LESSON 19: MORE INFLUENCE LINES:

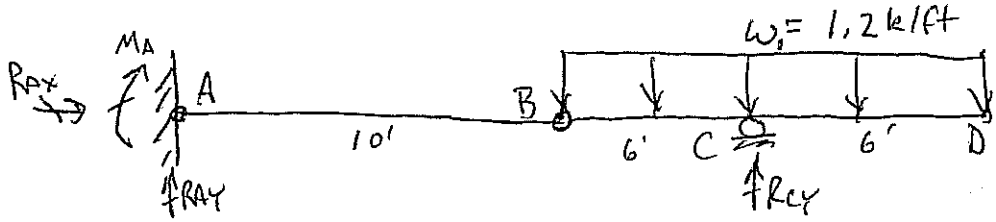
- DISTRIBUTED LOADS
- PATTERN LOADS
- APPLICATION TO TRUSSES

A. DISTRIBUTED LOADS:

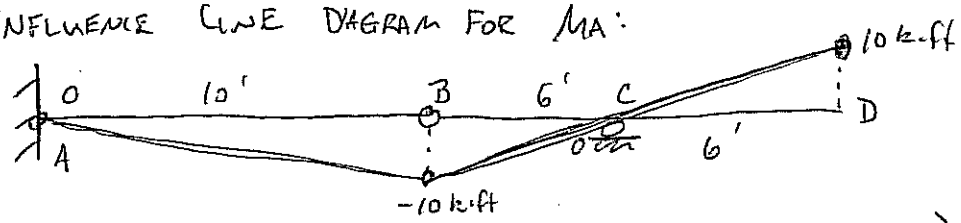
UNIFORM DIST. LOADS:

LOAD EFFECT IS AREA UNDER INFLUENCE LINE DIAGRAM TIMES MAGNITUDE OF DISTRIBUTED LOAD:

EX: GIVEN INFLUENCE LINE DIAGRAM, FIND MOMENT (M_A) DUE TO DISTRIBUTED LOAD w_1



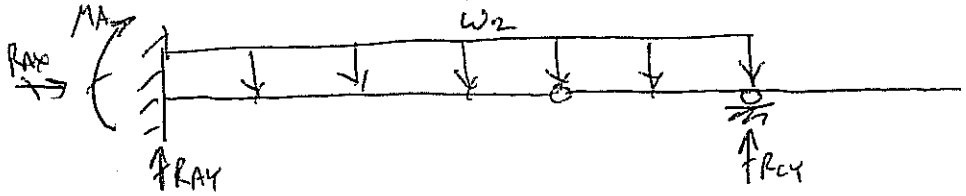
INFLUENCE LINE DIAGRAM FOR M_A:



$$M_A = \frac{1}{2}(10\text{k-ft})(6\text{ft})(1.2\text{k/ft}) + \frac{1}{2}(10\text{k-ft})(6')(1.2\text{k/ft})$$

$$\boxed{M_A = 0 \text{ k-ft}}$$

What about w_2?

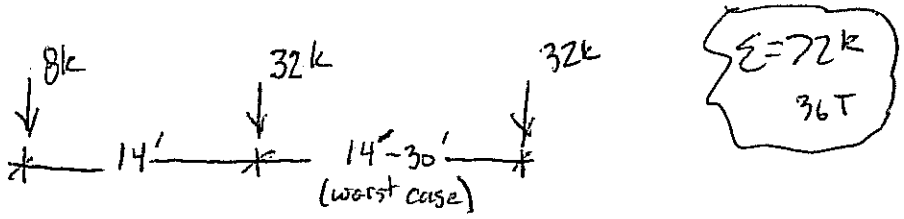


$$M_A = (1.2\text{k/ft})\left(\frac{1}{2}\right)(16')(-10\text{k-ft})$$

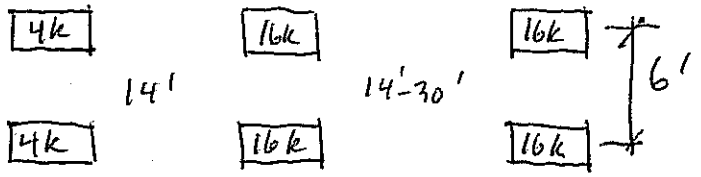
$$\boxed{M_A = -96 \text{ k-ft}}$$

B. PATTERN LOADS:

→ Which patterns? Equivalent Standard Axel Load (ESAL)



HS-20-44 Standard Truck Load
2-AXLE TRUCK WITH SINGLE-AXLE TRAILER
(AASHTO STANDARD LOAD FOR BRIDGES)



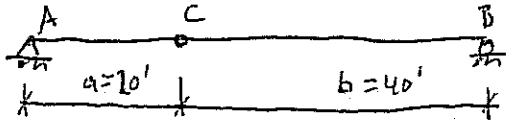
PLAN VIEW

→ INCREASE-DECREASE METHOD

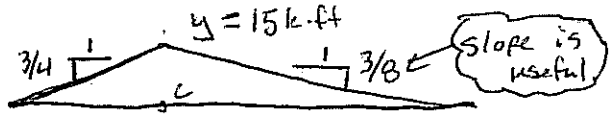
- METHOD TO DETERMINE EFFECT OF PATTERN LOADS
- APPLY PATTERN LOAD IN SUCCESSIVE POSITIONS, KEEP PEAK VALUE

EXAMPLE

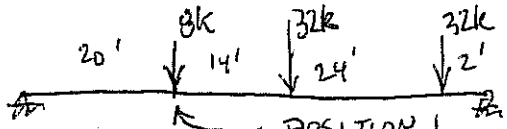
SAMPLE BEAM



SAMPLE INFLUENCE DIAGRAM: M_C



SAMPLE PATTERN FORWARD AT POSITION 1

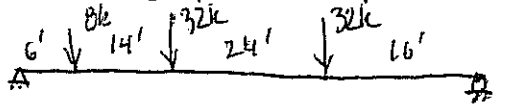


Where is worst case location?

FRONT LOAD @ Peak of Influence Dia.

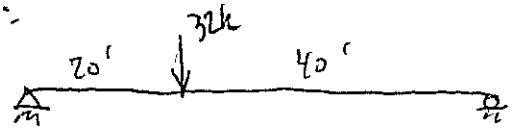
Shift ← to POSITION 2

FORWARD AT POSITION 2



NET INCREASE KEEP GOING

FORWARD AT POSITION 2



Net Decrease, Stop

WORST CASE, FORWARD PASS: POS. 2

Change in Moment

INCREASE: $(32+32)(3/8)(14) = 336$ k-ft

DECREASE: $(8)(3/4)(14) = 84$ k-ft

Net = 252 k-ft

INCREASE: $(32)(3/8)(24) = 288$ k-ft

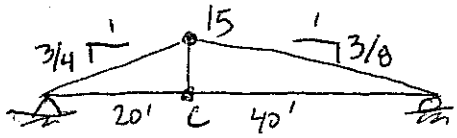
DECREASE: $8(3/4)(6)+(32)(3/4)20 = 516$ k-ft

Net = −228 k-ft

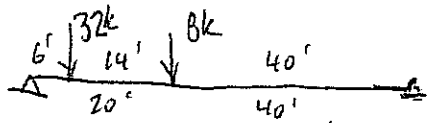
EXAMPLE CONT...

MUST REPEAT FOR OTHER DIRECTION

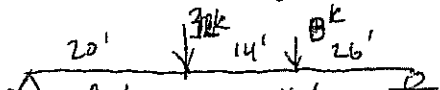
BACKWARD



BACKWARD POSITION 1

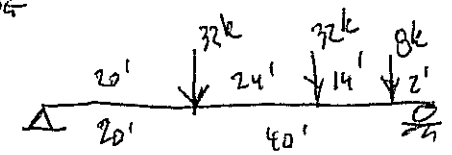


BACKWARD POSITION 2
INCREASE KEEP GOING



INCREASE = (14)(32)(3/4) = 336 k-ft
DECREASE = (14)(8)(3/8) = 42k-ft
Net = +294 ft·k

BACKWARD PASS POSITION 3



INCREASE = 20(32)(3/4) = 480 k-ft
DECREASE = (24)(32+8)(3/8) = 360k-ft
Net = +120 k-ft

INCREASE, OUT OF LOADS, WORST CASE, BACKWARD PASS IS POS. 3

MOMENT @ C
FORWARD PASS
POS. 2

$M_C = 8\left(\frac{6}{20}\right)(15) + (32)(15) + 32\left(\frac{16}{40}\right)(15)$

$M_C = 708$ k-ft ← CONTROLS.

MOMENT @ C
BACKWARD PASS
POS. 3

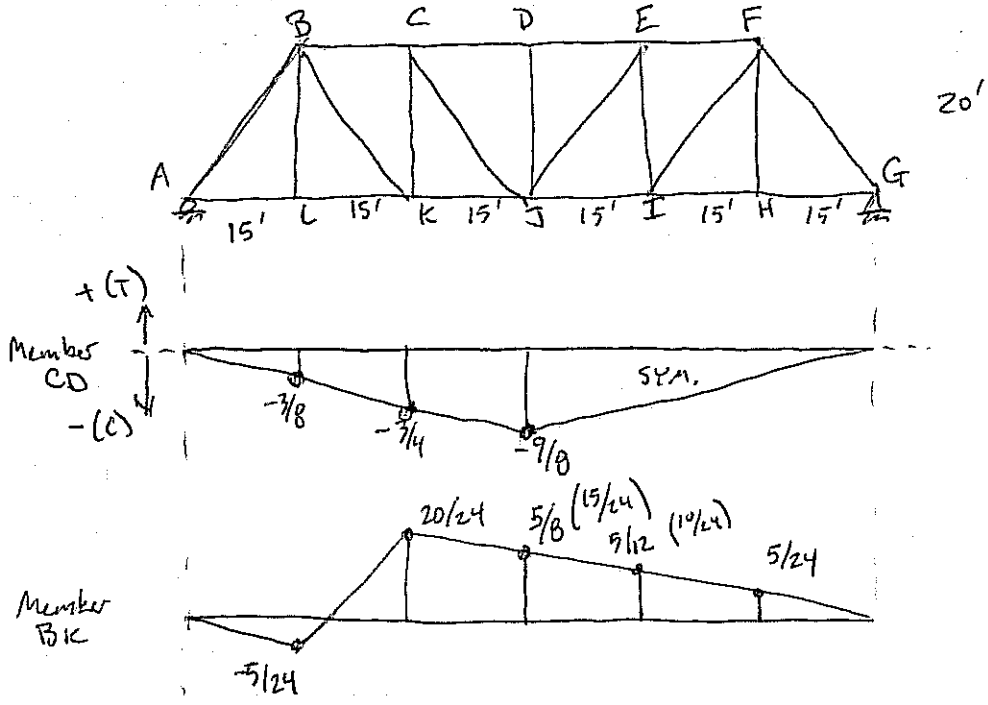
$M_C = 32(15) + 32(16/40)(15) + 8(2/40)(15)$

$M_C = 678$ k-ft

C. INFLUENCE DIAGRAMS IN TRUSSES

→ CAN COMPUTE INFLUENCE LINE DIAGRAMS FOR EVERY BAR
→ REQUIRES SUCCESSIVE APPLICATIONS OF UNIT LOADS AND SOLUTION OF INTERNAL BAR FORCES (Connect via straight lines)
- Very long & Tedious
- Good for computers to do.
- Method of sections useful for single bar

EX:



AND SO FORTH ...