

Arch314

STRUCTURES I

Fall 2024
Recitation

FACULTY: Prof. Peter von Bülow
Mohsen Vatandoost

Arch314: STRUCTURES I

Welcome to Recitation session 10/24

Mohsen Vatandoost {Ph.D., M.Sc., M. Arch}

mohsenv@umich.edu

Office hours:

Room 3122

Wed: 11:30 – 13:30

Mon, Fri: 11:30 - 12:30

Please feel free to ask questions.

Arch314: STRUCTURES I

Welcome to Recitation session 10/24

Outline:

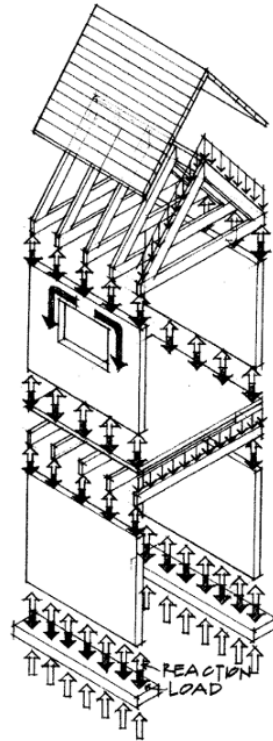
- Quick **Recap** of the week
- Provide the solution for the assignment (**Homework 9**)
- Answering student's questions
- Lab: **Lateral Stability**
- **Bridge_1** project (providing detailed feedbacks + Comments + free discussion + Q&A)

Please feel free to ask questions.

Recap of the week

Load Paths

Gravity loads trace from top down to their resolution at the foundation.



Load Paths

Floor Loads

Dead Load

weight of structure

Live Load

occupancy load

Member Hierarchy

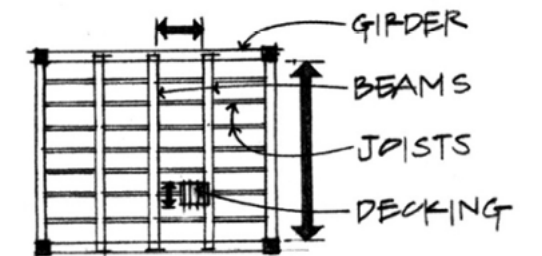
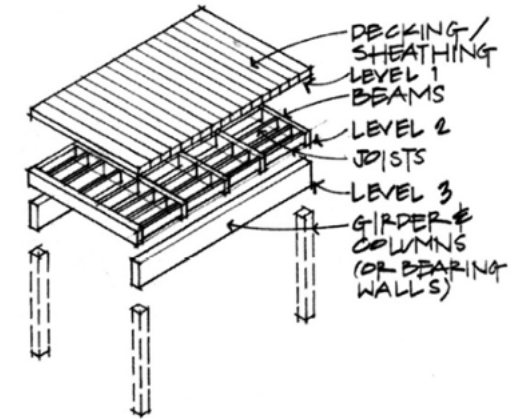
Flooring spans between joists

Joists span between beams

Beams span between girders

Girders span between columns

Columns carry load to ground



Recap of the week

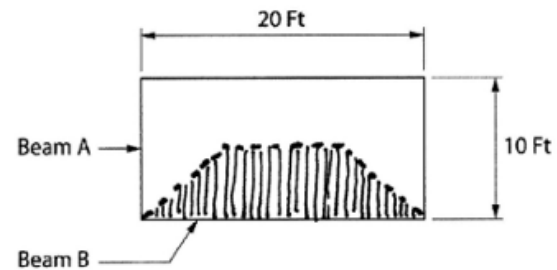
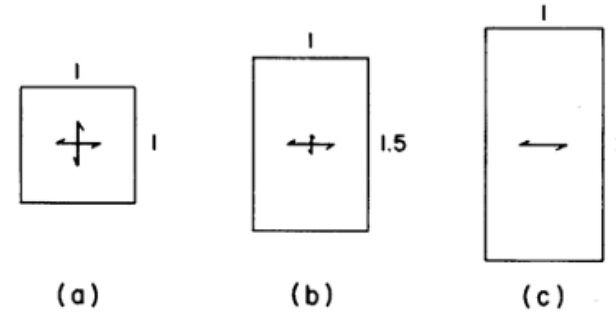
Load Paths

Floor Slabs

Concrete slabs span in the direction of the steel reinforcement.

One-way slabs should span the shortest direction.

Two-way slabs span in both directions. Aspect ratios should be square or less than 2:1. The load path divides at 45° from corner.



two-way slab tributary area of beam B

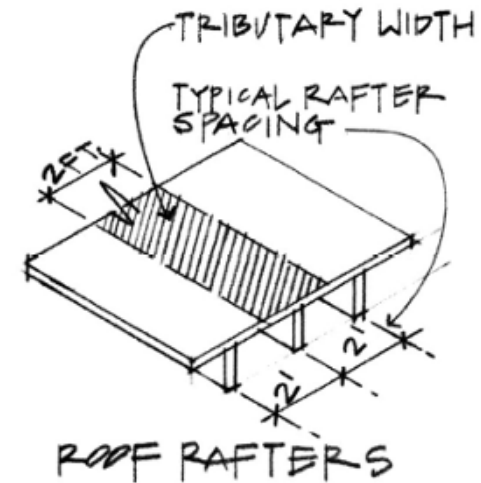


two-way waffle slab

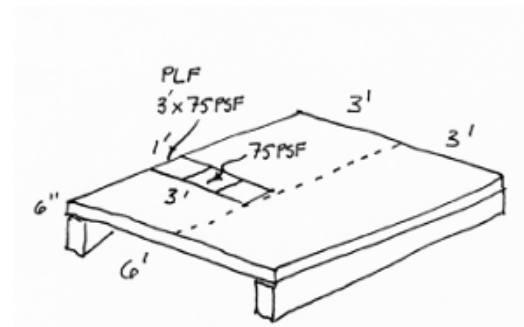
Recap of the week

Tributary Area

The **tributary area** is an area used to determine the load on a member.



Each member has a tributary area that can be used to find the total load on that member.



Provide the solution for the assignment – HW9

- Problem:

10. Floor Systems

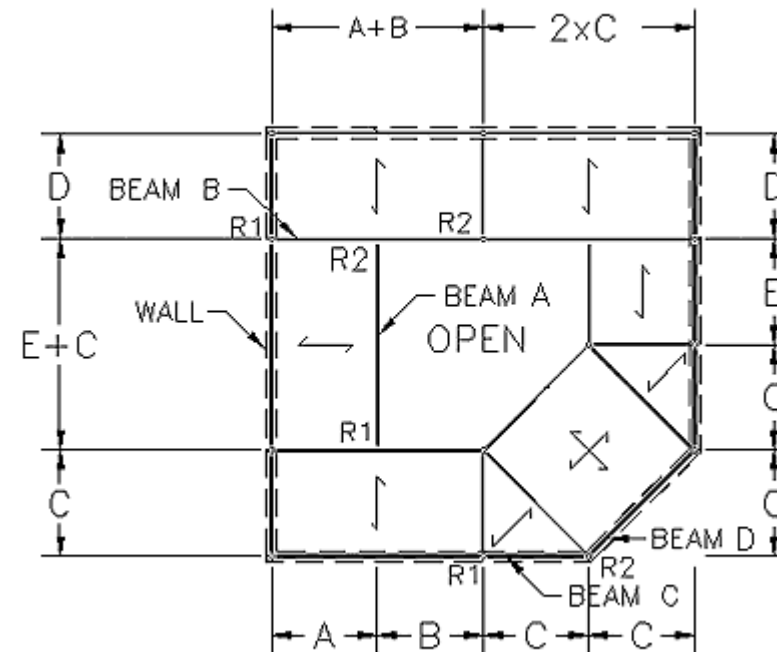
For each beam, A through G, determine the loading from the floor, the wall and from other beam reactions. Then, calculate the end reactions for each beam.

DATASET: 1

-2-

-3-

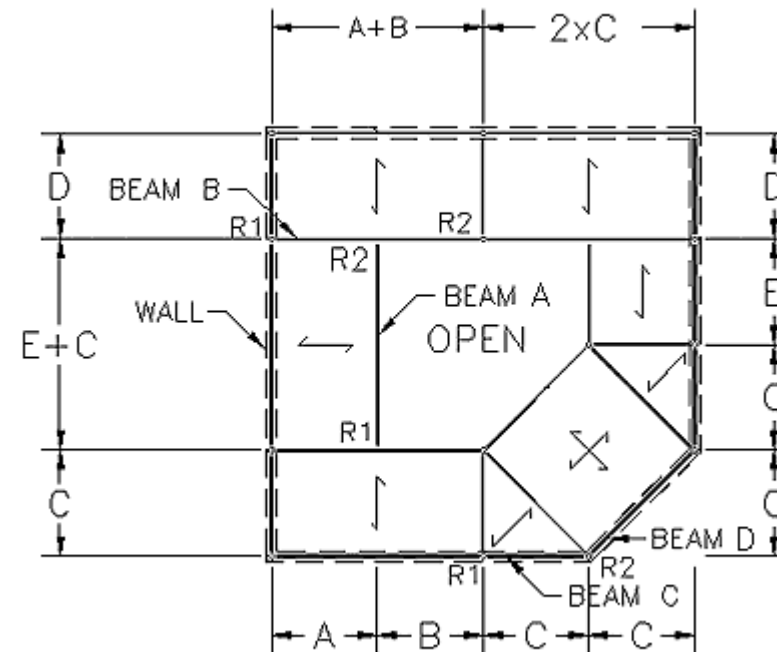
| | |
|--------------------|---------|
| Span A | 11 FT |
| Span B | 10 FT |
| Span C | 17 FT |
| Span D | 14 FT |
| Span E | 18 FT |
| Dead load of wall | 912 PLF |
| Dead load of floor | 48 PSF |
| Live load on floor | 60 PSF |



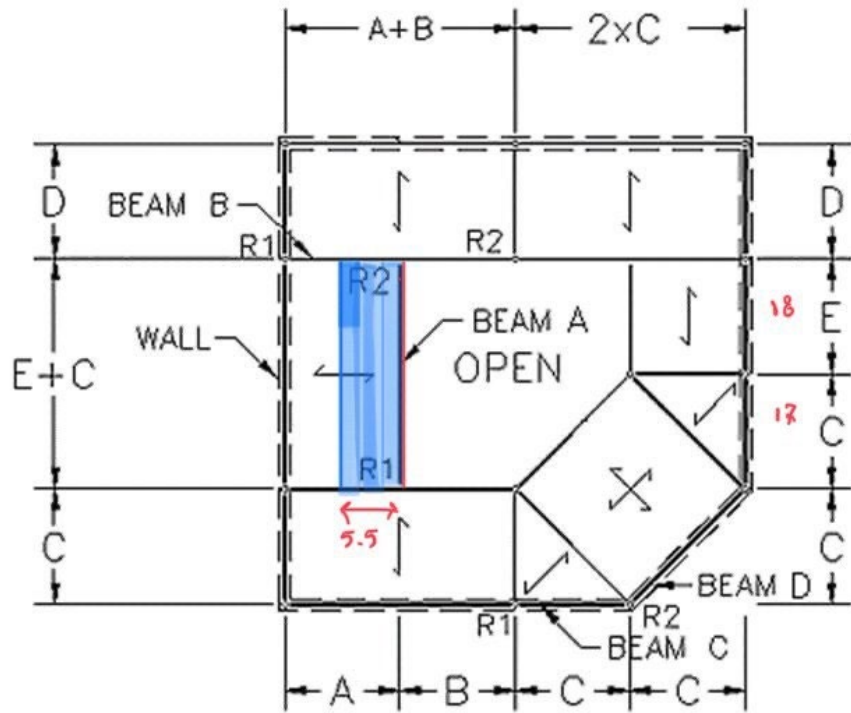
Provide the solution for the assignment – HW9

- Problem:

| # | Question | Your Response |
|----|---|--------------------------|
| 1 | Full uniform load on Beam A | <input type="text"/> PLF |
| 2 | End reaction R1 on Beam A | <input type="text"/> LBS |
| 3 | End reaction R2 on Beam A | <input type="text"/> LBS |
| 4 | Full uniform load on Beam B | <input type="text"/> PLF |
| 5 | Point load on Beam B | <input type="text"/> LBS |
| 6 | End reaction R1 on Beam B | <input type="text"/> LBS |
| 7 | End reaction R2 on Beam B | <input type="text"/> LBS |
| 8 | Full uniform load on Beam C | <input type="text"/> PLF |
| 9 | Peak value of triangular load on Beam C | <input type="text"/> PLF |
| 10 | End reaction R1 on Beam C | <input type="text"/> LBS |
| 11 | End reaction R2 on Beam C | <input type="text"/> LBS |
| 12 | Full uniform load on Beam D | <input type="text"/> PLF |
| 13 | Peak value of triangular load on Beam D | <input type="text"/> PLF |
| 14 | End reaction R1 on Beam D | <input type="text"/> LBS |
| 15 | End reaction R2 on Beam D | <input type="text"/> LBS |



Provide the solution for the assignment – HW9



Floor Dead load:

$$48 \text{ psf} \times \frac{A}{2} \text{ ft} = 264 \text{ PLF (per Linear Foot)}$$

Floor Live load:

$$60 \text{ psf} \times \frac{A}{2} \text{ ft} = 330 \text{ PLF}$$

$$594 \text{ PLF } \textcircled{1}$$

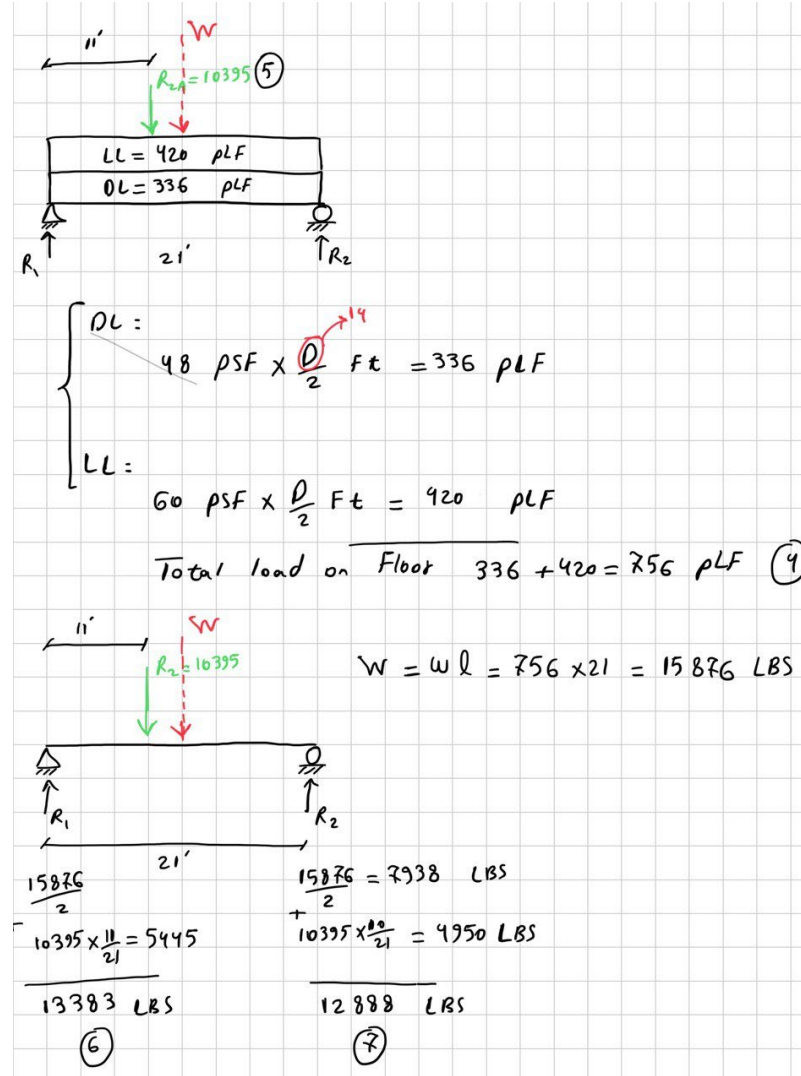
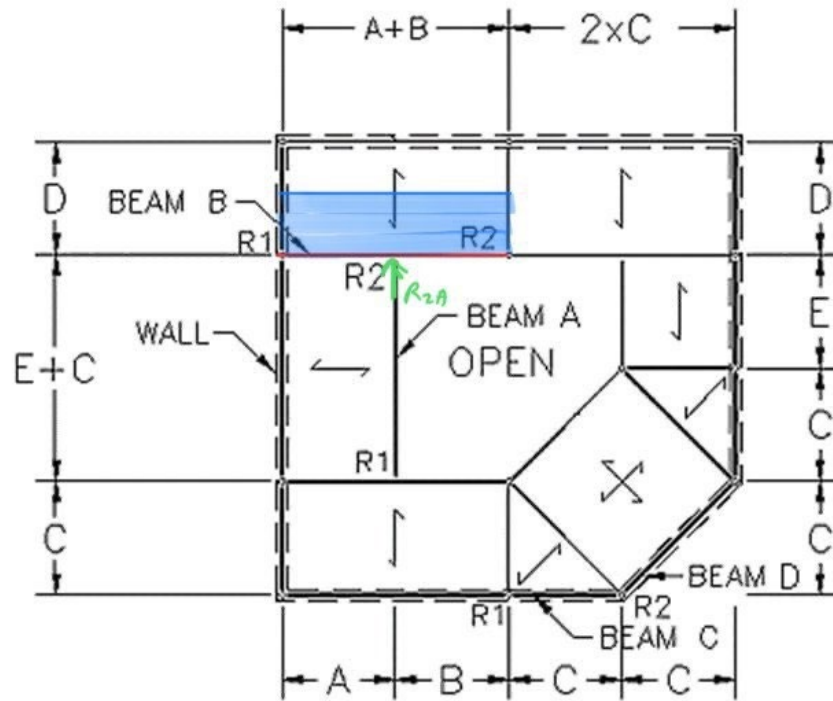
Free body diagram showing a beam of length $35'$ with a uniformly distributed load W . The load is composed of $LL = 330 \text{ PLF}$ and $DL = 264 \text{ PLF}$. Reaction forces R_1 and R_2 are shown at the ends.

$$W = (W)l = 594 \text{ PLF} \times 35' = 20790 \text{ LBS}$$

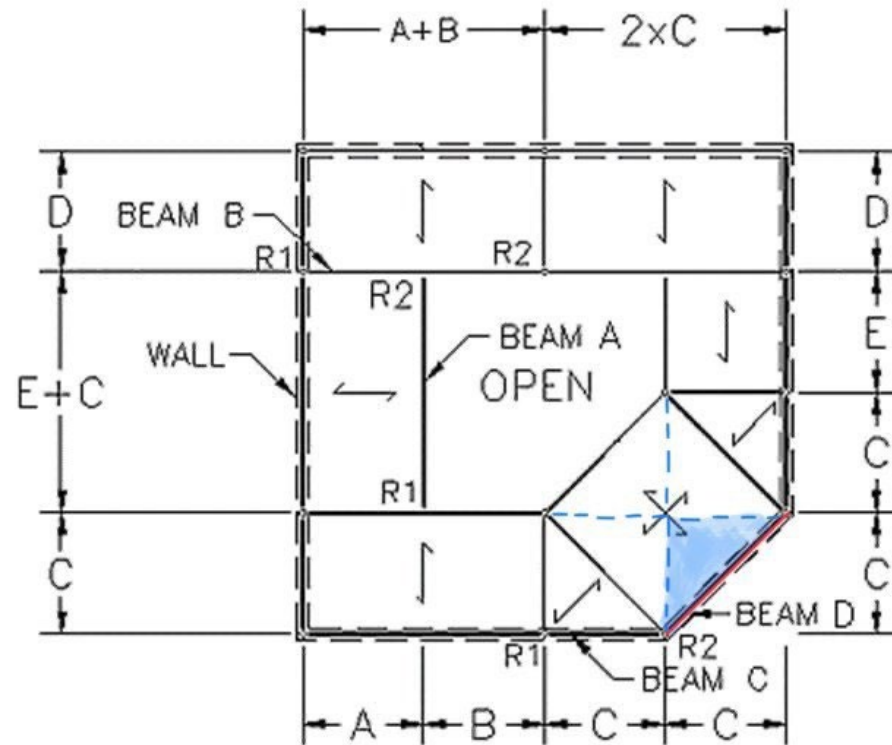
$$R_1 = R_2 = \frac{20790}{2} = 10395 \text{ LBS}$$

$\textcircled{2}, \textcircled{3}$

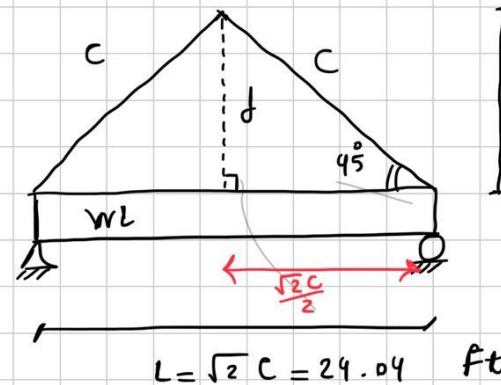
Provide the solution for the assignment – HW9



Provide the solution for the assignment – HW9



uniform load = wall load = 912 plf (12)



$$\sin 45^\circ = \frac{d}{c} \rightarrow d = \frac{c\sqrt{2}}{2}$$

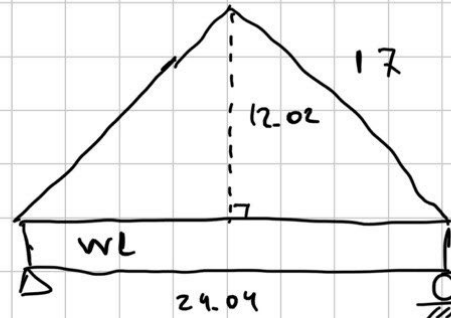
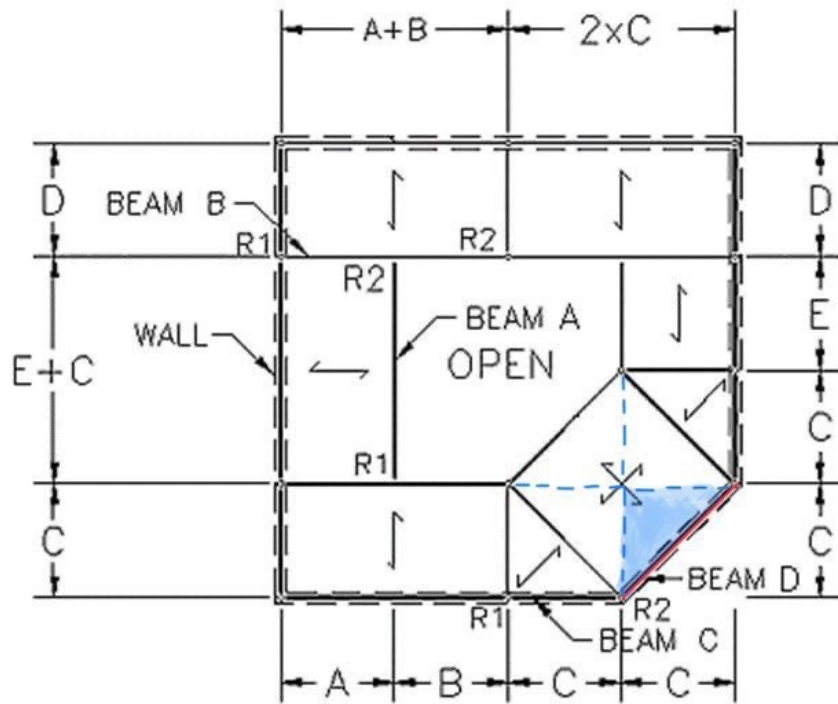
$$\rightarrow d = \frac{17 \times \sqrt{2}}{2} = \underline{12.02}$$

or:

$$\tan 45^\circ = \frac{d}{\frac{\sqrt{2}c}{2}} \rightarrow d = \frac{\sqrt{2}c}{2}$$

Triangle Area : $d \times \frac{\sqrt{2}c}{2} \times \frac{1}{2}$

Provide the solution for the assignment – HW9



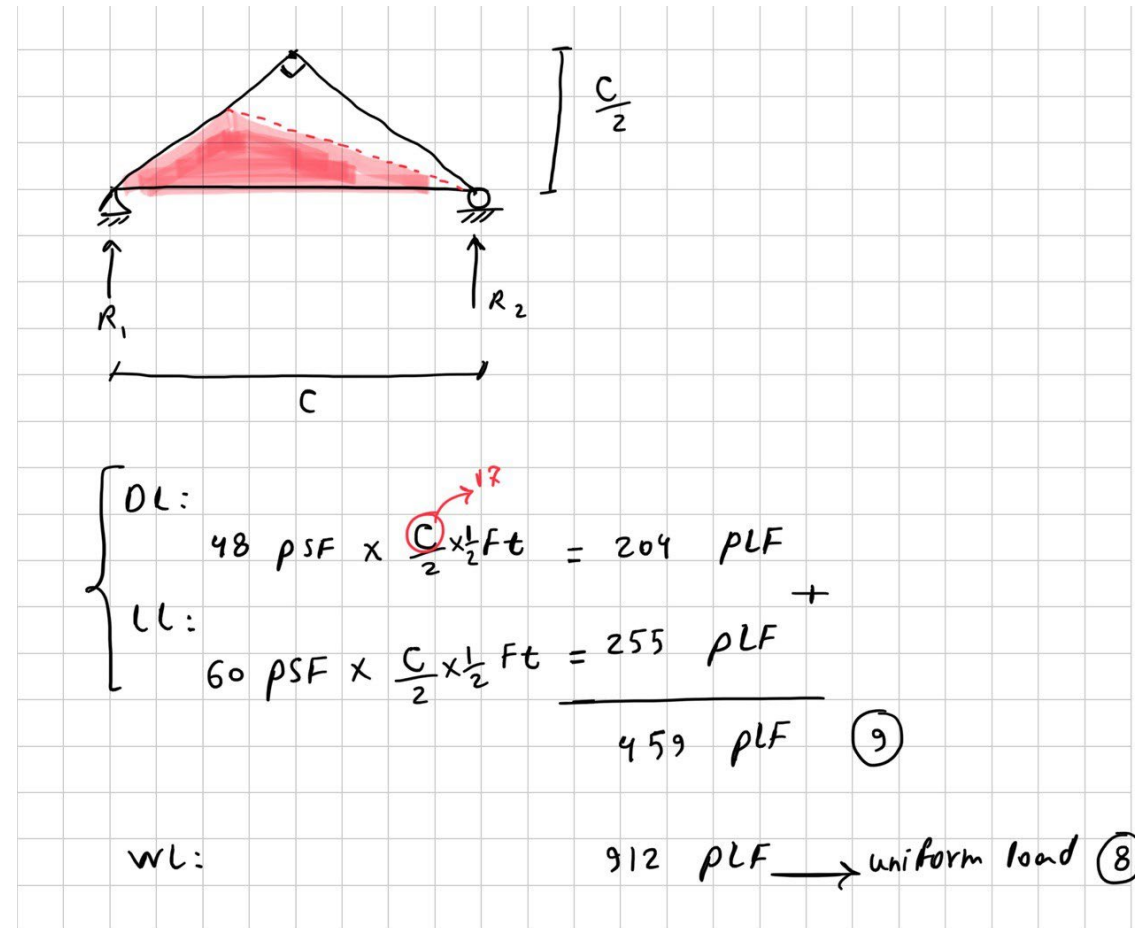
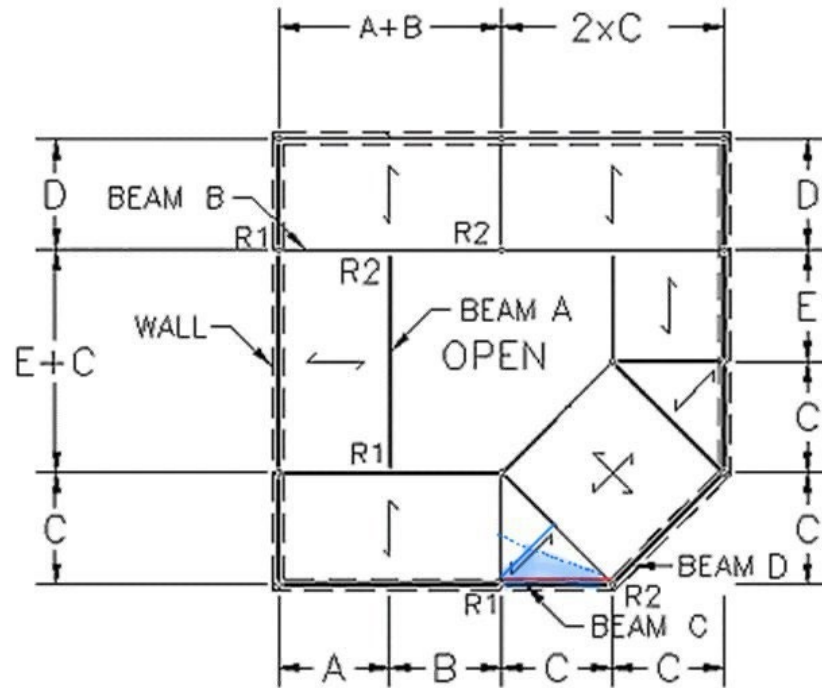
peak of Triangle load:

$$d \times (DL + LL) \rightarrow 12.02 \times (60 + 48) = \frac{1298.16}{\text{PLF}} \text{ (13)}$$

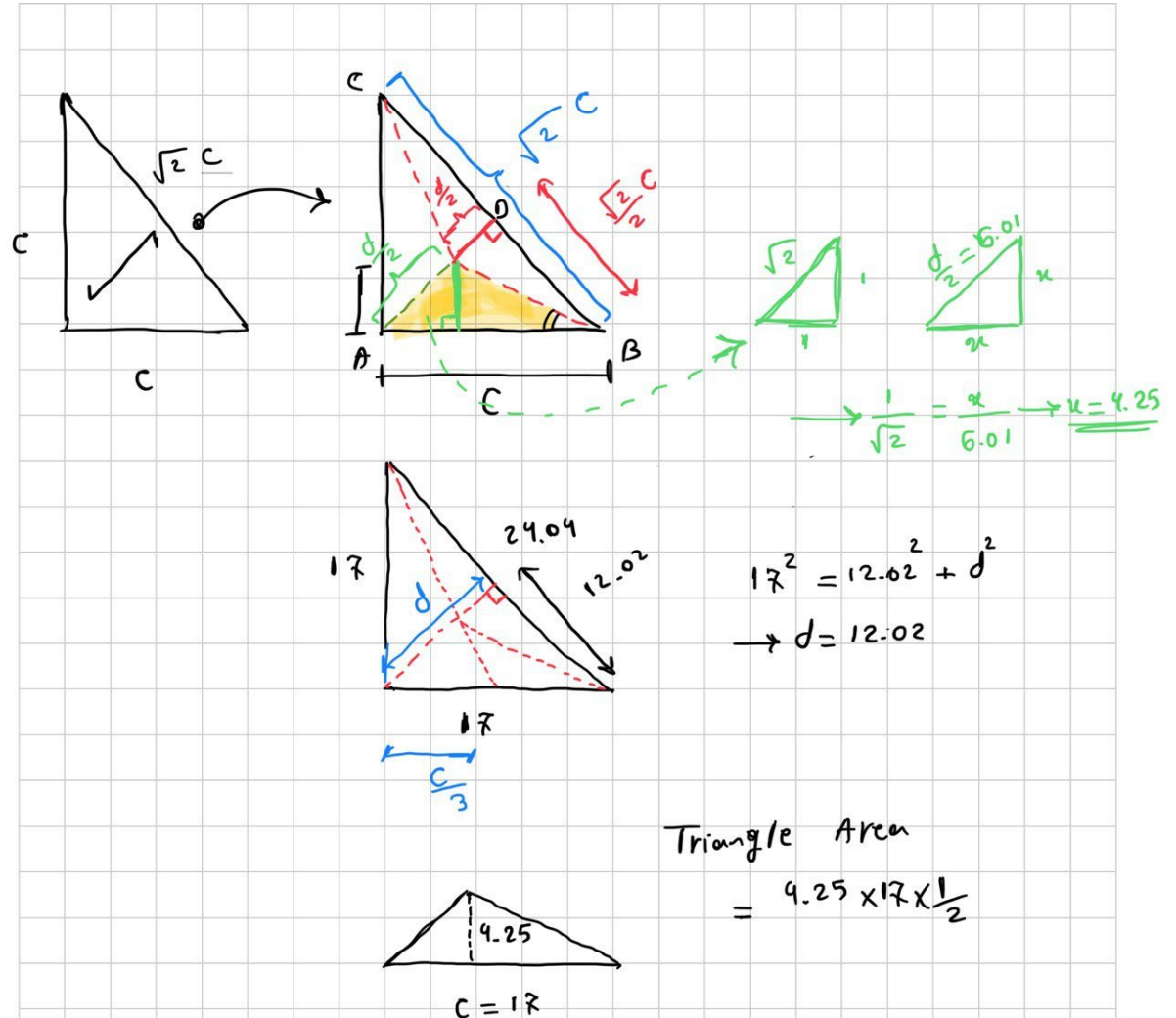
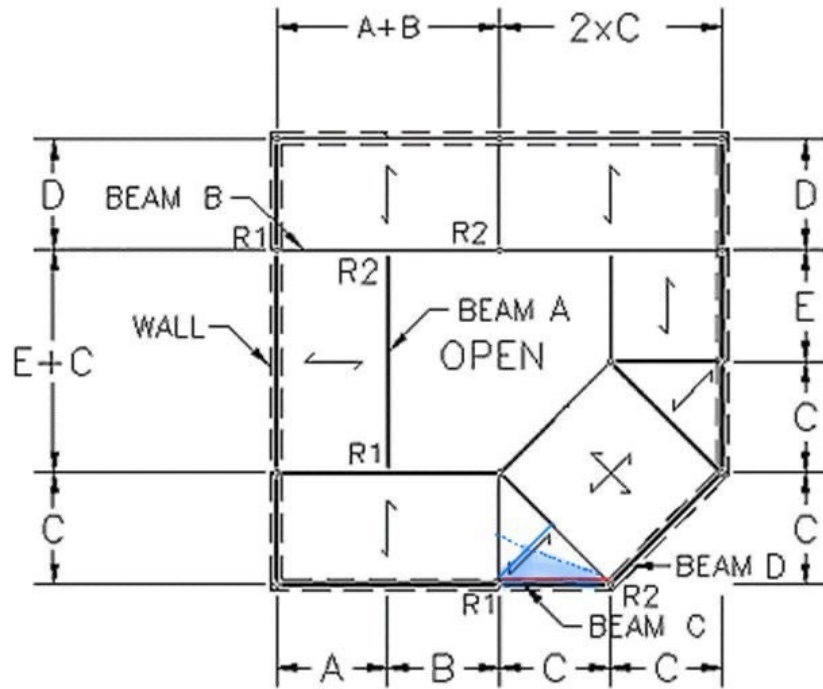
$$\begin{aligned} W_{WL} &= W \times L = 912 \times 24.04 = 21929.48 \text{ LBS} \\ W_{\text{Floor}} &= W \times \frac{L}{2} = 1298.16 \times 24.04 = 15603.88 \text{ LBS} \\ \hline &37528.36 \text{ LBS} \end{aligned}$$

$$R_1 = R_2 = \frac{37528.36}{2} = 18764.18 \text{ LBS} \text{ (14), (15)}$$

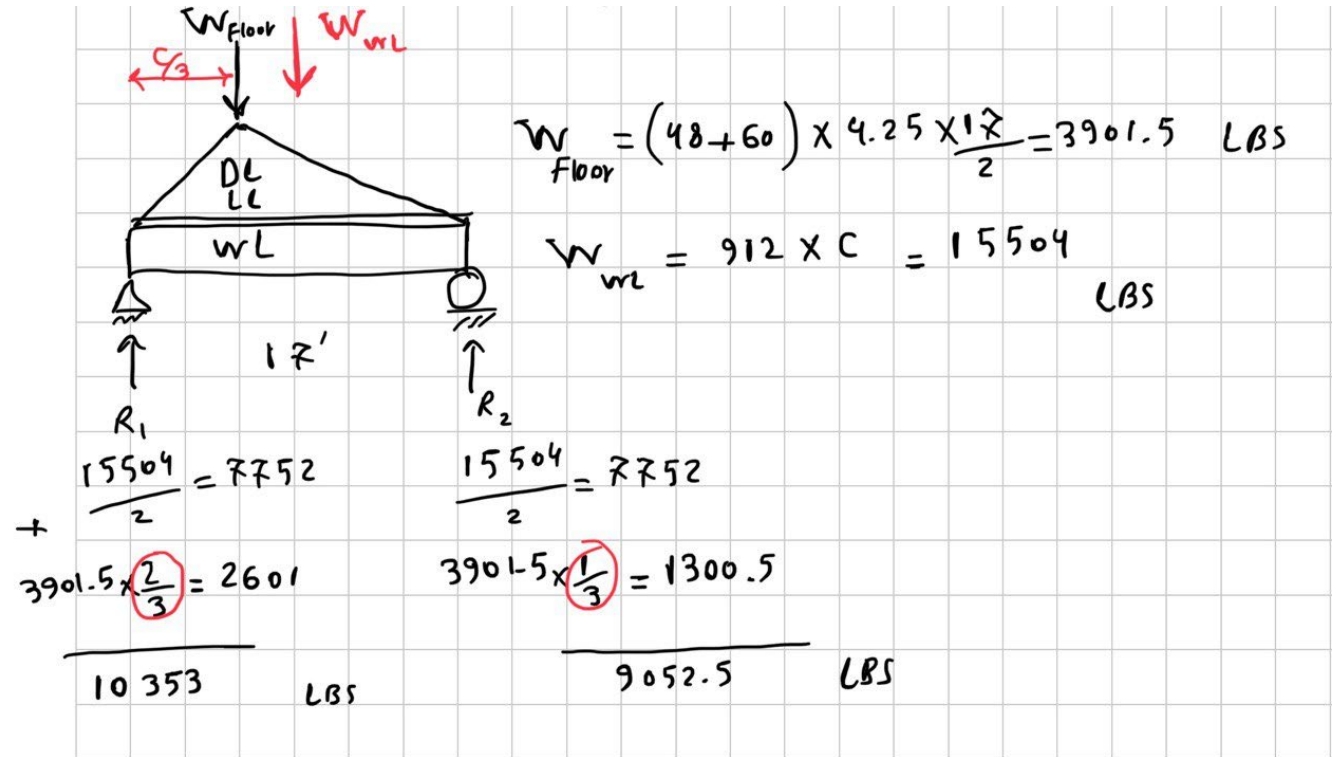
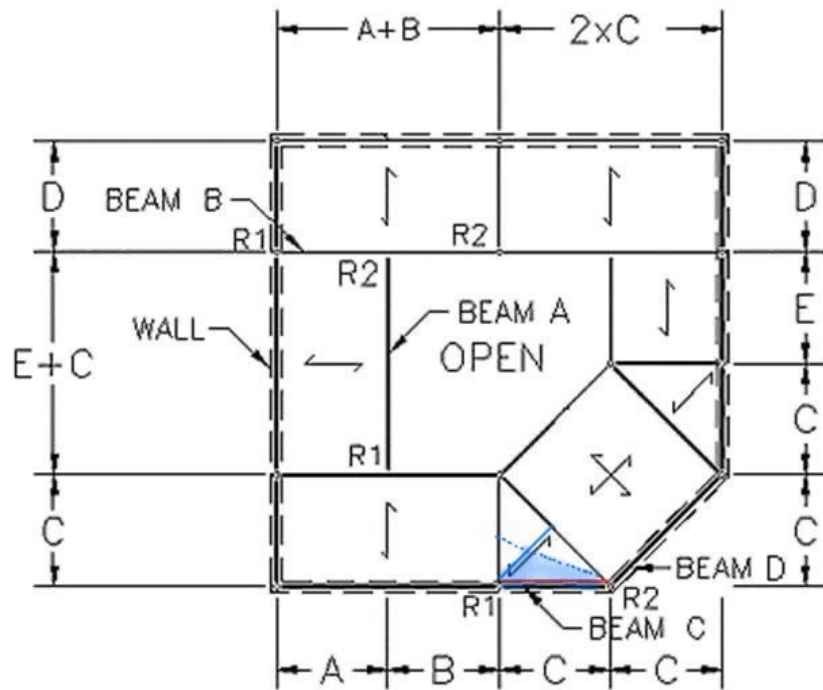
Provide the solution for the assignment – HW9



Provide the solution for the assignment – HW9



Provide the solution for the assignment – HW9



Lab: Lateral Stability

Description

This project investigates stable arrangements of structural walls against lateral loading.

Goals

To observe the effects of lateral loading

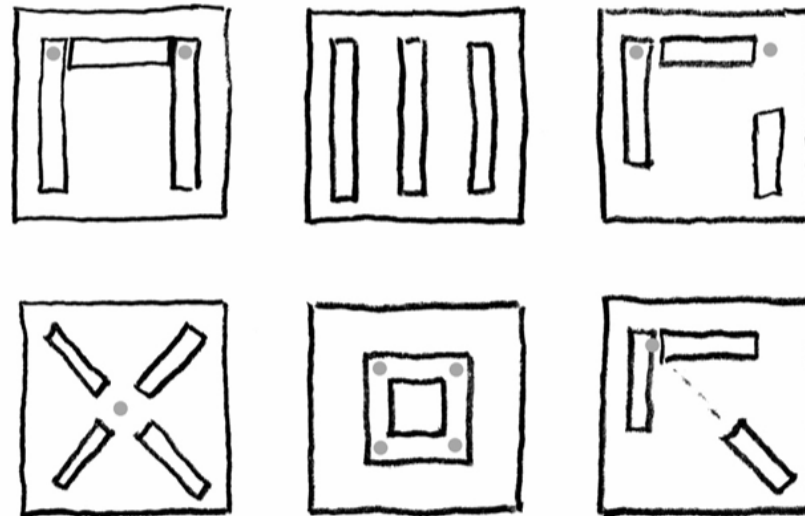
To investigate the criteria of stable wall patterns

To develop stable arrangements of shear walls based on the 2 point rule

Lab: Lateral Stability

Procedure

1. Arrange the small wood walls on the foam core base to support the MDF slab.
2. Make each of the six arrangements.
3. Apply lateral and torsional accelerations to the base and note the effects on the assembly. Mark on the diagrams below which fail and which remain stable.
4. Make your own stable and unstable arrangement.
5. Sketch the arrangements below and mark the intersection points.

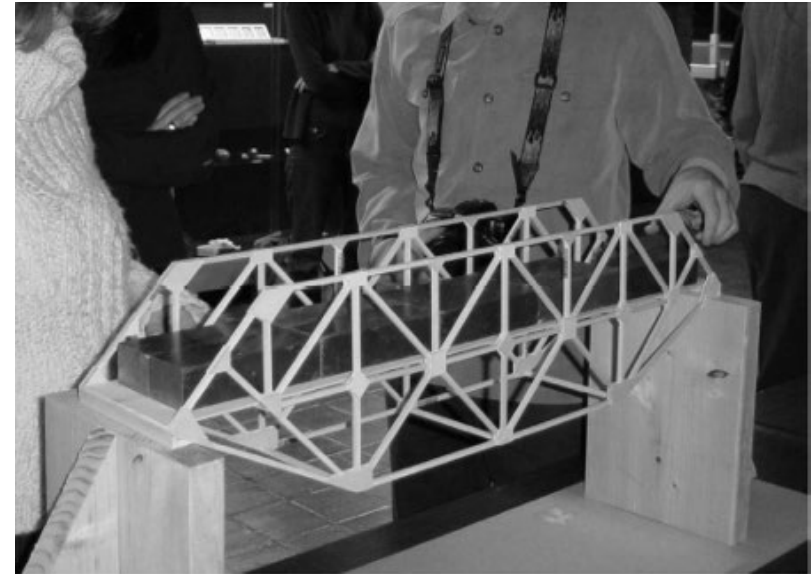


Bridge Project

FEEDBACKS + Evaluations + Comments Answering Questions

Span=160 ft (scaled = 30 in)
Max. Depth = 53 ft (10 in)
Max. Deck = 8 in (1/8 in thick)

Max Weight = 68k (4 oz)
Material = wood + glue



Bridge Project

- Have creativity!
- Refine your initial design
- Iteration to upgrade your design
- Pay attention to the Tally sheet requirements.
(We Don't want you to lose points!)
- A long-continuous member is allowed.
- Deck required to be designed flat
- Look at the examples provided in the course website

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Thank you.

Any question?

Please feel free to ask questions.