

## Hand Calculation

### Problem Statement 1:

Determine the final reduced roof live load per ASCE 7-22

Interior roof beam tributary area  $A_T := 570 \text{ ft}^2$   
Roof pitch is 5:12, therefore,  $F := 5$   
Unreduced roof live load  $L_0 := 20 \cdot \text{psf}$

### Solution:

#### Step 1: Calculate area-based reduction, $R_1$

For tributary area larger than 200 ft<sup>2</sup> but small than 600 ft<sup>2</sup>

$$R_1 := 1.2 - 0.001 \cdot A_T = 0.63$$

#### Step 2: Calculate slope factor, $R_2$

For roof pitch larger than 4 but small than 12

$$R_2 := 1.2 - 0.05 \cdot F = 0.95$$

#### Step 3: Calculate the reduced roof live load, $L_r$

$$L_{r\_cal} := L_0 \cdot R_1 \cdot R_2 = 11.97 \text{ psf} \quad \text{ASCE 7-22 Eq 4.8-1} \quad L_{r\_min} := 12 \text{ psf}$$

$L_{r\_cal} < L_{r\_min}$ , hence, ASCE 7-22 required minimum controls

$$L_r := L_{r\_min} = 12 \text{ psf}$$

## Hand Calculation

### Problem Statement 2:

Determine the final reduced floor live load on column per ASCE 7-22

Interior column tributary area

$$A_T := 570 \text{ ft}^2$$

Live load element factor

$$K_{LL} := 4 \quad \text{per ASCE 7-22 - Table 4.7-1}$$

Unreduced live load

$$L_0 := 80 \cdot \text{psf}$$

This column supports only (1) floor

### Solution:

$$L_{cal} := L_0 \cdot \left( 0.25 + \frac{15}{\sqrt{K_{LL} \cdot A_T}} \right) = 45.131 \text{ psf}$$

Note: ASCE 7-22 has a lower bound reduced live load. For members supporting only (1) floor, the reduced live load shall not be less than

$$L_{min} := 0.5 \cdot L_0 = 40 \text{ psf}$$

Since  $L_{cal} > L_{min}$ , hence,

$$L := L_{cal} = 45.131 \text{ psf}$$

*See the following ENERCALC printed calculation report for comparison*



Project Title: ASCE 7-22 Live Load Reduction  
Engineer: ENERCALC Engr. Div.  
Project ID: ENERCALC  
Project Descr: Verification Example

Project File: LL Reduction.ec6

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**Live Load Reduction ASCE 7-22, Sect 4.7 & 4.8**

**DESCRIPTION:** Live Load Reduction

Load Description	Load Type	Lo	A <sub>T</sub> : Trib Area	K <sub>LL</sub>	Roof Pitch	R1	R2	Reduced L -or- Lr
Interior Roof Beam (Typ)	Roof Live	20.0 psf	570.0 sq ft		5:12	0.630	0.950	12.0 psf
Interior Column (Typ)	Floor Live	80.0 psf	570.0 sq ft	4		0.5641		45.131 psf