Reinforced Concrete Shear Wall — Validation Report

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

Engine	Kouzouki — Reinforced Concrete Shear Wall
Basis	Acv = tw (lw - opening); Vn = Acv(alpha_c sqrt(f'c) + rho_t fy) <= 10 sqrt(f'c) Acv (ACI 11.5.4.3 / 18.10.4.1); phi = 0.75.
Validation type	Independent validation
Report date	2026-06-20
Result	**PASS** — 2/2 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.

CW1. Net shear area Acv

Inputs: wall_length=20.0, thickness=10.0, wall_height=12.0, fc=4000.0, fy=60000.0, rho_horizontal=0.0025, rho_vertical=0.0025, Vu=250.0, Pu=200.0, Mu=3000.0, opening_length=4.0

Checked quantity	Independent value	Tool output	Dev.	Verdict
Acv = tw(lw - opening) ACI 11.5.4.3	1,920.0 in^2	1,920.0 in^2	0.00%	**PASS**

CW2. Shear capacity phiVn

Inputs: wall_length=20.0, thickness=10.0, wall_height=12.0, fc=4000.0, fy=60000.0, rho_horizontal=0.0025, rho_vertical=0.0025, Vu=250.0, Pu=200.0, Mu=3000.0, opening_length=4.0

Checked quantity	Independent value	Tool output	Dev.	Verdict
phi Acv(alpha_c sqrt f'c + rho_t fy) ACI 11.5.4.3	489.2 kip	489.0 kip	0.05%	**PASS**

2. Assumptions

- alpha_c = 3.0 for hw/lw <= 1.5 (here 0.6).
- Opening deducted from the shear web length.
- Distributed reinforcement >= 0.0025 each way.

3. Limitations

- Flexural strength is an approximate axial-assisted value.
- Pier/boundary-element design confirmed separately.

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

Acv = tw (lw - opening); Vn = Acv(alpha_c sqrt(f'c) + rho_t fy) <= 10 sqrt(f'c) Acv (ACI 11.5.4.3 / 18.10.4.1); phi = 0.75.

Governing standards & published sources

- ACI 318 — Building Code Requirements for Structural Concrete (318-14 / 318-19), American Concrete Institute (Ch. 7, 8, 13, 20, 22).

Per-check citations (Section 1): ACI 11.5.4.3.

5. Conclusion

All 2 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.