CE 479 Assignment #4 A floor slab on form deck (non-composite) is to support a service live load of 200-psf. Use the Vulcraft catalog to select slab thickness and reinforcement. Check the form deck stresses and deflection during construction using the SDI specifications. The normal weight concrete is 3000 psi. The form deck is to be used on 3 continuous 5'-0" equal clear spans. Using a 1.5C deck, indicate the gage required to satisfy construction load requirements and minimize the normal weight concrete slab thickness. Select mesh reinforcement and check flexural capacity at the critical sections for positive and negative moment.

1.) select gage and reinforcement:

From the maximum construction clear spans (SDI criteria) Table, use a 1.5C24 deck with a maximum construction span of 6'-7" on a 3-span condition

6'-7" > 5'-0" therefore OK

This is based on a required minimum slab thickness of 4.5" with t=3" and a mesh reinforcement of 6x6 W2.9xW2.9 (Draped per the code requirement)

This from Table "Reinforced Concrete Slab Allowable Loads" with self weight = 49 psf and the uniform live load = 215 psf

2.) check steel deck stresses and deflections under SDI construction loads

From Figure 1 on page 36:

$P := 150 \quad w1 := 49 \ \text{psf} \quad w2 := 20 \ \text{psf} \quad L := 5 \ \text{ft} \quad As := 0.058 \ \text{in}^2$

$$M1 := 0.20 \cdot P \cdot L + 0.094 \cdot w1 \cdot L^2$$

$$M1 = 265.15 \ \text{ft} \cdot \text{lbs}$$

$$M1 = 3181.8 \ \frac{1}{\text{lb} \cdot \text{ft}} \ \text{in} \cdot \text{lb}$$

$$M2 := 0.094 \cdot (w1 + w2) \cdot L^2$$

$$M2 = 162.15 \ \text{ft} \cdot \text{lbs}$$

$$M2 = 1945.8 \ \frac{1}{\text{lb} \cdot \text{ft}} \ \text{in} \cdot \text{lb}$$

$$M3 := 0.117 \cdot (w1 + w2) \cdot L^2$$

$$M3 = 201.825 \ \text{ft} \cdot \text{lbs}$$

$$M3 = 2421.9 \ \frac{1}{\text{lb} \cdot \text{ft}} \ \text{in} \cdot \text{lb}$$

Controls for +M = M1 = 3181.8 in*lbs and -M = M3 = 2421.9 in*lbs

Stesses for these moments:

$Sp := 0.132 \quad \frac{in^3}{ft} \qquad Sn := 0.120 \quad \frac{in^3}{ft} \qquad fy := 60 \quad ksi$

$fb\_positive := \frac{M1}{Sp} \cdot \frac{12}{1000}$

$fb\_positive = 24.1 \quad ksi$

$fb\_negative := \frac{M3}{Sn} \cdot \frac{12}{1000}$

$fb\_negative = 20.183 \quad ksi$

$f\_max := 0.6 \cdot fy$

$f\_max = 36 \quad ksi$

Therefore both the positive and negative stresses check out with the Fmax = 0.6Fy = 36 ksi

Flexural deflections:

$E := 29500000 \quad psi$

$Ip := 0.136 \quad \frac{in^4}{ft}$

$\Delta := \frac{0.0069 \cdot w1 \cdot L^4 \cdot 1728}{E \cdot Ip}$

$\Delta = 0.091 \quad inches$

$\Delta\_max := \frac{L \cdot 12}{180}$

$\Delta\_max = 0.333 \quad inches$

Therefore the deflection = 0.091 inches < max deflection = 0.333"

3.) check flexural strength of concrete slab:

$D := 4.5 \quad inches$ Mesh is 6x6 W2.9xW2.9 draped

$t := 3 \quad inches$

Factored load moments:

$w := 1.7 \cdot 200 \quad psf$

$Mu\_pos := \frac{1}{16} \cdot w \cdot L^2 \cdot 12 \qquad Mu\_neg := \frac{1}{12} \cdot w \cdot L^2 \cdot 12$

$Mu\_pos = 6375 \quad \frac{in \cdot lb}{ft} \qquad Mu\_neg = 8500 \quad \frac{in \cdot lb}{ft}$

Find ϕMn for both positive and negative cases:

$\phi := 0.9 \quad d\_wire := \sqrt{As \cdot \frac{4}{2 \cdot \pi}} \qquad d\_wire = 0.192$ inches

Positive case:

$d\_pos := t - \frac{3d\_wire}{2} \quad d\_pos = 2.712$ inches

$a\_p := \frac{As \cdot fy}{.85 \cdot t \cdot 12} \quad a\_p = 0.114$ inches

$Mn\_pos := As \cdot fy \cdot \left(d\_pos - \frac{a\_p}{2}\right) \qquad Mn\_pos = 9.239$ in·kips

$\phi \cdot Mn\_pos = 8.315$ in·kips

In the positive moment case, the ϕMn > Mu so we are OK

Negative case:

$d\_neg := 4.5 - (0.75 + 0.5d\_wire)$

$d\_neg = 3.654$ inches

$a\_n := \frac{As \cdot fy}{0.85 \cdot t \cdot 2 \cdot 3.5}$ (2 ribs/foot with b_minimum = 3.5")

$a\_n = 0.195$ inches

$Mn\_neg1 := As \cdot fy \cdot \left(d\_neg - \frac{a\_n}{2}\right) \qquad Mn\_neg1 = 12.376$ in·kips

$\phi \cdot Mn\_neg1 = 11.139$ in·kips

$Mn\_neg2 := As \cdot fy \cdot (d\_neg - a\_n) \qquad Mn\_neg2 = 12.037$ in·kips

$\phi \cdot Mn\_neg2 = 10.833$ in·kips

In the negative moment case, the ϕMn > Mu so we are OK f