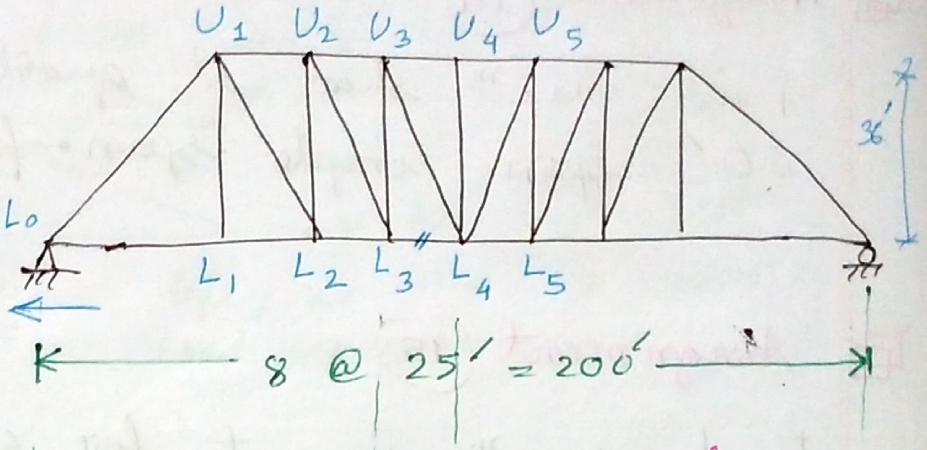
**Example**

Calculate Maximum stress in members $L_3L_4$ of the Truss.

$L_3L_4$ = chord member




$$\frac{W}{L} = \frac{W_1}{a}$$ → Criterion is used to find

ⓐ Maximum moment at a section of Beam

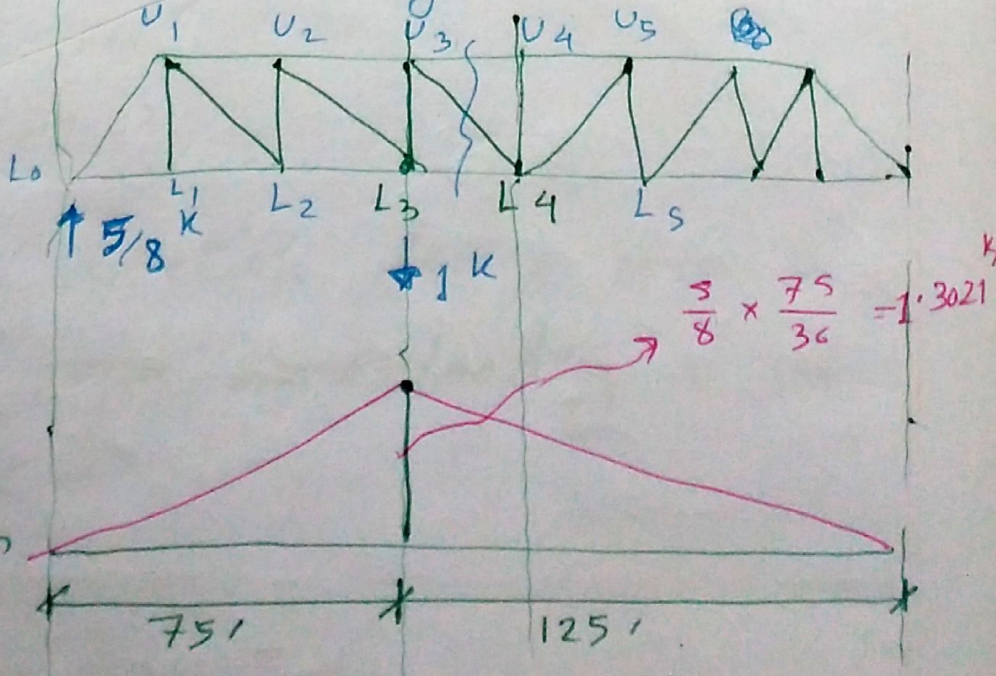
ⓑ Maximum Chord Stress (Bar Force) of TRUSS

- Bottom chord
- Top chord

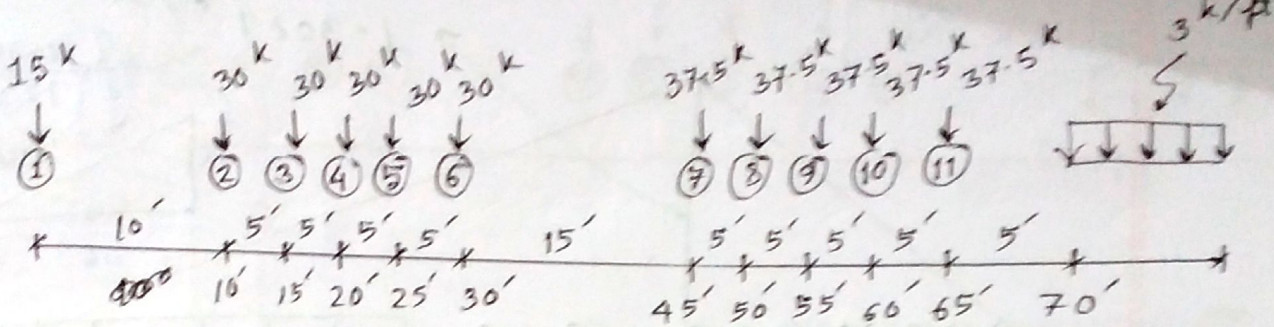
Stress → means force per unit area

→ but in this case stress means bar force so, no need to divide by area.

(*) Except special truss, IL is same type for all truss.

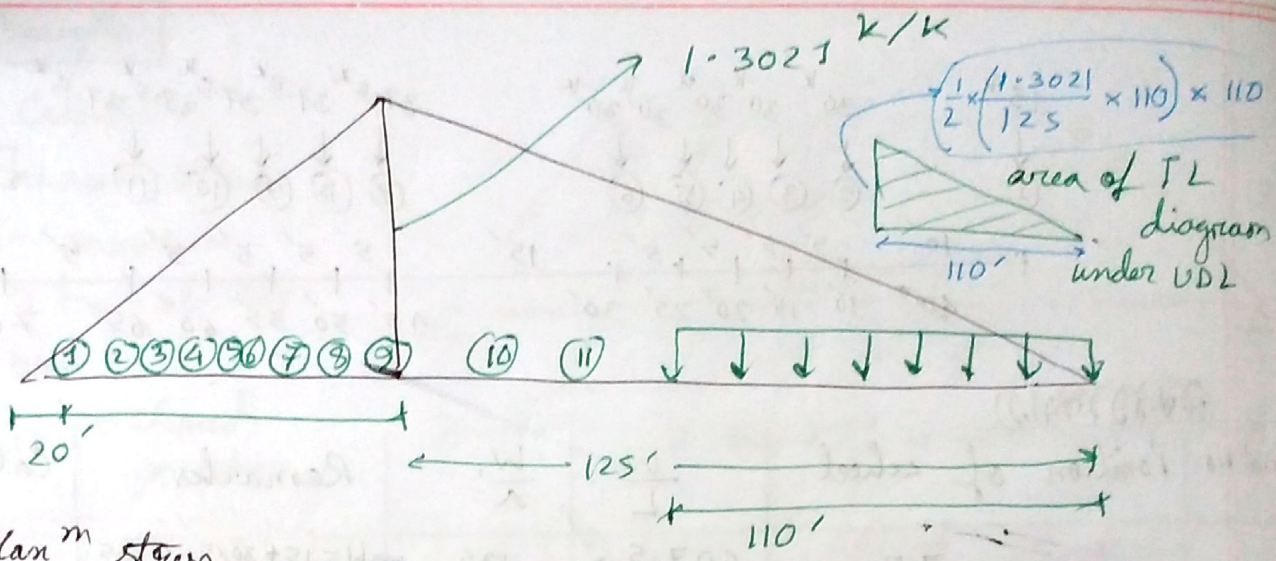


at least cover $\frac{1}{3}$rd → start from wheel ⑥




| Trial No. | Position of wheel | $\frac{W}{L}$ | $\frac{W_1}{a}$ | Remarks | Calculation |
|---|---|---|---|---|---|
| 1 | wheel ⑥ at $L_3$ → JR | $\frac{607.5}{200}$ | $>\frac{135}{75}$ | $W = 154 + 30\times5 + 37.5\times5 + 85\times3$ | |
| | → JL | $\frac{607.5}{200}$ | $>\frac{165}{75}$ | | |
| 2 | wheel ⑦ → JR | $\frac{652.5\,k}{200}$ | $>\frac{165\,k}{75}$ | | |
| | → JL | $\frac{652.5}{200}$ | $>\frac{202.5\,k}{75}$ | | |
| 3 | wheel ⑧ → JR | $\frac{667.5}{200}$ | $>\frac{202.5}{75}$ | | |
| | → JL | $\frac{667.5}{200}$ | $>\frac{240\,k}{75}$ | | |
| 4 | wheel ⑨ → JR | $\frac{682.5}{200}$ | $>\frac{240\,k}{75}$ | | |
| | → JL | $\frac{682.5}{200}$ | $<\frac{277.5\,k}{75}$ | | |

Hence, wheel ⑨ gives max$^m$ stress at members $L_3$ $L_4$




Max$^m$ stress

$$= \frac{1·3021}{125}\left[125\times 37·5 + 120\times 37·5 + 115\times 37·5\right]$$

$$+ \frac{1}{2}\left(\frac{1·3021}{125}\times 110\right)\times 110\times 3^{k/ft}$$

↓ UDL

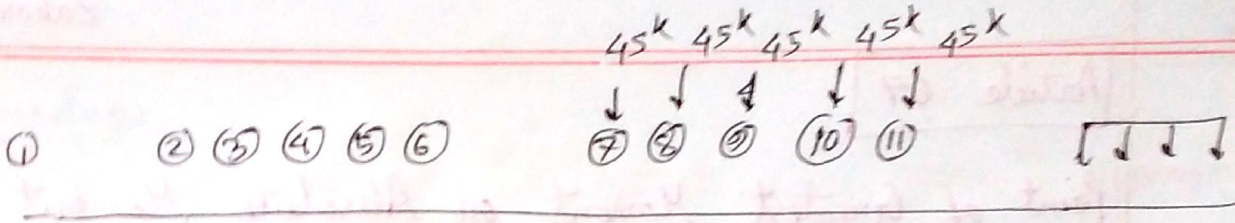
$$+ \frac{1·3021}{75}\left[70\times 37·5 + 65\times 37·5 + 50\times 30 + 45\times 30 + 40\times 30 + 35\times 30 + 30\times 30 + 20\times 15\right]$$

$$= 526·96^{k} \text{ (Tension +)}$$

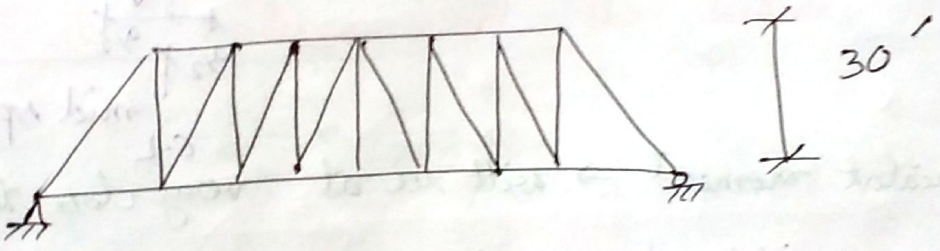
CT → week after next week → Monday (25.05.15)

→ syllabus upto next week.

Assignment (16) :




member → $U_4 U_5$ → answer will be compression

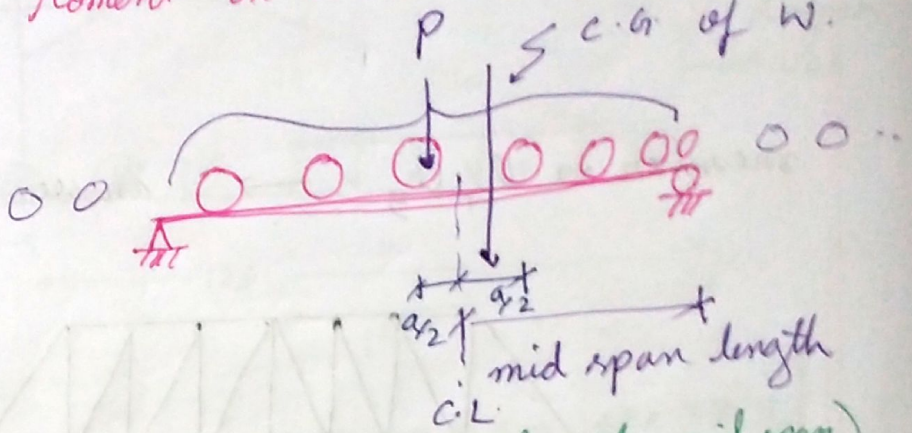


16-05-15

Zakaria Sir

## Article 67

### Point of Greatest Moment or Absolute Moment




(Greatest moment → will be at very close to mid span)

W = weight of wheels on the span

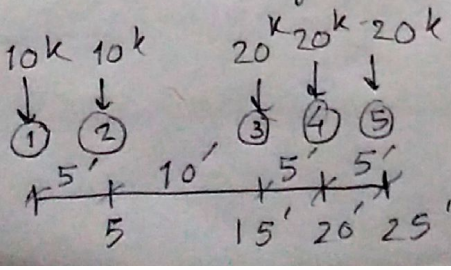
P = wheel that gives maximum moment at mid-span.

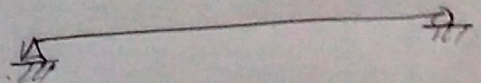
a = Distance between "P" & C.G. of W

Greatest Moment or Absolute Moment may occur under 'P'

P & C.G. of W are placed equidistant from mid-section (or center line, CL)

**Example**: Find Greatest or Absolute moment for a Simple span 40 ft.



## Procedure:

(i) Find the wheel 'P' that gives max$^m$ moment at mid-section.

(ii) Place 'P' & CG of W (wheels on the span) such that they are equidistant from center line (Mid-span).

(iii) Check criterion for max$^m$ moment at the section under "P".

$$\left(\frac{W}{L} = \frac{W_1}{a'}\right)$$

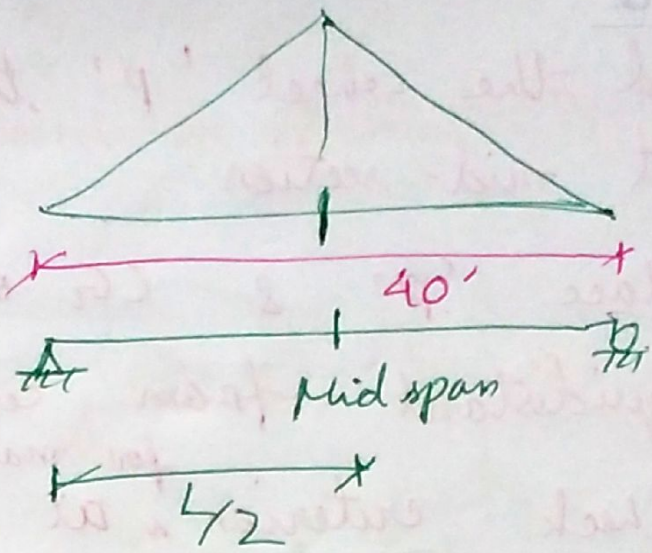
If ok., then calculate Greatest Moment.

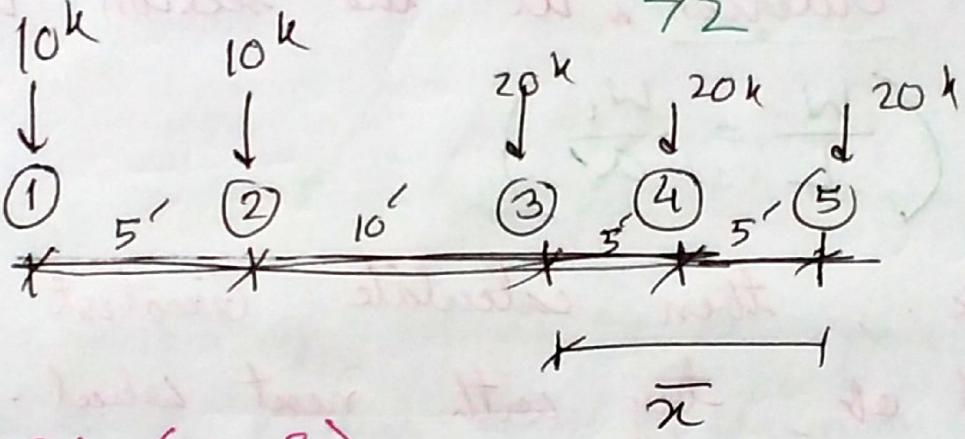
If not ok, try with next wheel.

## Step 1: Find 'P'

| Trial No. | Position of Wheel | | $\frac{W}{L}$ | | $\frac{W_1}{a'}$ | Remarks | Calculation |
|---|---|---|---|---|---|---|---|
| 1. | Wheel ② at mid section | JR | $\frac{60}{40}$ | > | $\frac{10}{20}$ | Criterion not ok | W = wheel ① to ④ = 60 k<br>$W_1$ = wheel ① = 10 k |
| | | JL | $\frac{80}{40}$ | > | $\frac{20}{20}$ | | W = wheel ① to ⑤ = 80 k<br>$W_1$ = wheel ① & ② = 20 k |
| 2. | Wheel ③ at mid section | JR | $\frac{80}{40}$ | > | $\frac{20}{20}$ | Criterion is Satisfied | $W_R$ = 80 k<br>$W_1$ = 20 k |
| | | JL | $\frac{80}{40}$ | = | $\frac{40}{20}$ | | W = 80 k<br>$W_1$ = 40 k |

Hence, P = wheel ③ gives max$^m$ moment at Mid-Point




**Step 2: ($\frac{a}{2}$ = ?)**

C.G of W from wheel (5)

$$\bar{x} = \frac{20^k \times 0 + 20 \times 5 + 20 \times 10 + 10 \times 20 + 10 \times 25}{20^k + 20^k + 20 + 10 + 10}$$

$$= 9.375'$$

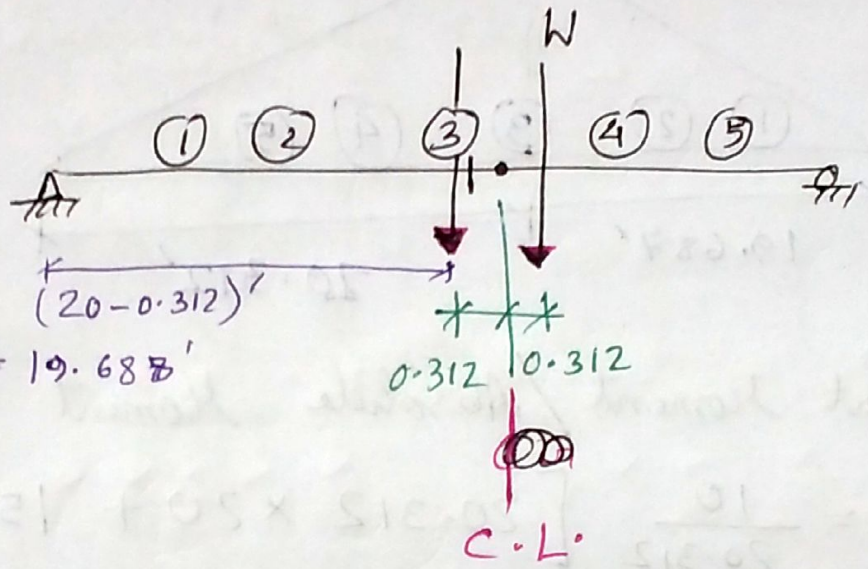
$a$ = Distance bet$^n$ "P" & C.G of W

$$= 10' - 9.375'$$

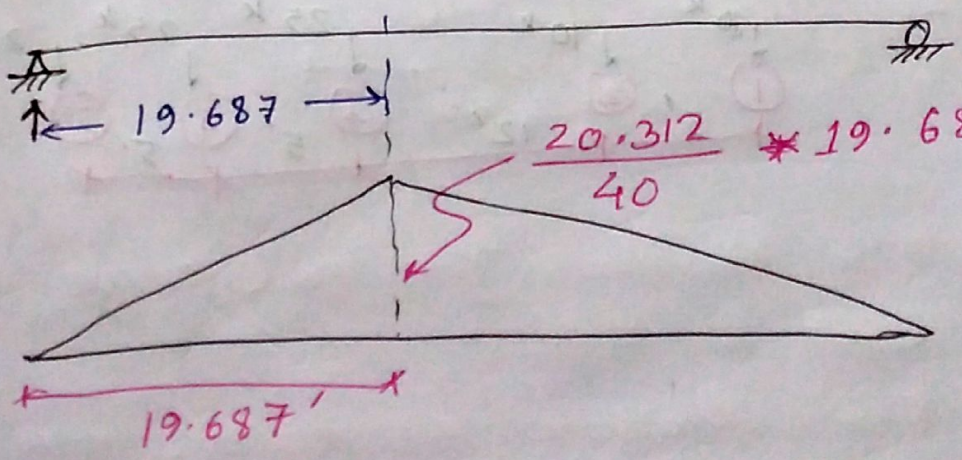
$$= 0.625'$$

$$\frac{a}{2} = \frac{0.625}{2} = 0.312'$$

**Step 3:** Draw fig. & check the criterion under P.

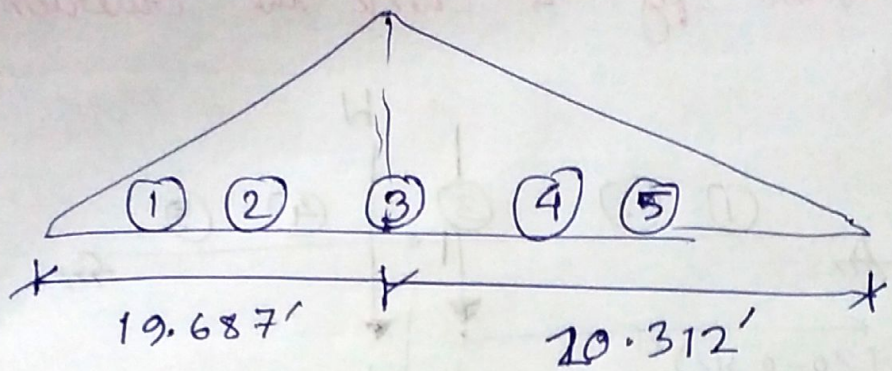



| Trial No. | Position of Wheel | | $\frac{W}{L}$ | $\frac{W_1}{a_1}$ | Remarks | Calculation |
|---|---|---|---|---|---|---|
| | Wheel ③ at 19.687' from Left span. | JR | $\frac{80}{40}$ | $> \frac{20}{19.687}$ | Criterion is satisfied | |
| | | JL | $\frac{80}{40}$ | $< \frac{40}{19.687}$ | | |




I.L. Diagram

19.687'




Greatest Moment / Absolute Moment

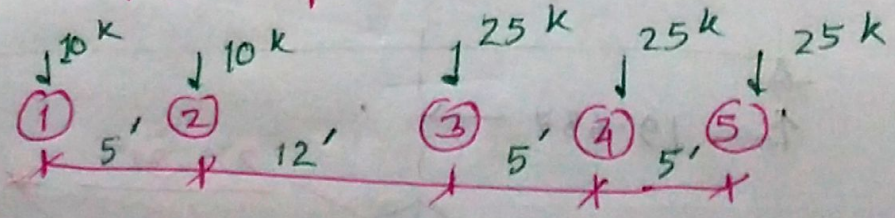
$$= \frac{10}{20.312}\left[20.312 \times 20 + 15.312 \times 20 + 10.312 \times 20\right]$$

$$+ \frac{10}{19.687}\left[9.687 \times 10 + 4.687 \times 10\right]$$

$$= 525.317 \text{ k-ft.}$$

## Assignment 17

Find Greatest or Absolute moment for a simple span of 50 ft.



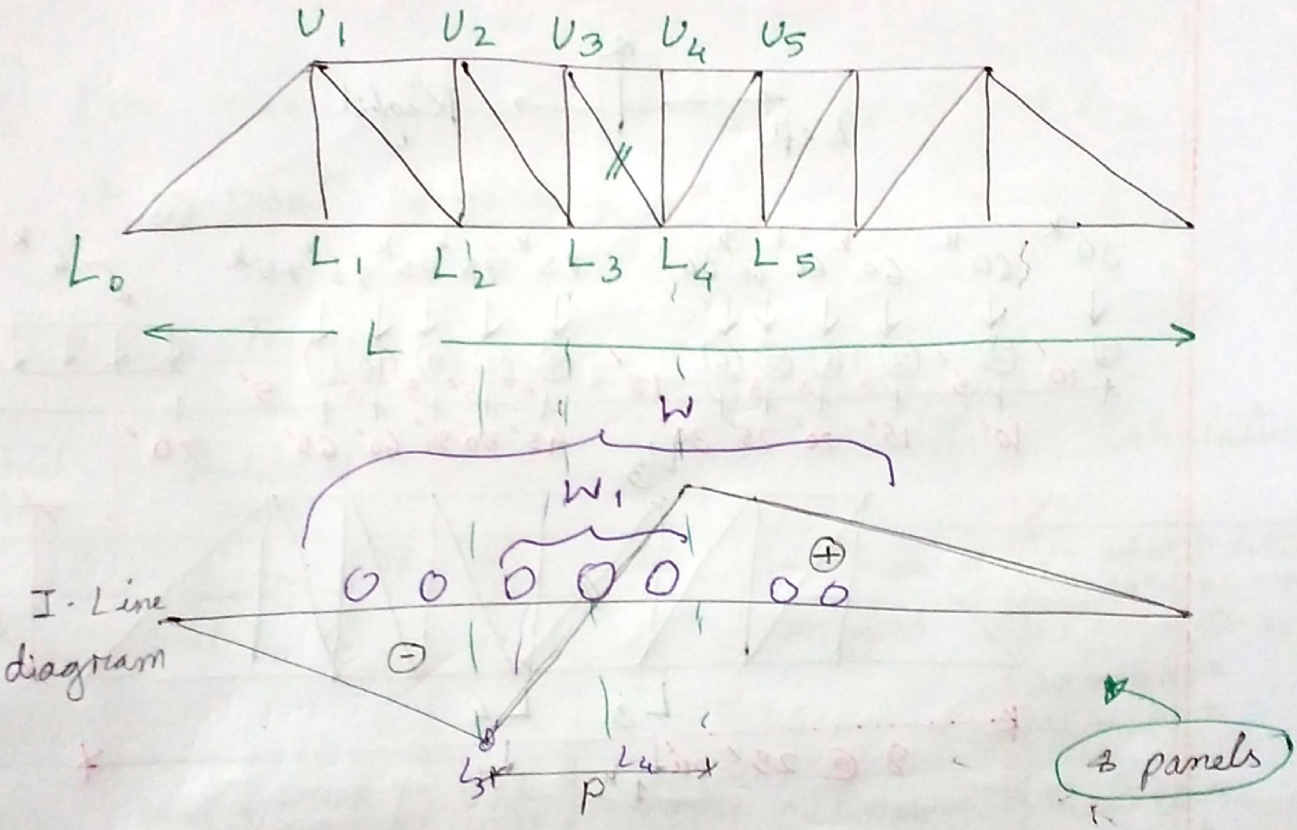
18.05.15



Zakaria Sir

## Article 69 Maximum Web Stress of a Truss.

Web Stress = Diagonal Member Stress




Required Criterion:

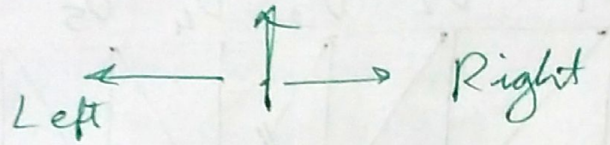
$$\frac{W}{L} = \frac{W_1}{P}$$

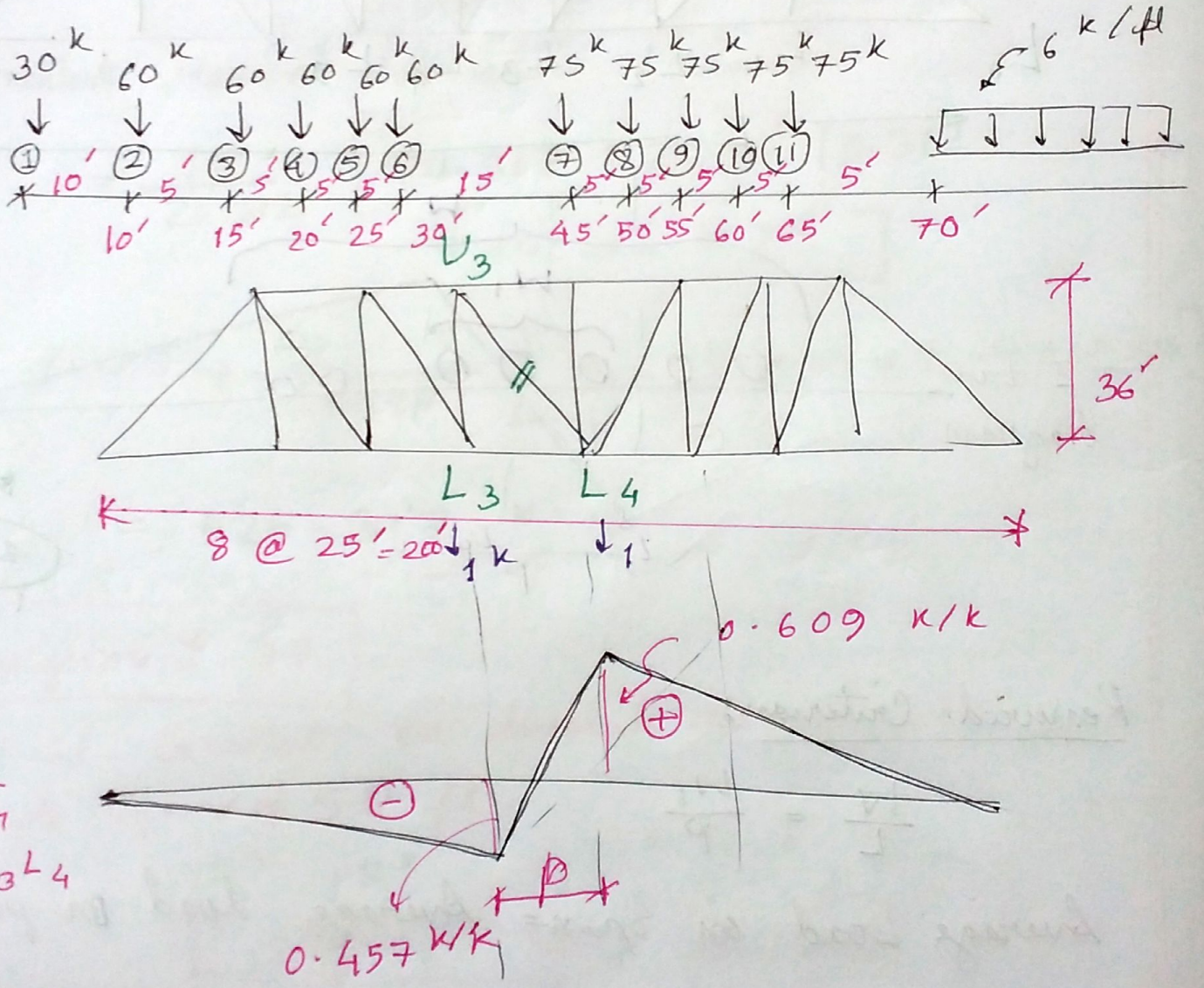
Average Load on Span = Average load on panel.

P = Panel Length

L = Length of Truss.

**Problem 221** Calculate maximum tension in member $U_3L_4$ of the truss shown.




(1) For Maximum Tension, move Locomotive Right to Left.

(2) For Maximum compression, move Locomotive Left to Right.

$W_1$ = load on panel $L_3L_4$ (P)

(*) If tension - compression → nothing mentioned, then, find for Tension (as its value is always higher in the diagram)

(*) For max$^m$ tension, control point → $L_4$

" max$^m$ compression, " " → $L_3$

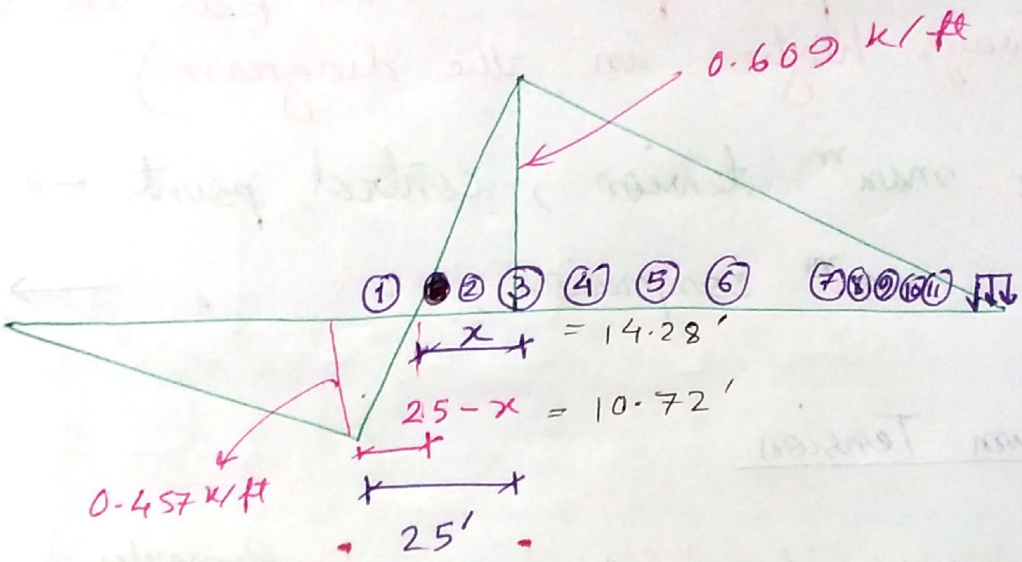
# Maximum Tension

| Trial No. | Position of Wheel | $\frac{W}{L}$ | $\frac{W_1}{P}$ | Remarks | Calculation |
|---|---|---|---|---|---|
| (1) | wheel (2) / at $L_4$ — JR | $\frac{945}{200}$ > | $\frac{30}{25}$ | criterion not satisfied | W = wheel (1) to (11) + 40' UDL = 945$^k$<br>$W_1$ = wheel (1) = 30$^k$ |
| | JL | $\frac{945}{200}$ > | $\frac{90}{25}$ | | W = 945$^k$<br>$W_1$ = 90$^k$ |
| (2) | wheel (3) / at $L_4$ — JR | $\frac{975}{200}$ > | $\frac{90}{25}$ | Criterion | W = 975$^k$<br>$W_1$ = 90$^k$ |
| | JL | $\frac{975}{200}$ < | $\frac{150}{25}$ | Satisfied | W = 975$^k$<br>$W_1$ = 150$^k$ |

Hence, wheel (3) gives maximum web stress on member $U_3L_4$

C.T → Monday →

(* for ①, start from 0.457)

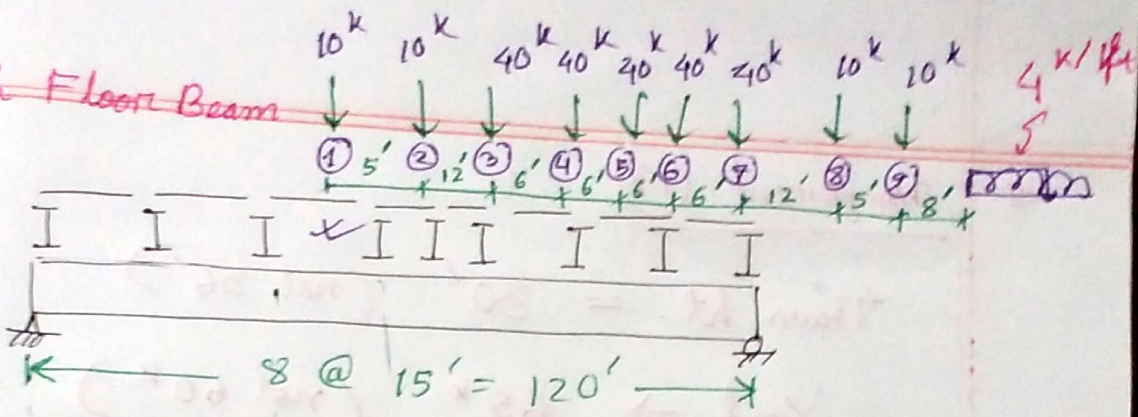



$$\frac{0.609}{x} = \frac{0.457}{25-x}$$

$\therefore x = 14.28'$

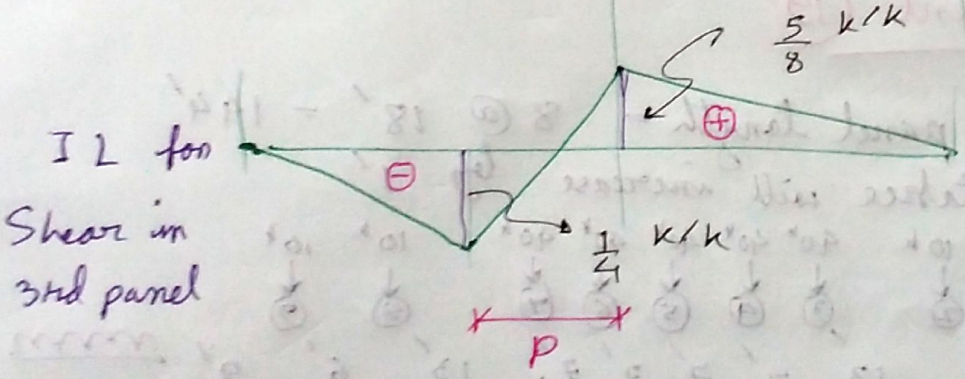
Do it { Max$^m$ Tension ~~Web Stress~~ in $U_3L_4$
= 166.04 k

## Girder with Floor Beam




**Problem 134**

Calculate max^m shear in Third panel of 8-panel Girder with Floor Beam.




(*) Same criterion : $\frac{W}{L} = \frac{W_1}{P}$

Here, $L = 120'$

$P = 15'$

(*) Max^m shear → +ve one bigger → move from L to R

Ans: 119.26 k → Max^m shear.

# $\frac{W}{L} = \frac{W_1}{P}$ → valid for ① panel shear of girder
② web stress of Truss.

# 7 types of maths → at least 3 maths.

# Assignment (18)

Truss ht. = 30′ (not 36′)

Load → 65 k (not 60 k)

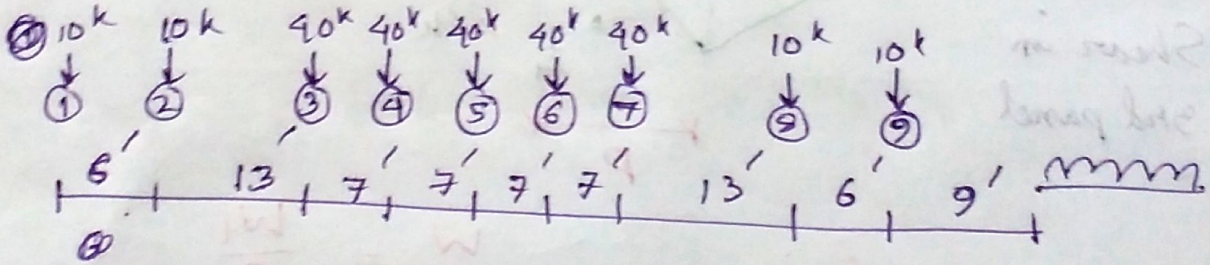
Panel → $L_4 U_5$

Calculate max$^m$. web stress in $L_4 U_5$

# Assignment (19)

panel length = 8 @ 18′ = 144′

all distance will increase by 1′




Find shear in 4th panel.