

Continuous (Wall/Strip) Footing — Validation Report

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

Engine	Kouzouki — Continuous (Wall/Strip) Footing
Basis	ACI per 12-in strip: $q_u = w_u/B$, one-way shear at d ($\phi \sqrt{f'c}(12)d$, ACI 318-14), transverse flexure $M_u = q_u l^2/2$. ACI 318-19 adds a size-effect λ_{bs} for $d > 10$ in.
Validation type	Independent validation
Report date	2026-06-18
Result	PASS — 7/7 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.

CF1. 7000 plf, 3 ft wide — factored pressure & depth

Inputs: $w_{dead}=4000.0$, $w_{live}=3000.0$, $wall_thickness=8.0$, $q_{allow}=2500.0$, $footing_width=3.0$, $thickness=12.0$, $fc=3000.0$, $fy=60000.0$, $bar_size=\#5$, $bar_spacing=12.0$, $cover=3.0$

Checked quantity	Independent value	Tool output	Dev.	Verdict
Factored $w_u = 1.2D+1.6L$ ACI 5.3.1	9,600.0 plf	9,600.0 plf	0.00%	PASS
$q_u = w_u/B$ ACI 13.3	3,200.0 psf	3,200.0 psf	0.00%	PASS
$d = h - cover - d_b$ ACI 20.5.1.3	8.375 in	8.375 in	0.00%	PASS

CF2. One-way shear at d (per strip)

Inputs: $w_{dead}=4000.0$, $w_{live}=3000.0$, $wall_thickness=8.0$, $q_{allow}=2500.0$, $footing_width=3.0$, $thickness=12.0$, $fc=3000.0$, $fy=60000.0$, $bar_size=\#5$, $bar_spacing=12.0$, $cover=3.0$

Checked quantity	Independent value	Tool output	Dev.	Verdict
$V_u = q_u (l-d)$ ACI 7.4.3.2	1,500.0 lb	1,500.0 lb	0.00%	PASS
$\phi V_c = 0.75 \cdot 2 \cdot \sqrt{f'c} \cdot 12 \cdot d$ ACI 22.5.5.1	8,256.9 lb	8,256.9 lb	0.00%	PASS

CF3. Transverse flexure

Inputs: $w_{dead}=4000.0$, $w_{live}=3000.0$, $wall_thickness=8.0$, $q_{allow}=2500.0$, $footing_width=3.0$, $thickness=12.0$, $fc=3000.0$, $fy=60000.0$, $bar_size=\#5$, $bar_spacing=12.0$, $cover=3.0$

Checked quantity	Independent value	Tool output	Dev.	Verdict
$M_u = q_u l^2/2$ (per ft) ACI 13.2.7.1	26,133.3 lb-in	26,133.3 lb-in	0.00%	PASS

CF4. Minimum reinforcement

Inputs: $w_{dead}=4000.0$, $w_{live}=3000.0$, $wall_thickness=8.0$, $q_{allow}=2500.0$, $footing_width=3.0$, $thickness=12.0$, $fc=3000.0$, $fy=60000.0$, $bar_size=\#5$, $bar_spacing=12.0$, $cover=3.0$

Checked quantity	Independent value	Tool output	Dev.	Verdict
$A_{s,min} = 0.0018 (12) h$ ACI 7.6.1.1	0.259 in ² /ft	0.259 in ² /ft	0.00%	PASS

2. Assumptions

- Continuous wall footing; one-way action (no punching).
- Designed per 12-in strip of wall length; uniform soil pressure.
- Strength loads for concrete; service loads for soil bearing.

3. Limitations

- Allowable soil bearing is a geotechnical input — confirm with soils report.
- Concentric wall load; no overturning/eccentricity.

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

ACI per 12-in strip: $q_u = w_u/B$, one-way shear at d ($\phi \sqrt{f_c}(12)d$, ACI 318-14), transverse flexure $M_u = q_u l^2/2$. ACI 318-19 adds a size-effect λ_{ds} for $d > 10$ in.

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 5.3.1; ACI 13.3; ACI 20.5.1.3; ACI 7.4.3.2; ACI 22.5.5.1; ACI 13.2.7.1; ACI 7.6.1.1.

5. Conclusion

All 7 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.