

SIP Shear Wall (in-plane) — Validation Report

Independent verification of the Kouzouki calculation engine against closed-form statics, published design-standard values and worked examples

Engine	Kouzouki — SIP Shear Wall (in-plane)
Basis	In-plane racking: segmented capacity $v = V/\text{Sum}(b_i)$ over full-height piers, perforated $v = V/(\text{Co Sum_Li})$ with the SDPWS opening factor $\text{Co} = r/(3-2r)$, $r = 1/(1+\text{Ao}/(h \text{ Sum_Li}))$. Allowable unit shear is a product ESR (AC04 / ASTM E72) input.
Validation type	Independent validation
Report date	2026-06-18
Result	PASS — 6/6 checks within tolerance

1. Validation cases

Each case feeds the tool a defined input set and compares its output against a value derived independently of the engine (cited per row). Tolerance is 1% unless noted.

SS1. Segmented effective length & unit shear

Inputs: wall_length=16.0, wall_height=9.0, method=Segmented, openings=4x7@6, V=4000.0, dead_load=200.0, v_allow=380.0, spline_capacity=380.0, aspect_limit=3.5, holddown_capacity=4000.0

Checked quantity	Independent value	Tool output	Dev.	Verdict
Effective shear length = 6 + 6 ft Full-height piers	12 ft	12 ft	0.00%	PASS
Unit shear $v = V / \text{Sum } b_i$ SDPWS 4.3.4	333.3 plf	333.3 plf	0.01%	PASS

SS2. Critical pier aspect ratio

Inputs: wall_length=16.0, wall_height=9.0, method=Segmented, openings=4x7@6, V=4000.0, dead_load=200.0, v_allow=380.0, spline_capacity=380.0, aspect_limit=3.5, holddown_capacity=4000.0

Checked quantity	Independent value	Tool output	Dev.	Verdict
Aspect ratio $h/b = 9/6$ Geometry	1.5	1.5	0.00%	PASS

SS3. Perforated opening factor Co

Inputs: wall_length=20.0, wall_height=10.0, method=Perforated, openings=3x7@4, 4x4@12, V=6000.0, dead_load=150.0, v_allow=900.0, spline_capacity=900.0, aspect_limit=3.5, holddown_capacity=0.0

Checked quantity	Independent value	Tool output	Dev.	Verdict
Sheathing area ratio $r = 1/(1+\text{Ao}/(h \text{ Sum_Li}))$ SDPWS 4.3.3.5	0.778	0.778	0.00%	PASS
$\text{Co} = r/(3-2r)$ SDPWS 4.3.3.5	0.539	0.539	0.00%	PASS

SS4. Perforated unit shear demand

Inputs: wall_length=20.0, wall_height=10.0, method=Perforated, openings=3x7@4, 4x4@12, V=6000.0, dead_load=150.0, v_allow=900.0, spline_capacity=900.0, aspect_limit=3.5, holddown_capacity=0.0

Checked quantity	Independent value	Tool output	Dev.	Verdict
$v = V/(\text{Co Sum_Li})$ SDPWS 4.3.3.5	855.6 plf	855.6 plf	0.00%	PASS

2. Assumptions

- OSB facings act as the in-plane shear web; allowable unit shear from the product ESR (full-scale ASTM E72 racking test).
- Openings handled with the SDPWS segmented and perforated methods, as for wood shear walls.
- Overturning about the critical pier toe; 0.6D resisting dead load.

3. Limitations

- Allowable in-plane shear, spline/connection and hold-down values are PRODUCT-SPECIFIC - confirm with the panel ESR / PRS-610.
- SIP aspect-ratio limit is an input (default 3.5) - verify per the ESR.
- Rigid-base, single-story wall; no force-transfer-around-openings detailing check.

4. Sources of the independent values

How the independent values are obtained. Every value in the Independent-value column of Section 1 is computed in a validation harness (validation/cases.py) written and run separately from the calculation engine. Each is an independent re-derivation of the governing closed-form equation, or a value read from a cited published worked example or design-standard table - never copied from the engine's own output. The match therefore confirms the engine reproduces the cited source within tolerance. The source beside each value (Section 1) and the references below identify the governing standard section, equation, or publication.

Basis of the independent values

In-plane racking: segmented capacity $v = V/\text{Sum}(b_i)$ over full-height piers, perforated $v = V/(\text{Co Sum}_L i)$ with the SDPWS opening factor $\text{Co} = r/(3-2r)$, $r = 1/(1+A_o/(h \text{ Sum}_L i))$. Allowable unit shear is a product ESR (AC04 / ASTM E72) input.

Governing standards & published sources

- AWC SDPWS — Special Design Provisions for Wind and Seismic (2015 / 2021), incl. Tables 4.2A/4.3A and Sec. 4.3.3-4.3.6.
- ASTM C273 / C393 / E72 — sandwich core shear, flexural, and panel racking (in-plane shear) test methods.
- ICC-ES AC04 — Acceptance Criteria for Sandwich Panels (product evaluation report allowable values).

Per-check citations (Section 1): Full-height piers; SDPWS 4.3.4; Geometry; SDPWS 4.3.3.5.

5. Conclusion

All 6 independent checks reproduce the reference values within tolerance. The engine correctly implements the governing equations for this tool.

Reproduce: `python scripts/run_tool_validation.py` → `python scripts/make_tool_validation_pdfs.py`. This report is for verification/demonstration; results are for preliminary design and must be confirmed by a licensed engineer against the current adopted code and project-specific conditions.