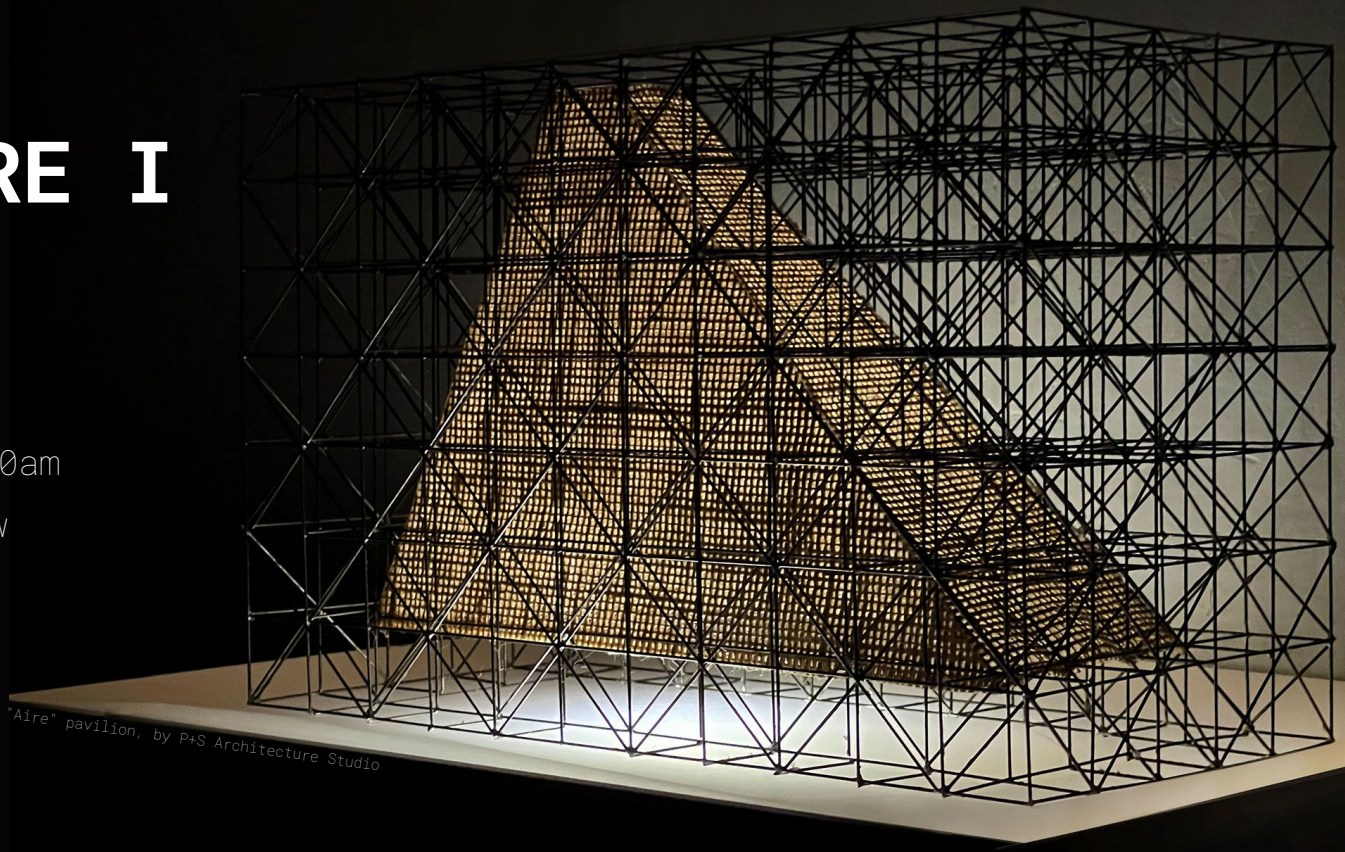
STRUCTURE I

ARCH-314

9:30am - 10:30am

East Review


"Aire" pavilion, by P+S Architecture Studio

Today:

- Problem No.9: Floor Systems
- Lab 07:Lateral Stability

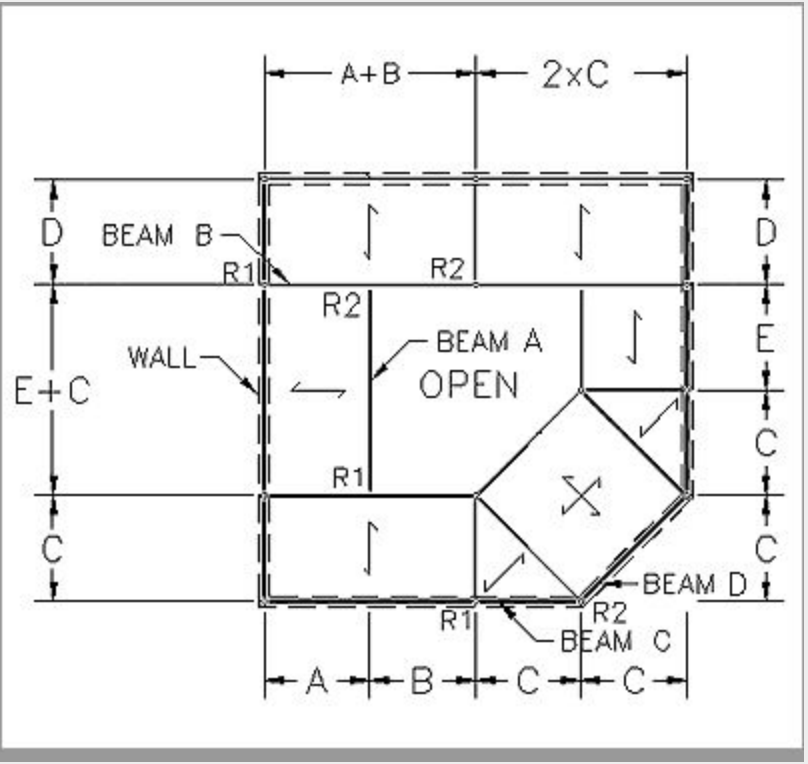
PROBLEM NO.9

9. 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	12 FT
Span B	14 FT
Span C	9 FT
Span D	12 FT
Span E	18 FT
Dead load of wall	580 PLF
Dead load of floor	49 PSF
Live load on floor	27 PSF



PROBLEM NO.9

Question 1: **Full uniform load on Beam A**

$$W_A(\,Deadload) = Floor\ Deadload \times \frac{Span\ A}{2}$$

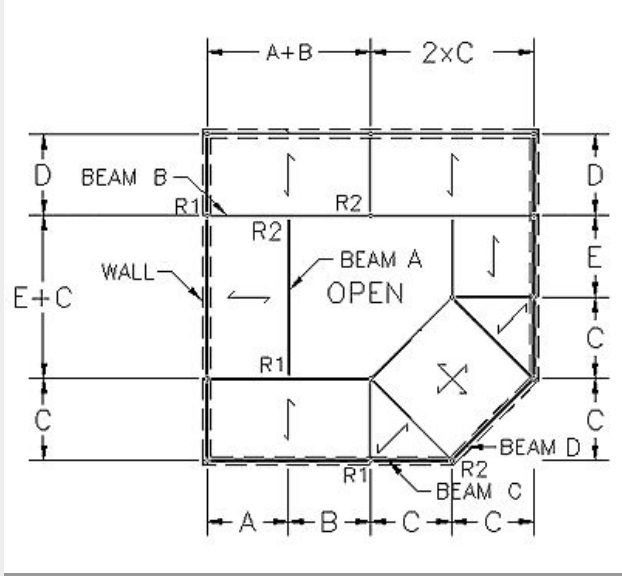
$$W_A(\,Deadload) = 49 \times \frac{12}{2} = 294\ PLF$$

$$W_A(\,Live\ load) = Floor\ Live\ load \times \frac{Span\ A}{2}$$

$$W_A(\,Live\ load) = 27 \times \frac{12}{2} = 162\ PLF$$

$$W_{TA} = W_A(\,Live\ load) + W_A(\,Deadload)$$

$$W_{TA} = 162\ PLF + 294\ PLF = 456 PLF$$



DATASET: 1 -2- -3-	
Span A	12 FT
Span B	14 FT
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Dead load of wall	580 PLF
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Live load on floor	27 PSF

PROBLEM NO.9

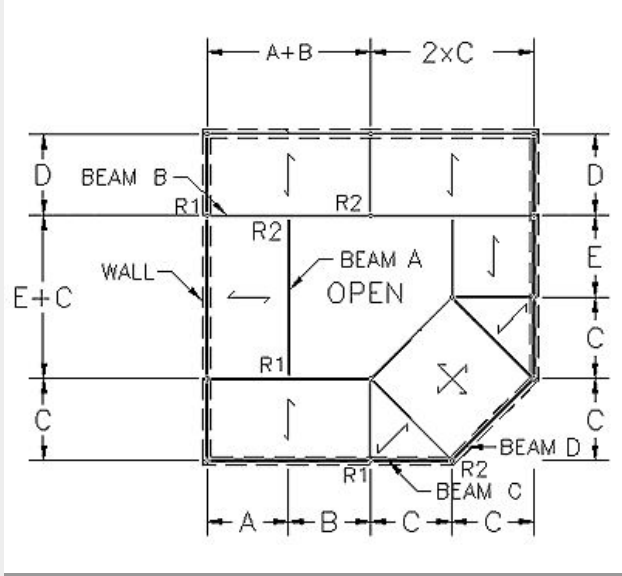
Question 2&3: **End reaction R1&R2 on Beam A**

$$W_A = w_{TA} \times LL(\ Liveload)$$

$$W_A = 456 \times 27 = 12312\ LBS$$

$$Symmetry \rightarrow R_1 = R_2 = \frac{W_A}{2}$$

$$R_1 = R_2 = \frac{12312}{2} = 6156 LBS$$



DATASET: 1	-2-	-3-
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Dead load of floor		49 PSF
Live load on floor		27 PSF

PROBLEM NO.9

Question 4: **Full uniform load on Beam B**

$$W_B(\,Deadload) = Floor\ Deadload \times \frac{Span\ D}{2}$$

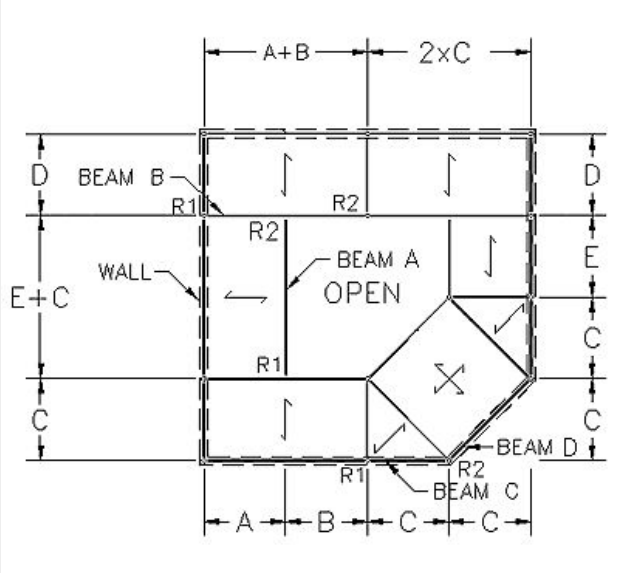
$$W_B(\,Deadload) = 49 \times \frac{12}{2} = 294\ PLF$$

$$W_B(\,Live\ load) = Floor\ Live\ load \times \frac{Span\ B}{2}$$

$$W_B(\,Live\ load) = 27 \times \frac{12}{2} = 162\ PLF$$

$$W_{TB} = W_B(\,Live\ load) + W_B(\,Deadload)$$

$$W_{TB} = 162\ PLF + 294\ PLF = 456 PLF$$



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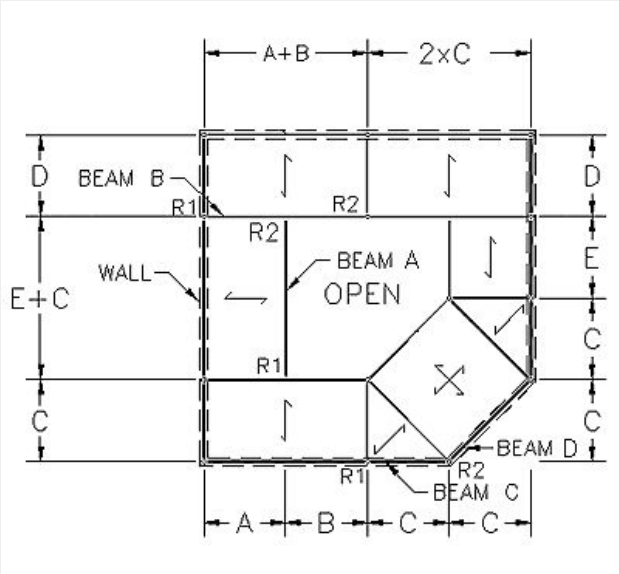
PROBLEM NO.9

Question 5: **Point load on Beam B**

$$W_B = \frac{w_B \times LL}{2}$$

$$W_B = \frac{456 \times 27}{2}$$

$$W_B = 6156\ LBS$$



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PROBLEM NO.9

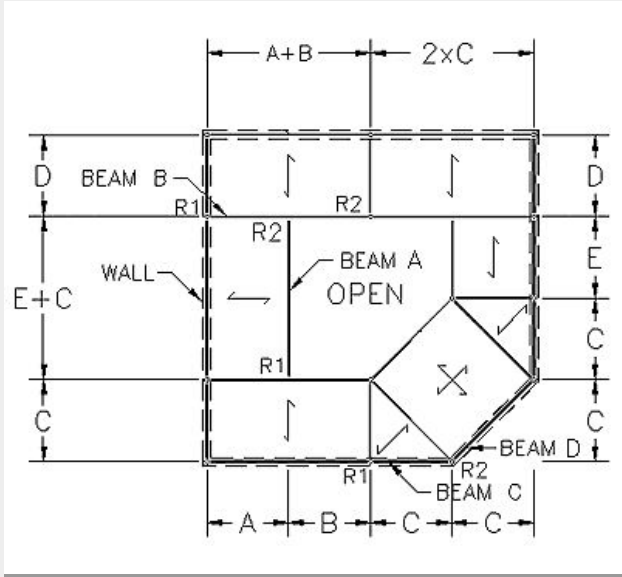
Question 7: **End reaction R2 on Beam B**

$$\sum_{M_{R1}} = 0$$

$$W_B \times (Span\ D) + W_A \times \frac{Span\ A + Span\ B}{2} - R_2 \times (Span\ A + Span\ B) = 0$$

$$6156 \times 12 + 11856 \times 13 - R_2 \times 26 = 0$$

$$R_2 = 8769.23\ LBS$$



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PROBLEM NO.9

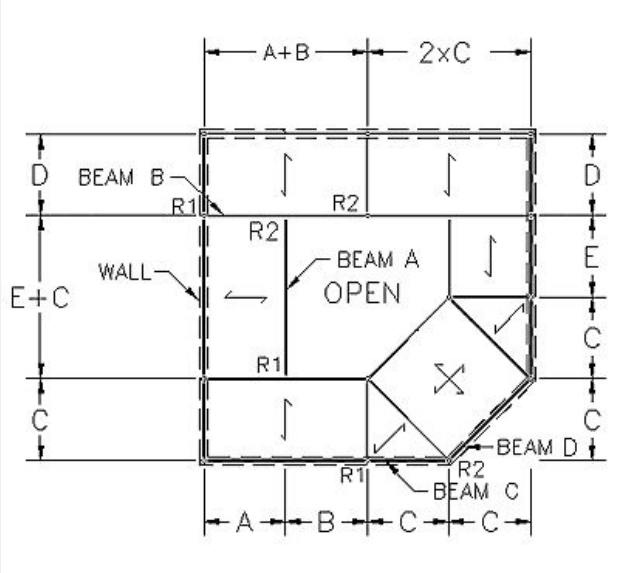
Question 6: **End reaction R1 on Beam B**

$$\sum_{F_y} = 0$$

$$R_1 - W_B - W_A + R_2 = 0$$

$$R_1 - 6156 - 11856 + 8769.23 =$$

$$R_2 = 8769.23\ LBS$$



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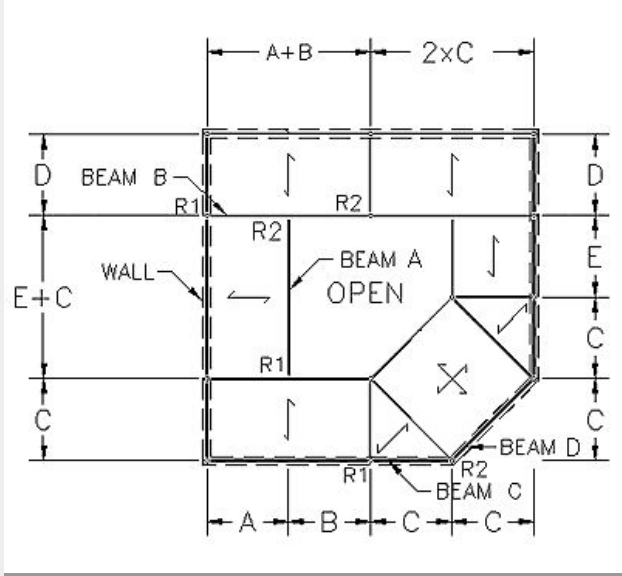
Live load on floor	27 PSF

PROBLEM NO.9

Question 8: **Full uniform load on Beam C**

$$W_C = W_{wall} = 580\ PLF$$



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PROBLEM NO.9

Question 9: **Peak value of triangular load on Beam C**

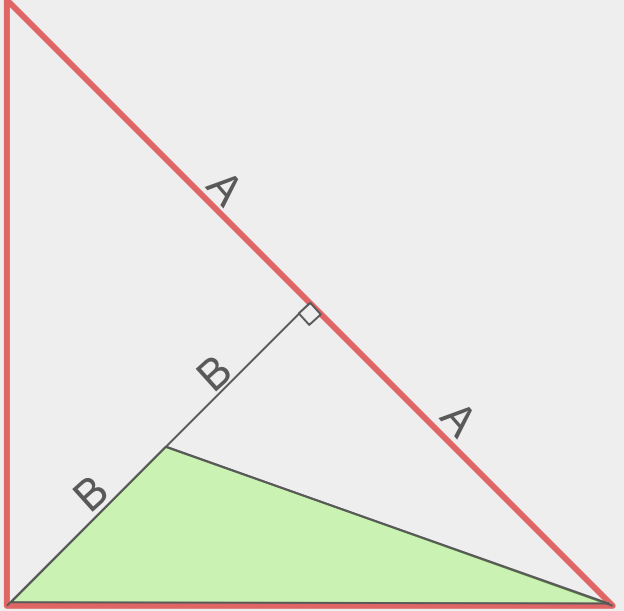
$$S = \frac{B \times A}{2}$$

$$A = 2B$$

$$A = Span\ C \times cos(45)$$

$$S = \frac{\left(\frac{Span\ C \times cos(45)}{2}\right) \times Span\ C \times cos(45)}{2}$$

$$S = \frac{\frac{9 \times \cos(45)}{2} \times 9 \times \cos(45)}{2} = \boxed{10.125\ FT^2}$$



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Live load on floor	27 PSF

PROBLEM NO.9

Question 9: **Peak value of triangular load on Beam C**

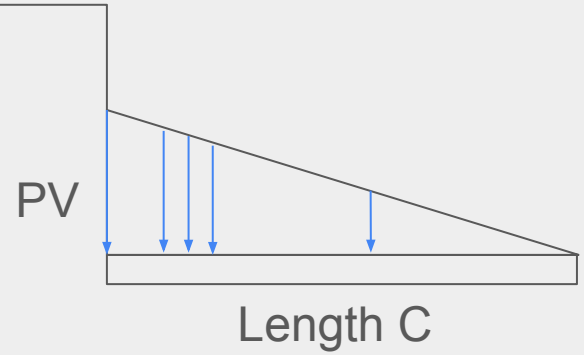
$$S \times (DL + LL) = \frac{PV \times Span\ C}{2}$$

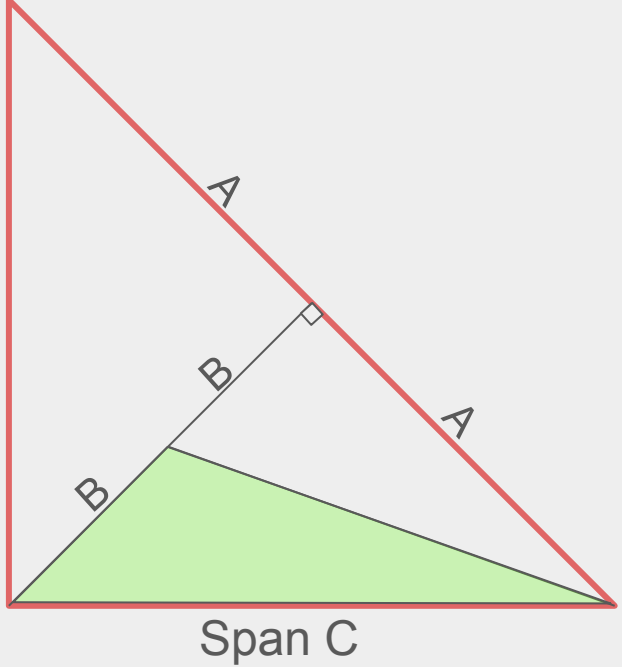
$$10.125 \times (49 + 27) = \frac{PV \times 9}{2}$$

$$769.5 = \frac{PV \times 9}{2}$$

$$PV = \frac{2 \times 769.5}{9}$$

$$PV = 171\ PLF$$





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PROBLEM NO.9

Question 11: **End reaction R2 on Beam C**

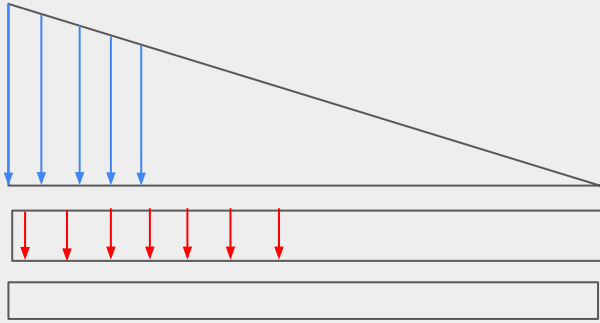
$$\sum_{R_1=0}$$

$$W_{Floor} \times \frac{L\,C}{3} + W_{Wall} \times \frac{L\,C}{2} - R_2 \times L\,C = 0$$

$$\left(\frac{171 \times 9}{2}\right) \times \frac{9}{3} + (580 \times 9) \times \frac{9}{2} - R_2 \times 9 = 0$$

$$R_2 = 2866.5\ LBS$$

PV



$$Length\ C = Span\ C$$

DATASET: 1 -2- -3-	
Span A	12 FT
Span B	14 FT
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Span D	12 FT
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Dead load of wall	580 PLF
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PROBLEM NO.9

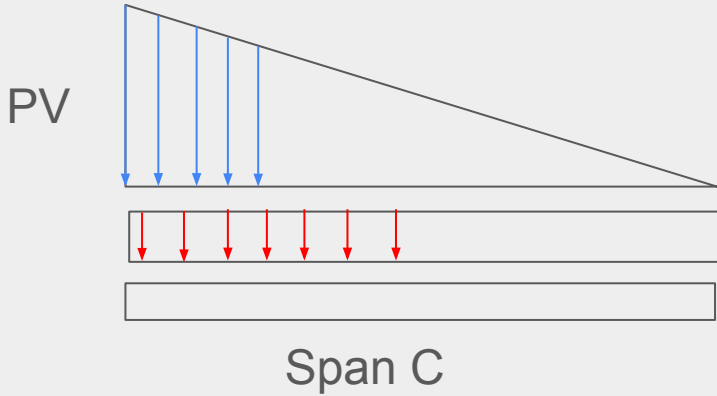
Question 10: **End reaction R1 on Beam C**

$$\sum_{Fy=0}$$

$$R_1 - W_{Floor} - W_{Wall} + R_2 = 0$$

$$R_1 - \left(\frac{171 \times 9}{2}\right) - (580 \times 9) + 2866.5 = 0$$

$$R_1 = 3123\ LBS$$



DATASET: 1	-2-	-3-
Span A		12 FT
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Span E		18 FT
Dead load of wall		580 PLF
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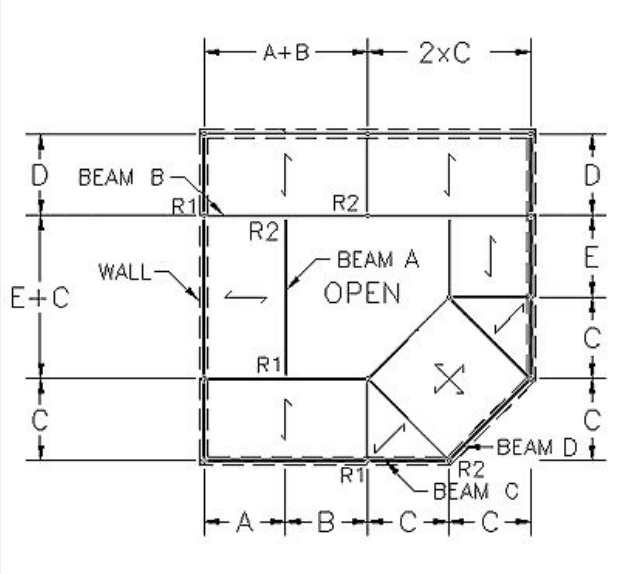
Live load on floor		27 PSF

PROBLEM NO.9

Question 12: **Full uniform load on Beam D**

$$W_D = W_{Wall} = 580\ PLF$$



DATASET: 1 -2- -3-	
Span A	12 FT
Span B	14 FT
Span C	9 FT
Span D	12 FT
Span E	18 FT
Dead load of wall	580 PLF
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Live load on floor	27 PSF

PROBLEM NO.9

Question 13: **Peak value of triangular load on Beam D**

$$S_D = \frac{Span\ C \times Span\ C}{2}$$

$$S_D = \frac{9 \times 9}{2} = 40.5\ FT^2$$

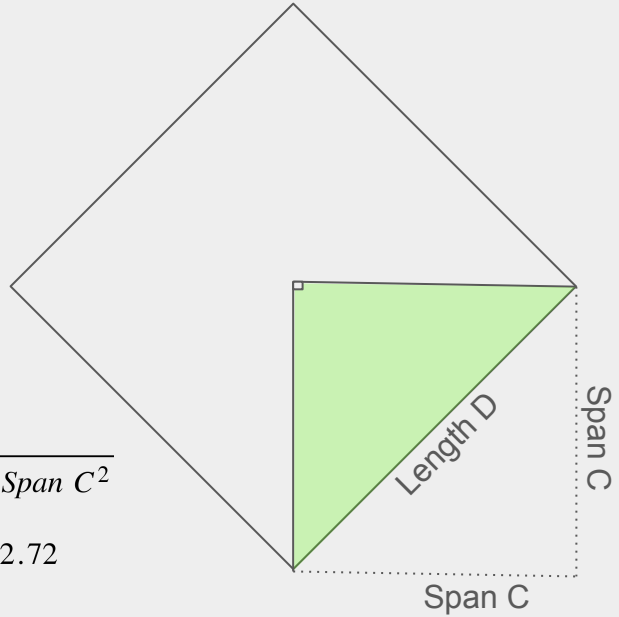
$$S_D \times (LL + DL) = \frac{PV_D \times Span\ C}{2}$$

$$40.5 \times 76 = \frac{PV_D \times 9}{2}$$

$$\boxed{PV_D = 483.66\ PLF}$$

$$L_D = \sqrt{Span\ C^2 + Span\ C^2}$$

$$L_D = \sqrt{9^2 + 9^2} = 12.72$$

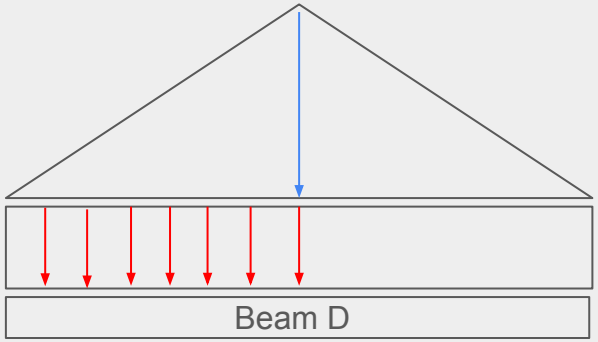


DATASET: 1 -2- -3-

Span A	12 FT
Span B	14 FT
Span C	9 FT
Span D	12 FT
Span E	18 FT
Dead load of wall	580 PLF
Dead load of floor	49 PSF
Live load on floor	27 PSF

PROBLEM NO.9

Question 14&15: **End reaction R1&R2 on Beam D**



$$\sum_{R_1=0}$$

$$W_{Floor} \times \frac{L_D}{2} + W_{Wall} \times \frac{L_D}{2} - R_2 \times L\,D = 0$$

$$\left(\frac{483.66 \times 12}{2}\right) \times \frac{12.72}{2} + (580 \times 12.72) \times \frac{12.72}{2} - R_2 \times 12.72 = 0$$

$$R_2 = 5230\ LBS$$

Symmetry

$$R_1 = 5230\ LBS$$

DATASET: 1	-2-	-3-
Span A		12 FT
Span B		14 FT
Span C		9 FT
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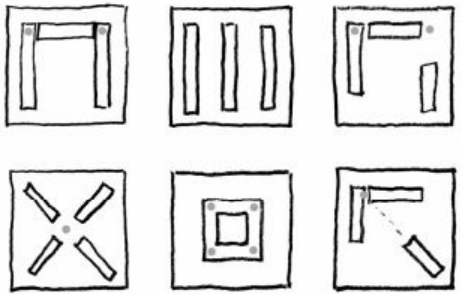
Lab 07: Lateral Stability

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.



Stable	Unstable