Recitation 004

11/15/2024

GSI Info

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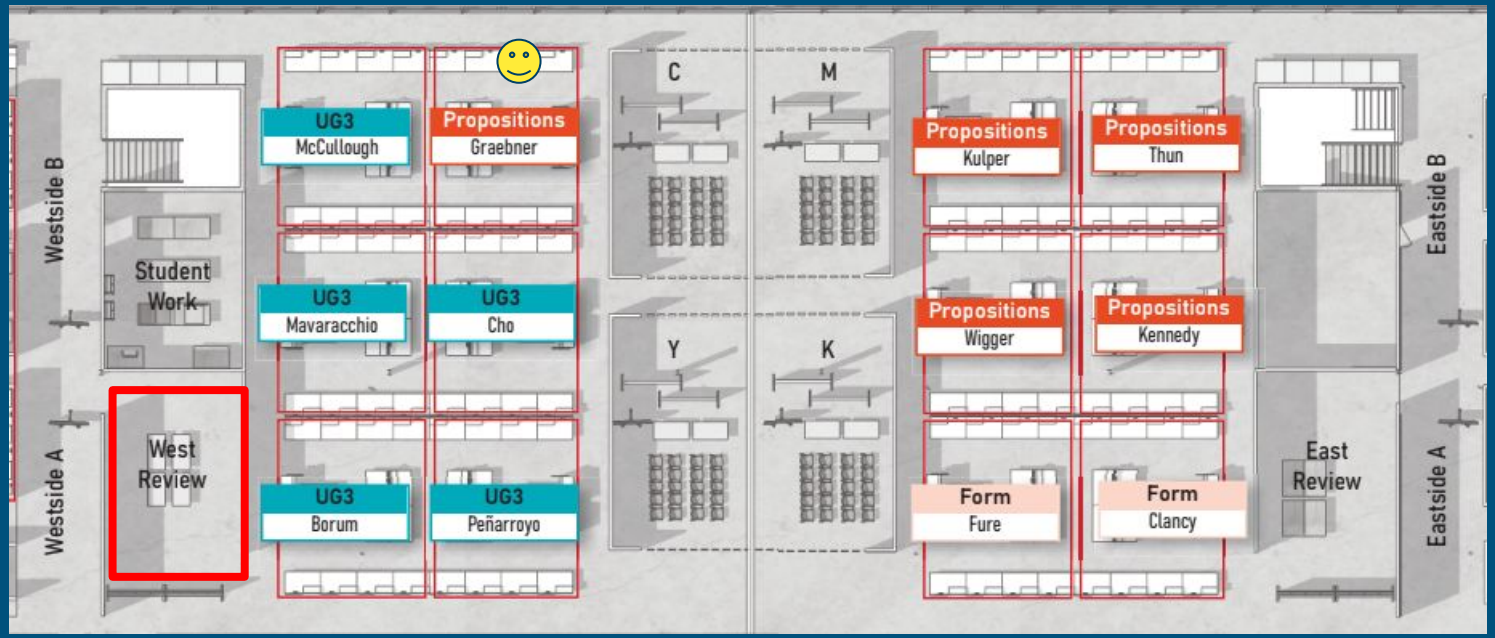


Questions

FINAL BRIDGE REPORT

- FINAL REPORT IS DUE NOVEMBER 25TH (150 Points)
  - Less than 10 days away
  - Reviews, deadlines, etc.
  - Don't ruin my Thanksgiving

Revised Bridge Design Analysis	**50**	
Internal axial force calculations/modeling (with proper design loading indicated) (Dr. Frame acceptable)	10	
Derivation of member cross-sectional areas from axial forces	10	
Member size selection from available stock	4	
Est. weight calculation of bridge - including members, glue & fasteners	6	
Method of joints/sections calculation for at least 1 joint (@ reaction is usually easiest based on truss geometry, but could be done elsewhere)	10	
Member crushing calculations/check (show work) using $F'_c=P/A$	4	
Prediction of capacity of bridge and mode of failure	6	
Illustration of Tested (Revised from Preliminary) Design	**20**	
Cross-section of bridge	4	
Elevation(s) of bridge	4	
Dimensions and units labeled in elevation and cross-section	4	
Member sizes labeled (with dimensions)	4	
Member stresses labeled (with units)	4	
Testing Results	**30**	
Weight and height of bridge	5	
Capacity of bridge	5	
Observations of testing	6	
Description of mode of failure	5	
Images of failure	5	
Following the guidelines	4	
Post-Testing Analysis	**30**	
Comparison of testing with predicted capacity and modes of failure	10	
Discussion of discrepancies between results	10	
Suggested improvements for future designs with reasoning discussed	10	

HW #12

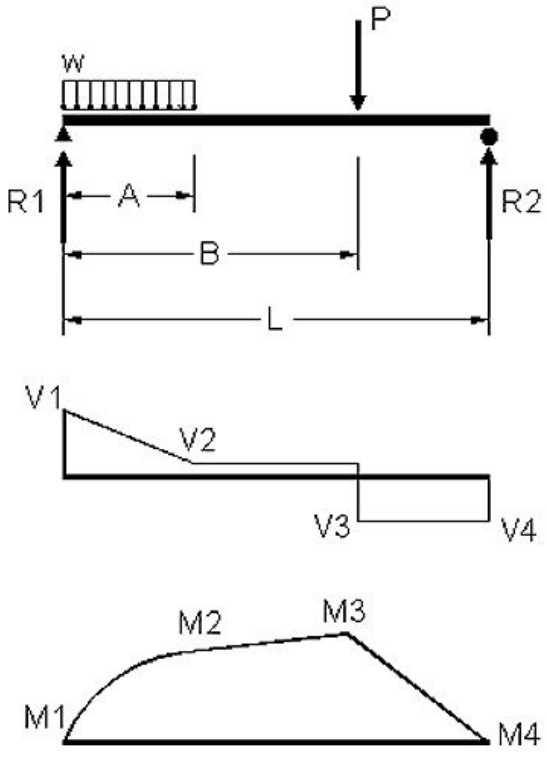
12. Shear and Moment Diagrams

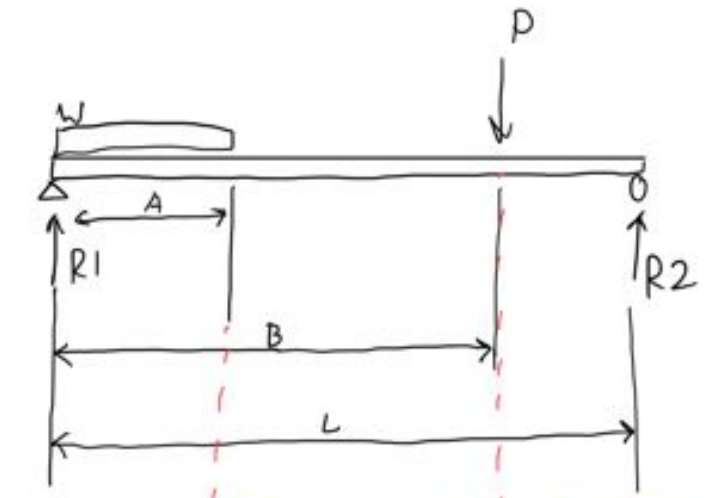
Calculate end reactions and construct the shear & moment diagrams for the loading shown.

DATASET: 1 -2- -3-

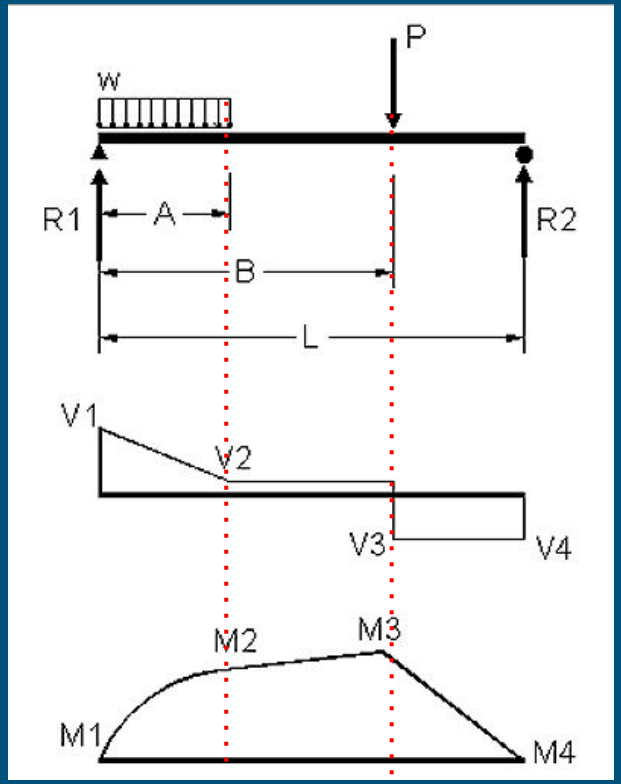
Total Span L	32 FT
Length A	14 FT
Length B	21 FT
Uniform Load on Length A (w)	270 PLF
Point Load (P)	1350 LBS

#	Question
1	Left Reaction (R1) (+ is upward; - is downward)
2	Right Reaction (R2) (+ is upward; - is downward)
3	Peak Shear value at R1 (V1) (use + or - sign)
4	Moment value at R1 (M1)
5	Shear value at A distance from R1 (V2) (use + or - sign)
6	Moment value at A dist. from R1 (M2 tension on bottom is +)
7	Peak Shear value at B distance from R1 (V3) (use + or - sign)
8	Moment value at B dist. from R1 (M3 tension on bottom is +)
9	Peak Shear value at R2 (V4) (use + or - sign)
10	Moment value at R2 (M4)
11	Maximum Moment (tension on bottom is +)
12	Distance from Left to Max. Moment in (decimal)





P = 1310 lb L = 30' B = 20'
A = 9' w = 160 PLF



1. Find the Left Reaction

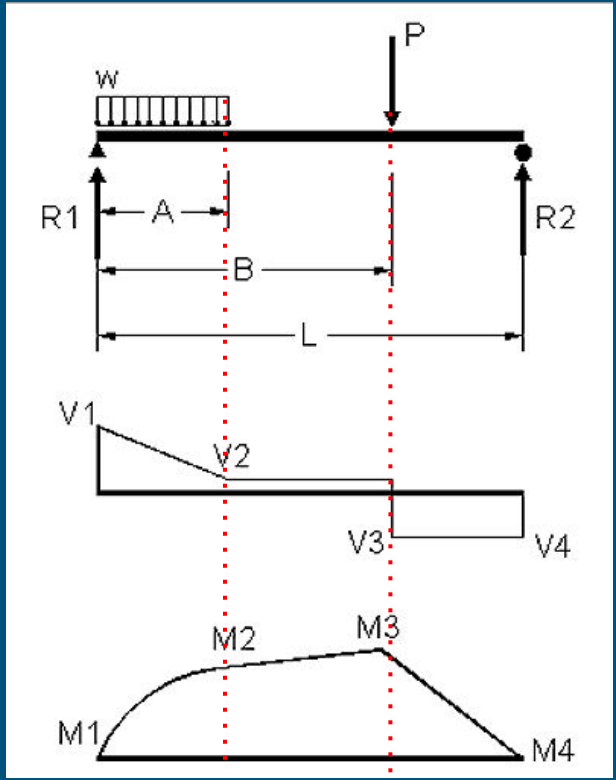
$$\Sigma M_{R_2} = M_P + M_w + M_{R_1} = 0$$

$$0 = -P(L-B) + -wA(L-A/2) + R_1(L)$$

$$R_1 = \frac{wA\left(L-\frac{A}{2}\right) + P(L-B)}{L}$$

$$R_1 = \frac{270(14')\left(32'-\frac{14'}{2}\right) + 1350\,(32'-21')}{32'} = 3417.19\,\text{lb}$$

#1



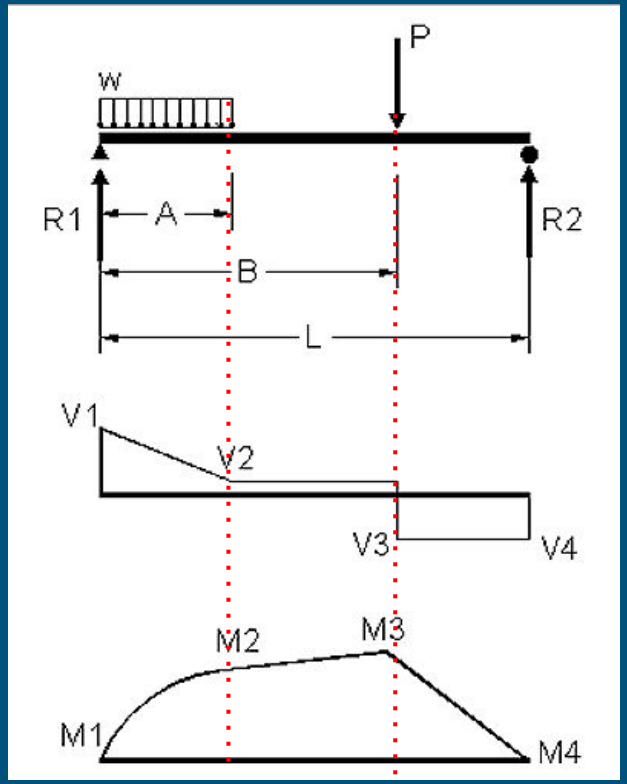
2.) Find Reaction R_2

$$\Sigma F_y = 0 = R_1 + R_2 - P - w(A)$$

$0 = 3417.19 + R_2 - 1350 - 270(14') = 1712.81$ lbs

3417.19: From #1

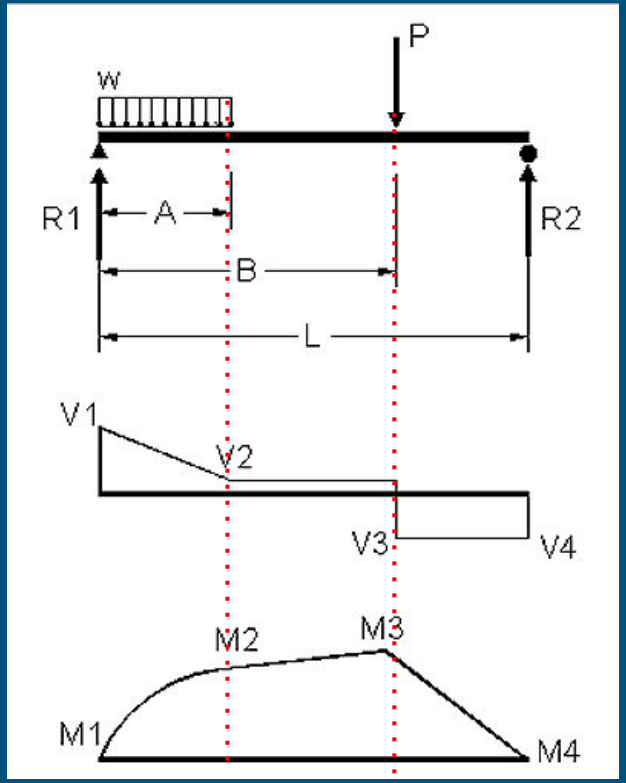
1712.81: #2



3.) Peak Shear Value @ R1

$V_1 = R_1 = 3417.19$ lbs

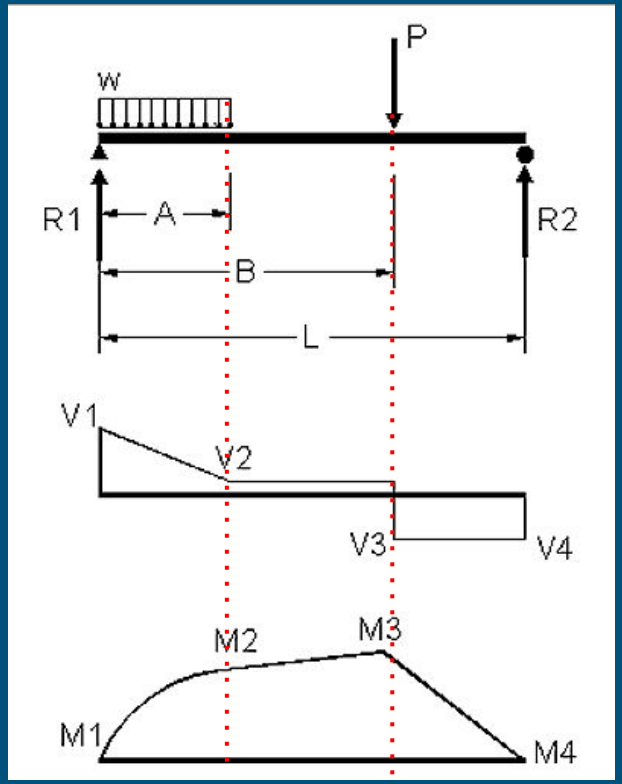
From #1 ↑ ↑ #3



4.) Moment value at R1 (M1)

$M_1 = 0$ ← #4

↑ Pinned end



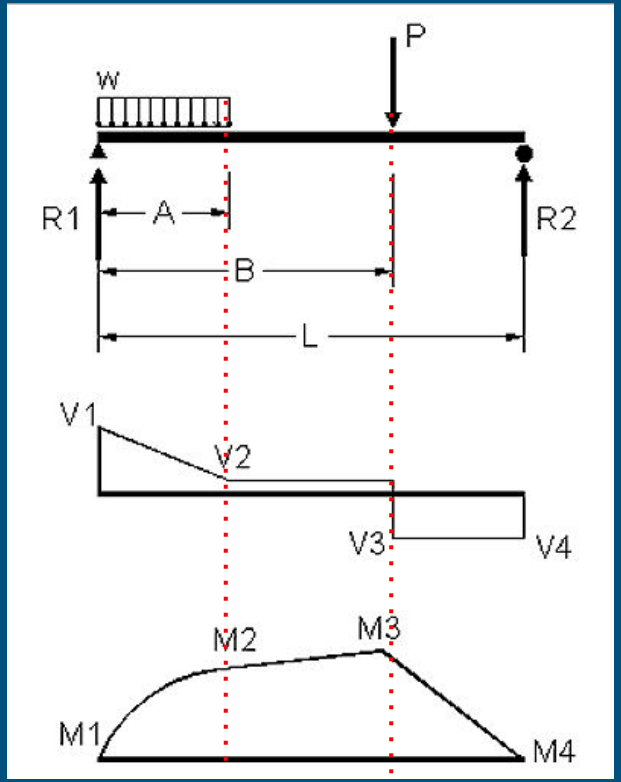
5.) Shear Value @ A

$V_2 = \Sigma F_y @ A = V_1 - wA$

$= 3417.19 \text{ lbs} - 270_{PLF}(14') = -362.812 \text{ lbs}$

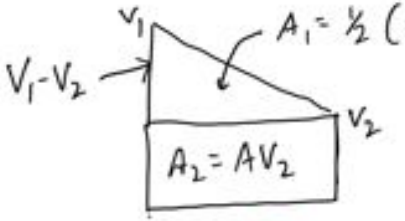
↑ From #1

↑ #5



6.) Moment at A distance from R_1 (M_2)

Sum area under the curve from x=0 to x=A



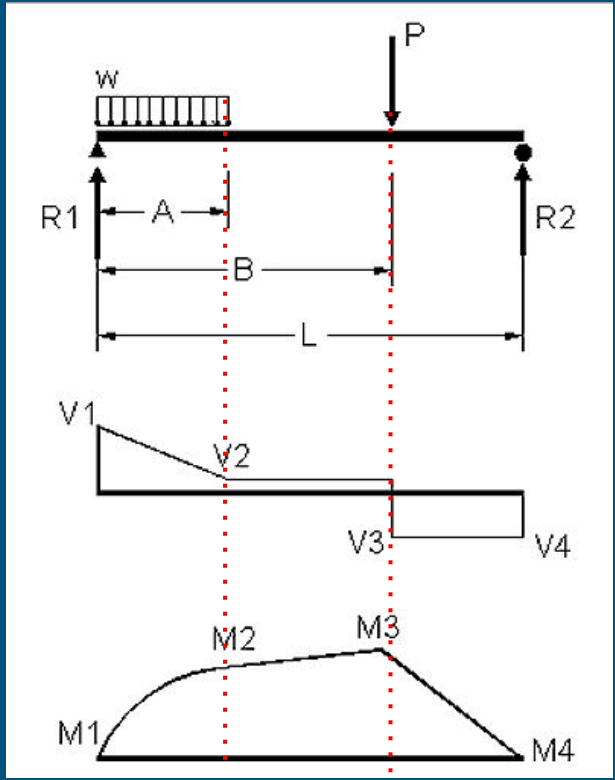
$M_2 = A_1 + A_2$

Remember your sign

$M_2 = \frac{1}{2}(3417.19 + 362.81)(14') + (-362.81)(14') = 21380.66$ ft-lbs

From #3 | From #5 | From #5

6



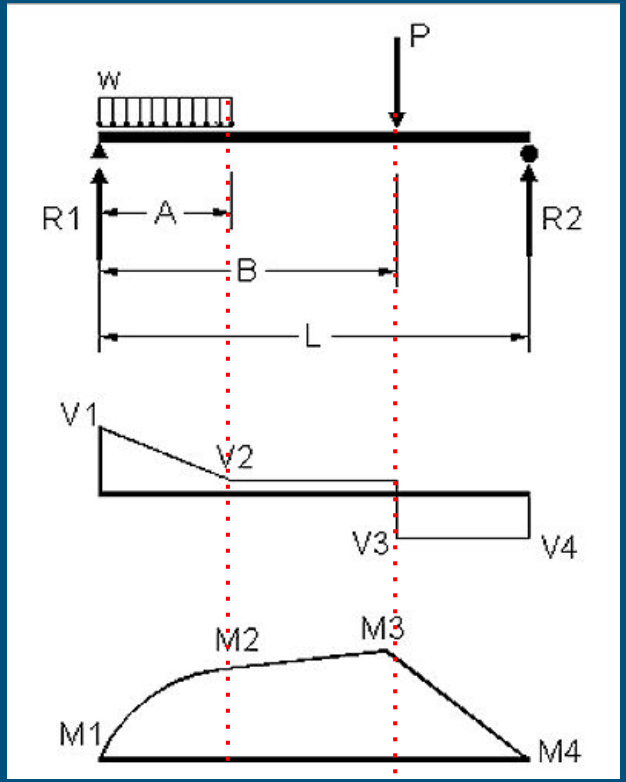
7.) Shear Value B distance from R1 (V_3)

$$V_3 = \Sigma F @ B = R_1 - wA - P$$

$$= 3417.19 \text{ lbs} - 270 (14') - 1350 \text{ lbs} = -1712.81 \text{ lbs}$$

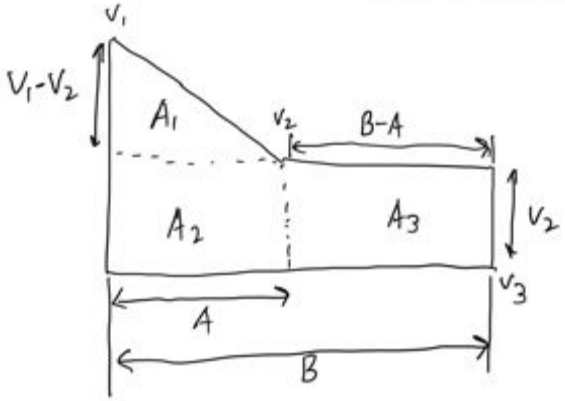
↑ from #1

↑ #7



8. moment @ distance B from R_1

Sum areas under the curve from X=0 to X=B



$$M_3 = A_1 + A_2 + A_3$$

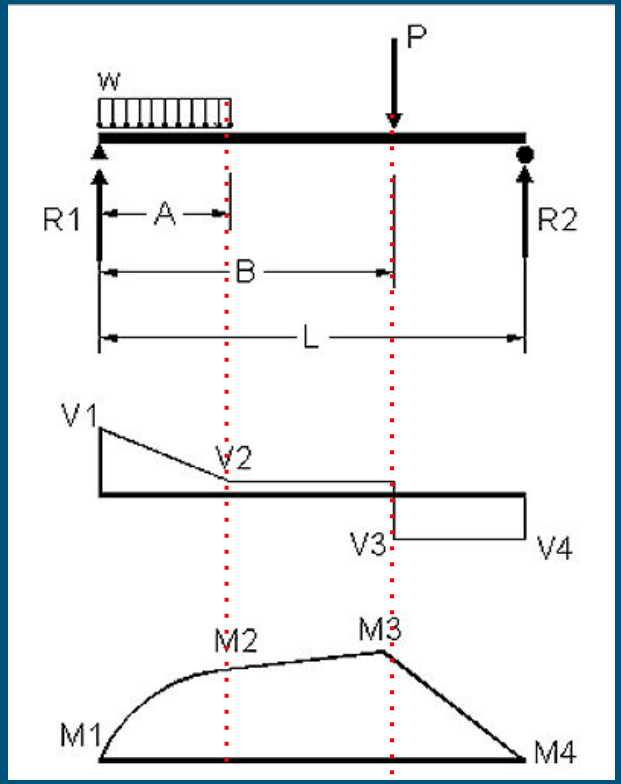
$$M_3 = M_2 + (B-A)(V_2)$$

$= 21380.6$ ft-lbs $+ (21' - 14')(-362.81) = 18840.93$ ft-lbs

#8

From #6

From #5



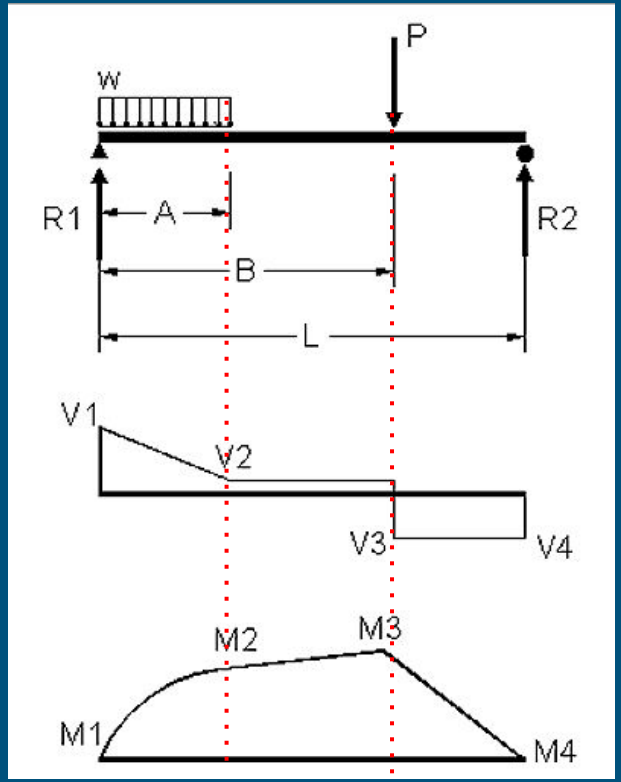
9.) Peak Shear Value @ R2 (M4)

$V_4 = \Sigma F @ L = R_1 - wA - P$

$V_3 = V_4 = -1712.81$ lbs

↑ #9

↳ from #7

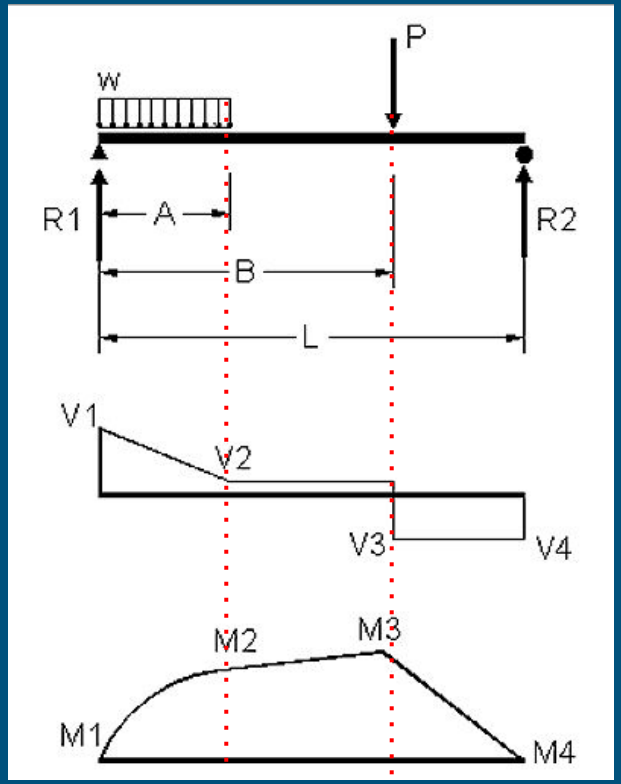


10.) Moment Value @ R_2 (M4)

$M4 = 0$ ← #10

↑ at Reaction (Roller)

* You can check by Summing areas under the curve *



11.) Maximum Moment

Max. = $V_1 \left(\frac{d}{2}\right)$ $\quad d = \frac{V_1}{w} = \frac{3417.19}{270\ plf} = 12.66'$ ← from #3

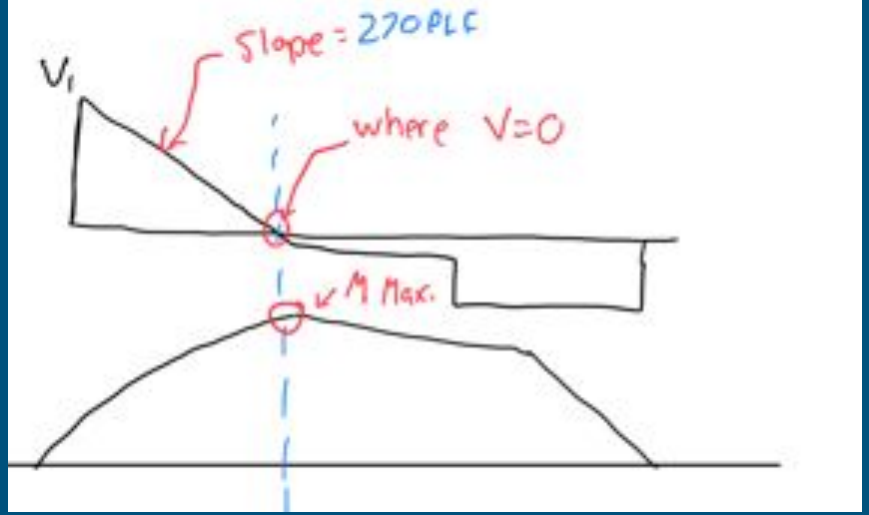
= 3417.19 ($\frac{12.66'}{2}$) = 21624.42 Ft-lbs ← #11

12.) Distance from Left to Max Moment

$$d = \frac{V_1}{w} = \frac{3417.19}{270\ plf} = 12.66'$$

3417.19 ← from #3

12.66' ↑ #12



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