and without heads.

METHOD

Spec 22 section 10.1. OpenPT's punching calculator (with Competing software 1's quirks switched on) is fed with Competing software 1's own .PUI records, materials and factors, and every block of the .PUO is compared field by field, per support and load combination. A combination matches when every field equals Competing software 1's. Gates of the tool: the strict cases at 100 %, and at least 99 % of all combinations when the open classes are left out (EC2 stirrup bar count, ACI heads, EC2 stirrup heads, EC2 phi < 1 minimum steel, octagonal column with C2 = 0).

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
combinations that equal Competing software 1's .PUO field by field, all cases, of 5426	–	–	5227	–	see next row	INFO
same, excluding the open classes (188 combinations), of 5238	–	–	5227	–	>= 99 % of combinations	PASS
strict cases (hn2_ec2, k2_ec2, hn2ACI08, hn2aci1, hn2aci14, k2aci) at 100 %, of 6	–	–	6	–	all 100 %	PASS
EC2 stirrup bar-count rows (no head) that match, of 6711	–	–	6577	–	report only	INFO
EC2: combinations that match, of 2808 (49 cases; 104 in open classes)	–	–	2694	–	report only	INFO
ACI14: combinations that match, of 2384 (40 cases; 84 in open classes)	–	–	2299	–	report only	INFO
ACI08: combinations that match, of 234 (1 cases; 0 in open classes)	–	–	234	–	report only	INFO
misses in the open class open-stirrup-bar-count (reported separately by the tool)	–	–	86	–	open class	INFO
misses in the open class open-aci-head (reported separately by the tool)	–	–	80	–	open class	INFO
misses in the open class open-ec2-stirrup-head (reported separately by the tool)	–	–	13	–	open class	INFO
misses in the open class open-phi-min (reported separately by the tool)	–	–	5	–	open class	INFO
misses in the open class open-octagonal (reported separately by the tool)	–	–	4	–	open class	INFO

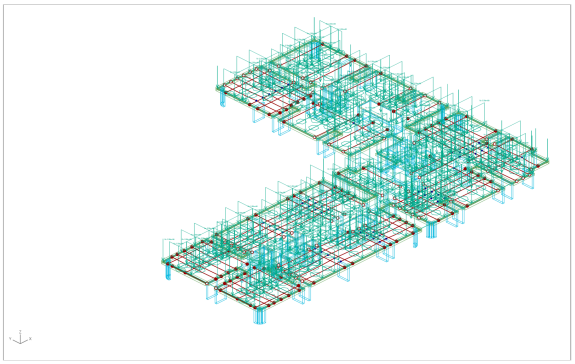
NOTES

The 188 combinations of the open classes are known, listed and reported separately by the tool (spec 22 section 10.1 gives the same count of 5227 / 5238 matching without them). Outside the open classes the tool lists 11 combinations that do not match: stirrups-other 5, stud+-1 4, ec2-head-studs 2.

OpenPT build: 7d86603 Release (tag installed-20261118-1237), run 2026-11-18
Command: `OpenPT.Regress.exe punching calc (cwd openpt-build\ver-run\B\out\final)`
Sources: `OpenPT-ref\punching\index.txt`
`OpenPT-ref\punching\<case>\case.PUI, case.PUO, case.MAI, case.cri (90 cases)`
`openpt-build\ver-run\B\out\final\ch6_punching.txt`

5.8 V-610 .adm reader against Competing software 1's own exchange INP: 7 saves of two projects

Perspective: Data exchange: reading .adm model files · **Reference:** Competing software 1, exchange INP written by Competing software 1 for the same save as the .ADM · **Status:** PASS



Structure: OSI_typ_v2

MODEL

Seven pairs of a .ADM file and the INP that Competing software 1 wrote for the same save (the `backup` folder keeps both): six saves of OSI_typ_v2 and one of H1HH1_F9-12. The blocks cover levels, beams, columns, walls, openings, loads, tendons with their geometry, materials, load combinations and, in one pair, reinforcement.

METHOD

Spec 46 section 11. OpenPT's `AdmModelReader` turns each .ADM into INP text; every block of that text is compared with the exchange INP row by row and field by field (11.1), and the typed models built from both are compared (11.2). Pass: every block meets the tolerance table of the spec, no pair throws, and the models agree. The pairs list of `bench\adm_pairs.txt` (447 pairs) points to folders of another PC; the seven pairs that exist here were used.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
pairs (.ADM and the exchange INP of the same save) read without error, of 7	–	–	7	–	all	PASS
blocks (normalised paths) with a mismatch, of 97 blocks	–	–	0	–	0	PASS
reference rows of the exchange INP found equal in OpenPT's reading of the .ADM, of 11228	–	–	11228	–	all rows	PASS
fields of the exchange INP that equal OpenPT's reading, of 149341 fields compared (bad fields: 0)	–	–	149341	–	no bad field	PASS
typed models identical between the two readings, of 7 pairs	–	–	7	–	all pairs	PASS

NOTES

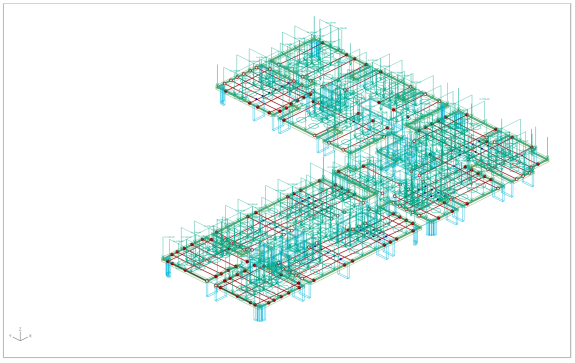
The list of 447 pairs in bench\adm_pairs.txt could not be used (paths on the other PC); this case covers 7 of them in kind, not the full list.

OpenPT build: 7d86603 Release (tag installed-20261118-1237), run 2026-11-18
Command: `OpenPT.Regress.exe admread --pairs D:\NETtool\openpt-build\ver-run\B\out\final\ch6_adm_pairs.txt (cwd openpt-build\ver-run\B\out\final)`
Sources: `NDC_san\OSI_typ_v2\backup\osi_typ_v2_001.ADM`

```
NDC_san\OSI_typ_v2\backup\osi_typ_v2_001.INP
NDC_san\OSI_typ_v2\backup\osi_typ_v2_002.ADM
NDC_san\OSI_typ_v2\backup\osi_typ_v2_002.INP
NDC_san\OSI_typ_v2\backup\osi_typ_v2_003.ADM
NDC_san\OSI_typ_v2\backup\osi_typ_v2_003.INP
NDC_san\OSI_typ_v2\backup\osi_typ_v2_004.ADM
NDC_san\OSI_typ_v2\backup\osi_typ_v2_004.INP
NDC_san\OSI_typ_v2\backup\osi_typ_v2_005.ADM
NDC_san\OSI_typ_v2\backup\osi_typ_v2_005.INP
NDC_san\OSI_typ_v2\backup\osi_typ_v2_006.ADM
NDC_san\OSI_typ_v2\backup\osi_typ_v2_006.INP
NDC_san\H1HH1_F9-12\backup\h1hh1_f9-12_001.ADM
NDC_san\H1HH1_F9-12\backup\h1hh1_f9-12_001.INP
openpt-build\ver-run\B\out\final\ch6_adm_pairs.txt
openpt-build\ver-run\B\out\final\ch6_admread.txt
```

5.9 V-611 OSI_typ_v2: OpenPT's FE solver against Competing software 1's analyser on Competing software 1's own input deck

Perspective: FE solver, same mesh and same deck · **Reference:** Competing software 1 analyser FRAME.exe, run on 2026-11-18 · **Status:** PASS



Structure: OSI_typ_v2

MODEL

OSI_typ_v2: Competing software 1 project with 100 tendons (groups Group_1). The tendon polylines cover 74.1 x 60.5 m in plan. Tendon system in the segment data: unbonded; tendon areas 280, 700 mm2; E = 200000 MPa, fpu = 1860 MPa, fpy = 1700 MPa; friction coefficient 0.07, wobble coefficient K = 3.28e-06 per mm; jacking ratio 0.8 of fpu, seating 6 mm (stage 1 of TendonOperation). Reference files from NDC_san\OSI_typ_v2 (Competing software 1 run of 2026-10-27).

METHOD

The tool takes the analysis deck Competing software 1 wrote for the project (`cracked_OSI_TYP_V2.inp`, 5333 nodes), makes a linear variant of it, runs Competing software 1's analyser `FRAME.exe` on it and solves the same deck with OpenPT.Fem. Displacements and rotations are compared node by node; errors are relative to the largest value of the case. Gates: spec 07 section 8.3.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
dead + live loads: uz, maximum error (5333 nodes)	%	–	0.028	–	<= 0.15 %	PASS
dead + live loads: uz, median error (5333 nodes)	%	–	0.012	–	<= 0.05 %	PASS
dead + live loads: uz, 95th percentile error (5333 nodes)	%	–	0.056	–	<= 0.25 %	PASS
dead + live loads: rotation rx, error (5333 nodes)	%	–	0.094	–	<= 0.5 %	PASS
dead + live loads: rotation ry, error (5333 nodes)	%	–	0.197	–	<= 0.5 %	PASS
dead + live loads: equilibrium residual of OpenPT's solution, relative	–	–	0.0000000000021	–	<= 1e-6	PASS
self-weight: uz, maximum error (5333 nodes)	%	–	0.032	–	<= 0.15 %	PASS
self-weight: uz, median error (5333 nodes)	%	–	0.013	–	<= 0.05 %	PASS
self-weight: uz, 95th percentile error (5333 nodes)	%	–	0.056	–	<= 0.25 %	PASS
self-weight: rotation rx, error (5333 nodes)	%	–	0.109	–	<= 0.5 %	PASS
self-weight: rotation ry, error (5333 nodes)	%	–	0.188	–	<= 0.5 %	PASS
self-weight: equilibrium residual of OpenPT's solution, relative	–	–	0.0000000000011	–	<= 1e-6	PASS

NOTES

The cracked variant (`crk`, report only) gives the same figures as the self-weight variant on this project: Competing software 1 found no cracked section in it.

OpenPT build: 7d86603 Release (tag installed-20261118-1237), run 2026-11-18
Command: `OpenPT.Regress.exe fem --frame-exe=<FRAME.exe> --only=OSI_typ_v2 --variant=lin|sw`
Sources: `openpt-build\ver-run\lead\out6\fem_lin.txt`
`openpt-build\ver-run\lead\out6\fem_sw.txt`
`openpt-build\ver-run\lead\out6\fem_crk.txt`

5.10 V-612 OSI_typ_v2: prestress loads and the deflection they cause

Perspective: Prestress as load, FE result · **Reference:** Competing software 1: PRESTRESSING.ADO and the analysis deck of the project · **Status:** PASS

MODEL

OSI_typ_v2: Competing software 1 project with 100 tendons (groups Group_1). The tendon polylines cover 74.1 x 60.5 m in plan. Tendon system in the segment data: unbonded; tendon areas 280, 700 mm2; E = 200000 MPa, fpu = 1860 MPa, fpy = 1700 MPa; friction coefficient 0.07, wobble coefficient K = 3.28e-06 per mm; jacking ratio 0.8 of fpu, seating 6 mm (stage 1 of TendonOperation). Reference files from NDC_san\OSI_typ_v2 (Competing software 1 run of 2026-10-27).

METHOD

OpenPT cuts the 100 tendons into pieces, turns them into nodal loads and solves the Prestressing case, first on Competing software 1's mesh (R1), then on its own mesh (R2). The deflection is compared with Competing software 1's stored `PRESTRESSING.ADO`. Gates: spec 13 section 10.2.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
R1.1 deck cut points on cell edges that OpenPT also cuts (2914 of 2922)	%	–	99.7	–	>= 95%	PASS
R1.3 Prestressing max |uz| vs PRESTRESSING.ADO	mm	2.027	2.078	+2.52	<= 5%	PASS
R1.3 RMS(uz - uz_ref) / max |uz_ref|	%	–	0.46	–	<= 5%	PASS
R1.4 sum of the support reactions / sum|g|	–	–	0.0000000000000568	–	<= 1e-6	PASS
R2.1 Prestressing max |uz| on OpenPT's mesh vs PRESTRESSING.ADO	mm	2.027	2.132	+5.18	<= 10%	PASS
R2.2 max |uz| of D + L + self-weight + Prestressing vs the Competing software 1 sum	mm	15.73	15.79	+0.38	<= 10%	PASS

OpenPT build: 7d86603 Release (tag installed-20261118-1237), run 2026-11-18
Command: `OpenPT.Regress.exe prestress`
Sources: `openpt-build\ver-run\lead\out6\prestress.txt`

5.11 V-613 OSI_typ_v2: hyperstatic (secondary) effects of prestress

Perspective: Hyperstatic case · **Reference:** Competing software 1: HYPERSTATIC.ADO of the project; analyser FRAME.exe for row H4 · **Status:** PASS

MODEL

OSI_typ_v2: Competing software 1 project with 100 tendons (groups Group_1). The tendon polylines cover 74.1 x 60.5 m in plan. Tendon system in the segment data: unbonded; tendon areas 280, 700 mm2; E = 200000 MPa, fpu = 1860 MPa, fpy = 1700 MPa; friction coefficient 0.07, wobble coefficient K = 3.28e-06 per mm; jacking ratio 0.8 of fpu, seating 6 mm (stage 1 of TendonOperation). Reference files from NDC_san\OSI_typ_v2 (Competing software 1 run of 2026-10-27).

METHOD

The hyperstatic case is the structure released to three kept supports and loaded by the support reactions of the Prestressing case. H2 solves Competing software 1's own joint loads with OpenPT's solver, H3 is OpenPT's full chain on Competing software 1's mesh, H4 the same on OpenPT's own mesh. Gates: spec 14 section 4.2.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
H0 kept supports and flags equal HYPERSTATIC.ADO's	nodes	–	3	–	exact	PASS
H2 max |uz| (Competing software 1's loads, OpenPT solver) vs HYPERSTATIC.ADO	mm	221.2	221	-0.10	<= 1%	PASS
H2 RMS(uz - uz_ref) / max |uz_ref|	%	–	0.04	–	<= 1%	PASS
H3 max |uz| of the full chain vs HYPERSTATIC.ADO	mm	221.2	217.2	-1.82	<= 10%	PASS
H3 RMS(uz - uz_ref) / max |uz_ref|	%	–	0.67	–	<= 10%	PASS
H4 max |uz| on OpenPT's mesh vs HYPERSTATIC.ADO	mm	221.2	214.8	-2.87	report only	INFO
H4 FRAME.exe on the _HYP deck vs OpenPT.Fem, max |uz| difference	%	–	0.11	–	report only	INFO

NOTES

The case is close to a rigid-body tilt about the kept supports, hence the large deflection values.

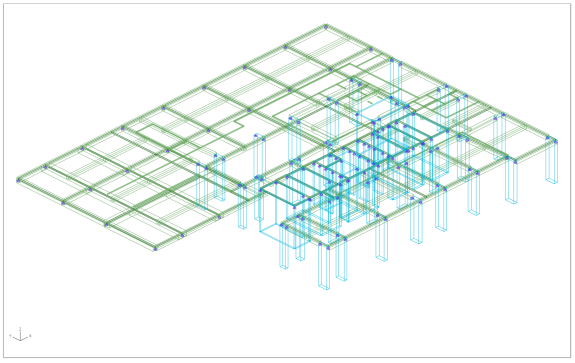
OpenPT build: 7d86603 Release (tag installed-20261118-1237), run 2026-11-18
Command: `OpenPT.Regress.exe hyperstatic --only=OSI_typ_v2 --frame-exe=<FRAME.exe>`
Sources: `openpt-build\ver-run\lead\out6\hyperstatic_frame.txt`

6 A building floor imported from an F2K file

OpenPT reads F2K files and analyses them with its own plate, membrane and frame elements (spec 75 to 75c). In the program as it is today an F2K file is opened with File ▸ Import ▸ Import model... and becomes an OpenPT model with the same analysis rules; its results agree with the F2K path used for the cases below to about 1e-9 (spec 254). The cases were run on the F2K path. The test model is the floor of a real tower (K2HH1 Tower A), exported from ETABS to Competing software 2: 269 points, 243 beam and wall lines, 46 slab areas, 16 static load cases, 12 imported modes, 2 response-spectrum cases and 28 combinations. Competing software 2's own results were exported at full precision (`bench\cs2\K2HH1_TowerA\cs2_results`, modes in `modes\cs2_results`) and are the stored reference; Competing software 2 was not run for this manual. OpenPT was run again (build 7d86603, Release) on Competing software 2's own mesh with `OpenPT.Regress f2k --cs2-mesh` and compared with `OpenPT.Bench cs2cmp`; one more case (V-711) uses OpenPT's own mesh. Each case is a group of load steps; for every statistic the worst step of the group is given (p90 and maximum over the supports, point objects, beam stations or shell corners, in percent of the largest Competing software 2 value of that component in that step). The comparison has no accuracy gate in the specifications (spec 75: "no accuracy gate yet"), so the comparison rows are INFO; the one gate the tool prints is the equilibrium of applied load and reactions (1e-6), which is shown as a PASS/DIFF row for the static cases and modes. Known and documented: Competing software 2 drops point loads that sit on no element (OpenPT does the same and warns), and slab moments at point supports and at joints with applied point moments are singular in both programs, so the maxima of the shell moments are not figures of merit. The folder `bench\cs2\micro_patch` holds no Competing software 2 result tables (only Competing software 2's own work files), so it is not compared.

6.1 V-701 Gravity: self weight (SWL)

Perspective: Building floor imported from Competing software 2: gravity load · **Reference:** Competing software 2 (full-precision result tables) · **Status:** PASS



Structure: K2HH1_TowerA

MODEL

A real building floor of a tower (K2HH1 Tower A, exported from ETABS to Competing software 2 as an F2K file): 269 points (142 restrained), 243 line objects, 46 areas, 18 beam sections, 2 slab sections, 16 static load cases, 12 modes, 2 response-spectrum cases, 28 combinations (F2K counts read by OpenPT: see the import log). OpenPT is run on Competing software 2's own mesh (`--cs2-mesh`: 3072 joints, 2596 shells, 1642 frames, 44 edge constraints, 17 568 equations), so any difference left is in the elements, loads and supports, not in the mesher. Case SWL = pattern SWL (dead, self weight) plus pattern SWL_ABOVE (the actions of the storeys above, imposed support displacements from the ETABS model).

METHOD

`OpenPT.Bench cs2cmp` against Competing software 2's full-precision tables (`cs2_results`, and `modes\cs2_results` for the modes): the support reactions of the 142 supports, the displacements of the 266 point objects that belong to an element, the beam forces at Competing software 2's object stations, the shell forces at every element corner (element by element) and the base reactions. Errors are |OpenPT - Competing software 2| / max|Competing software 2| of that component in that step (percent); p90 and max are over the objects. Groups of steps give the worst step. Base reactions are given as values with their percentage difference.

Quantity	Unit	Competing software 2	OpenPT	Differ
base reaction FZ	N	268500000	268500000	+
base reaction MX	N mm	10720000000000	10720000000000	+
base reaction MY	N mm	-8673000000000	-8673000000000	
joint displacement U3 at the point objects, p90 of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 266	%	–	0.003711	
joint displacement U3 at the point objects, max of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 266	%	–	0.01461	
support reaction F3, p90 of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 142	%	–	0.225	
support reaction F3, max of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 142	%	–	0.9544	
beam moment M3 at Competing software 2's stations, p90 of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 3463	%	–	0.0457	
beam moment M3 at Competing software 2's stations, max of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 3463	%	–	11.24	
shell moment M11 at element corners, p90 of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 10298	%	–	2.894	
shell moment M11 at element corners, max of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 10298	%	–	143.1	
equilibrium of applied load and reactions, largest relative residual over 1 steps (SWL)	-	–	0.0000000173	

NOTES

Competing software 2 silently drops point loads that sit on no element (the import warnings file `import_warnings.txt` and OpenPT's import report list them: Wx at joint 684, Wy at joint 1116); OpenPT matches Competing software 2 by dropping them and writes a warning (spec 75b section 1). Slab moments at point supports and at joints with applied point moments are singular: they do not converge with mesh refinement in either program, and `cs2cmp` does not exclude them, so the **max** of the shell moments is dominated by those points and by 5-50 mm sliver elements (spec 75b section 6.4). The p90 values are the figures to read. No accuracy gate was defined for the comparison (spec 75: "No accuracy gate yet"), so all comparison rows are INFO; the equilibrium row is the gate printed by the tool (1e-6).

OpenPT build: 7d86603 Release, run 2026-11-18
Command: `OpenPT.Regress.exe f2k --f2k bench\cs2\K2HH1_TowerA\K2HH1_TowerA.F2K --out openpt-build\ver-run\C\k2hh1\cs2mesh --cs2-mesh bench\cs2\K2HH1_TowerA\cs2_tables; OpenPT.Bench.exe cs2cmp --case bench\cs2\K2HH1_TowerA --openpt openpt-build\ver-run\C\k2hh1\cs2mesh --out openpt-build\ver-run\C\k2hh1\cs2mesh`
Sources: `bench\cs2\K2HH1_TowerA\K2HH1_TowerA.F2K`
`bench\cs2\K2HH1_TowerA\cs2_results\base_react.csv`
`bench\cs2\K2HH1_TowerA\cs2_results\joint_displ.csv`
`bench\cs2\K2HH1_TowerA\cs2_results\joint_react.csv`
`bench\cs2\K2HH1_TowerA\cs2_results\frame_force.csv`
`bench\cs2\K2HH1_TowerA\cs2_results\shell_force.csv`
`openpt-build\ver-run\C\k2hh1\cs2mesh\compare.csv`
`openpt-build\ver-run\C\k2hh1\cs2mesh\base_compare.csv`
`openpt-build\ver-run\C\k2hh1\cs2mesh\report.md`
`openpt-build\ver-run\C\logs\k2hh1_cs2mesh_f2k.txt`
`openpt-build\ver-run\C\logs\k2hh1_cs2mesh_cs2cmp.txt`

6.2 V-702 Gravity: superimposed dead loads (FNS, MRS)

Perspective: Building floor imported from Competing software 2: gravity load · **Reference:** Competing software 2 (full-precision result tables) · **Status:** PASS

MODEL

A real building floor of a tower (K2HH1 Tower A, exported from ETABS to Competing software 2 as an F2K file): 269 points (142 restrained), 243 line objects, 46 areas, 18 beam sections, 2 slab sections, 16 static load cases, 12 modes, 2 response-spectrum cases, 28 combinations (F2K counts read by OpenPT: see the import log). OpenPT is run on Competing software 2's own mesh (`--cs2-mesh`: 3072 joints, 2596 shells, 1642 frames, 44 edge constraints, 17 568 equations), so any difference left is in the elements, loads and supports, not in the mesher. Cases FNS and MRS = superimposed-dead patterns (FNS, MSR) plus their _ABOVE patterns; the worst of the two steps is given.

METHOD

`OpenPT.Bench cs2cmp` against Competing software 2's full-precision tables (`cs2_results`, and `modes\cs2_results` for the modes): the support reactions of the 142 supports, the displacements of the 266 point objects that belong to an element, the beam forces at Competing software 2's object stations, the shell forces at every element corner (element by element) and the base reactions. Errors are |OpenPT - Competing software 2| / max|Competing software 2| of that component in that step (percent); p90 and max are over the objects. Groups of steps give the worst step. Base reactions are given as values with their percentage difference.

Quantity	Unit	Competing software 2	C
base reaction FZ, worst step FNS	N	61470000	61
base reaction MX, worst step FNS	N mm	2629000000000	2629000
base reaction MY, worst step FNS	N mm	-1947000000000	-1947000
joint displacement U3 at the point objects, p90 of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 266, worst step MRS	%	–	0.
joint displacement U3 at the point objects, max of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 266, worst step MRS	%	–	(
support reaction F3, p90 of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 142, worst step MRS	%	–	
support reaction F3, max of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 142, worst step FNS	%	–	
beam moment M3 at Competing software 2's stations, p90 of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 3463, worst step FNS	%	–	
beam moment M3 at Competing software 2's stations, max of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 3463, worst step FNS	%	–	
shell moment M11 at element corners, p90 of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 10298, worst step MRS	%	–	
shell moment M11 at element corners, max of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 10298, worst step FNS	%	–	
equilibrium of applied load and reactions, largest relative residual over 2 steps (MRS)	-	–	0.0000

NOTES

Competing software 2 silently drops point loads that sit on no element (the import warnings file `import_warnings.txt` and OpenPT's import report list them: Wx at joint 684, Wy at joint 1116); OpenPT matches Competing software 2 by dropping them and writes a warning (spec 75b section 1). Slab moments at point supports and at joints with applied point moments are singular: they do not converge with mesh refinement in either program, and `cs2cmp` does not exclude them, so the **max** of the shell moments is dominated by those points and by 5-50 mm sliver elements (spec 75b section 6.4). The p90 values are the figures to read. No accuracy gate was defined for the comparison (spec 75: "No accuracy gate yet"), so all comparison rows are INFO; the equilibrium row is the gate printed by the tool (1e-6).

OpenPT build: 7d86603 Release, run 2026-11-18
Command: `OpenPT.Regress.exe f2k --f2k bench\cs2\K2HH1_TowerA\K2HH1_TowerA.F2K --out openpt-build\ver-run\C\k2hh1\cs2mesh --cs2-mesh bench\cs2\K2HH1_TowerA\cs2_tables; OpenPT.Bench.exe cs2cmp --case bench\cs2\K2HH1_TowerA --openpt openpt-build\ver-run\C\k2hh1\cs2mesh --out openpt-build\ver-run\C\k2hh1\cs2mesh`
Sources: `bench\cs2\K2HH1_TowerA\K2HH1_TowerA.F2K`
`bench\cs2\K2HH1_TowerA\cs2_results\base_react.csv`
`bench\cs2\K2HH1_TowerA\cs2_results\joint_displ.csv`
`bench\cs2\K2HH1_TowerA\cs2_results\joint_react.csv`
`bench\cs2\K2HH1_TowerA\cs2_results\frame_force.csv`
`bench\cs2\K2HH1_TowerA\cs2_results\shell_force.csv`
`openpt-build\ver-run\C\k2hh1\cs2mesh\compare.csv`
`openpt-build\ver-run\C\k2hh1\cs2mesh\base_compare.csv`
`openpt-build\ver-run\C\k2hh1\cs2mesh\report.md`
`openpt-build\ver-run\C\logs\k2hh1_cs2mesh_f2k.txt`
`openpt-build\ver-run\C\logs\k2hh1_cs2mesh_cs2cmp.txt`

6.3 V-703 Gravity: live-load cases (11 cases LLa to LLi)

Perspective: Building floor imported from Competing software 2: gravity load · **Reference:** Competing software 2 (full-precision result tables) · **Status:** PASS

MODEL

A real building floor of a tower (K2HH1 Tower A, exported from ETABS to Competing software 2 as an F2K file): 269 points (142 restrained), 243 line objects, 46 areas, 18 beam sections, 2 slab sections, 16 static load cases, 12 modes, 2 response-spectrum cases, 28 combinations (F2K counts read by OpenPT: see the import log). OpenPT is run on Competing software 2's own mesh (`--cs2-mesh`: 3072 joints, 2596 shells, 1642 frames, 44 edge constraints, 17 568 equations), so any difference left is in the elements, loads and supports, not in the mesher. The eleven live-load and settlement cases LLa, LLc, LLdb, LLe-cl, LLe-hp, LLe-tb, LLe1, LLf, LLg, LLh, LLi; the worst step of each statistic is given.

METHOD

`OpenPT.Bench cs2cmp` against Competing software 2's full-precision tables (`cs2_results`, and `modes\cs2_results` for the modes): the support reactions of the 142 supports, the displacements of the 266 point objects that belong to an element, the beam forces at Competing software 2's object stations, the shell forces at every element corner (element by element) and the base reactions. Errors are |OpenPT - Competing software 2| / max|Competing software 2| of that component in that step (percent); p90 and max are over the objects. Groups of steps give the worst step. Base reactions are given as values with their percentage difference.

Quantity	Unit	Competing software 2	OpenPT
base reaction FZ, worst step LLf	N	-0.04172	0.01584
base reaction MX, worst step LLf	N mm	-2462	-730.3
base reaction MY, worst step LLf	N mm	2921	1898
joint displacement U3 at the point objects, p90 of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 266, worst step LLe-hp	%	–	0.006048
joint displacement U3 at the point objects, max of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 266, worst step LLe-tb	%	–	0.2975
support reaction F3, p90 of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 142, worst step LLf	%	–	2.583
support reaction F3, max of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 142, worst step LLf	%	–	8.95
beam moment M3 at Competing software 2's stations, p90 of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 3463, worst step LLc	%	–	0.4514
beam moment M3 at Competing software 2's stations, max of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 3463, worst step LLdb	%	–	94.95
shell moment M11 at element corners, p90 of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 10298, worst step LLe-hp	%	–	5.824
shell moment M11 at element corners, max of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 10298, worst step LLe-hp	%	–	556.6
equilibrium of applied load and reactions, largest relative residual over 11 steps (LLf)	-	–	0.0000000688

NOTES

In Competing software 2 the steps LLe1, LLg, LLh carry no load (all results are zero), so no statistic exists for them. In the f2k log the applied-load totals of LLe-hp and LLf are below 0.038 N, while Competing software 2's largest support reaction F3 is 1833 N and 22581 N: the reactions of these two steps are self-equilibrating (loads that balance each other, or imposed support displacements), not a response to a net applied load, so their percentages rest on small absolute values. Competing software 2 silently drops point loads that sit on no element (the import warnings file `import_warnings.txt` and OpenPT's import report list them: Wx at joint 684, Wy at joint 1116); OpenPT matches Competing software 2 by dropping them and writes a warning (spec 75b section 1). Slab moments at point supports and at joints with applied point moments are singular: they do not converge with mesh refinement in either program, and `cs2cmp` does not exclude them, so the **max** of the shell moments is dominated by those points and by 5-50 mm sliver elements (spec 75b section 6.4). The p90 values are the figures to read. No accuracy gate was defined for the comparison (spec 75: "No accuracy gate yet"), so all comparison rows are INFO; the equilibrium row is the gate printed by the tool (1e-6).

OpenPT build: 7d86603 Release, run 2026-11-18

Command: `OpenPT.Regress.exe f2k --f2k bench\cs2\K2HH1_TowerA\K2HH1_TowerA.F2K --out openpt-build\ver-run\C\k2hh1\cs2mesh --cs2-mesh bench\cs2\K2HH1_TowerA\cs2_tables; OpenPT.Bench.exe cs2cmp --case bench\cs2\K2HH1_TowerA --openpt openpt-build\ver-run\C\k2hh1\cs2mesh --out openpt-build\ver-run\C\k2hh1\cs2mesh`

Sources: `bench\cs2\K2HH1_TowerA\K2HH1_TowerA.F2K`

`bench\cs2\K2HH1_TowerA\cs2_results\base_react.csv`
`bench\cs2\K2HH1_TowerA\cs2_results\joint_displ.csv`
`bench\cs2\K2HH1_TowerA\cs2_results\joint_react.csv`
`bench\cs2\K2HH1_TowerA\cs2_results\frame_force.csv`
`bench\cs2\K2HH1_TowerA\cs2_results\shell_force.csv`
`openpt-build\ver-run\C\k2hh1\cs2mesh\compare.csv`
`openpt-build\ver-run\C\k2hh1\cs2mesh\base_compare.csv`
`openpt-build\ver-run\C\k2hh1\cs2mesh\report.md`
`openpt-build\ver-run\C\logs\k2hh1_cs2mesh_f2k.txt`
`openpt-build\ver-run\C\logs\k2hh1_cs2mesh_cs2cmp.txt`

6.4 V-704 Wind in X (Wx)

Perspective: Building floor imported from Competing software 2: wind load · **Reference:** Competing software 2 (full-precision result tables) · **Status:** PASS

MODEL

A real building floor of a tower (K2HH1 Tower A, exported from ETABS to Competing software 2 as an F2K file): 269 points (142 restrained), 243 line objects, 46 areas, 18 beam sections, 2 slab sections, 16 static load cases, 12 modes, 2 response-spectrum cases, 28 combinations (F2K counts read by OpenPT: see the import log). OpenPT is run on Competing software 2's own mesh (`--cs2-mesh`: 3072 joints, 2596 shells, 1642 frames, 44 edge constraints, 17 568 equations), so any difference left is in the elements, loads and supports, not in the mesher. Case Wx = wind pattern Wx (point loads at the joints) plus Wx_ABOVE; the point load at joint 684 (338000 N, from the import log) sits on no element and is dropped by both programs.

METHOD

`OpenPT.Bench cs2cmp` against Competing software 2's full-precision tables (`cs2_results`, and `modes\cs2_results` for the modes): the support reactions of the 142 supports, the displacements of the 266 point objects that belong to an element, the beam forces at Competing software 2's object stations, the shell forces at every element corner (element by element) and the base reactions. Errors are |OpenPT - Competing software 2| / max|Competing software 2| of that component in that step (percent); p90 and max are over the objects. Groups of steps give the worst step. Base reactions are given as values with their percentage difference.

Quantity	Unit	Competing software 2	OpenPT	Difference %
base reaction FX	N	-4327000	-4327000	-0.00
base reaction MZ	N mm	171100000000	171100000000	-0.00
joint displacement U3 at the point objects, p90 of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 266	%	–	0.01577	–
joint displacement U3 at the point objects, max of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 266	%	–	0.07888	–
support reaction F3, p90 of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 142	%	–	1.394	–
support reaction F3, max of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 142	%	–	5.14	–
beam moment M3 at Competing software 2's stations, p90 of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 3463	%	–	0.02424	–
beam moment M3 at Competing software 2's stations, max of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 3463	%	–	12.23	–
shell moment M11 at element corners, p90 of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 10298	%	–	3.384	–
shell moment M11 at element corners, max of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 10298	%	–	250.8	–
equilibrium of applied load and reactions, largest relative residual over 1 steps (Wx)	-	–	0.0000000526	–

NOTES

Competing software 2 silently drops point loads that sit on no element (the import warnings file `import_warnings.txt` and OpenPT's import report list them: Wx at joint 684, Wy at joint 1116); OpenPT matches Competing software 2 by dropping them and writes a warning (spec 75b section 1). Slab moments at point supports and at joints with applied point moments are singular: they do not converge with mesh refinement in either program, and `cs2cmp` does not exclude them, so the **max** of the shell moments is dominated by those points and by 5-50 mm sliver elements (spec 75b section 6.4). The p90 values are the figures to read. No accuracy gate was defined for the comparison (spec 75: "No accuracy gate yet"), so all comparison rows are INFO; the equilibrium row is the gate printed by the tool (1e-6).

OpenPT build: 7d86603 Release, run 2026-11-18
Command: `OpenPT.Regress.exe f2k --f2k bench\cs2\K2HH1_TowerA\K2HH1_TowerA.F2K --out openpt-build\ver-run\C\k2hh1\cs2mesh --cs2-mesh bench\cs2\K2HH1_TowerA\cs2_tables; OpenPT.Bench.exe cs2cmp --case bench\cs2\K2HH1_TowerA --openpt openpt-build\ver-run\C\k2hh1\cs2mesh --out openpt-build\ver-run\C\k2hh1\cs2mesh`
Sources: `bench\cs2\K2HH1_TowerA\K2HH1_TowerA.F2K`
`bench\cs2\K2HH1_TowerA\cs2_results\base_react.csv`
`bench\cs2\K2HH1_TowerA\cs2_results\joint_displ.csv`
`bench\cs2\K2HH1_TowerA\cs2_results\joint_react.csv`
`bench\cs2\K2HH1_TowerA\cs2_results\frame_force.csv`
`bench\cs2\K2HH1_TowerA\cs2_results\shell_force.csv`
`openpt-build\ver-run\C\k2hh1\cs2mesh\compare.csv`
`openpt-build\ver-run\C\k2hh1\cs2mesh\base_compare.csv`
`openpt-build\ver-run\C\k2hh1\cs2mesh\report.md`
`openpt-build\ver-run\C\logs\k2hh1_cs2mesh_f2k.txt`
`openpt-build\ver-run\C\logs\k2hh1_cs2mesh_cs2cmp.txt`

6.5 V-705 Wind in Y (Wy)

Perspective: Building floor imported from Competing software 2: wind load · **Reference:** Competing software 2 (full-precision result tables) · **Status:** PASS

MODEL

A real building floor of a tower (K2HH1 Tower A, exported from ETABS to Competing software 2 as an F2K file): 269 points (142 restrained), 243 line objects, 46 areas, 18 beam sections, 2 slab sections, 16 static load cases, 12 modes, 2 response-spectrum cases, 28 combinations (F2K counts read by OpenPT: see the import log). OpenPT is run on Competing software 2's own mesh (`--cs2-mesh`: 3072 joints, 2596 shells, 1642 frames, 44 edge constraints, 17 568 equations), so any difference left is in the elements, loads and supports, not in the mesher. Case Wy = wind pattern Wy plus Wy_ABOVE; the point load at joint 1116 (482460 N, from the import log) sits on no element and is dropped by both programs.

METHOD

`OpenPT.Bench cs2cmp` against Competing software 2's full-precision tables (`cs2_results`, and `modes\cs2_results` for the modes): the support reactions of the 142 supports, the displacements of the 266 point objects that belong to an element, the beam forces at Competing software 2's object stations, the shell forces at every element corner (element by element) and the base reactions. Errors are |OpenPT - Competing software 2| / max|Competing software 2| of that component in that step (percent); p90 and max are over the objects. Groups of steps give the worst step. Base reactions are given as values with their percentage difference.

Quantity	Unit	Competing software 2	OpenPT	Differen
base reaction FY	N	-5367000	-5367000	-0.(
base reaction MZ	N mm	-165400000000	-165400000000	+0.(
joint displacement U3 at the point objects, p90 of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 266	%	–	0.01107	
joint displacement U3 at the point objects, max of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 266	%	–	0.2015	
support reaction F3, p90 of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 142	%	–	1.689	
support reaction F3, max of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 142	%	–	9.905	
beam moment M3 at Competing software 2's stations, p90 of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 3463	%	–	0.02043	
beam moment M3 at Competing software 2's stations, max of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 3463	%	–	3.269	
shell moment M11 at element corners, p90 of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 10298	%	–	3.354	
shell moment M11 at element corners, max of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 10298	%	–	253.5	
equilibrium of applied load and reactions, largest relative residual over 1 steps (Wy)	-	–	0.0000000419	

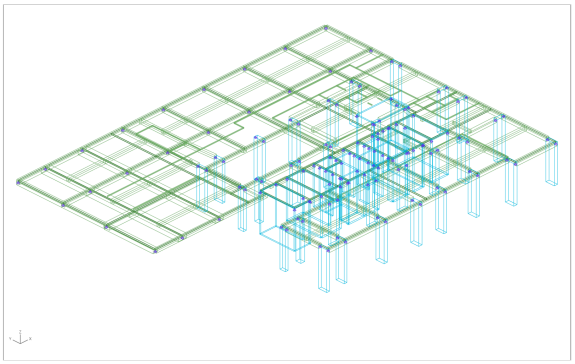
NOTES

Competing software 2 silently drops point loads that sit on no element (the import warnings file `import_warnings.txt` and OpenPT's import report list them: Wx at joint 684, Wy at joint 1116); OpenPT matches Competing software 2 by dropping them and writes a warning (spec 75b section 1). Slab moments at point supports and at joints with applied point moments are singular: they do not converge with mesh refinement in either program, and `cs2cmp` does not exclude them, so the **max** of the shell moments is dominated by those points and by 5-50 mm sliver elements (spec 75b section 6.4). The p90 values are the figures to read. No accuracy gate was defined for the comparison (spec 75: "No accuracy gate yet"), so all comparison rows are INFO; the equilibrium row is the gate printed by the tool (1e-6).

OpenPT build: 7d86603 Release, run 2026-11-18
Command: `OpenPT.Regress.exe f2k --f2k bench\cs2\K2HH1_TowerA\K2HH1_TowerA.F2K --out openpt-build\ver-run\C\k2hh1\cs2mesh --cs2-mesh bench\cs2\K2HH1_TowerA\cs2_tables; OpenPT.Bench.exe cs2cmp --case bench\cs2\K2HH1_TowerA --openpt openpt-build\ver-run\C\k2hh1\cs2mesh --out openpt-build\ver-run\C\k2hh1\cs2mesh`
Sources: `bench\cs2\K2HH1_TowerA\K2HH1_TowerA.F2K`
`bench\cs2\K2HH1_TowerA\cs2_results\base_react.csv`
`bench\cs2\K2HH1_TowerA\cs2_results\joint_displ.csv`
`bench\cs2\K2HH1_TowerA\cs2_results\joint_react.csv`
`bench\cs2\K2HH1_TowerA\cs2_results\frame_force.csv`
`bench\cs2\K2HH1_TowerA\cs2_results\shell_force.csv`
`openpt-build\ver-run\C\k2hh1\cs2mesh\compare.csv`
`openpt-build\ver-run\C\k2hh1\cs2mesh\base_compare.csv`
`openpt-build\ver-run\C\k2hh1\cs2mesh\report.md`
`openpt-build\ver-run\C\logs\k2hh1_cs2mesh_f2k.txt`
`openpt-build\ver-run\C\logs\k2hh1_cs2mesh_cs2cmp.txt`

6.6 V-706 Modes 1 to 12

Perspective: Building floor imported from Competing software 2: modal analysis (mode shapes imported from ETABS) · **Reference:** Competing software 2 (full-precision result tables) · **Status:** PASS



Structure: K2HH1_TowerA

MODEL

A real building floor of a tower (K2HH1 Tower A, exported from ETABS to Competing software 2 as an F2K file): 269 points (142 restrained), 243 line objects, 46 areas, 18 beam sections, 2 slab sections, 16 static load cases, 12 modes, 2 response-spectrum cases, 28 combinations (F2K counts read by OpenPT: see the import log). OpenPT is run on Competing software 2's own mesh (`--cs2-mesh`: 3072 joints, 2596 shells, 1642 frames, 44 edge constraints, 17 568 equations), so any difference left is in the elements, loads and supports, not in the mesher. The twelve imported mode shapes act as load patterns (imposed displacements of the supports); OpenPT mode k is compared with Competing software 2's case MODEk, joint displacements, support reactions and base reactions (Competing software 2 does not report beam or shell forces for modes).

METHOD

`OpenPT.Bench cs2cmp` against Competing software 2's full-precision tables (`cs2_results`, and `modes\cs2_results` for the modes): the support reactions of the 142 supports, the displacements of the 266 point objects that belong to an element, the beam forces at Competing software 2's object stations, the shell forces at every element corner (element by element) and the base reactions. Errors are |OpenPT - Competing software 2| / max|Competing software 2| of that component in that step (percent); p90 and max are over the objects. Groups of steps give the worst step. Base reactions are given as values with their percentage difference.

Quantity	Unit	Competing software 2	OpenPT	Differ
base reaction FX, worst step MODE4	N	-0.7689	-0.7689	
base reaction FY, worst step MODE4	N	-0.05024	-0.05024	
base reaction MZ, worst step MODE4	N mm	11530	11530	
joint displacement U3 at the point objects, p90 of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 266, worst step MODE12	%	–	0.5749	
joint displacement U3 at the point objects, max of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 266, worst step MODE5	%	–	2.849	
support reaction F3, p90 of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 142, worst step MODE4	%	–	1.529	
support reaction F3, max of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 142, worst step MODE4	%	–	4.261	
equilibrium of applied load and reactions, largest relative residual over 12 steps (Modal_MODE2)	-	–	0.00000000119	

NOTES

Competing software 2 has no beam or shell forces for the modes, so none are compared. The worst of the twelve modes is given for each statistic. Competing software 2 silently drops point loads that sit on no element (the import warnings file `import_warnings.txt` and OpenPT's import report list them: Wx at joint 684, Wy at joint 1116); OpenPT matches Competing software 2 by dropping them and writes a warning (spec 75b section 1). Slab moments at point supports and at joints with applied point moments are singular: they do not converge with mesh refinement in either program, and `cs2cmp` does not exclude them, so the **max** of the shell moments is dominated by those points and by 5-50 mm sliver elements (spec 75b section 6.4). The p90 values are the figures to read. No accuracy gate was defined for the comparison (spec 75: "No accuracy gate yet"), so all comparison rows are INFO; the equilibrium row is the gate printed by the tool (1e-6).

OpenPT build: 7d86603 Release, run 2026-11-18

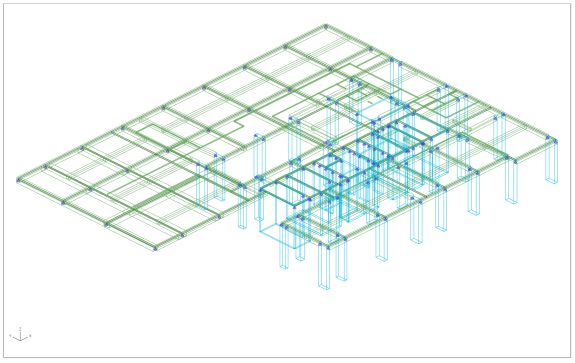
Command: `OpenPT.Regress.exe f2k --f2k bench\cs2\K2HH1_TowerA\K2HH1_TowerA.F2K --out openpt-build\ver-run\C\k2hh1\cs2mesh --cs2-mesh bench\cs2\K2HH1_TowerA\cs2_tables; OpenPT.Bench.exe cs2cmp --case bench\cs2\K2HH1_TowerA --openpt openpt-build\ver-run\C\k2hh1\cs2mesh --out openpt-build\ver-run\C\k2hh1\cs2mesh`

Sources: `bench\cs2\K2HH1_TowerA\K2HH1_TowerA.F2K`
`bench\cs2\K2HH1_TowerA\cs2_results\base_react.csv`
`bench\cs2\K2HH1_TowerA\cs2_results\joint_displ.csv`
`bench\cs2\K2HH1_TowerA\cs2_results\joint_react.csv`
`bench\cs2\K2HH1_TowerA\modes\cs2_results\base_react.csv`
`bench\cs2\K2HH1_TowerA\modes\cs2_results\joint_displ.csv`
`bench\cs2\K2HH1_TowerA\modes\cs2_results\joint_react.csv`
`openpt-build\ver-run\C\k2hh1\cs2mesh\compare.csv`

```
openpt-build\ver-run\C\k2hh1\cs2mesh\base_compare.csv
openpt-build\ver-run\C\k2hh1\cs2mesh\report.md
openpt-build\ver-run\C\logs\k2hh1_cs2mesh_f2k.txt
openpt-build\ver-run\C\logs\k2hh1_cs2mesh_cs2cmp.txt
```

6.7 V-711 OpenPT's own mesh (cell 1200) against Competing software 2: self weight

Perspective: Building floor imported from Competing software 2: OpenPT's own mesh · **Reference:** Competing software 2 (full-precision result tables) · **Status:** PASS



Structure: K2HH1_TowerA

MODEL

The same floor as V-701 (K2HH1 Tower A, F2K file). OpenPT builds its own mesh (`--cell 1200`, geometry tolerance 10 mm) instead of Competing software 2's: 8001 nodes, 7752 shells (112 triangles), 2450 frames. Case SWL (self weight).

METHOD

`OpenPT.Bench cs2cmp` against Competing software 2's full-precision tables (`cs2_results`, and `modes\cs2_results` for the modes): the support reactions of the 142 supports, the displacements of the 266 point objects that belong to an element, the beam forces at Competing software 2's object stations, the shell forces at every element corner (element by element) and the base reactions. Errors are |OpenPT - Competing software 2| / max|Competing software 2| of that component in that step (percent); p90 and max are over the objects. Groups of steps give the worst step. Base reactions are given as values with their percentage difference.

Quantity	Unit	Competing software 2	OpenPT	Differ
base reaction FZ	N	268500000	268500000	
base reaction MX	N mm	10720000000000	10720000000000	
base reaction MY	N mm	-8673000000000	-8673000000000	
joint displacement U3 at the point objects, p90 of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 266	%	–	0.002582	
joint displacement U3 at the point objects, max of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 266	%	–	0.03885	
support reaction F3, p90 of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 142	%	–	0.3237	
support reaction F3, max of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 142	%	–	10.07	
beam moment M3 at Competing software 2's stations, p90 of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 3464	%	–	0.03711	
beam moment M3 at Competing software 2's stations, max of |OpenPT - Competing software 2| in % of max|Competing software 2|, n = 3464	%	–	11.24	
equilibrium of applied load and reactions, largest relative residual over 1 steps (SWL)	-	–	0.000000283	

NOTES

Here OpenPT meshes the floor itself (cell 1200, tolerance 10 mm): 8001 nodes, 7752 shells (112 triangles), 2450 frames against Competing software 2's 3072, 2596, 1642; the meshes differ, so the shell forces are not compared element by element (not in the table) and the comparison is joint by joint at Competing software 2's point objects and stations. The comparison is therefore a measure of mesh sensitivity as well as of the elements. The f2k run exits with code 1 because LLc 1.81e-06, LLe-hp 1.35e-06, LLf 5.59e-06, LLi 2.01e-06, LLdb 1.57e-06, Wy 1.46e-06 miss the 1e-6 equilibrium gate (documented in spec 75b section 6.2: round-off of the reactions of stiff deep wall beams, not a modelling error); SWL passes. Competing software 2 silently drops point loads that sit on no element (the import warnings file `import_warnings.txt` and OpenPT's import report list them: Wx at joint 684, Wy at joint 1116); OpenPT matches Competing software 2 by dropping them and writes a warning (spec 75b section 1). Slab moments at point supports and at joints with applied point moments are singular: they do not converge with mesh refinement in either program, and `cs2cmp` does not exclude them, so the **max** of the shell moments is dominated by those points and by 5-50 mm sliver elements (spec 75b section 6.4). The p90 values are the figures to read. No accuracy gate was defined for the comparison (spec 75: "No accuracy gate yet"), so all comparison rows are INFO; the equilibrium row is the gate printed by the tool (1e-6).

OpenPT build: 7d86603 Release, run 2026-11-18
Command: `OpenPT.Regress.exe f2k --f2k bench\cs2\K2HH1_TowerA\K2HH1_TowerA.F2K --out openpt-build\ver-run\C\k2hh1\own --cell 1200; OpenPT.Bench.exe cs2cmp --case bench\cs2\K2HH1_TowerA --openpt openpt-build\ver-run\C\k2hh1\own --out openpt-build\ver-run\C\k2hh1\own`
Sources: `bench\cs2\K2HH1_TowerA\K2HH1_TowerA.F2K`
`bench\cs2\K2HH1_TowerA\cs2_results\base_react.csv`
`bench\cs2\K2HH1_TowerA\cs2_results\joint_displ.csv`
`bench\cs2\K2HH1_TowerA\cs2_results\joint_react.csv`

```
bench\cs2\K2HH1_TowerA\cs2_results\frame_force.csv
openpt-build\ver-run\C\k2hh1\own\compare.csv
openpt-build\ver-run\C\k2hh1\own\base_compare.csv
openpt-build\ver-run\C\k2hh1\own\report.md
openpt-build\ver-run\C\logs\k2hh1_own_f2k.txt
openpt-build\ver-run\C\logs\k2hh1_own_cs2cmp.txt
```

7 Long-term deflection by TCVN 5574: Competing software 2, Competing software 1 and OpenPT

TCVN 5574:2018 (8.2.3) gives the long-term deflection of a cracked slab as f = f1 - f2 + f3: f1 under the total load (short-term cracked stiffness), f2 under the sustained load (short term) and f3 under the sustained load (long-term stiffness with creep, phi_b,cr = 2.1 for B35 at 40-75 % humidity). Competing software 1 has no TCVN route (its long-term value is the EC2 one, (1 + phi) x the cracked sustained deflection with phi = 2). Competing software 2 was driven through its API in 2026-11-10/11 (`bench\results_calib\<model>\cs2`, `cs2_uncr3`, `cs2_strip`, `skill_test_cs2`): linear uncracked cases, and the nonlinear cracked cases f1, f2, f3 with strip-based reinforcement. Three models are compared: B01 (RC flat plate), B09 (RC irregular floor) and Xuan La (a real floor). Per model three cases: (1) sustained and EC2 long-term deflection of Competing software 1 against OpenPT, and the uncracked Competing software 2 linear values against OpenPT; (2) TCVN f = f1 - f2 + f3 on the uncracked slab, Competing software 2 against OpenPT; (3) TCVN f on the cracked slab, Competing software 2 against OpenPT. **Reference numbers are stored files** (Competing software 1 and Competing software 2 were not started). **OpenPT numbers of cases (1) and (2) were produced again** with the 7d86603 Release `OpenPT.Bench run` (and, for B01, agree with the stored 2026-11-10 values); **case (3) uses the stored OpenPT TCVN runs of 2026-11-10**, because the `OpenPT.Bench` of the installed build has no `--code TCVN` option (the TCVN mode ran from a work copy of the source). Tolerances: only the EC2 long-term row (Competing software 1 against OpenPT) has a defined gate (PLAN.md M1: 10 %, or 1 mm when Competing software 1 is below 10 mm); everything else is INFO. The cracked TCVN cases (3) are INFO by method: Competing software 2 applies the creep coefficient to the cracked section (f3 / f2 about 2.05), TCVN 5574 uses E_b,red (f3 / f2 about 1.45 to 1.6), so Competing software 2 is larger by method, not by error.

7.1 V-801 B01 RC flat plate: sustained and long-term deflection, Competing software 1, Competing software 2 and OpenPT

Perspective: Long-term deflection: sustained and EC2 long-term values, uncracked linear values · **Reference:** Competing software 1 (EC2) and Competing software 2 (linear uncracked) · **Status:** PASS

MODEL

Model B01 (see V-801 to V-803 for the TCVN cases of the same model). Rows 1 to 3 (Competing software 1 and the EC2 route) use the concrete of the Competing software 1 model, E = 32443 MPa (exported INP); rows 4 and 5 (Competing software 2 and the TCVN input) use B35 with E = 34 500 MPa, as in the calibration of 2026-11-10. Sustained load = SW + SDL + 0.3 LL for Competing software 1 and the EC2 route, SW + Dead + 0.35 Live for the TCVN/Competing software 2 rows (TCVN 2737 sustained fraction 0.35).

METHOD

Rows 1 to 3: Competing software 1 stored results (EC2, `compare.json`) against OpenPT run again with the EC2 route on the exported INP. Rows 4 and 5: Competing software 2 linear static cases SUS_LIN and TOT_LIN (uncracked, `cs2\cs2_summary.json`) against OpenPT's uncracked maximum |uz| on the TCVN input (`B01_tcvn.INP`, sustained live fraction 0.35 and total 1.0 respectively, E = 34 500 MPa). Maximum over the slab nodes; downward positive.

Quantity	Unit	Competing software 1 (EC2)	OpenPT	Difference %	Tolerance	Status
max |uz|, uncracked sustained (SW + SDL + 0.3 LL)	mm	8.133	8.068	-0.80	soft target 5 % (PLAN.md M2, report only)	INFO
max |uz|, cracked sustained (SW + SDL + 0.3 LL)	mm	8.318	8.221	-1.17	none defined	INFO
max |uz|, cracked long-term, (1 + phi) x cracked sustained, phi = 2 (EC2 route)	mm	24.95	24.66	-1.17	10 %, or 1.0 mm when Competing software 1 < 10 mm (PLAN.md M1)	PASS
max |uz|, uncracked sustained (SW + SDL + 0.35 LL, E = 34 500 MPa), Competing software 2 linear case SUS_LIN	mm	7.56	7.736	+2.33	none defined	INFO
max |uz|, uncracked total (SW + SDL + LL, E = 34 500 MPa), Competing software 2 linear case TOT_LIN	mm	9.308	9.517	+2.25	none defined	INFO

NOTES

Competing software 1 and Competing software 2 results are stored files (rule 2.2); OpenPT was run again with the Release tools of 7d86603 and reproduces the stored 2026-11-10 EC2 numbers. Competing software 1's stored files hold the uncracked sustained, cracked sustained and EC2 long-term values; Competing software 1 has no TCVN route. The Competing software 2 models of the calibration have their own mesh (max 500 mm) and OpenPT its own (cell from the run json), so the uncracked rows compare two different discretisations; differences of a few percent between the reference programs and OpenPT are expected on that account and no tolerance is defined for them (U0 soft target 5 %, report only).

OpenPT build: 7d86603 Release, run 2026-11-18
Command: `OpenPT.Bench.exe run --case B01 --inp bench\work\...\export\*_export.INP --adm ... --run-json ... --out openpt-build\ver-run\C\ch8\B01\run_ec2 (EC2); the same with the TCVN input and the live factor 0.35 (run_sus) and 1.00 (run_tot)`
Sources: `bench\results_calib\B01\compare.json`
`bench\results_calib\B01\cs2\cs2_summary.json`
`bench\results_calib\inputs\B01_tcvn.INP`
`bench\work\B01\export\B01_export.INP`
`openpt-build\ver-run\C\ch8\B01\run_ec2\openpt.json1`
`openpt-build\ver-run\C\ch8\B01\run_sus\openpt.json1`
`openpt-build\ver-run\C\ch8\B01\run_tot\openpt.json1`
`openpt-build\ver-run\C\logs\ch8_B01_ec2.txt`
`openpt-build\ver-run\C\logs\ch8_B01_sus.txt`
`openpt-build\ver-run\C\logs\ch8_B01_tot.txt`

7.2 V-804 B09 RC irregular floor: sustained and long-term deflection, Competing software 1, Competing software 2 and OpenPT

Perspective: Long-term deflection: sustained and EC2 long-term values, uncracked linear values · **Reference:** Competing software 1 (EC2) and Competing software 2 (linear uncracked) · **Status:** PASS

MODEL

Model B09 (see V-804 to V-806 for the TCVN cases of the same model). Rows 1 to 3 (Competing software 1 and the EC2 route) use the concrete of the Competing software 1 model, E = 32443 MPa (exported INP); rows 4 and 5 (Competing software 2 and the TCVN input) use B35 with E = 34 500 MPa, as in the calibration of 2026-11-10. Sustained load = SW + SDL + 0.3 LL for Competing software 1 and the EC2 route, SW + Dead + 0.35 Live for the TCVN/Competing software 2 rows (TCVN 2737 sustained fraction 0.35).

METHOD

Rows 1 to 3: Competing software 1 stored results (EC2, `compare.json`) against OpenPT run again with the EC2 route on the exported INP. Rows 4 and 5: Competing software 2 linear static cases SUS_LIN and TOT_LIN (uncracked, `cs2\cs2_summary.json`) against OpenPT's uncracked maximum |uz| on the TCVN input (`B09_tcvn.INP`, sustained live fraction 0.35 and total 1.0 respectively, E = 34 500 MPa). Maximum over the slab nodes; downward positive.

Quantity	Unit	Competing software 1 (EC2)	OpenPT	Difference %	Tolerance	Status
max |uz|, uncracked sustained (SW + SDL + 0.3 LL)	mm	8.14	8.121	-0.23	soft target 5 % (PLAN.md M2, report only)	INFO
max |uz|, cracked sustained (SW + SDL + 0.3 LL)	mm	8.252	8.218	-0.42	none defined	INFO
max |uz|, cracked long-term, (1 + phi) x cracked sustained, phi = 2 (EC2 route)	mm	24.76	24.65	-0.42	10 %, or 1.0 mm when Competing software 1 < 10 mm (PLAN.md M1)	PASS
max |uz|, uncracked sustained (SW + SDL + 0.35 LL, E = 34 500 MPa), Competing software 2 linear case SUS_LIN	mm	7.872	7.797	-0.96	none defined	INFO
max |uz|, uncracked total (SW + SDL + LL, E = 34 500 MPa), Competing software 2 linear case TOT_LIN	mm	9.692	9.597	-0.98	none defined	INFO

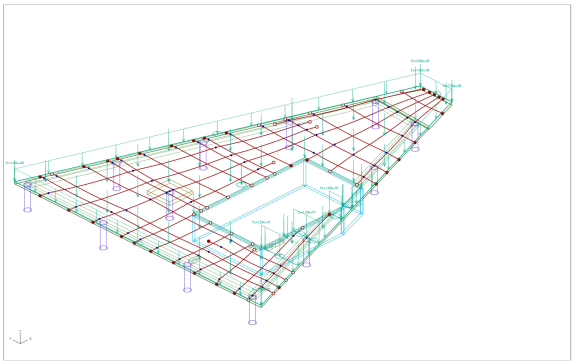
NOTES

Competing software 1 and Competing software 2 results are stored files (rule 2.2); OpenPT was run again with the Release tools of 7d86603 and reproduces the stored 2026-11-10 EC2 numbers. Competing software 1's stored files hold the uncracked sustained, cracked sustained and EC2 long-term values; Competing software 1 has no TCVN route. The Competing software 2 models of the calibration have their own mesh (max 500 mm) and OpenPT its own (cell from the run json), so the uncracked rows compare two different discretisations; differences of a few percent between the reference programs and OpenPT are expected on that account and no tolerance is defined for them (U0 soft target 5 %, report only).

OpenPT build: 7d86603 Release, run 2026-11-18
Command: `OpenPT.Bench.exe run --case B09 --inp bench\work\...\export\*_export.INP --adm ... --run-json ... --out openpt-build\ver-run\C\ch8\B09\run_ec2 (EC2); the same with the TCVN input and the live factor 0.35 (run_sus) and 1.00 (run_tot)`
Sources: `bench\results_calib\B09\compare.json`
`bench\results_calib\B09\cs2\cs2_summary.json`
`bench\results_calib\inputs\B09_tcvn.INP`
`bench\work\B09\export\B09_export.INP`
`openpt-build\ver-run\C\ch8\B09\run_ec2\openpt.jsonl`
`openpt-build\ver-run\C\ch8\B09\run_sus\openpt.jsonl`
`openpt-build\ver-run\C\ch8\B09\run_tot\openpt.jsonl`
`openpt-build\ver-run\C\logs\ch8_B09_ec2.txt`
`openpt-build\ver-run\C\logs\ch8_B09_sus.txt`
`openpt-build\ver-run\C\logs\ch8_B09_tot.txt`

7.3 V-807 Xuan La real floor: sustained and long-term deflection, Competing software 1, Competing software 2 and OpenPT

Perspective: Long-term deflection: sustained and EC2 long-term values, uncracked linear values · **Reference:** Competing software 1 (EC2) and Competing software 2 (linear uncracked) · **Status:** PASS



Structure: XuanLa_F_7-16_2024

MODEL

Model XuanLa (see V-807 to V-809 for the TCVN cases of the same model). Rows 1 to 3 (Competing software 1 and the EC2 route) use the concrete of the Competing software 1 model, E = 32443 MPa (exported INP); rows 4 and 5 (Competing software 2 and the TCVN input) use B35 with E = 34 500 MPa, as in the calibration of 2026-11-10. Sustained load = SW + SDL + 0.3 LL for Competing software 1 and the EC2 route, SW + Dead + 0.35 Live for the TCVN/Competing software 2 rows (TCVN 2737 sustained fraction 0.35).

METHOD

Rows 1 to 3: Competing software 1 stored results (EC2, `compare.json`) against OpenPT run again with the EC2 route on the exported INP. Rows 4 and 5: Competing software 2 linear static cases SUS_LIN and TOT_LIN (uncracked, `cs2\cs2_summary.json`) against OpenPT's uncracked maximum |uz| on the TCVN input (`XuanLa_tcvn.INP`, sustained live fraction 0.35 and total 1.0 respectively, E = 34 500 MPa). Maximum over the slab nodes; downward positive.

Quantity	Unit	Competing software 1 (EC2)	OpenPT	Difference %	Tolerance	Status
max |uz|, uncracked sustained (SW + SDL + 0.3 LL)	mm	10.02	10.01	-0.05	soft target 5 % (PLAN.md M2, report only)	INFO
max |uz|, cracked sustained (SW + SDL + 0.3 LL)	mm	12.85	12.91	+0.43	none defined	INFO
max |uz|, cracked long-term, (1 + phi) x cracked sustained, phi = 2 (EC2 route)	mm	38.56	38.72	+0.43	10 %, or 1.0 mm when Competing software 1 < 10 mm (PLAN.md M1)	PASS
max |uz|, uncracked sustained (SW + SDL + 0.35 LL, E = 34 500 MPa), Competing software 2 linear case SUS_LIN	mm	9.664	9.628	-0.38	none defined	INFO
max |uz|, uncracked total (SW + SDL + LL, E = 34 500 MPa), Competing software 2 linear case TOT_LIN	mm	10.37	10.51	+1.40	none defined	INFO

NOTES

Competing software 1 and Competing software 2 results are stored files (rule 2.2); OpenPT was run again with the Release tools of 7d86603 and reproduces the stored 2026-11-10 EC2 numbers. Competing software 1's stored files hold the uncracked sustained, cracked sustained and EC2 long-term values; Competing software 1 has no TCVN route. The Competing software 2 models of the calibration have their own mesh (max 500 mm) and OpenPT its own (cell from the run json), so the uncracked rows compare two different discretisations; differences of a few percent between the reference programs and OpenPT are expected on that account and no tolerance is defined for them (U0 soft target 5 %, report only).

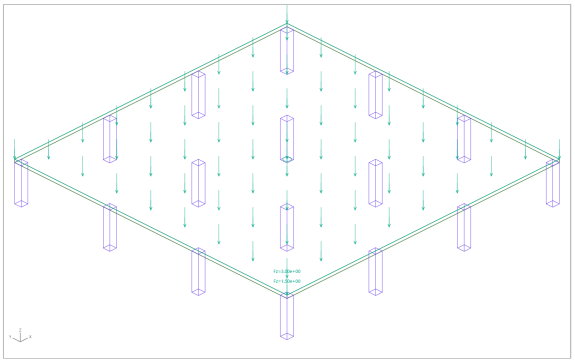
OpenPT build: 7d86603 Release, run 2026-11-18
Command: `OpenPT.Bench.exe run --case XuanLa_F_7-16_2024 --inp bench\work\...\export\*_export.INP --adm ... --run-json ... --out openpt-build\ver-run\C\ch8\XuanLa\run_ec2 (EC2); the same with the TCVN input and the live factor 0.35 (run_sus) and 1.00 (run_tot)`
Sources: `bench\results_calib\XuanLa\compare.json`
`bench\results_calib\XuanLa\cs2\cs2_summary.json`
`bench\results_calib\inputs\XuanLa_tcvn.INP`
`bench\work\real\XuanLaNT\export\XuanLa_F_7-16_2024_export.INP`
`openpt-build\ver-run\C\ch8\XuanLa\run_ec2\openpt.jsonl`
`openpt-build\ver-run\C\ch8\XuanLa\run_sus\openpt.jsonl`
`openpt-build\ver-run\C\ch8\XuanLa\run_tot\openpt.jsonl`
`openpt-build\ver-run\C\logs\ch8_XuanLa_ec2.txt`
`openpt-build\ver-run\C\logs\ch8_XuanLa_sus.txt`
`openpt-build\ver-run\C\logs\ch8_XuanLa_tot.txt`

8 Data exchange: Revit and AutoCAD

OpenPT exports the model to Revit as an IFC2X3 file and the structural plan to AutoCAD as a DXF file. A file is verified when the receiving program opens it without a warning and holds as many objects of each kind as OpenPT wrote. Both programs were run on 2026-11-18 on the files written by the build under test. The reading of `.adm` model files is verified in chapter 6 and the F2K import in chapter 7. The exports that were added after these runs are not covered by a case: the native Revit exchange file (File ▸ Export ▸ Model to Revit (native)..., spec 114), the DXF of all levels and the tendons and rebar in the IFC, DXF and Revit files, the export to F2K, FDB, INP and `.adm` files (specs 135, 137, 195), and the import of FDB files (specs 195, 225).

8.1 V-901 M01: model exported as IFC and opened in Revit 2024

Perspective: Data exchange, Revit · **Reference:** Revit 2024 (build 24.0.4.427) · **Status:** PASS



Structure: M01

MODEL

Three storeys of the flat plate B01 (multi-level benchmark M01): 24 x 24 m plan, 16 columns per storey, storey height 3.3 m.

METHOD

File > Export > Model to Revit writes an IFC2X3 file. Revit opens it (`OpenIFCDocument`) and its elements are counted by category; the counts are compared with the number of objects OpenPT wrote. The reference column is Revit's count, the OpenPT column is the count printed by the export.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
levels (Revit Levels)	–	5	5	+0.00	equal	PASS
slabs (Revit Floors)	–	3	3	+0.00	equal	PASS
columns (Revit Structural Columns)	–	48	48	+0.00	equal	PASS
columns filed by Revit as architectural Columns	–	–	0	–	0	PASS
Revit warnings after opening	–	–	0	–	0	PASS
elements whose solid an independent IFC reader (ifcopenshell) cannot build	–	–	0	–	0	PASS
IfcColumn + IfcSlab + IfcBeam + IfcWall counted by ifcopenshell	–	51	51	+0.00	equal	PASS

NOTES

Columns carry `Pset_ColumnCommon.LoadBearing = TRUE`, which makes Revit file them as Structural Columns. Tendons are not part of the IFC export.

OpenPT build: 7d86603 Release (openpt-build\rel-105\OpenPT.Gui.exe), run 2026-11-18
Command: `OpenPT.Gui.exe --export-ifc M01.INP M01.ifc`
Sources: `openpt-build\ver-run\lead\M01.ifc.out.txt`
`openpt-build\ver-run\lead\revit_counts.txt`
`openpt-build\ver-run\lead\parser_counts.txt`

8.2 V-902 M03: model exported as IFC and opened in Revit 2024

Perspective: Data exchange, Revit · **Reference:** Revit 2024 (build 24.0.4.427) · **Status:** PASS

MODEL

Three storeys of the beam-and-wall floor B04 (multi-level benchmark M03): perimeter beams, one wall, columns.

METHOD

File > Export > Model to Revit writes an IFC2X3 file. Revit opens it (`OpenIFCDocument`) and its elements are counted by category; the counts are compared with the number of objects OpenPT wrote. The reference column is Revit's count, the OpenPT column is the count printed by the export.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
levels (Revit Levels)	–	5	5	+0.00	equal	PASS
slabs (Revit Floors)	–	3	3	+0.00	equal	PASS
columns (Revit Structural Columns)	–	45	45	+0.00	equal	PASS
beams (Revit Structural Framing)	–	36	36	+0.00	equal	PASS
walls (Revit Walls)	–	3	3	+0.00	equal	PASS
columns filed by Revit as architectural Columns	–	–	0	–	0	PASS
Revit warnings after opening	–	–	0	–	0	PASS
elements whose solid an independent IFC reader (ifcopenshell) cannot build	–	–	0	–	0	PASS
IfcColumn + IfcSlab + IfcBeam + IfcWall counted by ifcopenshell	–	87	87	+0.00	equal	PASS

NOTES

Columns carry `Pset_ColumnCommon.LoadBearing = TRUE`, which makes Revit file them as Structural Columns. Tendons are not part of the IFC export.

OpenPT build: 7d86603 Release (openpt-build\rel-105\OpenPT.Gui.exe), run 2026-11-18
Command: `OpenPT.Gui.exe --export-ifc M03.INP M03.ifc`
Sources: `openpt-build\ver-run\lead\M03.ifc.out.txt`
`openpt-build\ver-run\lead\revit_counts.txt`
`openpt-build\ver-run\lead\parser_counts.txt`

8.3 V-903 B10: model exported as IFC and opened in Revit 2024

Perspective: Data exchange, Revit · **Reference:** Revit 2024 (build 24.0.4.427) · **Status:** PASS

MODEL

Large post-tensioned floor B10: 50.4 x 42 m, 6 x 5 bays, central core of walls, columns above and below.

METHOD

File > Export > Model to Revit writes an IFC2X3 file. Revit opens it (`OpenIFCDocument`) and its elements are counted by category; the counts are compared with the number of objects OpenPT wrote. The reference column is Revit's count, the OpenPT column is the count printed by the export.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
levels (Revit Levels)	–	3	3	+0.00	equal	PASS
slabs (Revit Floors)	–	1	1	+0.00	equal	PASS
columns (Revit Structural Columns)	–	84	84	+0.00	equal	PASS
walls (Revit Walls)	–	8	8	+0.00	equal	PASS
columns filed by Revit as architectural Columns	–	–	0	–	0	PASS
Revit warnings after opening	–	–	0	–	0	PASS
elements whose solid an independent IFC reader (ifcopenshell) cannot build	–	–	0	–	0	PASS
IfcColumn + IfcSlab + IfcBeam + IfcWall counted by ifcopenshell	–	93	93	+0.00	equal	PASS

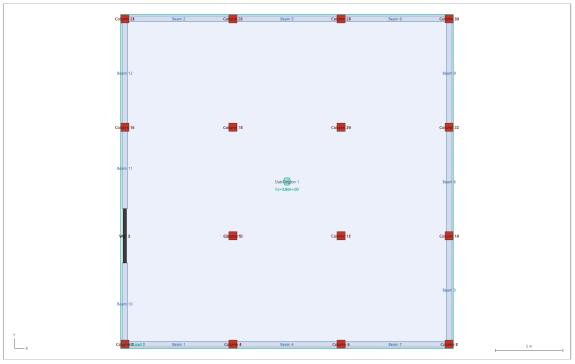
NOTES

Columns carry `Pset_ColumnCommon.LoadBearing = TRUE`, which makes Revit file them as Structural Columns. Tendons are not part of the IFC export.

OpenPT build: 7d86603 Release (openpt-build\rel-105\OpenPT.Gui.exe), run 2026-11-18
Command: `OpenPT.Gui.exe --export-ifc B10.INP B10.ifc`
Sources: `openpt-build\ver-run\lead\B10.ifc.out.txt`
`openpt-build\ver-run\lead\revit_counts.txt`
`openpt-build\ver-run\lead\parser_counts.txt`

8.4 V-904 B04: structural plan exported as DXF and opened in AutoCAD 2024

Perspective: Data exchange, AutoCAD · **Reference:** AutoCAD 2024 (core console) · **Status:** PASS



Structure: B04

MODEL

RC floor B04: 24 x 24 m, perimeter beams 400 x 700, one wall, columns above and below.

METHOD

File > Export > Structural plan to AutoCAD writes a DXF (release 12) of the current level. AutoCAD's core console imports it with DXFIN, counts the entities on each layer, runs AUDIT and saves a DWG. The reference column is AutoCAD's count, the OpenPT column is the count printed by the export.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
slab outlines (layer OPT-SLAB)	–	1	1	+0.00	equal	PASS
columns, below and above (layer OPT-COLUMN + OPT-COLUMN-ABOVE)	–	30	30	+0.00	equal	PASS
walls, below and above (layer OPT-WALL + OPT-WALL-ABOVE)	–	2	2	+0.00	equal	PASS
beams (layer OPT-BEAM)	–	12	12	+0.00	equal	PASS
labels (layer OPT-TEXT)	–	46	46	+0.00	equal	PASS
all entities in the drawing after DXFIN	–	91	91	+0.00	equal	PASS
errors reported by AutoCAD (DXFIN and AUDIT)	–	–	0	–	0	PASS

NOTES

An independent DXF reader (ezdxf) finds the same entities per layer with 0 recovery and 0 audit errors (`parser_counts.txt`).

OpenPT build: 7d86603 Release (openpt-build\rel-105\OpenPT.Gui.exe), run 2026-11-18
Command: `OpenPT.Gui.exe --export-dxf B04.INP B04.dxf`
Sources: `openpt-build\ver-run\lead\B04.dxf.out.txt`
`openpt-build\ver-run\lead\B04.acad.log`
`openpt-build\ver-run\lead\B04.scr`
`openpt-build\ver-run\lead\parser_counts.txt`

8.5 V-905 B05: structural plan exported as DXF and opened in AutoCAD 2024

Perspective: Data exchange, AutoCAD · **Reference:** AutoCAD 2024 (core console) · **Status:** PASS

MODEL

Post-tensioned floor B05 with cantilevers on two sides; 44 tendons.

METHOD

File > Export > Structural plan to AutoCAD writes a DXF (release 12) of the current level. AutoCAD's core console imports it with DXFIN, counts the entities on each layer, runs AUDIT and saves a DWG. The reference column is AutoCAD's count, the OpenPT column is the count printed by the export.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
slab outlines (layer OPT-SLAB)	–	1	1	+0.00	equal	PASS
columns, below and above (layer OPT-COLUMN + OPT-COLUMN-ABOVE)	–	32	32	+0.00	equal	PASS
tendons (layer OPT-TENDON)	–	44	44	+0.00	equal	PASS
labels (layer OPT-TEXT)	–	78	78	+0.00	equal	PASS
all entities in the drawing after DXFIN	–	155	155	+0.00	equal	PASS
errors reported by AutoCAD (DXFIN and AUDIT)	–	–	0	–	0	PASS

NOTES

An independent DXF reader (ezdxf) finds the same entities per layer with 0 recovery and 0 audit errors (`parser_counts.txt`).

OpenPT build: 7d86603 Release (openpt-build\rel-105\OpenPT.Gui.exe), run 2026-11-18
Command: `OpenPT.Gui.exe --export-dxf B05.INP B05.dxf`
Sources: `openpt-build\ver-run\lead\B05.dxf.out.txt`
`openpt-build\ver-run\lead\B05.acad.log`
`openpt-build\ver-run\lead\B05.scr`
`openpt-build\ver-run\lead\parser_counts.txt`

8.6 V-906 B10: structural plan exported as DXF and opened in AutoCAD 2024

Perspective: Data exchange, AutoCAD · **Reference:** AutoCAD 2024 (core console) · **Status:** PASS

MODEL

Large post-tensioned floor B10: 50.4 x 42 m, core walls, 80 tendons.

METHOD

File > Export > Structural plan to AutoCAD writes a DXF (release 12) of the current level. AutoCAD's core console imports it with DXFIN, counts the entities on each layer, runs AUDIT and saves a DWG. The reference column is AutoCAD's count, the OpenPT column is the count printed by the export.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
slab outlines (layer OPT-SLAB)	–	1	1	+0.00	equal	PASS
columns, below and above (layer OPT-COLUMN + OPT-COLUMN-ABOVE)	–	84	84	+0.00	equal	PASS
walls, below and above (layer OPT-WALL + OPT-WALL-ABOVE)	–	8	8	+0.00	equal	PASS
tendons (layer OPT-TENDON)	–	80	80	+0.00	equal	PASS
labels (layer OPT-TEXT)	–	174	174	+0.00	equal	PASS
all entities in the drawing after DXFIN	–	347	347	+0.00	equal	PASS
errors reported by AutoCAD (DXFIN and AUDIT)	–	–	0	–	0	PASS

NOTES

An independent DXF reader (ezdxf) finds the same entities per layer with 0 recovery and 0 audit errors (`parser_counts.txt`).

OpenPT build: 7d86603 Release (openpt-build\rel-105\OpenPT.Gui.exe), run 2026-11-18
Command: `OpenPT.Gui.exe --export-dxf B10.INP B10.dxf`
Sources: `openpt-build\ver-run\lead\B10.dxf.out.txt`
`openpt-build\ver-run\lead\B10.acad.log`
`openpt-build\ver-run\lead\B10.scr`
`openpt-build\ver-run\lead\parser_counts.txt`

9 Post-tensioning formulas against published worked examples

Level A of spec 150: one OpenPT Core routine at a time is run on the inputs of a published post-tensioning example (vendor technical notes, a program verification manual, a program report, a vendor note) and its numbers are compared with the printed ones, quantity by quantity. The sources are Competing software 1 TN T9-04 (losses), the midas EN 1992 loss verification, Aalami's TN461 beam frame (ACI 318-11 and EC2, unbonded and bonded), the report of Competing software 1 BestBuyBeam and the PTI T beam of the verification manual (edition 20) of Competing software 1. The tolerance is 1 % or half of the last printed digit of the reference, whichever is larger. A difference is explained only where the numbers show its cause; the text says so where they do not. ACI 318-11 is run as the design code ACI12 and ACI 318-05 as ACI08. Documents in US units are compared in SI with exact factors; stresses are tension positive in the document sign convention and converted. The reference documents are copyrighted and are not part of the repository: each case file in `bench\ptbeam\cases` gives the document, the page and the table of every number. OpenPT has no EC2 time-dependent loss, no pretensioned loss, no sequential multi-tendon elastic shortening and no required-prestress routine: those items are NOT RUN. Cases of 12 rows show a selection; the result files hold every row.

9.1 V-1103 Competing software 1 TN T9-04 5.3: box girder bridge, friction at the second support

Perspective: Post-tensioning formulas, losses · **Reference:** Technical Note of Competing software 1 T9-04 (2004), 5.3, p.13 · **Status:** PASS

MODEL

Tendon of 150 ft with the document's total angle change 0.329 rad (one kink of that angle at mid length), mu 0.25, K 0.0002 per ft. Fig 5.3-1 is not dimensioned well enough to rebuild the profile.

METHOD

`FrictionSolver.FrictionCurve` on the two-segment polyline; the ratio of the force at x = 150 ft to the jacking force.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
stress ratio Px / Pj at the second support (x = 150 ft, alpha = 0.329 rad)	-	0.89	0.8938	+0.43	1 % or half the printed last digit (0.005 -)	PASS

NOTES

The document prints Px = 0.89 Pj (exact exp(-(0.25 x 0.329 + 0.0002 x 150)) = 0.8938).

OpenPT build: branch spec-150a on main-next c9286a4, no change to src (build of 2026-11-22, tools\OpenPT.Bench ptref, Release)
Command: `dotnet tools\OpenPT.Bench\bin\Release\net8.0\OpenPT.Bench.dll ptref --cases bench\ptbeam\cases --out bench\ptbeam\results\20261122T0820`
Sources: `bench\ptbeam\cases\T904_53.json`
`bench\ptbeam\results\20261122T0820\T904_53.jsonl`

9.2 V-1105 midas EN 1992 verification: anchorage slip and friction of two cables

Perspective: Post-tensioning formulas, losses (EN 1992-1-1 5.10.4, 5.10.5.2) · **Reference:** midas, Prestress Tension Loss Verification as per EN 1992, 3.1.4 A and B, pp.15 to 22 · **Status:** PASS

MODEL

28 m PSC I beam, two post-tensioned cables of 1480.65 mm2 jacked at 1400 MPa at the first end: cable 1 with the printed profile (Fig 3.2), cable 2 straight at 1.6 m below the top; mu 0.3, K 0.0066 per m, 6 mm slip at the first end. Anchorage slip is run with no friction as in the document.

METHOD

`FrictionSolver.FrictionCurve` at the nodes, `FrictionSolver.Solve` (`AnchorSeating.Solve`) for the slip, `Tendon.Length` for the length. The document's element k is the stress at the start of element k (node k - 1). All 28 elements of both cables are compared in the result file; 12 rows are shown. Tolerance: 1 % or half the last printed digit.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
stress after anchorage slip, cable 1 (all 28 elements equal)	MPa	1356	1356	+0.00	1 % or half the printed last digit (0.005 MPa)	PASS
stress after anchorage slip, cable 2 (all 28 elements equal)	MPa	1356	1356	+0.00	1 % or half the printed last digit (0.005 MPa)	PASS
length of cable 1	mm	28010	28010	+0.00	1 % or half the printed last digit (0.005 mm)	PASS
length of cable 2	mm	28000	28000	+0.00	1 % or half the printed last digit (0.5 mm)	PASS
cable 1 friction, element 2 (stress at the start of the element)	MPa	1380	1391	+0.75	1 % or half the printed last digit (0.005 MPa)	PASS
cable 1 friction, element 3 (stress at the start of the element)	MPa	1361	1371	+0.75	1 % or half the printed last digit (0.005 MPa)	PASS
cable 1 friction, element 12 (stress at the start of the element)	MPa	1275	1283	+0.60	1 % or half the printed last digit (0.005 MPa)	PASS
cable 1 friction, element 14 (stress at the start of the element)	MPa	1245	1253	+0.60	1 % or half the printed last digit (0.005 MPa)	PASS
cable 1 friction, element 28 (stress at the start of the element)	MPa	1100	1108	+0.75	1 % or half the printed last digit (0.005 MPa)	PASS
cable 2 friction, element 2	MPa	1391	1391	+0.00	1 % or half the printed last digit (0.005 MPa)	PASS
cable 2 friction, element 14	MPa	1285	1285	+0.00	1 % or half the printed last digit (0.005 MPa)	PASS
cable 2 friction, element 28	MPa	1171	1171	+0.00	1 % or half the printed last digit (0.005 MPa)	PASS

NOTES

All 56 friction rows and both slip rows pass (largest difference 0.75 %, element 2 of cable 1). The differences are the convention at a kink: MIDAS includes the angle change of a node in the stress at that node (its sample calculation, alpha = 0.025 rad at element 2), OpenPT applies it when entering the next segment; the difference at a node is mu x the kink angle (0.3 x 0.025 = 0.75 % at nodes 1 and 2, 0.45 to 0.6 % at nodes 11 to 13 and their mirror). The printed profile of cable 1 is irregular (Z = -1.100 at x = 2 and -1.330 at x = 12) and its polyline is 28009.80 mm, the document says 28009.17 mm (+0.002 %). The document prints 20500 for Ep in the slip sample (20500 x 6 / 28009.17 = 43.91 only with 205000).

OpenPT build: branch spec-150a on main-next c9286a4, no change to src (build of 2026-11-22, tools\OpenPT.Bench ptref, Release)
Command: `dotnet tools\OpenPT.Bench\bin\Release\net8.0\OpenPT.Bench.dll ptref --cases bench\ptbeam\cases --out bench\ptbeam\results\20261122T0820`
Sources: `bench\ptbeam\cases\MIDAS_EN1992_LOSSES.json`
`bench\ptbeam\results\20261122T0820\MIDAS_EN1992_LOSSES.jsonl`

10 Slab sections and punching against published examples

Level A of spec 208: one OpenPT Core routine is run on the section and the actions of a published two-way floor example (design examples of Competing software 2, SOFiSTiK benchmarks, Autodesk Robot, the JRC Eurocode 2 book, StructurePoint spSlab, the verification manual (edition 20) of Competing software 1, VSL) and its numbers are compared with the printed ones, quantity by quantity: the flexural steel of strips for the document's moments, punching shear stress and capacity from the document's force and moments, the stresses and strength of post-tensioned strips, and the cracked section. No result of OpenPT's plate analysis is used (Levels B1 and B2 are chapters 14 and 15). The tolerance is 1 % (2 % for a perimeter where the row says so) or half of the last printed digit, whichever is larger. ACI 318-19 examples run as the code ACI19 (spec 209 C1; the size factor lambda_s of 318-19 is 1.0 for the depths of the examples), EN 1992-1-1 with the CEN values; a number that depends on a National Annex value OpenPT does not have (the German beta 1.10 and v_Rd,max, the Finnish formula) is NOT RUN with OpenPT's own number in the notes. The reference documents are copyrighted and are not part of the repository: each case file in `bench\floor\cases` gives the document, the page and the table of every number. Documents in US units keep the printed value; the SI value is converted with exact factors and compared. Cases of 12 rows show a selection; the result files hold every row. Differences that the numbers explain carry their cause; the strip flexure engine (`cs2FlexureCore`) gives 1.6 to 3.6 % more steel than the ACI rectangular block in every row with a moment (V-1301, V-1310 to V-1313). OpenPT lacks punching beta from the moments, a strip-deflection routine, u_out, and the unbonded tendon stress at ultimate as a returned number.

10.1 V-1301 Competing software 2 ACI 318-19 RC-SL-001 and RC-PN-001: slab strip flexure and punching shear

Perspective: Slab section, flexure and punching (ACI) · **Reference:** Software Verification manual of Competing software 2, ACI 318-19 RC-SL EXAMPLE 001 (pp.2-3) and RC-PN EXAMPLE 001 (pp.2-6) · **Status:** PASS

MODEL

RC-SL: 12 in strip of a 6 in slab, d 5 in, f'c 4000 psi, fy 60 ksi, design moment 55.629 k-in. RC-PN: interior column 12 x 36 in, slab 10 in, d 8.5 in, Vu 190.85 k, gamma_v M 147.662 and 89.507 k-in (gamma_v 0.4955 and 0.3115), biaxial option on.

METHOD

RC-SL: `cs2FlexureCore.Design` (strip engine) and `BeamDesigner.Flexure` (rectangular block). RC-PN: `PunchingCalculator.Run` (ACI layer at d/2). M = gamma_v M / gamma_v as unit test T5 of spec 170. Tolerance (spec 208, Level A): 1 % (2 % for a perimeter where the row says so) or half of the last printed digit.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
As+, strip 12 in wide (hand and Competing software 2) (document: 0.213 in2)	mm2	137.4	137.3	-0.12	1 % or half the printed last digit (0.3226 mm2)	PASS
As+ through the beam engine (rectangular block, the hand method) (document: 0.213 in2)	mm2	137.4	137.2	-0.15	1 % or half the printed last digit (0.3226 mm2)	PASS
As,min = 0.0018 b h (document: 0.1296 in2)	mm2	83.61	83.61	-0.00	1 % or half the printed last digit (0.03226 mm2)	PASS
Critical perimeter b0 at d/2 (document: 130 in)	mm	3302	3302	+0.00	1 % or half the printed last digit (1.27 mm)	PASS
gamma_v2 (block of the document's Mu2)	-	0.4955	0.4955	+0.00	1 % or half the printed last digit (5E-05 -)	PASS
gamma_v3 (block of the document's Mu3)	-	0.3115	0.3115	+0.01	1 % or half the printed last digit (5E-05 -)	PASS
Ixx of the critical section (block of Mu2) (document: 301922 in4)	mm4	125700000000	125700000000	+0.00	1 % or half the printed last digit (2.081E+04 mm4)	PASS
Iyy of the critical section (block of Mu3) (document: 93782.8 in4)	mm4	39040000000	39040000000	+0.00	1 % or half the printed last digit (2.081E+04 mm4)	PASS
Direct shear stress Vu/(b0 d) (document: 0.1727 ksi)	MPa	1.191	1.191	+0.01	1 % or half the printed last digit (0.0003447 MPa)	PASS
Largest shear stress vu (point C) (document: 0.1935 ksi)	MPa	1.334	1.333	-0.06	1 % or half the printed last digit (0.0003447 MPa)	PASS
phi vc, smallest of Table 22.6.5.2 (a), (b), (c) (document: 0.158 ksi)	MPa	1.089	1.09	+0.03	1 % or half the printed last digit (0.003447 MPa)	PASS
D/C ratio	-	1.22	1.224	+0.29	1 % or half the printed last digit (0.005 -)	PASS

NOTES

Result files, all rows: PASS 12, DIFF 0, NOT RUN 0, INFO 0. Strip flexure: the strip engine gives As 140.9 mm2 against the document's 137.4 mm2 (+2.5 %); the same section and moment through the rectangular-block engine give 137.2 mm2 (-0.15 %), so the difference is the strip engine's integrated stress-strain law (layered strain compatibility with the tabulated ACI bar curve), not the input. The same +1.6 to +3.6 % is in the strip-flexure rows of V-1310 to V-1313. Punching: every compared quantity agrees (b0, the two gamma_v, both J_c, the stresses, the capacity and the ratio within 0.3 %). ACI 318-19 Table 22.6.5.2 adds lambda_s, which is 1.0 for d 8.5 in, so the capacity is that of ACI 318-14. The 318-14 versions of both examples are unit tests T1 and T5 of spec 170 and are not repeated.

OpenPT build: branch spec-208a on main-next aca0799, no change to src (build of 2026-11-23, tools\OpenPT.Bench floorref, Release)
Command: `dotnet tools\OpenPT.Bench\bin\Release\net8.0\OpenPT.Bench.dll floorref --cases bench\floor\cases --out bench\floor\results\20261123T2359_209A --only cs2D_ACI19_RC_SL_A,cs2D_ACI19_RC_PN1_A`
Sources: `bench\floor\cases\cs2D_ACI19_RC_SL_A.json`
`bench\floor\results\20261123T2359_209A\cs2D_ACI19_RC_SL_A.jsonl`
`bench\floor\cases\cs2D_ACI19_RC_PN1_A.json`
`bench\floor\results\20261123T2359_209A\cs2D_ACI19_RC_PN1_A.jsonl`

10.2 V-1306 SOFiSTiK DCE-EN31: punching of a flat slab, DIN EN 1992-1-1

Perspective: Punching shear (EC2) · **Reference:** SOFiSTiK Verification Manual, Benchmark No. 31 DCE-EN31 (pp.8-14) · **Status:** PASS

MODEL

Slab 240 mm, C35/45, columns 450 x 450 mm, d 190 mm. Inner column B2: VEd 809 kN, rho_l 0.0166. Edge column A2/B1: VEd 319 kN, rho_l 0.0132, flush with the slab edge. No moments.

METHOD

`PunchingCalculator.Run` (EC2) with the document's forces. German NA values (beta 1.10, v_Rd,max = 1.4 v_Rd,c, the reinforcement design) are NOT RUN with OpenPT's own number in the note. Tolerance (spec 208, Level A): 1 % (2 % for a perimeter where the row says so) or half of the last printed digit.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
Inner column B2: perimeter u0 = 4 x 0.45 m	mm	1800	1800	+0.00	1 % or half the printed last digit (5 mm)	PASS
Inner column B2: control perimeter u1 at 2d	mm	4190	4186	-0.09	1 % or half the printed last digit (5 mm)	PASS
Inner column: v_Rd,c (k 2.0, rho_l 0.0166, f_ck 35)	MPa	0.928	0.9295	+0.17	1 % or half the printed last digit (0.0005 MPa)	PASS
Edge column A2/B1: control perimeter u1 = 3 x 0.45 + pi 2.0 x 0.19	mm	2540	2543	+0.13	1 % or half the printed last digit (5 mm)	PASS
Edge column: v_Ed = 1.4 VEd / (u1 d), VEd 319 kN	MPa	0.925	0.9242	-0.08	1 % or half the printed last digit (0.0005 MPa)	PASS
Edge column: v_Rd,c (k 2.0, rho_l 0.0132)	MPa	0.86	0.8612	+0.14	1 % or half the printed last digit (0.0005 MPa)	PASS

NOTES

Result files, all rows: PASS 6, DIFF 0, NOT RUN 8, INFO 0. Every compared quantity agrees within 0.2 %: u0, u1 (the engine's pi is 3.14), v_Rd,c at both columns and the edge-column stress (beta 1.4 is the same in the CEN text and the DIN NA). NOT RUN (8 rows): v_Ed of the inner column (DIN beta 1.10; OpenPT 1.17 MPa with 1.15), v_Rd,max = 1.4 v_Rd,c (OpenPT's is 0.4 nu f_cd since spec 209 A3; the figure 6.02 MPa of the earlier run was 0.5 nu f_cd), the punching steel (OpenPT 1175 mm2 for the edge column, a layer area), u_out of both columns (no routine), and the wall B2.

OpenPT build: branch spec-208a on main-next aca0799, no change to src (build of 2026-11-23, tools\OpenPT.Bench floorref, Release)
Command: `dotnet tools\OpenPT.Bench\bin\Release\net8.0\OpenPT.Bench.dll floorref --cases bench\floor\cases --out bench\floor\results\20261123T2359_209A --only SOF_EN31_A`
Sources: `bench\floor\cases\SOF_EN31_A.json`
`bench\floor\results\20261123T2359_209A\SOF_EN31_A.jsonl`

10.3 V-1310 StructurePoint flat plate: strip flexure for the document's moments

Perspective: Slab section, flexure (ACI) · **Reference:** StructurePoint, Two-Way Flat Plate Concrete Floor System Analysis and Design (ACI 318-14), spSlab v10.00, Tables 3, 4, 7 and 8 (printed pp.13-29) · **Status:** PASS

MODEL

Flat plate 7 in, d 5.75 in, f'c 4000 psi, fy 60 ksi, strips of 84 in; the moments of the direct design method (Table 3) and of the equivalent frame method (Table 7); the additional steel in b_b = 37 in (Tables 4 and 8).

METHOD

`cs2FlexureCore.Design` (strip engine) per row; the same DDM moments through `BeamDesigner.Flexure` (rows "beam engine"). Tolerance (spec 208, Level A): 1 % (2 % for a perimeter where the row says so) or half of the last printed digit.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
DDM column strip, exterior negative (document: 0.96 in2)	mm2	619.4	619.5	+0.03	1 % or half the printed last digit (3.226 mm2)	PASS
DDM column strip, exterior negative: As,min (document: 1.06 in2)	mm2	683.9	682.8	-0.15	1 % or half the printed last digit (3.226 mm2)	PASS
DDM column strip, interior negative (document: 1.98 in2)	mm2	1277	1275	-0.22	1 % or half the printed last digit (3.226 mm2)	PASS
DDM middle strip, end span positive (document: 0.77 in2)	mm2	496.8	494	-0.56	1 % or half the printed last digit (3.226 mm2)	PASS
EFM column strip, exterior negative (document: 1.28 in2)	mm2	825.8	828.3	+0.30	1 % or half the printed last digit (3.226 mm2)	PASS
EFM column strip, end span positive (document: 1.06 in2)	mm2	683.9	685.9	+0.30	1 % or half the printed last digit (3.226 mm2)	PASS
EFM middle strip, end span positive (document: 0.7 in2)	mm2	451.6	454.3	+0.60	1 % or half the printed last digit (3.226 mm2)	PASS
EFM additional steel at the exterior column (gamma_f Mu) (document: 1.17 in2)	mm2	754.8	754.6	-0.03	1 % or half the printed last digit (3.226 mm2)	PASS
DDM column strip, exterior negative (beam engine) (document: 0.96 in2)	mm2	619.4	619	-0.06	1 % or half the printed last digit (3.226 mm2)	PASS
DDM column strip, interior negative (beam engine) (document: 1.98 in2)	mm2	1277	1274	-0.27	1 % or half the printed last digit (3.226 mm2)	PASS
DDM middle strip, end span positive (beam engine) (document: 0.77 in2)	mm2	496.8	493.6	-0.64	1 % or half the printed last digit (3.226 mm2)	PASS
DDM middle strip, interior span positive (beam engine) (document: 0.51 in2)	mm2	329	330.7	+0.52	1 % or half the printed last digit (3.226 mm2)	PASS

NOTES

Result files, all rows: PASS 50, DIFF 2, NOT RUN 1, INFO 0. The strip engine gives 1.6 to 3.6 % more steel than the hand calculation in every row with a moment (16 of the 17 rows are outside the band, the 17th is inside it only through the rounding of the printed 0.18 in2; the 8 DDM rows through the beam engine are within 0.64 %): the strip engine's integrated stress-strain law, not the input. The minimum steel (0.0018 b h = 1.06 in2) agrees (-0.15 %). Zero-moment rows give zero.

OpenPT build: branch spec-208a on main-next aca0799, no change to src (build of 2026-11-23, tools\OpenPT.Bench floorref, Release)
Command: `dotnet tools\OpenPT.Bench\bin\Release\net8.0\OpenPT.Bench.dll floorref --cases bench\floor\cases --out bench\floor\results\20261123T2359_209A --only SP_FLAT_PLATE_A`
Sources: `bench\floor\cases\SP_FLAT_PLATE_A.json`
`bench\floor\results\20261123T2359_209A\SP_FLAT_PLATE_A.jsonl`

11 Slab analysis against exact solutions, tests and other programs

OpenPT's plate-and-floor analysis (the plate element and its recovery, beams, column springs) against published values (spec 208, Level B1): the plates of the Software Verification manual of Competing software 2 analysis examples 1 to 7 (exact solutions of Navier, Levy and Timoshenko, with Competing software 2's own values as the second reference), the test structures of examples 10, 11, 13 and 14 (moments in an interior design frame against the PCA and University of Illinois tests, the equivalent frame method and Competing software 2), and the flat slab of Dlubal Verification Example 1022 (median of several FE programs). The models are F2K files (version 12) (`bench\\floor\\models`) that the bench `floorfe` reads and meshes with the document's own grid, one element per cell, because the meshes of the documents are explicit (OpenPT's own quad mesher splits a few cells of a graded grid into four; those meshes are not used here). Springs that the F2K text (version 12) cannot hold (the column stiffnesses, the subgrade) are `$ FLOORFE` comment lines and are added in memory. Bands (spec 208 section 3): deflection 3 % against an exact value, moments, shears and reactions 5 % or 2 % of the largest printed value of the same load case and component, tests 15 % (the exterior negative moments are INFO: the documents say the tests are lower there), Dlubal the printed +-10 % (moments) or +-5 % (forces) range of the median. A DIFF is rerun at half the cell and both are in the result files. Examples 8, 9, 12 (the models are not fully given), 15 (temperature loading), 16 (cracked analysis) and 17 (crack width) and the JRC flat slab are NOT RUN, each with its reason; Table 5-5 of example 5 is NOT RUN. Every row, with its page and table, is in `bench\\floor\\results\\%s` (`summary.md` and one `.jsonl` per case); each case below shows at most twelve rows, always including the worst DIFF rows. Findings: deflections of OpenPT converge to the exact values from below with the mesh (12 x 12: 1 to 2 %; 4 x 4: 8 to 15 %); element-centre shears are 10 to 70 % low at the 8 x 8 mesh; frame moments of the test structures agree with Competing software 2 within 7 %; the Dlubal flat slab is inside the median band in 27 of 30 rows.

11.1 V-1402 Plate with clamped edges (Competing software 2 example 2)

Perspective: Plate FE against tabulated exact deflections and Competing software 2 · **Reference:** Software Verification manual of Competing software 2, Analysis Example 2 (vendor of Competing software 2), Table 2-1, pages 3 and 4; the exact value is the document's, Competing software 2 (thin plate) is ref2 · **Status:** PASS

MODEL

The plate and loads of example 1 with all four edges clamped (UZ, RX, RY on every edge node), the same three meshes.

METHOD

The document prints an exact (tabulated) deflection only at the centre for UL and PL; the other points are compared with Competing software 2 only (INFO). 12 x 12 mesh counts.

Quantity	Unit	exact solution (as printed in the document)	Competing software 2 thin plate, 4x4 / 8x8 / 12x12 mesh	OpenPT	Difference % vs exact solution (as printed in the document)	Tolerance	Status
deflection w, load case UL, at (60, 60) in [mesh 12x12]	in	–	0.0089	0.008601	–	none: the document prints no exact value here, compared with Competing software 2 thin plate, 4x4 / 8x8 / 12x12 mesh only	INFO
deflection w, load case UL, at (60, 120) in [mesh 12x12]	in	–	0.015	0.01459	–	none: the document prints no exact value here, compared with Competing software 2 thin plate, 4x4 / 8x8 / 12x12 mesh only	INFO
deflection w, load case UL, at (180, 60) in [mesh 12x12]	in	–	0.021	0.0204	–	none: the document prints no exact value here, compared with Competing software 2 thin plate, 4x4 / 8x8 / 12x12 mesh only	INFO
deflection w, load case UL, at (180, 120) in [mesh 12x12]	in	0.03604	0.0366	0.03553	-1.41	3 %	PASS
deflection w, load case PL, at (60, 60) in [mesh 12x12]	in	–	0.0052	0.005164	–	none: the document prints no exact value here, compared with Competing software 2 thin plate, 4x4 / 8x8 / 12x12 mesh only	INFO
deflection w, load case PL, at (60, 120) in [mesh 12x12]	in	–	0.01	0.01007	–	none: the document prints no exact value here, compared with Competing software 2 thin plate, 4x4 / 8x8 / 12x12 mesh only	INFO
deflection w, load case PL, at (180, 60) in [mesh 12x12]	in	–	0.0272	0.02628	–	none: the document prints no exact value here, compared with Competing software 2 thin plate, 4x4 / 8x8 / 12x12 mesh only	INFO
deflection w, load case PL, at (180, 120) in [mesh 12x12]	in	0.05745	0.0598	0.05648	-1.70	3 %	PASS
deflection w, load case LL, at (60, 60) in [mesh 12x12]	in	–	0.0071	0.006926	–	none: the document prints no exact value here, compared with Competing software 2 thin plate, 4x4 / 8x8 / 12x12 mesh only	INFO
deflection w, load case LL, at (60, 120) in [mesh 12x12]	in	–	0.0158	0.01529	–	none: the document prints no exact value here, compared with Competing software 2 thin plate, 4x4 / 8x8 / 12x12 mesh only	INFO
deflection w, load case LL, at (180, 60) in [mesh 12x12]	in	–	0.0184	0.0178	–	none: the document prints no exact value here, compared with Competing software 2 thin plate, 4x4 / 8x8 / 12x12 mesh only	INFO
deflection w, load case LL, at (180, 120) in [mesh 12x12]	in	–	0.0367	0.03566	–	none: the document prints no exact value here, compared with Competing software 2 thin plate, 4x4 / 8x8 / 12x12 mesh only	INFO

NOTES

Case totals (final rows of the result files): PASS 2, DIFF 0, NOT RUN 0, INFO 10 over 12 rows. Centre deflections -1.4 % (UL) and -1.7 % (PL) against the tabulated values at 12 x 12; Competing software 2's thin plate is +1.6 % and +4.1 %. The INFO rows compare the other points with Competing software 2: at the 8 x 8 mesh OpenPT is 2 to 10 % below Competing software 2 in most points.

OpenPT build: spec-208b branch, OpenPT.Bench floorfe (Release build of the branch, 2026-11-23)
Command: `tools\OpenPT.Bench\bin\Release\net8.0\OpenPT.Bench.exe floorfe --cases bench\floor\cases --out bench\floor\results\20261123T2359_209B1 --models bench\floor\models`
Sources: `bench\floor\cases\cs2A02_B1.json`
`bench\floor\results\20261123T2359_209B1\cs2A02_B1.jsonl`
`bench\floor\models\cs2A02_12x12.F2K`
`bench\floor\models\cs2A02_4x4.F2K`
`bench\floor\models\cs2A02_8x8.F2K`
`bench\floor\results\20261123T2359_209B1\summary.md`

11.2 V-1403 Plate with mixed boundary: two simply supported edges, one clamped, one free (Competing software 2 example 3)

Perspective: Plate FE against the Levy solution and Competing software 2 · **Reference:** Software Verification manual of Competing software 2, Analysis Example 3 (vendor of Competing software 2), Table 3-1, page 3; the exact value is the document's, Competing software 2 (thin plate) is ref2 · **Status:** PASS

MODEL

Plate 360 x 240 x 8 in, E 3000 ksi, nu 0.3, edges x = 0 and x = a simply supported, y = 0 clamped, y = b free, uniform 100 psf; the document's three meshes.

METHOD

Deflections along x = 180 in from the clamped to the free edge; the 12 x 12 mesh counts.

Quantity	Unit	exact solution (as printed in the document)	Competing software 2 thin plate, 4x4 / 8x8 / 12x12 mesh	OpenPT	Difference % vs exact solution (as printed in the document)	Tolerance	Status
deflection w at (180, 0) in [mesh 12x12]	in	0	0	0	– 0 in	3 %	PASS
deflection w at (180, 60) in [mesh 12x12]	in	0.08237	0.0827	0.08135	-1.24	3 %	PASS
deflection w at (180, 120) in [mesh 12x12]	in	0.2364	0.2372	0.2332	-1.35	3 %	PASS
deflection w at (180, 180) in [mesh 12x12]	in	0.3931	0.394	0.3875	-1.42	3 %	PASS
deflection w at (180, 240) in [mesh 12x12]	in	0.5491	0.5502	0.5412	-1.43	3 %	PASS

NOTES

Case totals (final rows of the result files): PASS 5, DIFF 0, NOT RUN 0, INFO 0 over 5 rows. All five points are within 1.4 % of the Levy values on the 12 x 12 mesh (Competing software 2 thin: within 0.5 %).

OpenPT build: spec-208b branch, OpenPT.Bench floorfe (Release build of the branch, 2026-11-23)
Command: `tools\OpenPT.Bench\bin\Release\net8.0\OpenPT.Bench.exe floorfe --cases bench\floor\cases --out bench\floor\results\20261123T2359_209B1 --models bench\floor\models`
Sources: `bench\floor\cases\cs2A03_B1.json`
`bench\floor\results\20261123T2359_209B1\cs2A03_B1.jsonl`
`bench\floor\models\cs2A03_12x12.F2K`
`bench\floor\models\cs2A03_4x4.F2K`
`bench\floor\models\cs2A03_8x8.F2K`
`bench\floor\results\20261123T2359_209B1\summary.md`

11.3 V-1404 Plate on elastic edge beams (Competing software 2 example 4)

Perspective: Plate with beams against Timoshenko and ACI DDM · **Reference:** Software Verification manual of Competing software 2, Analysis Example 4 (vendor of Competing software 2), Tables 4-1 to 4-3, pages 5 to 7; the exact value is the document's, Competing software 2 (thin plate) is ref2 · **Status:** PASS

MODEL

Plate 360 x 240 x 8 in on two simply supported edges and two edge beams of relative stiffness alpha = 4 (Ib = 67 516 in4, no torsion, no shear deformation); uniform 100 psf; three meshes.

METHOD

Deflections along x = 180, beam bending moments and shears at the document's sections (mean of the two beams) on the meshes that print them; ACI 318-95 Direct Design Method values are ref3 in the result files.

Quantity	Unit	exact solution (as printed in the document)	Competing software 2 thin plate, 4x4 / 8x8 / 12x12 mesh	OpenPT	Difference % vs exact solution (as printed in the document)	Tolerance	Status
deflection w at (180, 120) in [mesh 12x12]	in	0.1857	0.1854	0.183	-1.46	3 %	PASS
deflection w at (180, 60) in [mesh 12x12]	in	0.1535	0.153	0.1514	-1.37	3 %	PASS
deflection w at (180, 0) in [mesh 12x12]	in	0.07365	0.073	0.07316	-0.66	3 %	PASS
edge beam bending moment at X = 30 in [mesh 8x8]	kip-in	313.5	313	310.8	-0.85	5 % or 2 % of the largest (1120.152)	PASS
edge beam bending moment at X = 60 in [mesh 12x12]	kip-in	591.7	591.5	592.5	+0.13	5 % or 2 % of the largest (1120.152)	PASS
edge beam bending moment at X = 120 in [mesh 8x8]	kip-in	984.7	984.9	988.7	+0.41	5 % or 2 % of the largest (1120.152)	PASS
edge beam bending moment at X = 180 in [mesh 12x12]	kip-in	1120	1120	1122	+0.14	5 % or 2 % of the largest (1120.152)	PASS
edge beam shear at X = 10 in [mesh 12x12]	kip	10.61	10.58	10.5	-1.02	5 % or 2 % of the largest (10.612)	PASS
edge beam shear at X = 45 in [mesh 8x8]	kip	9.294	9.26	8.968	-3.50	5 % or 2 % of the largest (10.612)	PASS
edge beam shear at X = 90 in [mesh 8x8]	kip	6.585	6.55	6.374	-3.22	5 % or 2 % of the largest (10.612)	PASS
edge beam shear at X = 120 in [mesh 12x12]	kip	4.482	4.48	4.442	-0.90	5 % or 2 % of the largest (10.612)	PASS
edge beam shear at X = 160 in [mesh 12x12]	kip	1.513	1.51	1.501	-0.79	5 % or 2 % of the largest (10.612)	PASS

NOTES

Case totals (final rows of the result files): PASS 18, DIFF 0, NOT RUN 0, INFO 0 over 18 rows. At the finest mesh that prints each value, the deflections are within 1.5 %, the edge-beam moments within 0.9 % and the shears within 3.5 % of the theoretical values; all 18 rows pass. The beam end moment (exact 0) is 0.35 kip-in at the 12 x 12 mesh (7 kip-in at 4 x 4), under 1 % of the largest moment.

OpenPT build: spec-208b branch, OpenPT.Bench floorfe (Release build of the branch, 2026-11-23)
Command: `tools\OpenPT.Bench\bin\Release\net8.0\OpenPT.Bench.exe floorfe --cases bench\floor\cases --out bench\floor\results\20261123T2359_209B1 --models bench\floor\models`
Sources: `bench\floor\cases\cs2A04_B1.json`
`bench\floor\results\20261123T2359_209B1\cs2A04_B1.jsonl`
`bench\floor\models\cs2A04_12x12.F2K`
`bench\floor\models\cs2A04_4x4.F2K`
`bench\floor\models\cs2A04_8x8.F2K`
`bench\floor\results\20261123T2359_209B1\summary.md`

11.4 V-1410 University of Illinois two-way slab test T1 (Competing software 2 example 13)

Perspective: Two-way slab with beams against a test, EFM and Competing software 2 · **Reference:** Software Verification manual of Competing software 2, Analysis Example 13 (vendor of Competing software 2), Table 13-1, page 5; the exact value is the document's, Competing software 2 (thin plate) is ref2 (test T1 and EFM from Corley and Jirsa 1970) · **Status:** PASS

MODEL

Nine 5 ft panels, h 1.5 in, E 3000 ksi, beams 3 in wide on every line (4.25 in overall at the edges, 5 in inside), columns 4 x 4, 4 x 6, 6 x 6 (Kc = 8 E I / lc, lc 15.875 in) with stiff footprints, 150 psf.

METHOD

Frame moment = slab strip integral plus the moment of the beam on the frame line, W l1 = 18.75 kip-ft, interior frame on line 2. Band 15 %, exterior negative moment INFO.

Quantity	Unit	test measurement	Competing software 2	OpenPT	Difference % vs test measurement	Tolerance	Status
-M at A (exterior end of the end span), frame on line 2: M / (W l1)	M / (W l1)	0.043	0.044	0.04517	+5.04	INFO	INFO
+M of the end span, frame on line 2: M / (W l1)	M / (W l1)	0.046	0.049	0.04684	+1.83	15 %	PASS
-M at B (end span side), frame on line 2: M / (W l1)	M / (W l1)	0.079	0.071	0.07605	-3.73	15 %	PASS
-M at B (middle span side), frame on line 2: M / (W l1)	M / (W l1)	0.071	0.061	0.06482	-8.71	15 %	PASS
+M of the middle span, frame on line 2: M / (W l1)	M / (W l1)	0.036	0.041	0.03856	+7.12	15 %	PASS
-M at C (middle span side), frame on line 2: M / (W l1)	M / (W l1)	0.071	0.061	0.06482	-8.71	15 %	PASS

NOTES

Case totals (final rows of the result files): PASS 5, DIFF 0, NOT RUN 0, INFO 1 over 6 rows. All five banded rows pass (within 9 % of the test); OpenPT is within 7.1 % of Competing software 2 in every row. The EFM differs from OpenPT by up to 29 % in the exterior negative moment (EFM 0.035, test 0.043, Competing software 2 0.044, OpenPT 0.045).

OpenPT build: spec-208b branch, OpenPT.Bench floorfe (Release build of the branch, 2026-11-23)
Command: `tools\OpenPT.Bench\bin\Release\net8.0\OpenPT.Bench.exe floorfe --cases bench\floor\cases --out bench\floor\results\20261123T2359_209B1 --models bench\floor\models`
Sources: `bench\floor\cases\cs2A13_B1.json`
`bench\floor\results\20261123T2359_209B1\cs2A13_B1.jsonl`
`bench\floor\models\cs2A13_grid.F2K`
`bench\floor\results\20261123T2359_209B1\summary.md`

12 Floor design end to end against published examples

OpenPT's whole chain on floors of published two-way slab examples (spec 208, Level B2): the document's floor is written as an OpenPT model (slab, drop panels, beams, columns above and below, loads, combinations and tendons), meshed and analysed, designed on support lines with the column-strip and middle-strip widths of the document, and checked for punching; strip moments, required steel, reactions and punching stresses are compared with the documents' hand calculations (EFM, DDM) and with the programs they report (spSlab, Competing software 2, Competing software 1). The documents' own numbers are quoted with their page and table; where a document's hand value uses a convention that a plate analysis does not have (the ACI percentages of the lateral distribution, the equivalent column, the load reduction inside the critical perimeter), the difference is reported with that cause, not removed. Model choices that matter are given in the notes of each case and in `bench\floor\README.md`.

12.1 V-1504 Flat slab punching, 3 x 24 ft spans, ACI 318-14 (Competing software 2 RC-PN-001)

Perspective: Punching, end to end · **Reference:** Software Verification manual of Competing software 2, ACI 318-14 RC-PN Example 001, pages 1 to 6 · **Status:** PASS

MODEL

Flat slab 10 in, three 24 ft spans each way, 6 in overhang, columns 12 x 36 in (long side along y), f'c 4000 psi, DL = self weight + 20 psf, LL 80 psf; column B-2 interior; 12 ft columns above and below, far ends fixed (not printed).

METHOD

Floor model of `bench\floor\models\cs2_ACI14_RCPN001.INP`; combination 1.2 D + 1.6 L; OpenPT's punching check with both moments (rs block), d = 8.5 in as the document.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
effective depth d	mm	215.9	215.9	+0.00	2 % or half the last digit	PASS
perimeter b0 of the critical section	mm	3302	3302	+0.00	2 % or half the last digit	PASS
gamma_v of the larger factor (hand gamma_v2 = 0.4955, bending about axis 2)	-	0.4955	0.4955	+0.00	2 % or half the last digit	PASS
gamma_v of the smaller factor (hand gamma_v3 = 0.3115)	-	0.3115	0.3115	+0.01	2 % or half the last digit	PASS
vertical force VU at grid B-2	kN	842.7	873.8	+3.69	5 %	PASS
maximum shear stress vu at grid B-2 (point C)	MPa	1.331	1.371	+3.00	10 % (V from the model)	PASS
shear capacity vc (phi vc, equation 11-34)	MPa	1.089	1.09	+0.03	1 % or half the last digit	PASS
D/C ratio	-	1.22	1.258	+3.10	10 % (V from the model)	PASS

NOTES

8 PASS, 0 DIFF, 0 NOT RUN, 0 INFO over 8 rows. The document computes from Competing software 2's own V and M; OpenPT's V is within 3.7 % and its stress within 3.0 %.

OpenPT build: spec-208c branch, OpenPT.Bench floordesign (Release build of the branch)
Command: `OpenPT.Bench floordesign`
Sources: `bench\floor\cases\cs2_ACI14_RCPN001_B2.json`
`bench\floor\results\20261123T2359_209B2\cs2_ACI14_RCPN001_B2.jsonl`
`bench\floor\results\20261123T2359_209B2\summary.md`
`bench\floor\models\cs2_ACI14_RCPN001.INP`
`bench\floor\causes_B2.json`

12.2 V-1505 Flat slab punching, 3 x 24 ft spans, ACI 318-19 (Competing software 2 RC-PN-001)

Perspective: Punching, end to end · **Reference:** Software Verification manual of Competing software 2, ACI 318-19 RC-PN Example 001, pages 1 to 6 · **Status:** PASS

MODEL

Same floor as the ACI 318-14 example.

METHOD

As the ACI 318-14 example, with the code ACI19 (spec 209 C1): the size effect factor lambda_s of 318-19 is 1.0 at d = 8.5 in, so the capacity is that of 318-14.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
effective depth d	mm	215.9	215.9	+0.00	2 % or half the last digit	PASS
perimeter b0 of the critical section	mm	3302	3302	+0.00	2 % or half the last digit	PASS
vertical force VU at grid B-2	kN	848.9	873.8	+2.93	5 %	PASS
maximum shear stress vu at grid B-2 (point C)	MPa	1.334	1.371	+2.73	10 % (V from the model)	PASS
shear capacity vc (phi vc, equation (b) of Table 22.6.5.2)	MPa	1.089	1.09	+0.03	1 % or half the last digit	PASS
D/C ratio	-	1.22	1.258	+3.10	10 % (V from the model)	PASS

NOTES

6 PASS, 0 DIFF, 0 NOT RUN, 0 INFO over 6 rows.

OpenPT build: spec-208c branch, OpenPT.Bench floordesign (Release build of the branch)
Command: `OpenPT.Bench floordesign`
Sources: `bench\floor\cases\cs2_ACI19_RCPN001_B2.json`
`bench\floor\results\20261123T2359_209B2\cs2_ACI19_RCPN001_B2.jsonl`
`bench\floor\results\20261123T2359_209B2\summary.md`
`bench\floor\models\cs2_ACI19_RCPN001.INP`
`bench\floor\causes_B2.json`

12.3 V-1506 Flat slab punching at a circular column, ACI 318-19 (Competing software 2 RC-PN-002)

Perspective: Punching, end to end · **Reference:** Software Verification manual of Competing software 2, ACI 318-19 RC-PN Example 002, pages 1 to 6 · **Status:** PASS

MODEL

Same floor with a 24 in circular column at grid B-2.

METHOD

As the ACI 318-14 example, with the code ACI19; OpenPT checks the column as a circle (spec 209 C2): b0 = pi (D + d), J_c and c of the circular critical section.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
effective depth d	mm	215.9	215.9	+0.00	2 % or half the last digit	PASS
perimeter b0 of the critical section (circular column of 24 in)	mm	2593	2593	+0.00	2 % or half the last digit	PASS
vertical force VU at grid B-2 (circular column)	kN	918.7	874.6	-4.80	5 %	PASS
maximum shear stress vu at grid B-2	MPa	1.882	1.825	-3.02	10 % (V from the model)	PASS
shear capacity vc (equation (a) of Table 22.6.5.2)	MPa	1.31	1.308	-0.18	1 % or half the last digit	PASS
D/C ratio	-	1.44	1.396	-3.06	10 % (V from the model)	PASS

NOTES

6 PASS, 0 DIFF, 0 NOT RUN, 0 INFO over 6 rows. OpenPT and the document both take b0 on the circle (pi (24 + 8.5) = 102.1 in). OpenPT's V at B-2 is 4.8 % below Competing software 2's and its stress 3.0 % below. For the moment term OpenPT takes J_c of the circular section, the document J_c of the equal-area square (see V-1302). Before spec 209 C2 OpenPT checked the equal-area square (b0 119 in, vu -19 %).

OpenPT build: spec-208c branch, OpenPT.Bench floordesign (Release build of the branch)
Command: `OpenPT.Bench floordesign`
Sources: `bench\floor\cases\cs2_ACI19_RCPN002_B2.json`
`bench\floor\results\20261123T2359_209B2\cs2_ACI19_RCPN002_B2.jsonl`
`bench\floor\results\20261123T2359_209B2\summary.md`
`bench\floor\models\cs2_ACI19_RCPN002.INP`
`bench\floor\causes_B2.json`

12.4 V-1507 Flat slab punching, 3 x 8 m spans, EN 1992-1-1 (Competing software 2 RC-PN-001)

Perspective: Punching, end to end · **Reference:** Software Verification manual of Competing software 2, EN 2-2004 RC-PN Example 001, pages 1 to 7 · **Status:** PASS

MODEL

Flat slab 250 mm, three 8 m spans each way, 0.15 m overhang, columns 0.3 x 0.9 m, fck 30 N/mm2, DL = self weight + 1 kN/m2, LL 4 kN/m2, 1.35 G + 1.5 Q assumed; column B-2; 3.6 m columns above and below, far ends fixed (not printed).

METHOD

Floor model of `bench\floor\models\cs2_EN_RCPN001.INP`; OpenPT's EC2 punching check with the constant beta of 6.4.3(6) and the document's rho_1 = 0.004955; d = 218 mm as the document. CEN default only: the other National Annex rows are not run.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
effective depth d	mm	218	218	+0.00	2 % or half the last digit	PASS
control perimeter u1 at 2d	mm	5139	5138	-0.03	2 % or half the last digit	PASS
vertical force VEd at grid B-2	kN	1112	1115	+0.23	5 %	PASS
maximum design shear stress vEd, calculated	MPa	1.089	1.144	+5.10	10 % (V from the model)	PASS
maximum design shear stress vEd, Competing software 2	MPa	1.107	1.144	+3.39	10 % (V from the model)	PASS
shear capacity vRd,c, CEN default (calculated)	MPa	0.5777	0.5777	-0.01	1 % or half the last digit	PASS
shear ratio vEd / vRd,c (calculated, CEN default)	-	1.89	1.981	+4.83	10 % (V from the model)	PASS
D/C ratio, Competing software 2 (CEN default)	-	1.82	1.981	+8.86	10 % (V from the model)	PASS

NOTES

8 PASS, 0 DIFF, 0 NOT RUN, 0 INFO over 8 rows. vEd is +5.1 % on the document's hand value (+3.4 % on Competing software 2's): OpenPT uses beta = 1.15 times V/(u d), the document the moments of Competing software 2's model in 6.4.4(2).

OpenPT build: spec-208c branch, OpenPT.Bench floordesign (Release build of the branch)
Command: `OpenPT.Bench floordesign`
Sources: `bench\floor\cases\cs2_EN_RCPN001_B2.json`
`bench\floor\results\20261123T2359_209B2\cs2_EN_RCPN001_B2.jsonl`
`bench\floor\results\20261123T2359_209B2\summary.md`
`bench\floor\models\cs2_EN_RCPN001.INP`
`bench\floor\causes_B2.json`

12.5 V-1508 One-way simple-span slab, strip flexure, ACI 318-14 (Competing software 2 RC-SL-001)

Perspective: Strip design, end to end · **Reference:** Software Verification manual of Competing software 2, ACI 318-14 RC-SL Example 001, pages 1 to 3 (the ACI 318-19 version, `cs2_ACI19_RCSL001_B2`, has the same numbers) · **Status:** PASS

MODEL

6 in slab, 12 ft between two walls, 80 psf dead (unit weight 0) and 100 psf live, f'c 4000 psi, fy 60 ksi, d = 5 in; modelled 6 ft wide on two 50 mm walls with a 12 in design strip.

METHOD

Strip of 12 in at mid width, 1.2 D + 1.6 L, strength design of OpenPT.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
factored moment of the 1 ft strip at midspan	kNm	6.239	5.829	-6.57	10 % or 2 % of the largest of its group (0.125)	PASS
required As of the 12 in strip	mm2	137.4	127	-7.56	15 % or 1 bar (129 mm2)	PASS

NOTES

2 PASS, 0 DIFF, 0 NOT RUN, 0 INFO over 2 rows.

OpenPT build: spec-208c branch, OpenPT.Bench floordesign (Release build of the branch)
Command: `OpenPT.Bench floordesign`
Sources: `bench\floor\cases\cs2_ACI14_RCSL001_B2.json`
`bench\floor\results\20261123T2359_209B2\cs2_ACI14_RCSL001_B2.jsonl`
`bench\floor\results\20261123T2359_209B2\summary.md`
`bench\floor\models\cs2_ACI14_RCSL001.INP`
`bench\floor\causes_B2.json`

12.6 V-1509 One-way simple-span slab, strip flexure, EN 1992-1-1 (Competing software 2 RC-SL-001)

Perspective: Strip design, end to end · **Reference:** Software Verification manual of Competing software 2, EN 2-2004 RC-SL Example 001, pages 1 to 4 · **Status:** PASS

MODEL

150 mm slab, 4 m between two walls, 4 kPa dead (unit weight 0) and 5 kPa live, fck 30, fyk 460, d = 125 mm; 4 x 2 m on two 50 mm walls, 1 m strip.

METHOD

Strip of 1 m at mid width, 1.35 G + 1.5 Q; CEN default.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
factored moment of the 1 m strip at midspan	kNm	25.8	24.99	-3.15	10 % or 2 % of the largest of its group (0.516)	PASS
required As of the 1 m strip, CEN default	mm2	540	547.1	+1.31	15 % or 1 bar (129 mm2)	PASS

NOTES

2 PASS, 0 DIFF, 1 NOT RUN, 0 INFO over 3 rows. The other National Annex values (5.446 and 5.626 cm2) are not run.

OpenPT build: spec-208c branch, OpenPT.Bench floordesign (Release build of the branch)
Command: `OpenPT.Bench floordesign`
Sources: `bench\floor\cases\cs2_EN_RCSL001_B2.json`
`bench\floor\results\20261123T2359_209B2\cs2_EN_RCSL001_B2.jsonl`
`bench\floor\results\20261123T2359_209B2\summary.md`
`bench\floor\models\cs2_EN_RCSL001.INP`
`bench\floor\causes_B2.json`

12.7 V-1510 One-way PT slab strip, moments, mild steel and concrete stresses, ACI 318-14 (Competing software 2 PT-SL-001)

Perspective: PT strip, end to end · **Reference:** Software Verification manual of Competing software 2, ACI 318-14 PT-SL Example 001, pages 1 to 7 (the ACI 318-19 version, `cs2_ACI19_PTSL001_B2`, has the same stresses and 2.251 in2 of steel) · **Status:** PASS

MODEL

10 in x 36 in strip, 32 ft clear span, simply supported, one unbonded tendon of two 0.153 in2 strands (53.70 k, 57.83 k at transfer) with 4 in eccentricity at midspan, self weight 150 pcf, live 100 psf, f'c 4000 psi, fy 60 ksi; modelled 6 ft wide with four one-strand tendons (two in the strip) on two walls.

METHOD

Strip of 36 in at mid width; initial combination D + 1.0769 PT (189.0 / 175.5), total D + L + PT, sustained D + 0.5 L + PT, strength 1.2 D + 1.6 L + HYP; stresses at midspan with the tension positive; the PT moment and the dead moment are read separately.

Quantity	Unit	Reference	OpenPT	Difference %	Tolerance	Status
factored moment of the strip at midspan, 1.2 D + 1.6 L	kNm	161.5	157.8	-2.28	10 % or 2 % of the largest of its group (3.229)	PASS
required area of mild steel at midspan (strength)	mm2	1426	1408	-1.23	15 % or 1 bar (129 mm2)	PASS
moment of the prestressing (PTF x 4 in) at midspan	kNm	-24.27	-23.71	+2.31	10 % or 2 % of the largest of its group (0.485)	PASS
moment of the dead load at midspan	kNm	65.08	63.62	-2.25	10 % or 2 % of the largest of its group (1.302)	PASS
transfer concrete stress (D + PTI), top	MPa	-5.061	-4.982	+1.55	10 % or 0.3 MPa	PASS
transfer concrete stress (D + PTI), bottom	MPa	2.854	2.765	-3.15	10 % or 0.3 MPa	PASS
normal concrete stress (D + L + PTF), top	MPa	-10.47	-10.27	+1.91	10 % or 0.3 MPa	PASS
normal concrete stress (D + L + PTF), bottom	MPa	8.412	8.204	-2.47	10 % or 0.3 MPa	PASS
long-term concrete stress (D + 0.5 L + PTF), top	MPa	-7.819	-7.678	+1.80	10 % or 0.3 MPa	PASS
long-term concrete stress (D + 0.5 L + PTF), bottom	MPa	5.764	5.616	-2.56	10 % or 0.3 MPa	PASS

NOTES

10 PASS, 0 DIFF, 0 NOT RUN, 0 INFO over 10 rows. A slab exactly as wide as the strip (36 in, the document's) gives a section moment 27 % below statics in OpenPT's FE (cause not established); the model is 6 ft wide with the strip at mid width. A single tendon in the wide slab spreads sideways and the strip carries half its force at midspan: four tendons are used.

OpenPT build: spec-208c branch, OpenPT.Bench floordesign (Release build of the branch)
Command: `OpenPT.Bench floordesign`
Sources: `bench\floor\cases\cs2_ACI14_PTSL001_B2.json`
`bench\floor\results\20261123T2359_209B2\cs2_ACI14_PTSL001_B2.jsonl`
`bench\floor\results\20261123T2359_209B2\summary.md`
`bench\floor\models\cs2_ACI14_PTSL001.INP`
`bench\floor\causes_B2.json`