Calc. Fire Resistance of exposed wood roof deck.

Assembly: Hem-Fir +⅞g timber decking spans L=10'. Rubber membrane and metal roof panels installed over decking.

Loads: LL=20psf DL=10psf

Calc. deck load:

$$w_{total} = B(q_d + q_l) = 7.5\left(\tfrac{1}{12}\right)(30) = 18.75 \text{ plf}$$

Calc. Max induced moment:

$$M_{max} = w_{total} L^2/8 = 18.75(10^2)/8 = 234.4 \text{ ft-lbs}$$

Select nominal 3x8 (2½ x 7½) Hem-Fir Commercial decking with tabulated bending stress, F_b = 1840 psi

Calc Section Mod:

$$S_s = bd^2/6 = 7.5(2.5^2)/6 = 7.81 \text{ in}^3$$

Calc the adjustable allow. bending stress. Assume C_D=1.0 C_m=1.0 C_t=1.0 C_f=1.04

$$F'_b = F_b(C_D)(C_m)(C_t)(C_f) = 1840(1.04) = 1913 \text{ psi}$$

Calc resisting moment

$$M' = F'_b S_s = 1913(7.81)/12 = 1245 \text{ ft-lbs}$$

Structural Check: $M' \geq M_{max}$ 1245 > 234 OK

For design of timber deck, loading unchanged. Therefore, the max induced moment is unchanged. Fire resistance must be calculated.

Calc. beam section modulus: (one-side exposure)

$$S_f = b(d-a)^2/6 = 7.5(2.5-1.5)^2/6 = 1.25 \text{ in}^3$$

Calc. resisting moment:

$$M' = 2.85(F_b)(S_f) = 2.85(1913)(1.25)/12 = 568 \text{ ft-lbs}$$

Fire Check: $M' \geq M_{max}$ 568ft-lbs > 234 ft-lbs OK

Design Aid Appen.

$r_s = M_{max}/M' = 234.4/1245 = 0.18$

Max design load ratio from tbl. 9 R_s = 0.22 0.22 > 0.18 OK