Cold-Formed Steel Purlin Design Calculation

1. Project Information

Project Name: Test Project

Owner: Test Owner

Engineer: Test Eng

2. Design Parameters

Geometry	Loads	Materials
Spacing: 1.0 m	DL: 10 kg/m2	Fy: 2400 ksc
Span: 4.0 m	LL: 30 kg/m2	E: 2000000 ksc
Slope: 5.0 deg	WL: 50 kg/m2	

3. Section Properties

Selected Section: C-100x50x20x3.2

Weight: 5.5 kg/m | Ix: 78.6 cm4 | Zx: 15.7 cm3

4. Detailed Calculations

Dead Load (DL)

Formula: $w_{DL} = (DL_{surf} \times S) + W_{self}$

Subst: $w_{DL} = (10 \times 1.0) + 5.5$

Result: 15.50 kg/m

Live Load (LL)

Formula: $w_{LL} = LL_{surf} \times S$

Subst: $w_{LL} = 30 \times 1.0$

Result: 30.00 kg/m

Wind Load (Perpendicular)

Formula: $w_{WL} = (WL_{surf} \times S) \times \cos(\theta)$

Subst: $w_{WL} = (50 \times 1.0) \times 0.9962$

Result: 49.81 kg/m

Load Combination 1 (Gravity)

Formula: $w_{u1} = 1.4D + 1.7L$

Subst: $w_{u1} = 1.4(15.50) + 1.7(30.00)$

Result: 72.70 kg/m

Load Combination 2 (Combined)

Formula: $w_{u2} = 0.75(1.4D + 1.7L) + 1.6W$

Subst: $w_{u2} = 0.75(1.4 \times 15.50 + 1.7 \times 30.00) + 1.6(49.81)$

Result: 134.22 kg/m

Design Moment (Mu)

Formula: $M_u = \frac{w_u L^2}{8}$

Subst: $M_u = \frac{134.22 \times 4.0^2}{8}$

Result: 268.44 kg-m

Design Shear (Vu)

Formula: $V_u = \frac{w_u L}{2}$

Subst: $V_u = \frac{134.22 \times 4.0}{2}$

Result: 268.44 kg

Moment Capacity (Phi Mn)

Formula: $\phi M_n = 0.90(Z_x F_y)$

Subst: $\phi M_n = 0.90(15.7 \times 2400)/100$

Result: 339.12 kg-m [PASS]

Shear Capacity (Phi Vn)

Formula: $\phi V_n = 0.6 F_y A_w$

Subst: $\phi V_n = 0.6 \times 2400 \times 3.20$

Result: 4608.00 kg [PASS]

Deflection (Delta)

Formula: $\Delta = \frac{5 w_{ser} L^4}{384 E I_x}$

Subst: $\Delta = \frac{5 \times 0.46 \times 400^4}{384 \times 2000000 \times 78.6}$

Result: 0.96 cm (Limit: 1.11 cm) [PASS]

---

5. Summary of Results

Check	Demand	Capacity	Ratio	Result
Moment	268.44	339.12	0.79	**PASS**
Shear	268.44	4608.00	0.06	**PASS**
Deflection	0.96	1.11	0.87	**PASS**

Design Conclusion: PASSED (Max Ratio: 0.87)