

ARCH 331. Assignment #7

Date: 3/1/18, due 3/8/18

Pass-fail work

Problems: supplemental problems (7A, etc.) **and** from Onouye & Kane, Chapters 3 & 4

*Notes: Problems marked with a * have been altered with respect to the problem stated in the text.*

- (6%) 7A) A reinforced concrete slab is 6 in. thick. If the density is 150 lb/ft^3 , determine the weight per unit area in lb/ft^2 and in kN/m^2 . (un-dimensioned figure) (*dimensional analysis & conversions*)

Partial answer to check with: 3.59 kN/m^2

- (12%) 7B) The compressive force in a column to each service (unfactored) load are: $D = 465 \text{ kN}$, $L = 290 \text{ kN}$, $L_r = 65 \text{ kN}$, $W = 110 \text{ kN}$, $E = 245 \text{ kN}$. The wind load can also result in a tensile force. Determine the design load for the column based on LRFD using ASCE-7 load combinations (see Note Set 13.6) (*load factors*)

Partial answer to check with: $\max\{651, 1054.5, (952 \text{ or } 717, 607), (990.5 \text{ or } 770.5), 1093, (528.5 \text{ or } 308.5), 663.5\} \text{ kN}$.

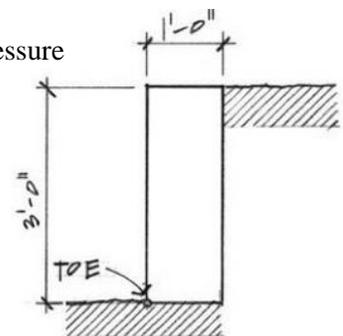
- (12%) 7C) Roof beams that weigh 50 lb/ft and are spaced at $10'$ center to center support an additional dead load of 30 lb/ft^2 . Code specified roof loads are 35 lb/ft^2 downward (due to roof live load, snow or rain) and 25 lb/ft^2 upward or downward (due to wind). Determine the critical loading for LRFD using ASCE-7 load combinations (see Note Set 13.6).

(load tracing and load factors)

Partial answer to check with: $\max\{490, 595, (1105 \text{ or } 855), (845 \text{ or } 345), 490, (565 \text{ or } 65), 315\} \text{ lb/ft}$.

- (20%) *3.58 A gravity retaining wall as shown is subjected to a lateral soil pressure as a result of an *equivalent fluid density* of 35 pcf . Calculate the resultant horizontal ~~pressure~~ force due to pressure against the wall and the wall's factor of safety against overturning. Assume that concrete has a density of 150 pcf . Check the bearing pressure under the footing. Assume the allowable bearing pressure is 3000 psf . Also check for factor of safety against sliding if the friction coefficient is 0.62 .

(retaining wall behavior)



Partial answer to check with: $SF_{over} = 1.43$, $SF_{slide} = 1.77$, $p_{max} = 2000 \text{ lb/ft}^2$ (under footing)

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with load values

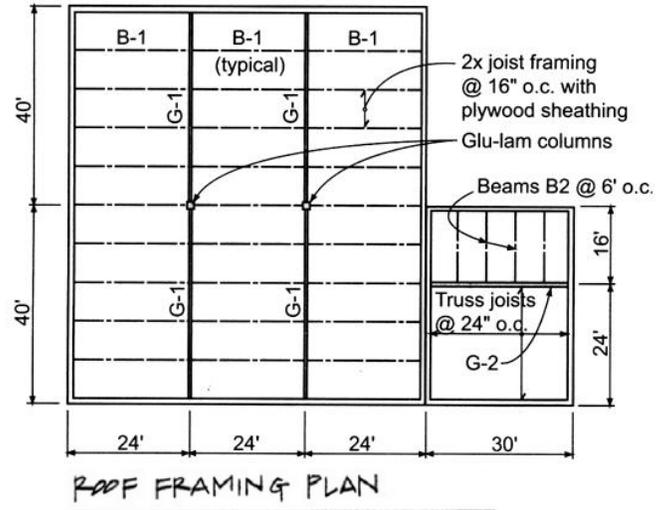
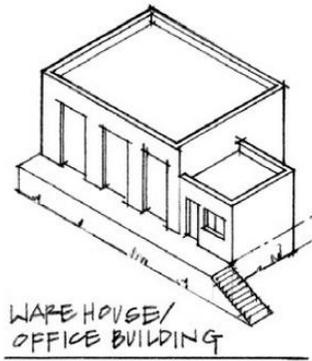
(20%) * 4.4 Draw FBDs and show load conditions for B-1, G-1, interior column, B-2, and G-2. Find all support reactions. (load tracing)

Loads:

- SL (snow load) = 25 psf
- Roofing and joists & (deck) = 10 psf
- Truss joist = 3 psf
- Insul., mech., elec. = 5 psf
- Beams B-1 and B-2 = 15 #/ft.
- Girders G-1 and G-2 = 50 #/ft.
- Beam B-2 = 12 lb/ft.
- Girder G-2 = 40 lb/ft.

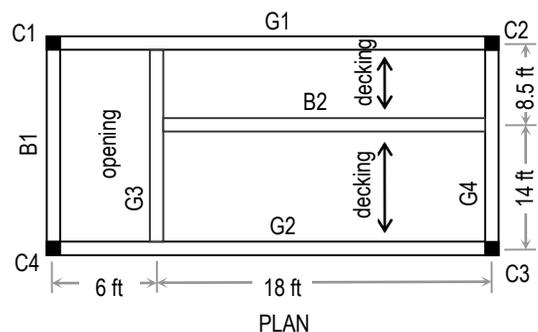
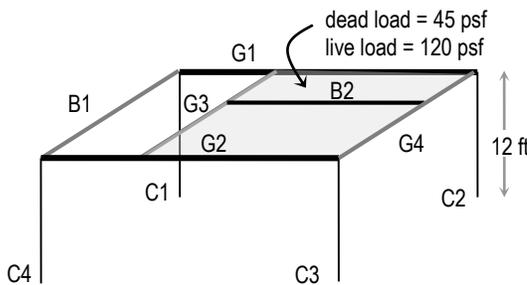
Partial answer to check with:

- B-1: $w = 335 \text{ lb/ft}$, reaction = 4020 lb
- G-1: 4 loads of 8040 lb and $w (50 \text{ lb/ft})$, reaction = 17.08 k; column: 2 girder and 2 beam reactions = 42.2 k
- B-2: $w = 252 \text{ lb/ft}$, reaction = 2016 lb
- G-2: 4 loads of 2016 and $w = 556 \text{ lb}$, reaction = 12,372 lb (note: the truss joist load is in lb/ft^2 and acts on G-2)



(25%) 7D) The floor framing plan is subject to uniform distributed loads of 45 psf dead load, and 120 psf live load. Determine the resulting reactions by the beams & loads on the columns. (load tracing)

Partial answer to check with: $R_{B2} = 16706.25 \text{ lb}$, $R_{G3@G1} = 10395 \text{ lb}$,
 $R_{G1@C1} = 12529.7 \text{ lb}$, $P_{omC2} = 20,882.8 \text{ lb}$.



(5%) 7E) For the frame of problem 7D, use Multiframe software to find the column loads to verify your work from load tracing by constructing a 3D model (View 3D). Use the standard steel section you have been assigned which is posted in My Grades on eCampus. . Submit the data file (.mfd) on eCampus (under Assignments: Assignment 7) and provide a print of the bending moment (M) and axial force (P) diagrams. Be careful to make joints on all the girders at the location of beam supports. Model the column bases as fixed. Do not use panels, but put on linearly distributed loads on G1, B2 and G2 only. Model the beam ends with rotational releases using the member restraint menu and release (check) the major moment resistance, M_z , for each end.