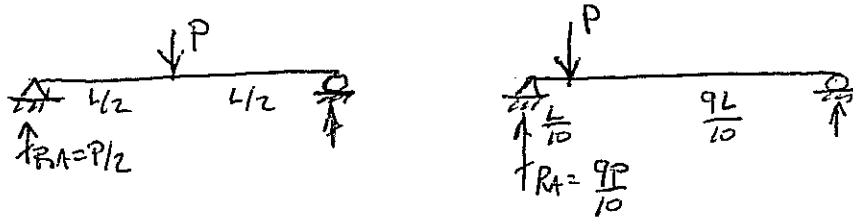


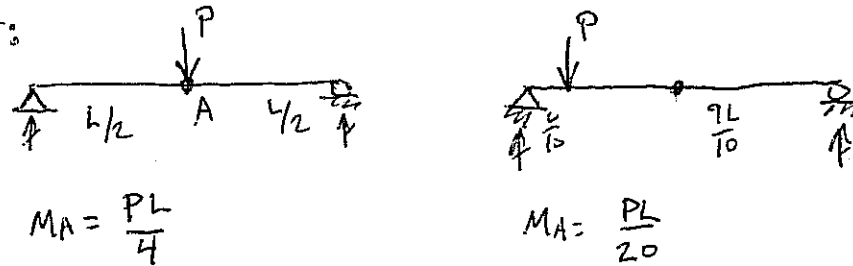
LESSON 17: INFLUENCE LINES: READING 3 TEXT Ch. 8

- LIVE LOAD LOCATIONS ARE, BY NATURE, VARIABLE.
- NOT ALL LOCATIONS ARE CREATED EQUAL:

REACTION:



MOMENT:

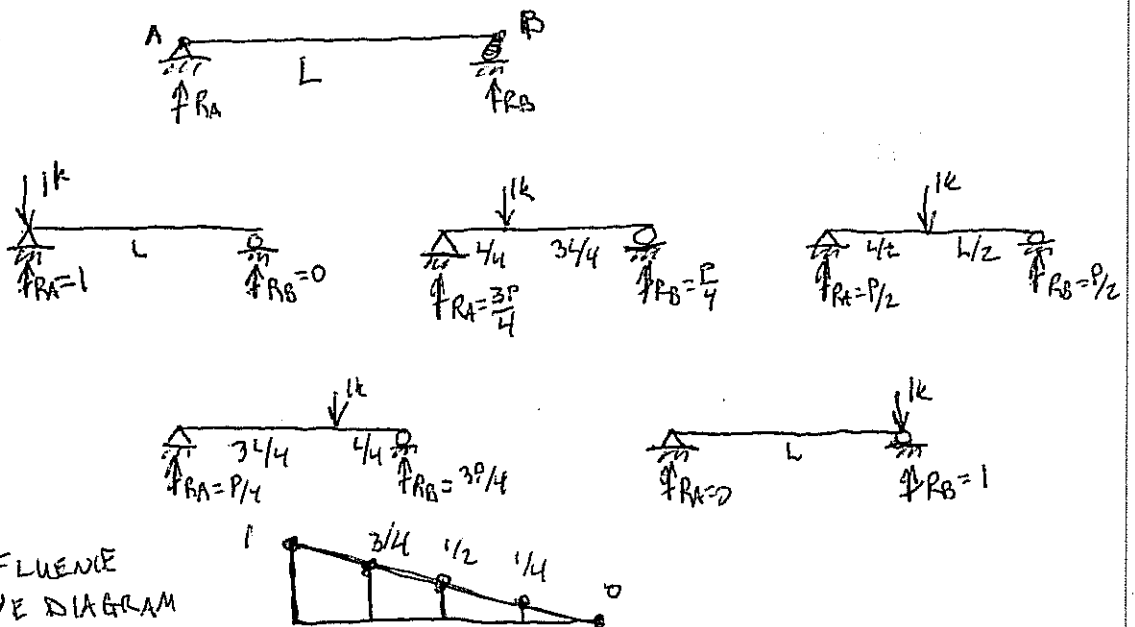


How CAN WE CHARACTERIZE THE EFFECT OF LOAD POSITIONING?

→ INFLUENCE LINES:

- DIAGRAM DEPICTING EFFECT OF unit load
  - Varies with location
  - Attributable to a specific effect; e.g., Reaction, Internal Shear, Moment, etc.
- APPLICABLE TO BUILDING DESIGN BUT MORE USED IN BRIDGE ANALYSIS

EXAMPLE: DRAW THE INFLUENCE LINE FOR THE REACTION AT A:



INFLUENCE LINE DIAGRAM FOR RA.

NOTE: The influence line diagram for RA is different than for RB, which is different than that for the moment at some other location.

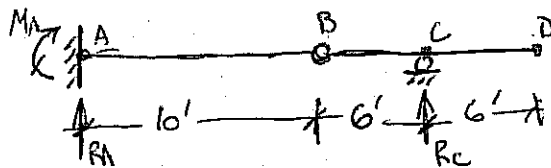
- DRAWING INFLUENCE LINES LIKE WE JUST DID IS TEDIOUS AND TIME-CONSUMING  
- NO REAL BENEFIT TO US.

- ARE THERE SOME RULES WE CAN APPLY?  
DETERMINATE STRUCTURES:

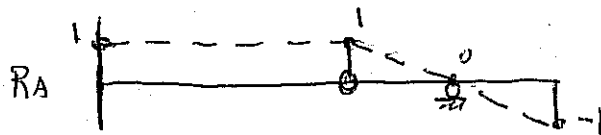
- INFLUENCE LINES ARE: STRAIGHT LINES  
- OR -  
COMPOSED OF LINEAR SEGMENTS.

LINEAR SEGMENTS?

EXAMPLE:



FIND  $R_A, R_C, \& MA$  INFLUENCE LINES



APPLY UNIT LOAD AT A, B, C, & D AND FIND  $R_A, R_C, MA$   
CONNECT USING LINEAR CURVES.

LOAD AT A:

$$\begin{aligned} \uparrow \sum M_A = 0 & \Rightarrow -M_A + 10R_C = 0 & \uparrow \sum M_B = 0 & \Rightarrow -M_A + 10R_A = -10(1) \\ \sum F_y = 0 & \Rightarrow R_A + R_C - 1 = 0 \end{aligned}$$

$$\begin{aligned} R_A + R_C &= 1 \\ -M_A - 10R_A + 10R_C &= -10 \end{aligned} \left. \begin{array}{l} \\ \end{array} \right\} \begin{array}{l} R_A = 1K \quad M_A = 0 \\ R_C = 0 \end{array}$$

LOAD AT B:

$$\begin{aligned} \uparrow \sum M_B = 0 & \Rightarrow -10R_A - M_A = -6 \\ \sum F_y = 0 & \Rightarrow R_A + R_C = 1 \\ \uparrow \sum M_C = 0 & \Rightarrow -10R_A = M_A \end{aligned}$$

$$\left. \begin{array}{l} R_A = 1K \\ M_A = 10K \end{array} \right\} \begin{array}{l} R_C = 0 \\ M_A = 0 \end{array}$$

LOAD AT C:

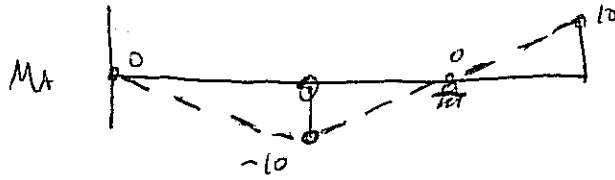
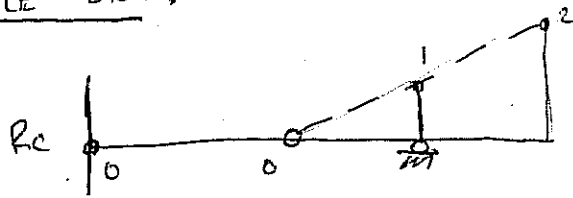
$$\begin{aligned} \uparrow \sum M_C = 0 & \Rightarrow -M_A - 10R_A = 0 \\ \uparrow \sum M_B = 0 & \Rightarrow -M_A + 10R_A = 0 \\ \sum F_y = 0 & \Rightarrow R_A + R_C = 1 \end{aligned}$$

$$\left. \begin{array}{l} R_A = 0 \\ R_C = 1K \\ M_A = 0 \end{array} \right\}$$

LOAD AT D:

$$\begin{aligned} \uparrow \sum M_C = 0 & \Rightarrow -M_A - 10R_A = 6 \\ \uparrow \sum M_B = 0 & \Rightarrow -M_A - 10R_A = 0 \\ \sum F_y = 0 & \Rightarrow R_A + R_C = 0 \end{aligned}$$

$$\left. \begin{array}{l} R_A = -1 \\ R_C = 2 \\ M_A = 10 \end{array} \right\}$$

EXAMPLE CONT.

→ Changes in support conditions will change the direction of the influence line.