SIP Header / Lintel — Validation Report

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

Engine	Kouzouki — SIP Header / Lintel
Basis	Simple-span statics M = wL^2/8 + PL/4, V = wL/2 + P/2. Panel self-header box beam: I = t_f h_b^3/6, facing stress sigma_f = 36 M/(t_f h_b^2), web shear 0.75 V/(t_f h_b). If the panel is inadequate an inserted header is sized for bending (S = M/F_b), shear and deflection.
Validation type	Independent validation
Report date	2026-06-18
Result	**PASS** — 8/8 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.

SH1. Self-header loads & facing stress

Inputs: opening_width=4.0, panel_thickness=6.5, skin_thickness=0.4375, header_depth=30.0, trib_width=6.0, w_dead=15.0, w_live=0.0, w_snow=40.0, point_dead=0.0, point_live=0.0, E_skin=1300000.0, Fb_skin=1400.0, Fv_skin=230.0, deflection_limit=240, bearing_length=3.0, Fc_perp=425.0, header_Fb=2600.0, header_E=1900000.0, header_Fv=285.0, header_width=3.5

Checked quantity	Independent value	Tool output	Dev.	Verdict
Max moment M = w L^2/8 Statics	660.0 lb-ft	660.0 lb-ft	0.00%	**PASS**
Facing stress sigma_f = 36 M/(t_f h_b^2) Box-beam (facings as webs)	60.343 psi	60.343 psi	0.00%	**PASS**

SH2. Self-header web shear

Inputs: opening_width=4.0, panel_thickness=6.5, skin_thickness=0.4375, header_depth=30.0, trib_width=6.0, w_dead=15.0, w_live=0.0, w_snow=40.0, point_dead=0.0, point_live=0.0, E_skin=1300000.0, Fb_skin=1400.0, Fv_skin=230.0, deflection_limit=240, bearing_length=3.0, Fc_perp=425.0, header_Fb=2600.0, header_E=1900000.0, header_Fv=285.0, header_width=3.5

Checked quantity	Independent value	Tool output	Dev.	Verdict
Max shear V = w L/2 Statics	660.0 lb	660.0 lb	0.00%	**PASS**
Facing web shear tau = 0.75 V/(t_f h_b) Parabolic web shear	37.714 psi	37.714 psi	0.00%	**PASS**

SH3. Inserted-header demand (wide opening)

Inputs: opening_width=10.0, panel_thickness=6.5, skin_thickness=0.4375, header_depth=12.0, trib_width=12.0, w_dead=15.0, w_live=0.0, w_snow=50.0, point_dead=0.0, point_live=1000.0, E_skin=1300000.0, Fb_skin=1400.0, Fv_skin=230.0, deflection_limit=240, bearing_length=3.0, Fc_perp=425.0, header_Fb=2600.0, header_E=1900000.0, header_Fv=285.0, header_width=3.5

Checked quantity	Independent value	Tool output	Dev.	Verdict
Max moment M = wL^2/8 + PL/4 Statics	12,250.0 lb-ft	12,250.0 lb-ft	0.00%	**PASS**
Max shear V = wL/2 + P/2 Statics	4,400.0 lb	4,400.0 lb	0.00%	**PASS**

SH4. Inserted-header required size

Inputs: opening_width=10.0, panel_thickness=6.5, skin_thickness=0.4375, header_depth=12.0, trib_width=12.0, w_dead=15.0, w_live=0.0, w_snow=50.0, point_dead=0.0, point_live=1000.0, E_skin=1300000.0, Fb_skin=1400.0, Fv_skin=230.0, deflection_limit=240, bearing_length=3.0, Fc_perp=425.0, header_Fb=2600.0, header_E=1900000.0, header_Fv=285.0, header_width=3.5

Checked quantity	Independent value	Tool output	Dev.	Verdict
Required S = M/F_b ASD bending	56.538 in^3	56.538 in^3	0.00%	**PASS**

Required depth d_req = max(d_b,d_v,d_d) Governs	9.845 in	9.845 in	0.00%	**PASS**

2. Assumptions

- Tributary gravity load delivered uniformly to the header over the opening; simple-span.
- Box beam = two OSB facings as webs of depth h_b; core/spline ignored (conservative).
- Inserted header is a solid rectangular section of the input width.

3. Limitations

- Facing E and allowable bending/shear are PRODUCT-SPECIFIC (ESR / AC04).
- End splines and edge lumber that add capacity are neglected.
- Inserted-header sizing reports a required depth and a nominal pick; confirm the actual member's NDS-adjusted capacity.

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

Simple-span statics M = wL^2/8 + PL/4, V = wL/2 + P/2. Panel self-header box beam: I = t_f h_b^3/6, facing stress sigma_f = 36 M/(t_f h_b^2), web shear 0.75 V/(t_f h_b). If the panel is inadequate an inserted header is sized for bending (S = M/F_b), shear and deflection.

Governing standards & published sources

- Classical statics & Euler-Bernoulli beam theory (equilibrium, M=wL^2/8, V=wL/2, deflection=5wL^4/384EI) — independently re-derived in the validation harness.

Per-check citations (Section 1): Statics; Box-beam (facings as webs); Parabolic web shear; ASD bending; Governs.

5. Conclusion

All 8 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.