

Assignment #4

Check the floor (30x40 bay) in Assignment #3 for Vibrations. Follow the example in the PPT except use the I_{tr} for beam and girder in Assignment #3 rather than increase E_c by 1.35.

Assume

$$\text{DL Beams} = 77 \text{ psf} = \overset{\text{Conc + Deck}}{51} + \overset{\text{MEP}}{10} + \overset{\text{LL}}{11} + \overset{\text{Beam}}{5}$$

$$\text{Girder} = 80 = 77 + 3 \text{ Girders}$$

$$I_{tr} \text{ Beams} = 2196 \text{ in}^4 \quad (n=8, b=120")$$

$$\text{Girders} = 5170 \text{ in}^4 \quad (n=8, b=90")$$

Homework #4 -- 30 x 40 foot typical bay

Beam
LB (ft) = 40
Spacing (ft) = 10
B (inches) 120
I_B(in4) = 2196
w_B(lbs/ft) = 770
Δ_B(in) = 0.6964
f_B (Hz) = 4.24
Slab d_e = 4
D_s (in4/ft) = 8.000
D_B (in4/ft) = 219.6
C_j = 2
B_b = C_j*(D_s/D_B) = 34.95
W_B = 1.5*w_B/S*B_b*L_B = 161472

Girder
L_G (ft) =
Spacing (ft) =
B (inches) =
I_G (in4) =
w_G (lbs/ft) =
Δ_G (in) =
f_G (Hz) =

D_G (in4/ft) = I_G/S =
C_G =
B_g = C_G*(D_B/D_G)*L_G =
W_G = w_G/L_B*B_g*L_G =
Δ_G' = L_G/B_b*Δ_G =

Combined Beam and Girder

f_{B+G} = 0.18*√(g/(Δ_B+Δ_G')) = 3.49
W_{B+G} (lbs) = 157094
Damping β= 0.03
P_o (lbs) = 65

a_p/g = P_o*exp(-0.35 f_{B+G})/βW = 0.00407
= 0.41 % g

Materials
E_c (ksi) = 3105
E_s (ksi) = 29000
n E_s/E_c = 8.00

Assumed DL:
Beams (psf) = 77
Girders (psf) = 80

30
40
90
5170
3200
0.3890
5.67

129.25
1.8
61.65
147964
0.3339

