Steel Column Base Plate with Moment — Validation Report

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

Engine	Kouzouki — Steel Column Base Plate with Moment
Basis	AISC Design Guide 1: e = Mu/Pu; small eccentricity (e <= e_crit) gives full bearing with Y = N - 2e; e_crit = N/2 - Pu/(2 qmax), qmax = phi fp B, phi fp = 0.65*0.85 f'c sqrt(A2/A1).
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.

BP1. Eccentricity

Inputs: plate_N=20.0, plate_B=20.0, fc=4000.0, plate_Fy=36.0, col_depth=12.0, Pu=150.0, Mu=80.0, a2_a1_ratio=1.0, n_anchor=2, anchor_area=0.79, anchor_Fnt=90.0, anchor_edge=2.0, plate_thickness=1.5

Checked quantity	Independent value	Tool output	Dev.	Verdict
e = Mu/Pu DG1 3.3	6.4 in	6.4 in	0.00%	**PASS**

BP2. Bearing length (small ecc)

Inputs: plate_N=20.0, plate_B=20.0, fc=4000.0, plate_Fy=36.0, col_depth=12.0, Pu=150.0, Mu=80.0, a2_a1_ratio=1.0, n_anchor=2, anchor_area=0.79, anchor_Fnt=90.0, anchor_edge=2.0, plate_thickness=1.5

Checked quantity	Independent value	Tool output	Dev.	Verdict
Y = N - 2e DG1 3.4.1	7.2 in	7.2 in	0.00%	**PASS**

2. Assumptions

- LRFD; concrete bearing per AISC J8.
- e = 6.4 in <= e_crit -> full bearing, no anchor tension.
- Plate thickness from cantilever-strip bending.

3. Limitations

- Large-eccentricity anchor-tension branch validated by the JS parity.
- Anchor breakout/pryout (ACI 17) checked 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

AISC Design Guide 1: e = Mu/Pu; small eccentricity (e <= e_crit) gives full bearing with Y = N - 2e; e_crit = N/2 - Pu/(2 qmax), qmax = phi fp B, phi fp = 0.65*0.85 f'c sqrt(A2/A1).

Governing standards & published sources

- AISC — Steel Construction Manual and ANSI/AISC 360 (bolt/rod tension Sec. J3.6 and shear).

Per-check citations (Section 1): DG1 3.3; DG1 3.4.1.

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.