ARCH 314
STRUCTURE I

RECITATION SESSION 10
FACULTY: Prof. Peter Von Buelow
GSI: Faezeh Choobkar
FALL 2025

Welcome to recitation session

Introduction:

Faezeh Choobkar (PhD student)
Contact: faezehch@umich.edu
Office hours: by appointment

Outline:

Quick Recap
Provide the solution for the assignment
Answering student's questions
Recitation lab

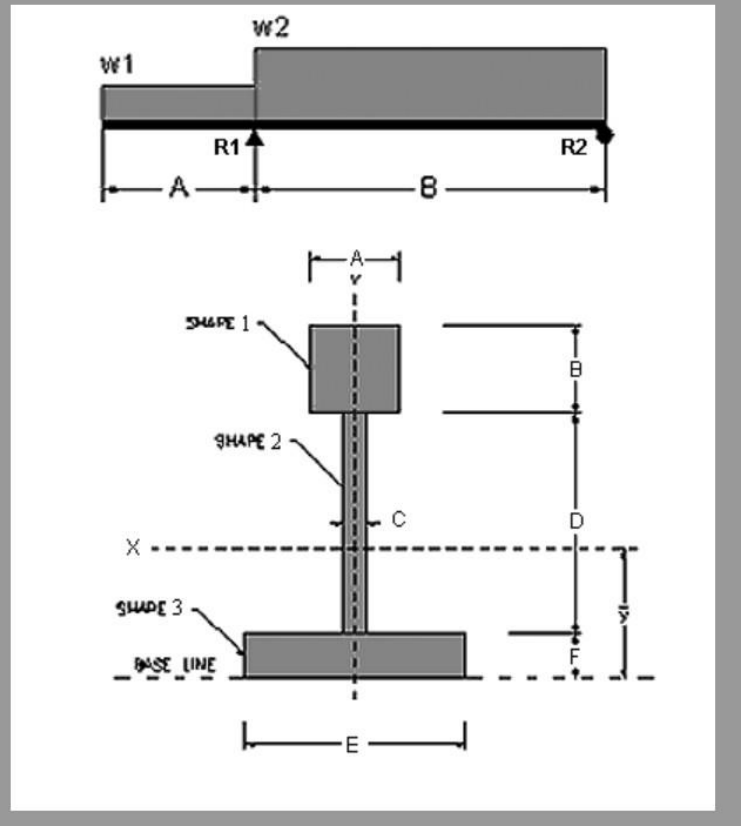
Problem Set

13. Horizontal Shear

Determine the maximum overall shear force and the horizontal shear stress at that location. Then find the horizontal shear stress at each end of the center web (top and bottom).

DATASET: 1 -2- -3-

Section dimension A	8 IN
Section dimension B	2 IN
Section dimension C	1 IN
Section dimension D	8 IN
Section dimension E	4 IN
Section dimension F	1 IN
Beam span A	5 FT
Beam span B	17 FT
Beam load w1	38 PLF
Beam load w2	15 PLF



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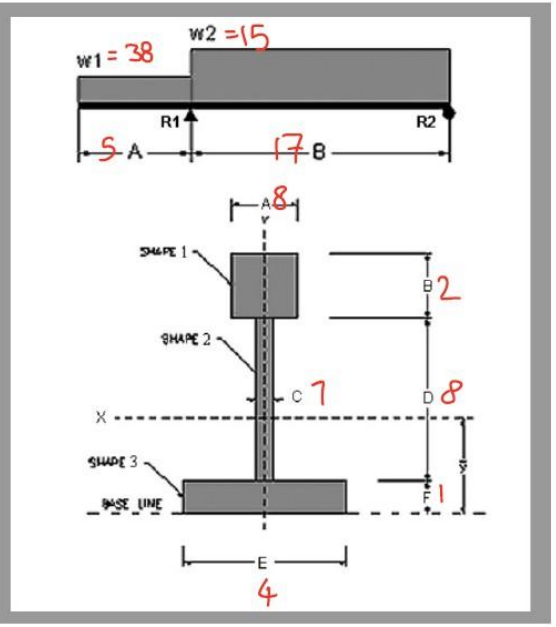
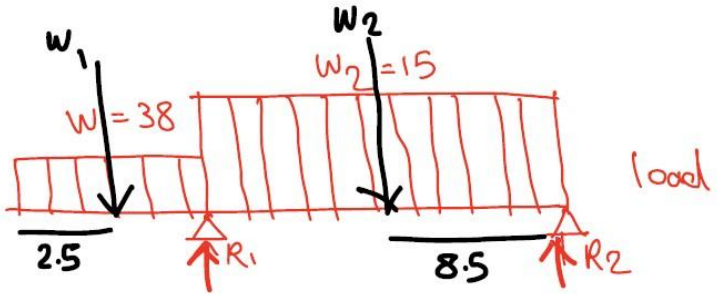


$W_1 = w_1 A = 38(5) = 190$

$W_2 = w_2 B = 15(17) = 255$



Problem Set

$$\Sigma M_1 = 0 \rightarrow$$

$$W_2(8.5) - R_2(17) + W_1(2.5) = 0$$

$$2167.5 - R_2(17) - 475 = 0$$

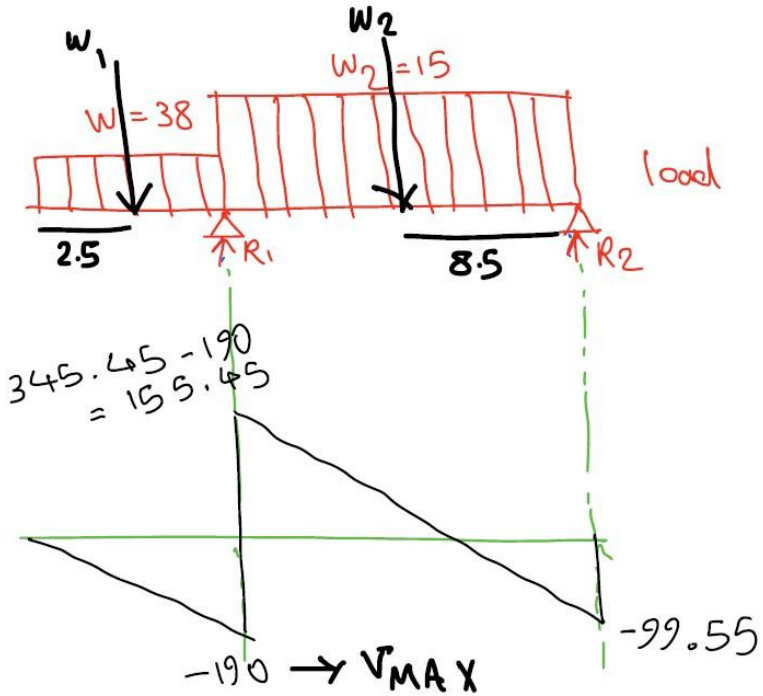
$$R_2 = \boxed{99.55}$$

$$\Sigma F_y = 0 \rightarrow R_1 + R_2 - W_1 - W_2 = 0$$

$$R_1 + 99.55 - 190 - 255 = 0$$

$$R_1 = \boxed{345.45}$$

Problem Set



$$f_{VH} = \frac{VQ}{Ib}$$

V = 190

I = ?

Problem Set

Calculation of centeroid →

Shape 1 :

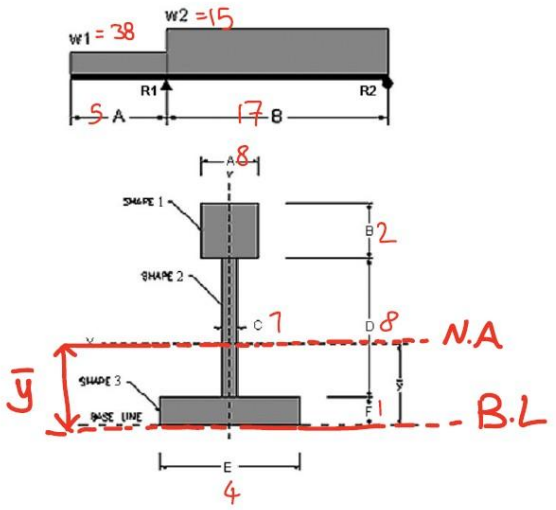
$A = 8 \times 2 = 16$ $\quad d = 10$ $\quad Axd = 160$

Shape 2 :

$A = 8 \times 1 = 8$ $\quad d = 5$ $\quad Axd = 40$

Shape 3 :

$A = 4 \times 1 = 4$ $\quad d = 0.5$ $\quad Axd = 2$



$$\bar{y} = \frac{\Sigma Axd}{\Sigma A} = \frac{202}{28} = 7.21$$

Problem Set

STEP 2: Second Moment of Area (I_x)
(Moment of inertia)

	I_x ($\frac{bh^3}{12}$)	A	d	Axd^2	$I_x + Ad^2$
Shape 1	$\frac{8 \times (2)^3}{12} = 5.33$	$8 \times 2 = 16$	$10 - 7.21 = 2.79$	124.54	129.87
Shape 2	$\frac{1 \times (8)^3}{12} = 42.66$	$8 \times 1 = 8$	$7.21 - 5 = 2.21$	39.07	81.73
Shape 3	$\frac{4(1)^3}{12} = 0.33$	$4 \times 1 = 4$	$7.21 - 0.5 = 6.71$	180.09	180.42
SUM	48.32	28 in	-	343.70	392.02

d: centroid of shape to the centroid of whole shape

Problem Set

$$f_{VH} = \frac{VQ}{Ib}$$

V = 190

I = 392.02

Q = ?

b = 7

↓

where the web is connected to top flange

Top of shape-2

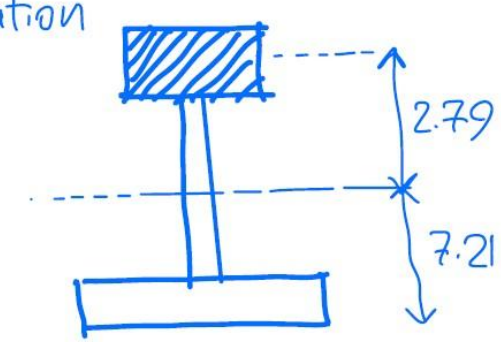
Static Moment Calculation

shape1 :

A = 8 x 2 = 16

y = 2.79

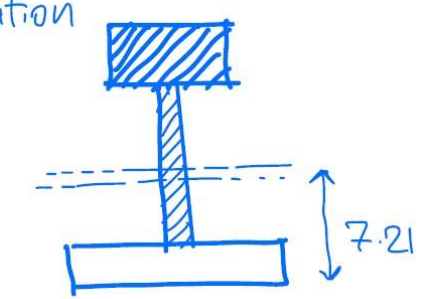
Axy = 44.64 = Q_1



Problem Set

Bot of shape-2

Static Moment Calculation



Shape 1 :

$A = 8 \times 2 = 16$

$y = 2.79$

$Axy = \underline{44.64} = Q_1$

Shape 2 :

$A = 8 \times 1 = 8$

$y = -2.21$

$Axy = \underline{-17.68}$

$Q_2 = 44.64 - 17.68 = 26.96$

Problem Set

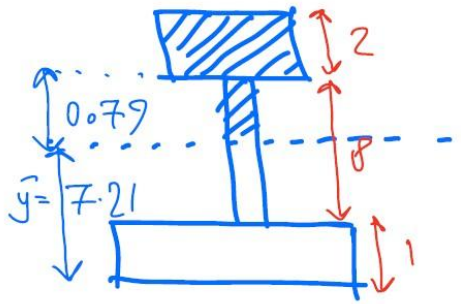
Q at neutral axis:

Shape 1:

$A = 8 \times 2 = 16$

$y = 2.79$

$Axy = 44,64$



Shape 2:

$A = 0,79 \times 1 = 0.79$

$y = 0.395$

$Axy = 0.312$

$Q_+ = 44,95$

Problem Set

$$f_v = \frac{VQ}{Ib}$$

V = 190

I = 392.02

Top of Sh-2:

Q = 44.64

b = 1

f_v = 21.63

Bot of Sh-2:

Q = 26.96

b = 1

f_v = 13.06

Neutral Axis:

Q = 44.95

b = 1

f_v = 21.78

Structures I

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Name 1 _____

Name 2 _____

Name 3 _____

Horizontal Shear Stress

Description

This project examines horizontal shear in a simple beam.

Goals

To observe an example of shear force in an element.
To gage the effect of shear stiffness.
To observe horizontal shear failure.

Procedure

1. Place the clips at each end of the beam and position it on the supports.
2. Add the washer weight and measure the deflection.
3. Remove the clips and repeat the loading and again measure the deflection.
4. Note the slippage of the planes particularly at each end.
5. Compare the deflections of the two tests.