Technical Roof Example

Technical Information

General **-** Presented in the load tables are maximum uniformly distributed specified loads.

Steel **-** Conforms to ASTM A653/A653M or A792/A792M. Grade 33/230; Yield stress 33 ksi/230 MPa and tensile stress 45 ksi/310 MPa. Grade 50 /345; Yield stress 50 ksi/345 MPa and tensile stress 65 ksi/450 MPa.

Finishes **-** A25/ZF75, G90/Z275 or AZ50/AZM150. For heavier metallic coatings, refer to ASTM A653/A653M or A792/A792M.

Load Tables **-** Significant changes have been made in the 2005 Edition of the National Building Code of Canada (NBCC) and are now contained in the 2010 Edition regarding the determination of the specified wind and snow loads. Importance factors have been introduced that are applied to both strength (ULS) and serviceability/deflection (SLS) limit state design considerations. A lower load factor for wind of 1.4, instead of 1.5 used for live and snow loads, has also been introduced. This lower load factor for wind somewhat offsets the higher wind loads (1 in 50 year return) that are now listed in the NBCC by geographic location. The importance category of the end use of the building/structure must also be recognized, such as Normal or Low.
All of these changes impact how the load tables are to be used. In an effort to help the design professional with the load tables, the information below was taken directly from Division B, Part 4 (Structural Design) of the NBCC.

Specified Wind Load

$$W = I_w \boxed{qC_eC_gC_p} \qquad [1]$$

Importance Category	Importance Factor, I_w	
	ULS	SLS
Low	***0.8***	***0.75***
Normal	***1.0***	***0.75***
High	1.15	0.75
Post-Disaster	1.25	0.75

Specified Snow Load

$$S = I_s \boxed{[S_s\,(C_b\,C_w\,C_s\,C_a) + S_r]} \qquad [2]$$

Importance Category	Importance Factor, I_s	
	ULS	SLS
Low	***0.8***	***0.9***
Normal	***1.0***	***0.9***
High	1.15	0.9
Post-Disaster	1.25	0.9

The importance factors, I_w and I_s, have been incorporated in the load tables, as well as the importance category. The parameters in the boxed-in portion of Equations [1] and [2] must be determined by the design professional in accordance with the NBCC.

Strength **-** The maximum uniformly distributed specified load based on strength in the load table must be equal to or greater than ***(Specified live load + 0.833 times the specified dead load).*** Where 0.833 = 1.25/1.5. The specified live load can be either due to use and occupancy or snow load. In cases where live load and snow load act together, the load combination factors in the NBCC must be followed.

Serviceability (Deflection) **-** The maximum uniformly distributed specified load based on deflection in the load table must be equal to or greater than the specified live load. The effective moment of inertia for deflection determination was calculated at an assumed specified live load stress of $\boldsymbol{0.6F_y}$.

EXAMPLE (Use of Load Table)

WF 636R Roof **(Normal Importance Category)**

Given: (Imperial units)

(LLF = 1.5 and I_s = 0.9)
~ Deck thickness, t = 0.024 in.
~ Double span continuous, L = 6.0 ft each span
~ Bearing length, N = 3 in.
~ L/240 deflection limit
~ Specified loads
1) Dead load (DL)
   a) Deck 1.3 psf
   b) Superimposed 9.3 psf; DL = 10.6 psf
2) Snow Live load (LL) LL = 40 psf
   The live load is the value of the boxed-in portion of the specified snow load expression [2].

Solution:

Strength "S"
1) Specified load [LL +0.833DL] = 48.8 psf
2) Maximum specified load (from Load Table)
   Is ***51 psf***
   Since ***51 > 48.8*** ∴OK
3) Check web crippling (N = 3 in.)
   a) End reaction = 0.375(48.8)6 = ***110 lb/ft***
      (from section property table)
      $P_e = P_{e1} + P_{e2}\,[N/t]^{1/2}$
      $= 110 + 27.5[3/0.024]^{1/2}$ = ***417 lb/ft***
      Since ***417 > 110*** ∴OK
   b) Interior reaction = 1.25(48.8)6 = ***366 lb/ft***
      (from section property table)
      $P_i = P_{i1} + P_{i2}\,[N/t]^{1/2}$
      $= 199 + 33.8[3/0.024]^{1/2}$ = ***577 lb/ft***
      Since ***577 > 366*** ∴OK

Deflection "D"
From table L/180 = ***154 psf***
For L/240, multiply 154 by 180/240 = ***116 psf***
Since ***116 > 40*** ∴OK