

Residential House
Bill Stavis

OAK LANE

Given: Two wide flange beams have been replaced
with Triple 2x12 #2 Southern Pine wood beams.

- ① W8x24 - 17.5 ft long
- ② W8x24 - 13.5 ft long.
- ③ The 2nd floor, floor joist changed direction, normal to the indicated direction. Length of floor joist span was 19' now 17.5'

Assume: Dead Loads
#2 Southern Pine Modulus of Elasticity =

Roof pitch = 8/12

Roofing materials = 2.8 psf

#2 Southern pine = 37.3 PCF

2x4 Wood Stud, gypsum board 2 sides = 8 psf

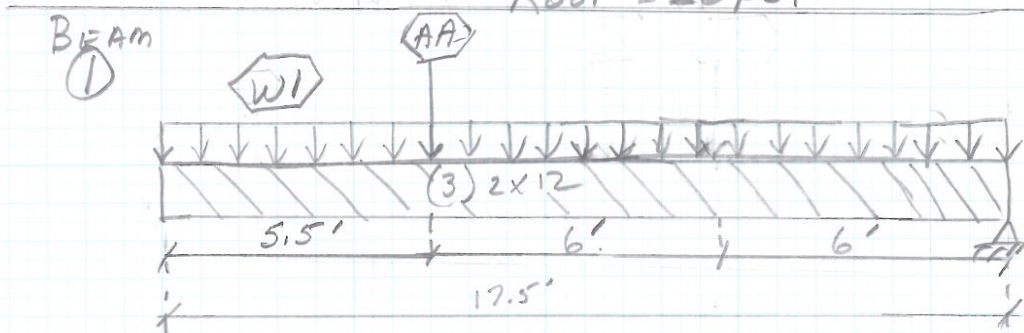
Decking = 1/2" = 1.7 psf; 3/4" = 2.5 psf

Allowed Deflection = $L/360$

Live Loads

Rooms = 40 psf

Roof = 20 psf



W1 = distributed load weight of vertical wall panel above
& 2nd floor bedroom ceiling & insulation

AA = point load from vertical support to Roof
& point load from floor joist (3) 1 3/4" x 9 1/4" G.L.

Continued:

$$\begin{aligned} \text{WI}_{\text{DEAD}} &= [8' \times 8 \text{ psf}] + [15' \times (2.9 + 2.2 + 2.4 + 2.1) \text{ psf}] \\ &= 64 + 144 \text{ \#/LF} = \boxed{208 \text{ \#/LF Dead Load}} \end{aligned}$$

$$\text{WI}_{\text{LIVE}} = 15' \times 40 \text{ psf} = \boxed{600 \text{ \#/LF Live Load}}$$

$$\begin{aligned} \text{AA}_{\text{DEAD}} &= [(19' \times 26') (1.7 + 2.8 + 1.1) \text{ psf}] \\ &\quad + [(6' + 3') (8') (3.3 + 2.5) \text{ psf}] + [8' \times 8' \times 8 \text{ psf}] \\ &= [494.5 \text{ sf} (5.6 \text{ psf})] + [(72 \text{ sf}) (5.8 \text{ psf})] + [512 \text{ \#}] \\ &= 2766.4 \text{ \#} + 929.6 \text{ \#} = \boxed{3696 \text{ \# DEAD LOAD}} \end{aligned}$$

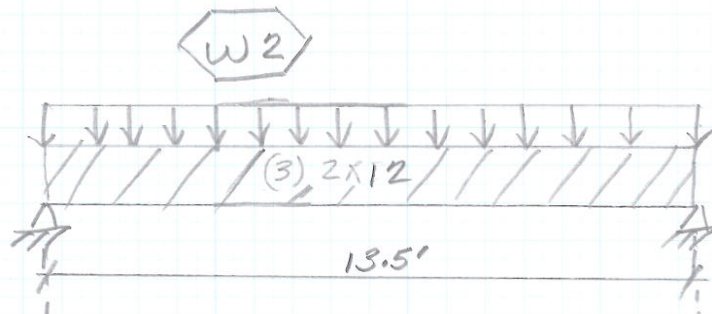
$$\begin{aligned} \text{AA}_{\text{LIVE}} &= [(19' \times 26') (20 \text{ psf})] + [(9' \times 8') (40 \text{ psf})] \\ &= 9880 \text{ \#} + 2880 \text{ \#} = \boxed{12,760 \text{ \# Live Load}} \end{aligned}$$

(ROOF LIVE) (Floor Live)

$$\begin{aligned} \text{AA}_{\text{WIND}} &= [\sin 33.7^\circ (40 \text{ psf}) (19' \times 26')] \\ &= (22.2 \text{ psf}) (494 \text{ sf}) = \boxed{10,967 \text{ \# Wind Load}} \end{aligned}$$

BEAM

(2)



W2 = distributed load from bedroom

$$\text{W2}_{\text{DEAD}} = [8.75' \times (3.3 + 2.5 + 4.0) \text{ psf}] + [8' \times 8 \text{ psf}] = \boxed{149.75 \text{ \#/LF DEAD LOAD}}$$

$$\text{W2}_{\text{LIVE}} = 8.75' \times 40 \text{ psf} = \boxed{350 \text{ \#/LF LIVE LOAD}}$$

Continued:

ASD Load Cases: $D+L$; $D+L_r$; $.6D+W$; $D+W$

$$\text{BEAM 1} \quad D+L = \left[(208 \#/\text{LF} \times 17.5') + 3696 \# \right] + \left[600 \#/\text{LF} \times 17.5' \right] \\ = 3640 \# + 3696 \# + 10,500 \# + 2880 \# = 20,716 \# \text{ or } 20.7 \text{ k}$$

$$D+L_r = \left[3640 \# + 3696 \# \right] + 9880 \# \\ = 17,216 \# \text{ or } 17.2 \text{ k}$$

$$.6D+W = \left[(.6)(3640 + 3696) \right] + 10,967 \# \\ = 15,369 \# \text{ or } 15.4 \text{ k}$$

$$D+W = \left[3640 \# + 3696 \# \right] + 10,967 \# \\ = 18,303 \# \text{ or } 18.3 \text{ k}$$

$$\boxed{\text{BEAM 1} \quad D+L = 20.7 \text{ k}}$$

$$\text{BEAM 2} \quad D+L = \left[149.7 \#/\text{LF} \times 13.5' \right] + \left[350 \#/\text{LF} \times 13.5' \right] \\ = 6747 \# \text{ or } 6.7 \text{ k}$$

$$D+L_r = \text{NO ROOF LOAD}$$

$$.6D+W = \text{NO WIND LOAD}$$

$$D+W = \text{NO WIND LOAD}$$

$$\boxed{\text{BEAM 2} \quad D+L = 6.7 \text{ k}}$$

$$\text{BEAM 1} \quad \Delta_{\text{LIVE}} = L/360 = \frac{17.5 \times 12''/\text{ft}}{360} = 0.58''$$

$$\Delta_{\text{TOTAL}} = L/200 = \frac{17.5 \times 12''/\text{ft}}{200} = 1.05''$$

$$I_w = \frac{5 W/\text{LF} L^4 1728}{384 E \Delta_{\text{TOTAL}}} \\ = \frac{5 \left(\frac{208 \text{ k}}{3} \right) (17.5')^4 1728}{(384 \times 1,600 \times 1.05)}$$

$$I_w = \boxed{338 \text{ in}^4}$$

$$I_{AA} = \frac{0.036 P_2 L^3 1728}{E \Delta_{\text{TOTAL}}}$$

$$= \frac{0.036 \left(\frac{16.5 \text{ k}}{3} \right) (17.5')^3 1728}{(1,600 \times 1.05)} = \boxed{1091 \text{ in}^4}$$

Continued

$$\text{Beam I} \quad I_w + I_{AA} = 338 \text{ in}^4 + 1091 \text{ in}^4 = \boxed{1429 \text{ in}^4}$$