

Problem A) A 1.5F-20 steel deck is to be used to carry uniform roof loads on a 6ft 3 equal span condition.

#1) Determine the maximum allowable roof load (psf)

Solution Vulcraft Manual pg 4  
For 3 span condition, F20, L=6ft **w=69 psf**

#2) Check bending stresses and deflection against the appropriate SDI Limits

Solution Section 3.3 on page 9

$$w := 69 \cdot \text{psf} \quad L := 6 \cdot \text{ft} \quad S_n := 0.148 \cdot \frac{\text{in}^3}{\text{ft}} \quad \text{pg 4 of manual}$$

$$M_{\max} := \frac{1}{10} \cdot w \cdot L^2 \quad M_{\max} = 248.4 \frac{\text{lb} \cdot \text{ft}}{\text{ft}}$$

$$f_{\max} := \frac{M_{\max}}{S_n} \quad f_{\max} = 20.141 \text{ ksi}$$

The maximum allowable working stress (pg 9, sec 3.1)

$$F_{\max} := 20 \cdot \text{ksi} \quad \text{or} \quad \frac{33 \cdot \text{ksi}}{1.65} = 20 \text{ ksi}$$

$$f_{\max} = 20.141 \text{ ksi} \quad \approx \quad F_{\max} = 20 \text{ ksi}$$

**Bending Stress very close to allowable OK**

$$\text{Check Deflection} \quad E := 29000000 \cdot \text{psi} \quad I_n := 0.151 \cdot \frac{\text{in}^4}{\text{ft}}$$

$$\Delta_{\max} := \frac{0.0069 \cdot w \cdot L^4}{E \cdot I_n} \quad \Delta_{\max} = 0.243 \text{ in}$$

$$\Delta_{\text{allow}} := \frac{L}{240} \quad \Delta_{\text{allow}} = 0.3 \text{ in}$$

**Maximum Deflection is less than the allowable deflection OK**

#3) What is the maximum construction span?

**Solution - from page 4 in manual L=6'-6" for 1.5F20 construction span**

Problem B) Assume the same deck is to be used on a simple span condition

#1) Determine the maximum SDI construction span

Solution - From manual  $L = 5'-5"$  for F1.5F20 simple span

#2) What is the maximum flexural stress produced by the 200 lb concentrated load during construction?  
Check against SDI Limit

$$P := 200 \cdot \text{lb} \quad L := 65 \cdot \text{in} \quad \text{construction span} \quad S_p := 0.139 \cdot \text{in}^3$$

$$M_{\text{max}} := \frac{P \cdot L}{4} \quad M_{\text{max}} = 3250 \text{ lb} \cdot \text{in}$$

$$f_{\text{max}} := \frac{M_{\text{max}}}{S_p} \quad f_{\text{max}} = 23.381 \text{ ksi}$$

Allowable Stress during construction pg 10 of manual

$$F_b := 26 \cdot \text{ksi} \quad \text{or} \quad 20 \cdot \text{ksi} \cdot \frac{4}{3} = 26.7 \text{ ksi}$$

**Construction stress is less than allowable limit OK**

#3) What is the midspan deflection produced by the same concentrated load. Check against SDI limit

$$I_p := 0.151 \cdot \text{in}^4$$

$$\Delta_{\text{max}} := \frac{P \cdot L^3}{48 \cdot E \cdot I_p} \quad \Delta_{\text{max}} = 0.261 \text{ in}$$

$$\text{Maximum allowable construction deflection} \quad \Delta_{\text{allow}} := \frac{L}{240} \quad \Delta_{\text{allow}} = 0.3 \text{ in}$$

**Construction deflection is less than the allowable OK**