

Cold-Formed Steel Purlin Design Calculation

1. Project Information

Project Name: Warehouse A
Owner: Safe Structures Co.
Engineer: Sarayut

2. Design Parameters

Geometry	Loads	Materials
Spacing: 1.0 m	DL: 10.0 kg/m2	Fy: 2498.265 ksc
Span: 4.0 m	LL: 30.0 kg/m2	E: 2080187.9999999998 ksc
Slope: 5.0 deg	WL: 50.0 kg/m2	

3. Section Properties

Selected Section: C-150x75x20x3.2
Weight: 8.01 kg/m | Ix: 366.0 cm4 | Zx: 48.9 cm3

4. Detailed Calculations

Dead Load (DL)

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

Subst: $w_{DL} = (10.0 \times 1.0) + 8.01$

Result: 18.01 kg/m

Live Load (LL)

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

Subst: $w_{LL} = 30.0 \times 1.0$

Result: 30.00 kg/m

Wind Load (Perpendicular)

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

Subst: $w_{WL} = (50.0 \times 1.0) \times 0.9962$

Result: 49.81 kg/m

Load Combination 1 (Gravity)

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

Subst: $w_{u1} = 1.4(18.01) + 1.7(30.00)$

Result: 76.21 kg/m

Load Combination 2 (Combined)

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

Subst: $w_{u2} = 0.75(1.4 \times 18.01 + 1.7 \times 30.00) + 1.6(49.81)$

Result: 136.86 kg/m

Design Moment (Mu)

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

Subst: $M_u = \frac{136.86 \times 4.0^2}{8}$

Result: 273.71 kg-m

Design Shear (Vu)

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

Subst: $V_u = \frac{136.86 \times 4.0}{2}$

Result: 273.71 kg

Moment Capacity (Phi Mn)

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

Subst: $\phi M_n = 0.90(48.9 \times 2498.265)/100$

Result: 1099.49 kg-m [PASS]

Shear Capacity (Phi Vn)

Formula: $\phi V_n = 0.6 F_y A_w$

Subst: $\phi V_n = 0.6 \times 2498.265 \times 4.80$

Result: 7195.00 kg [PASS]

Deflection (Delta)

Formula: $\Delta = \frac{5W_{ser}L^4}{384EI_x}$

Subst: $\Delta = \frac{5 \times 0.48 \times 400^4}{384 \times 2080187.9999999998 \times 366.0}$

Result: 0.21 cm (Limit: 1.11 cm) [PASS]

5. Summary of Results

Check	Demand	Capacity	Ratio	Result
Moment	273.71	1099.49	0.25	PASS
Shear	273.71	7195.00	0.04	PASS
Deflection	0.21	1.11	0.19	PASS

Design Conclusion: PASSED (Max Ratio: 0.25)