DRAW IL DIAGRAM OF THE FOLLOWING STRUCTURE

IL Part 1

Third Year Odd Semester,2021

Kinds of Loads

1. **Dead Loads:**
   Dead loads are loads which always fixed in position, always acting, and of unchanging magnitude.
   The dead load in a building includes the weight of walls, permanent partitions, framing, floors, roofs, and all other permanent stationary construction entering into building.
   (a) Weight of material of which a structure is composed
   (b) Permanent equipments such as gas/water/ sewerage pipe/ electric cables etc.
2. **Live loads: The live load includes all loads except dead loads.**
   Live loads which can move or movable.

Moving loads - Trucks, Trains, Cars, different types of Vehicles, Cranes etc.

Movable loads: Temporarily fixed in position can move according to the requirement. Such as furniture in an office and room, goods on a warehouse floor, books in a library, etc.

Influence Lines: An influence line is a diagram showing the variation in the shear, moment, stress in a member, reaction, or other direct function at a particular section or point or member, due to a unit load moving across the structure.

Construction of Influence Line: An influence line is constructed by plotting directly under the point where the unit load is placed an ordinate the height of which represents to some scale the value of the particular function being studied when the load is in that point.

Purpose of Influence Lines:

Influence lines can be used for two very important purposes:

1. To determine what position of live loads will lead to a maximum value of the particular function for which an influence line has been constructed.
2. To compute the value of that function with the loads so placed or, in fact, for any loading condition.

Theorem 1. To obtain the maximum value of a function due to a single concentrated live load, the load should be placed at the point where the ordinate to the influence line for that function is a maximum.

Theorem 2. The value of a function due to the action of a single concentrated live load equals the product of the magnitude of the load and the ordinate to the influence line for that function, measured at the point of application of the load.

Theorem 3. To obtain the maximum value of a function due to a uniformly distributed live load, the load should be placed over all those portions of the structure for which the ordinates to the influence line for that function have the sign of the character of the function desired.

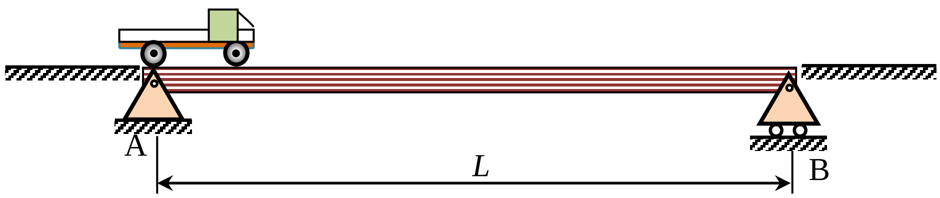
Theorem 4. The value of a function due to a uniformly distributed live load is equal to the product of the intensity of the loading and the net area under that portion of the influence line, for that function under consideration, which corresponds to the portion of the structure loaded.

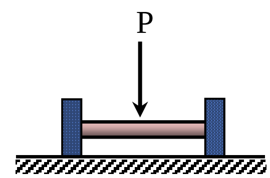
Preparation of Influence lines

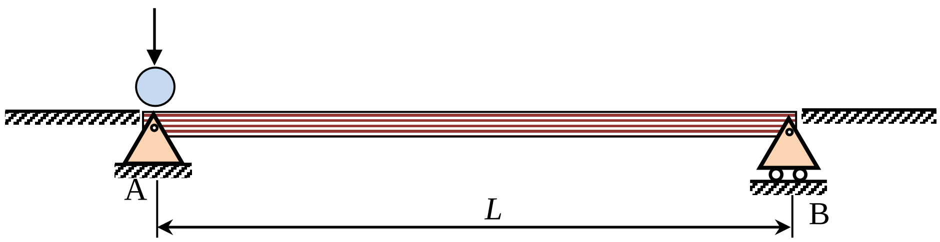
1. Select function of influence line you need.

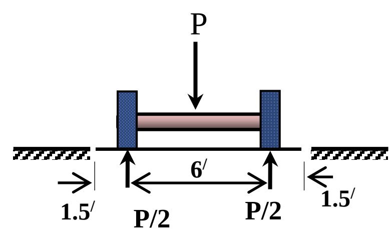
(Function – Reactions, shear force, bending moment, axial force, deflection etc.)

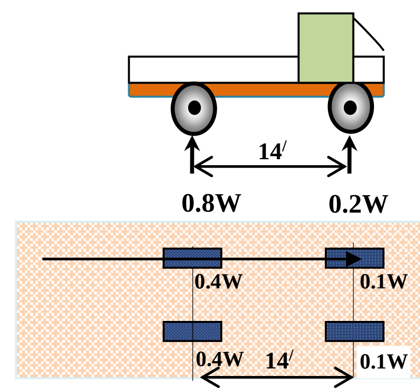
2. Place a unit load at various locations along the structure
3. Compute the value of the function for that particular position of the unit load.
4. Locate the magnitude of the function on the structure/structural member at current position of the unit load.
5. Draw a line by joining the ordinate along the member/structure.

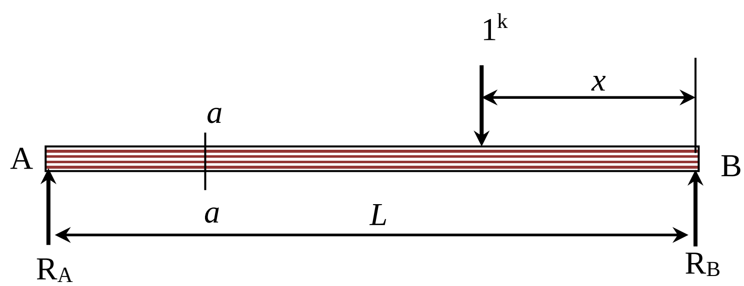




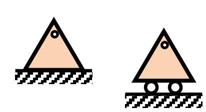








$R_A = x/L$

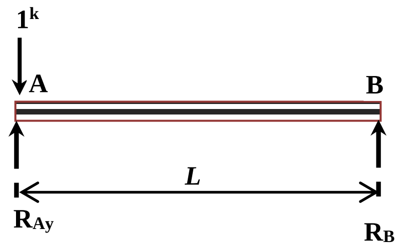


Influence Line for Reactions:

Unit load at A

$$\sum M_B = 0; \quad R_{Ay} \times L - 1 \times L = 0$$

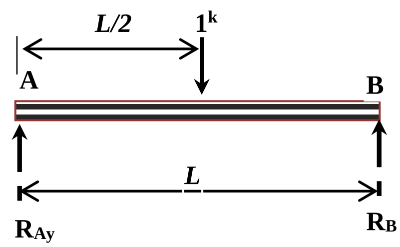
$$\sum F_y = 0; \quad R_{Ay} = 1^k, \quad R_B = 0^k$$



Unit load at mid-span,

$$\sum M_B = 0; \quad R_{Ay} \times L - 1 \times \frac{L}{2} = 0$$

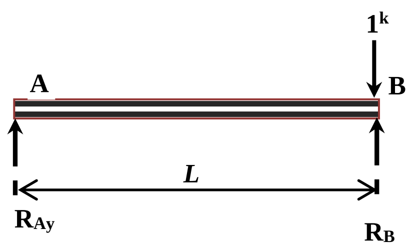
$$R_{Ay} = \frac{1}{2}^k; \quad R_B = \frac{1}{2}^k$$



Unit load at B,

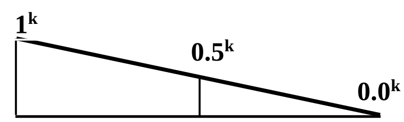
$$\sum M_B = 0; \quad R_{Ay} \times L - 1 \times 0 = 0$$

$$R_{Ay} = 0; \quad R_B = 1^k$$

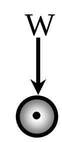


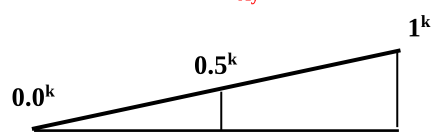
$$\sum M_B = 0; \quad R_{Ay} \times L - 1 \times (L - x) = 0$$

$$R_{Ay} = 1 - \frac{x}{L}$$



IL for R_{Ay}



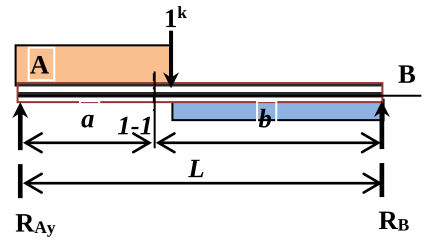


IL for R_B

Linear equation, when x = 0.0 then $R_{Ay} = 1^k$, and when x = L then $R_{Ay} = 0^k$,

Influence line for shear force and bending moment

When 1^k at A,
$\boldsymbol{V = 0.0, \quad M = 0.0}$



At any point within a distance $\boldsymbol{x}$ from **A**

$$\sum M_B = 0; \quad R_{Ay} \times L - (L - x) \times 1 = 0$$

$$R_{Ay} = 1 - \frac{x}{L}$$

Consider left side of section 1-1

Shear force at, $\quad V = 1 - \frac{x}{L} - 1 = -\frac{x}{L} = -R_B$; $\quad x = a$, V = $-a/L$

Bending moment, $\quad R_{Ay} \times a - 1 \times (a - x) - M = 0$

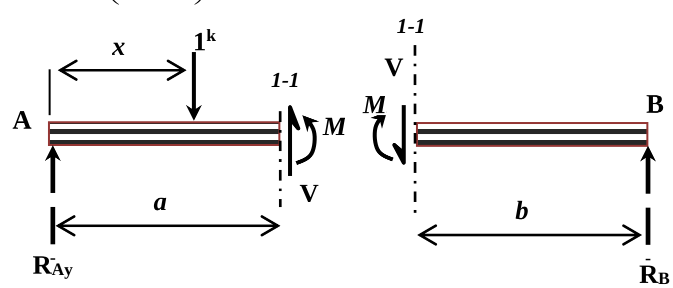
$$M = (1 - \frac{x}{L}) \times a - 1 \times (a - x) = x\left(\frac{L - a}{L}\right)$$

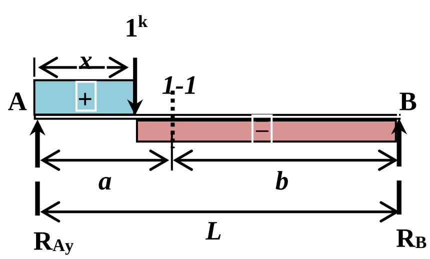
Bending moment,

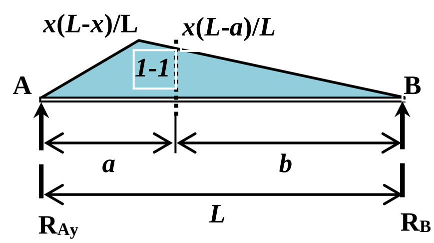
$$\sum M_{1-1} =; M - R_B \times b = 0$$

$$M = R_B.b$$

At any point within a distance $\boldsymbol{x}$ from **A**



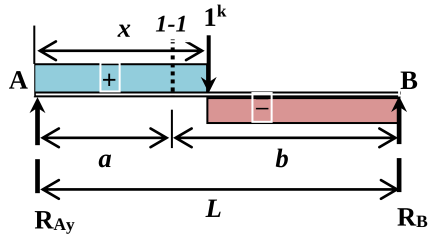


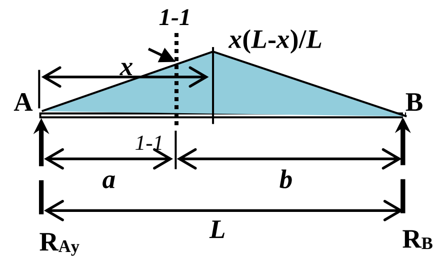


Therefore, shear force is negative any value of $\boldsymbol{x \le a}$ and the shear is positive for any value of *x*. The shear force changes it as a unit load crosses the section 1.

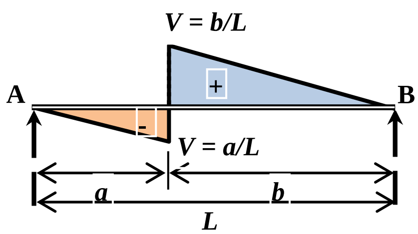
Bending at any section at a distance *x*

$M = x(L - x)/L$
$M_{max} = a.b/L$, when $x = a$

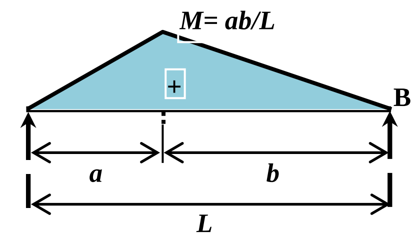




When load at just left of section 1, V = $-R_B = -a/L$ (Maximum –ve value)
When load at just right of section 1, V = $R_A = +b/L$ (Maximum +ve value)
Also the maximum value of ordinate of influence line for moment will occur when a unit load on the section. The value of bending moment
M = a.b/L



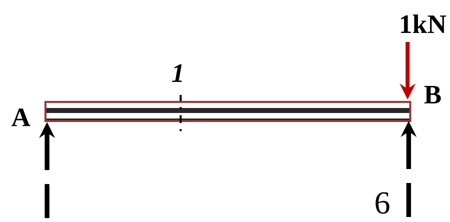
LI for shear force of section 1-1



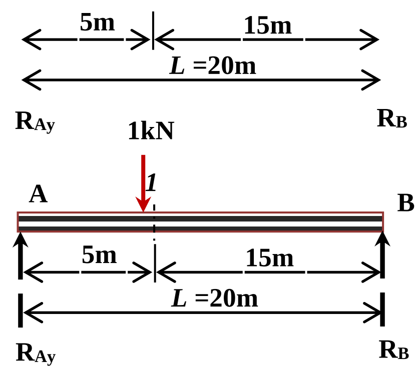
LI for bending moment of section 1-1

If a = 5m, b= 15m, draw influence line diagrams for reactions R_{Ay} and R_B as well as V_1 and M_1 at section 1.

Soln.
When a unit load at A

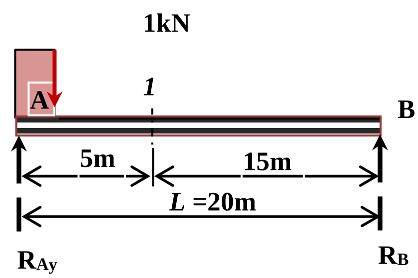


R_{Ay} = 1kN, R_B = 0, V_1 = 0, M_1 = 0



When a unit load at just left of section 1.
Using equilibrium equation,

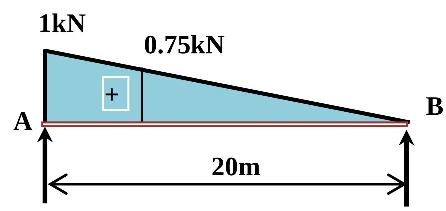
R_{Ay} = 0.75kN, R_B = 0.25, V_1 = − 0.25,
M_1 = 0.75x5 = 0.25x15 = 3.75kN-m



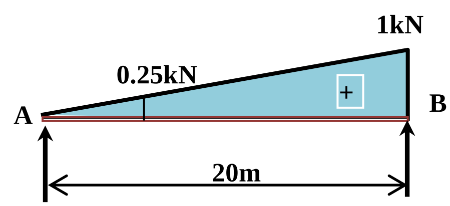
When a unit load at just right of section 1.
Using equilibrium equation,

R_{Ay} = 0.75kN, R_B = 0.25kN, V_1 = +0.75kN,
M_1 = 0.75x5 = 0.25x15 = 3.75kN-m

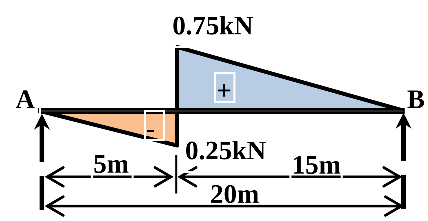
When a unit load at B.
Using equilibrium equation,
R_{Ay} = 0.0, R_B = 1.0, V_1 = +0.0,
M_1 = 0.0



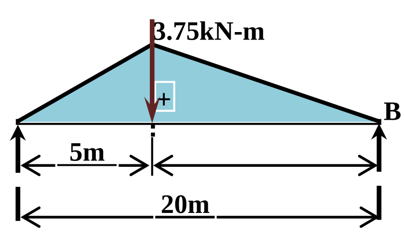
IL diagram for R_{Ay}



IL diagram for R_B

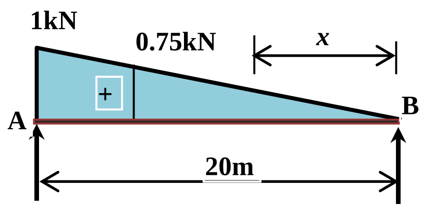


LI for shear force at section 1-1



LI for bending moment at section 1-1

Find the maximum R_{Ay}, R_B, V_1, and M_1 **for single moving concentrated load of magnitude 30kN.**



IL diagram for R_{Ay}

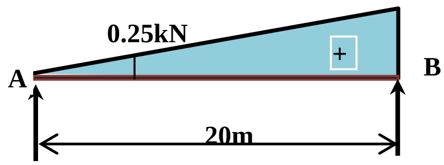
Place the load at A of IL diagram and compute the reaction As follows

R_{Ay} **= 1.0x30 = 30 kN**

If we want to find the reaction at any distance *x* for right support then
R_{Ay} = (1/20)x(x)(30) = 30x/20

When x = 20m =L, R_{Ay} = 30 kN, When x = 10m, R_{Ay} = 30x/20 = 15kN, When x = 15m, R_{Ay} = 30x/20 = 22.75kN

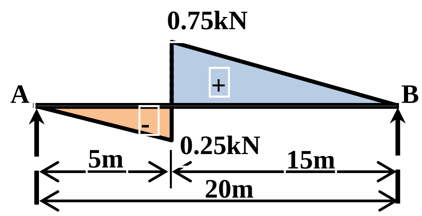
Similar operation can be conducted on IL to **find R_B for any position of load. However the maximum reaction R_B can be found by placing 30 kN at support B.**



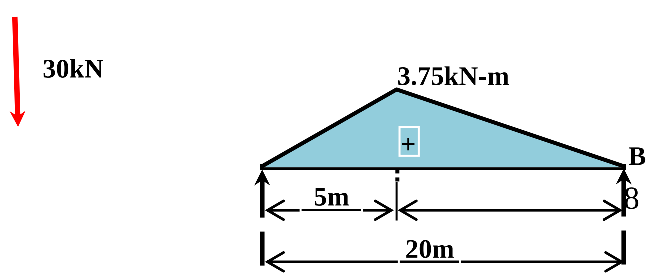
IL diagram for R_B

R_B **= 1.0x30= 30kN**

Shear Force



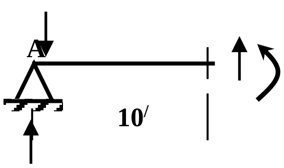
LI for shear force at section 1-1

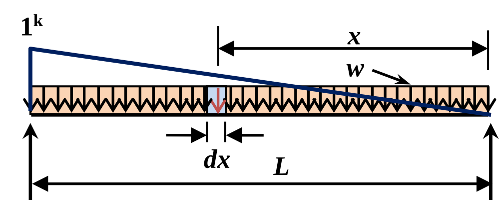


LI for bending moment at section 1-1

Q.3. Draw IL diagrams for R_A, R_B, V_a, and M_a of the following structures as a unit load moves from A to B. Find maximum effect of above function due to 10 kips/ft moving loads.

Soln.





IL *with UDL* for max. R_A

Ordinate of IL diagram at shaded area,

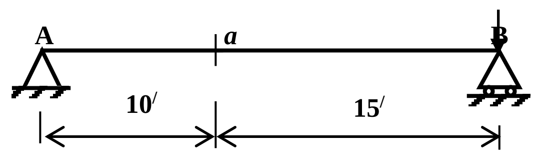
$$i = \frac{1}{L}x$$

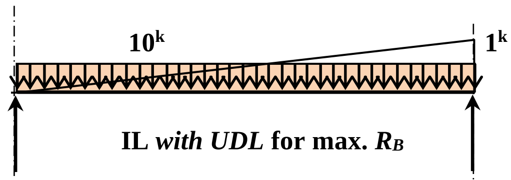
Load acting in this zone,

$$\Delta W = wdx$$

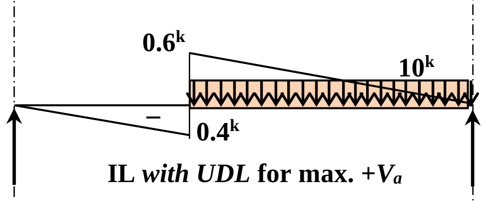
Reaction at A due to this load,

$$dR_A = (i)\Delta W = \left(\frac{1}{L}x\right)(wdx) = \frac{w}{L}x\,dx$$

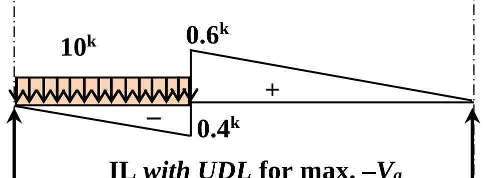




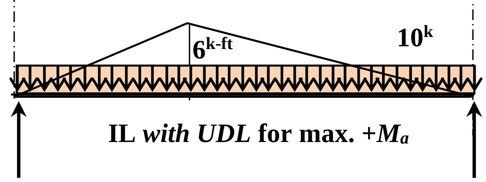
IL *with UDL* for max. R_B



IL *with UDL* for max. +V_a



IL *with UDL* for max. –V_a



IL *with UDL* for max. +M_a

Integrating,

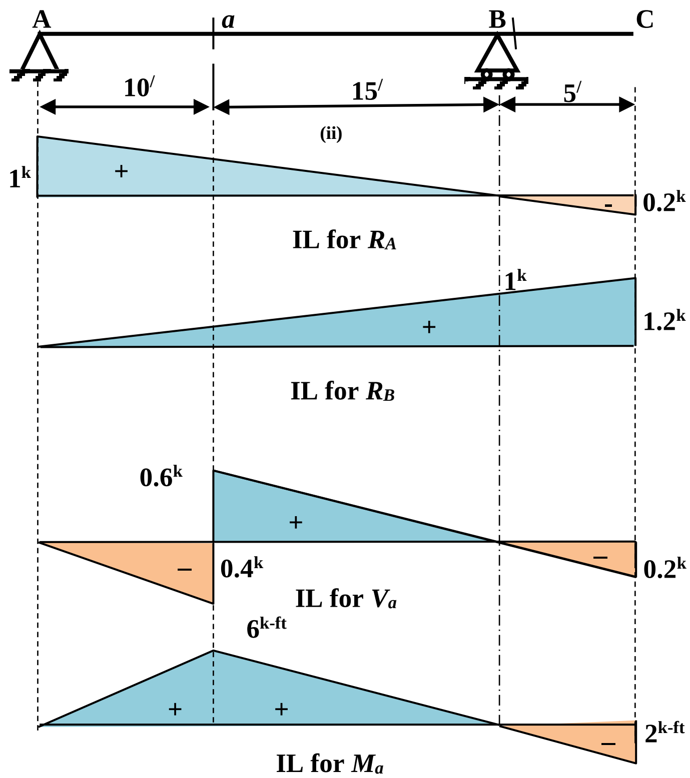
$$\int dR_A = \frac{w(1)}{L}\int_0^L x dx = \frac{w(1)L}{2} = w(Area\ under\ IL\ diagram)$$

$$R_A = \frac{1}{2}(1)(25)(10) = 125\ kips \qquad R_B = \frac{1}{2}(1)(25)(10) = 125\ kips$$

$$V_a = +\frac{1}{2}(0.6)(15)(10) = 45 \ kips \qquad V_a = -\frac{1}{2}(0.4)(10)(10) = 20 \ kips$$

$$M_a = +\frac{1}{2}(6)(25)(10) = 750 \ kip - ft$$

Draw IL diagrams for R_A, R_B, V_a, and M_a of the following structures as a unit load moves from A to C. Find maximum effect of above function due to 40 kips live loads.



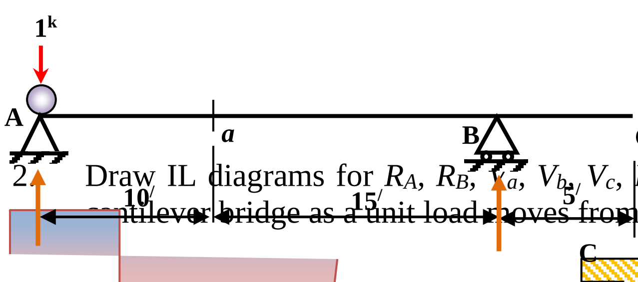
When a unit load at A.
R_{Ay} = 1.0 , R_B = 0.0, V_a = +0.0, M_a = 0.0

When a unit load at just left *a*,
R_{Ay} = 0.6 , R_B = 0.4, V_a = -0.4, M_a = +6.0

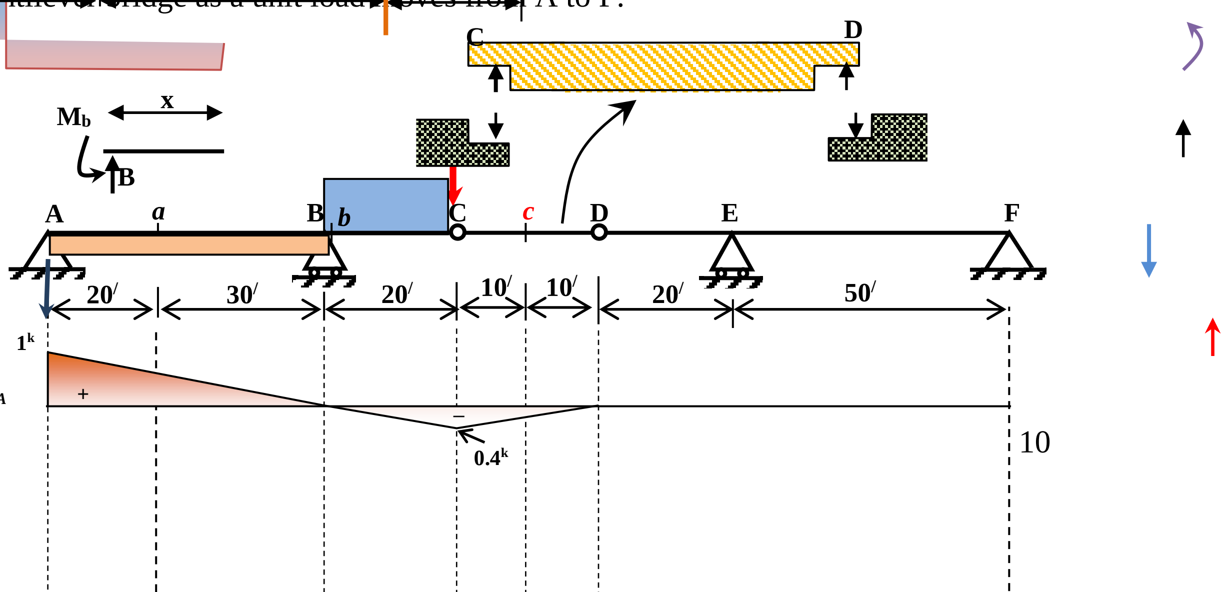
When a unit load at just right of *a*,
R_{Ay} = 0.6, R_B = 0.4, V_a = +0.6, M_a = +6.0

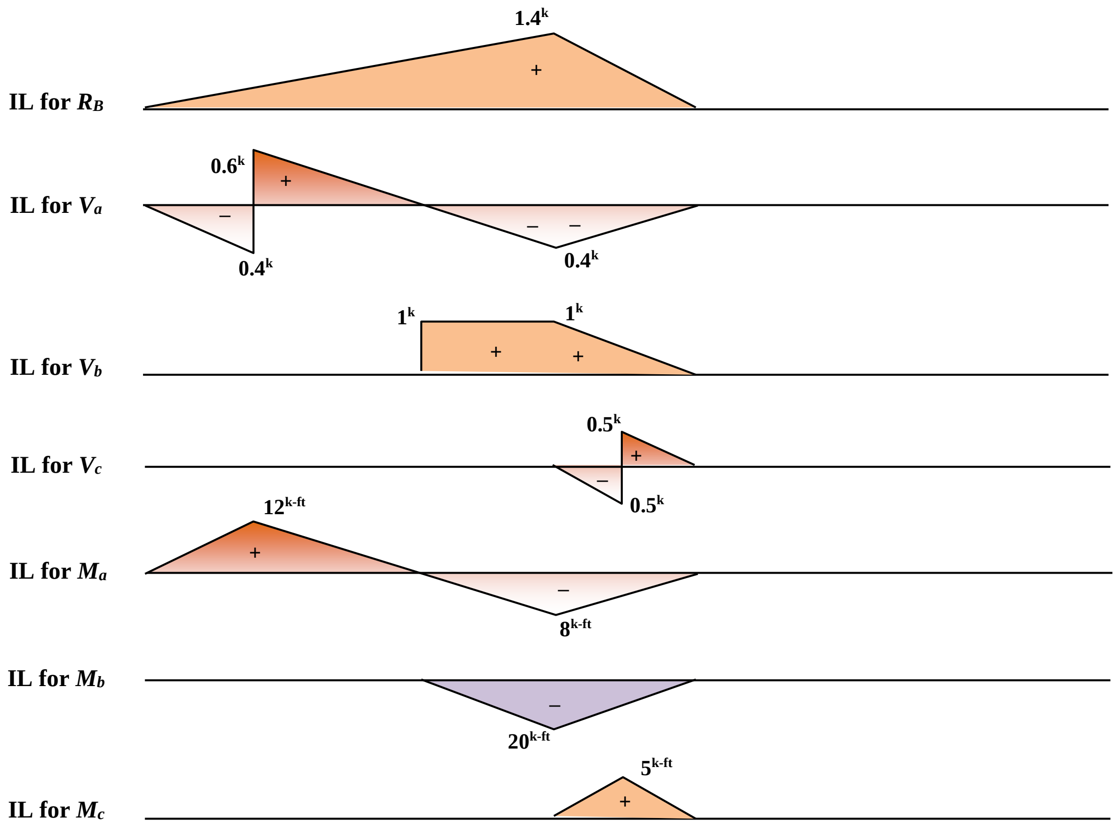
When a unit load at B.
R_{Ay} = 0.0 , R_B = 1.0, V_a = 0.0, M_a = 0.0

When a unit load at C.
R_{Ay} = -0.2 , R_B = 1.2, V_a = -0.2, M_a = -2.0

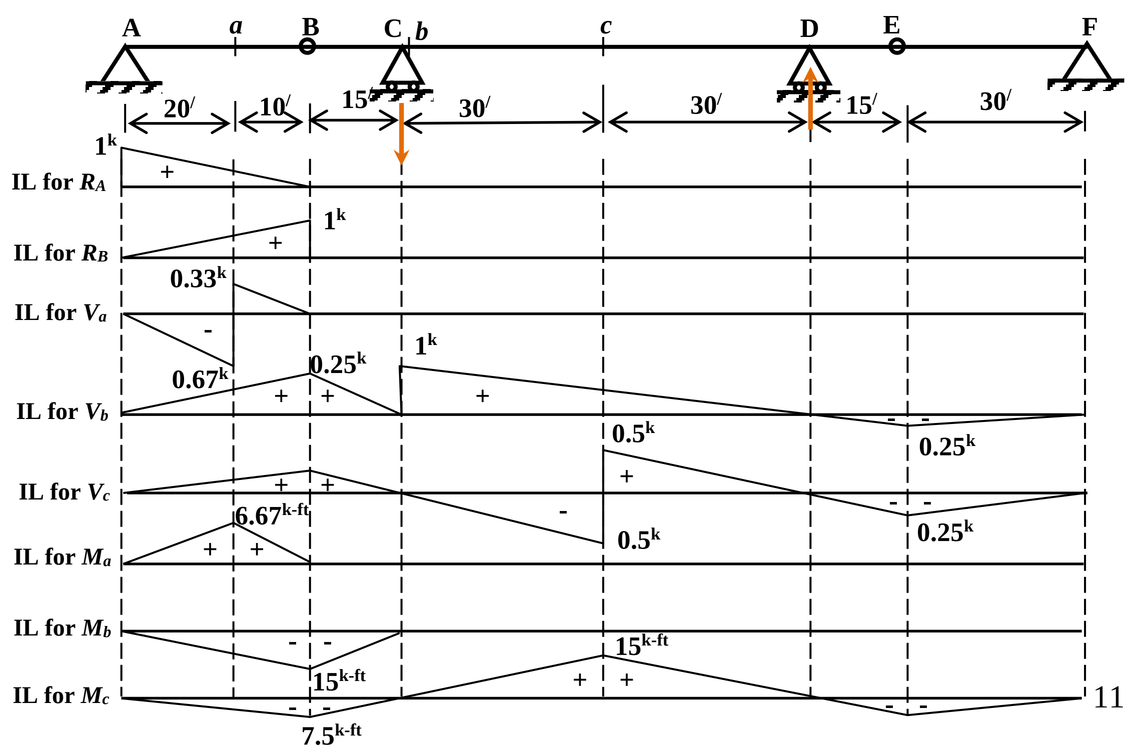


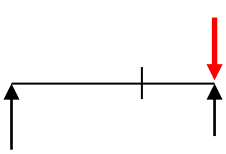
2 Draw IL diagrams for R_A, R_B, V_a, V_b, V_c, M_a, M_b and M_c of the following balance cantilever bridge as a unit load moves from A to F.





Q.3. Draw IL diagrams for R_A, R_B, V_a, V_b, V_c, M_a, M_b and M_c of the balance cantilever bridge as shown below in a line diagram as a unit load moves from A to F.





Q.4. Draw IL diagrams for R_A, R_B, V_b, V_c, M_b, M_c and reactive moment at support M_A of the following compound beam as a unit load moves from A to C.

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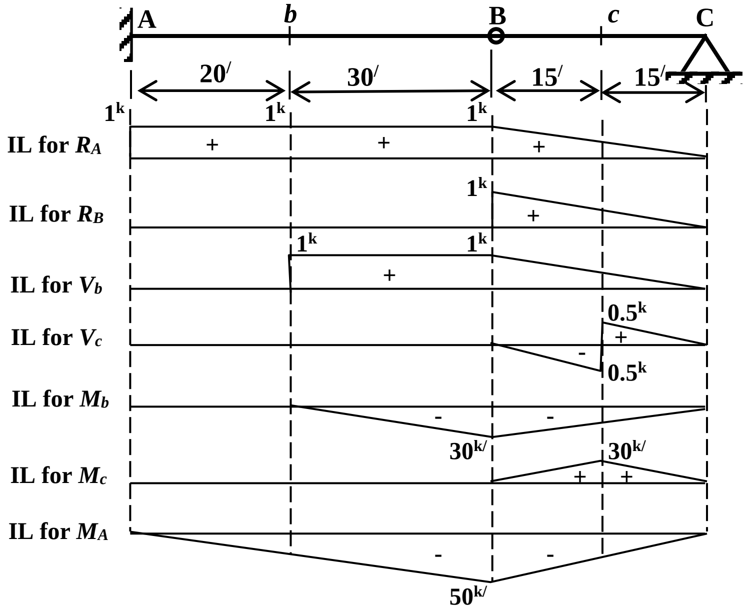
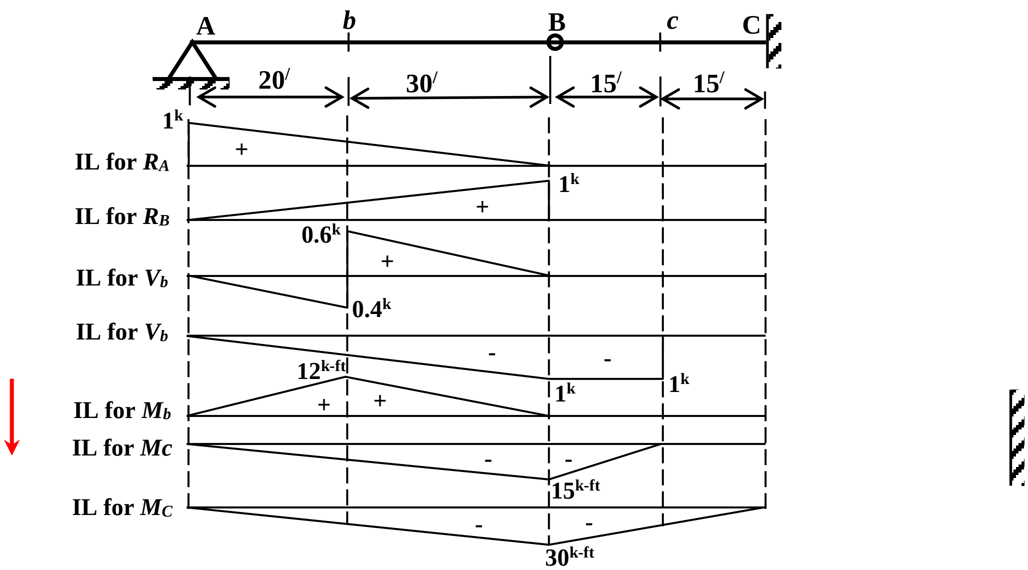
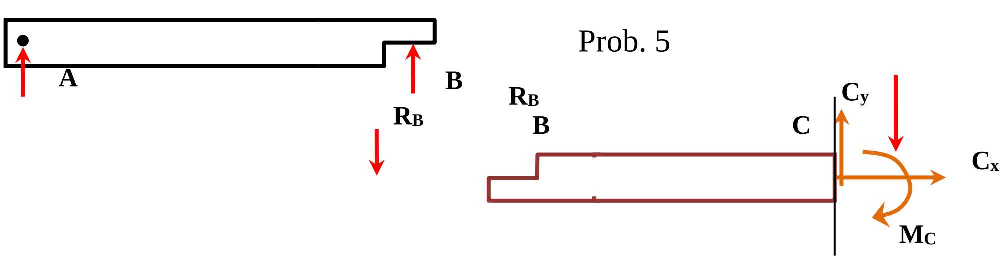


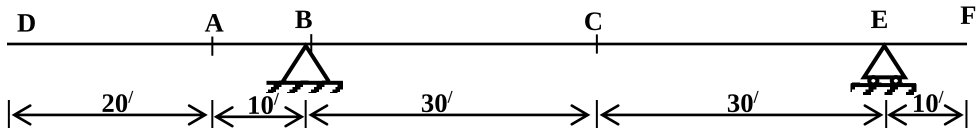
Q.5. Draw IL diagrams for R_A, R_B, V_b, V_c, M_b, M_c and M_C (reactive moment) of the balance cantilever bridge as shown below in a line diagram as a unit load moves from A to F.



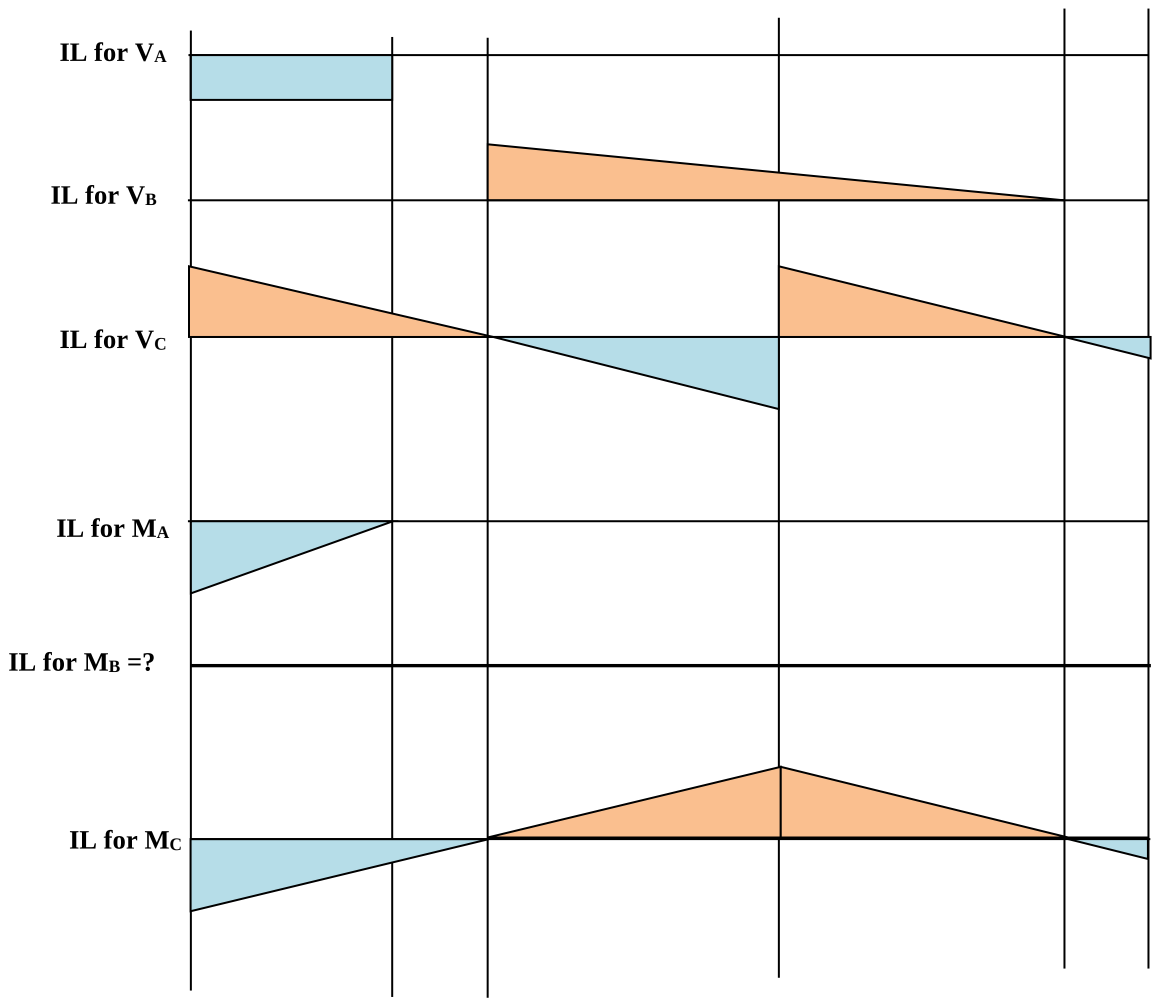


Prob. 5

1. Draw the influence lines for shear and the influence lines for moment at A, B, and C in the beam. B is just to the right of the left support. A unit load moves from left to right end of beams. (Shedd & Vawter, p-138, Prob.- 88)



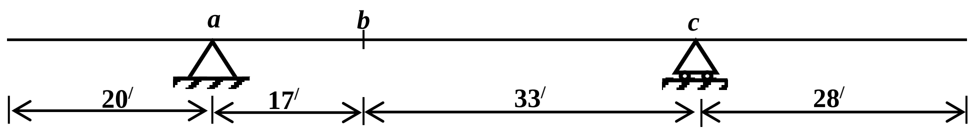
Prob. 1



2.(i) Draw the influence lines for shear at sections *a*, *b*, and *c*; *a* and *c* are to be taken an infinitesimal distance to the left of the supports.

(ii) Draw the influence lines for moment at *a*, *b*, and *c*.

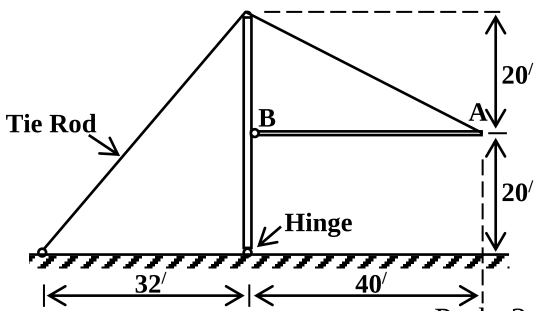
(iii) Draw the influence lines for shear at *a* and *c* when they are an infinitesimal distance to the right of the supports. (Shedd & Vawter, p-139, Prob.- 89)



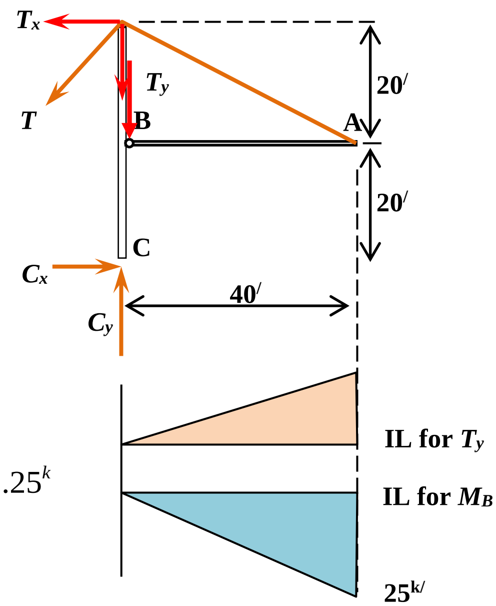
Prob. 2

3.(i) Draw the influence line for vertical component of the tie rod reaction as a unit load moves from A to B.(Shedd & Vawter, p-139, Prob.- 90)

(ii) Draw the influence line for moment in the must at B as a unit load moves from A to B.



Prob. 3



When a unit load at A

$$\sum M_C = -T_x \times 40 + 1 \times 40 = 0; \qquad T_x = 1; \quad T_y = \frac{40}{32} = 1.25^k$$

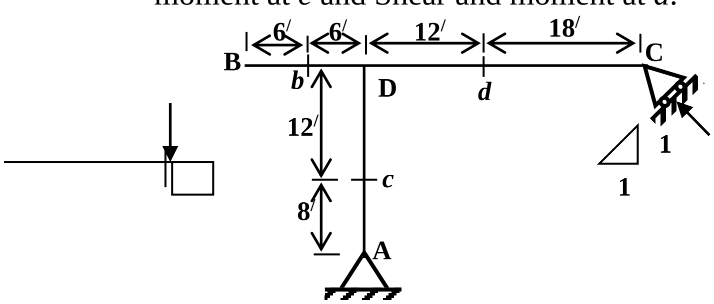
$$\sum F_x = -T_x + C_x = 0; \qquad T_x = C_x; \quad T_y = 1.25^k$$

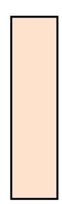
M_B = - 1.0*20 = -20$^{k/}$

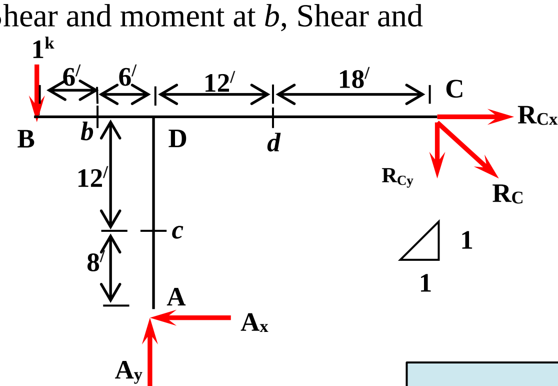
When a unit load at B

$$\sum M_C = -T_x \times 40 + 1 \times 0 = 0; \qquad T_x = 0; \quad T_y = \frac{0 \times 40}{32} = 0^k$$

4. Draw the following influence lines for the structure shown. In all cases the unit load moves between B and C.(Shedd & Vawter, p-139, Prob.- 89)
(i) Vertical component of the reaction at A, (ii) Shear and moment at *b*, Shear and moment at *c* and Shear and moment at *d*.







Prob. 4

When a unit load at B

$$\sum M_A = -1 \times 12 + R_C \sin 45^0 \times 20 + R_C \cos 45^0 \times 30 = 0; \qquad R_C = \frac{12\sqrt{2}}{50} = \frac{6\sqrt{2}}{25}$$

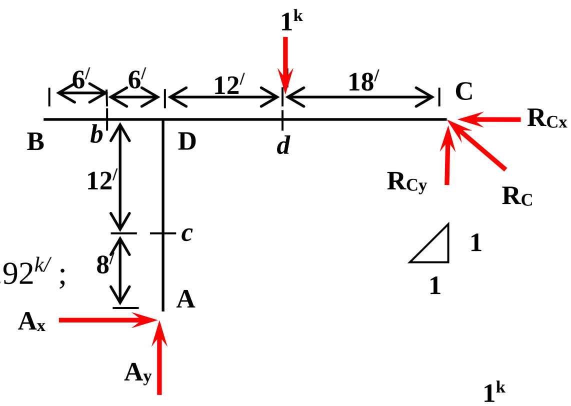
$$\sum F_X = R_C \cos 45^0 - A_x = 0; \qquad A_x = \frac{12}{50} = 0.24^k; \quad A_y = 1.24^k$$

A_y = +1.24^k; V_b = Ñ1^k ; M_b = Ñ6$^{k\text{-}ft}$; V_c = 0.24^k ; M_c = +0.24*8$^{k\text{-}ft}$=1.92$^{k\text{-}ft}$; V_d = 0.24^k ; M_d = -R_{cy}*8$^{k\text{-}ft}$ = -4.32$^{k\text{-}ft}$;

When a unit load at left of *b*; V_b = Ñ1^k ; M_b = 0$^{k\text{-}ft}$

When a unit load at right of *b*; V_b =0 ^{k} ; M_b = 0$^{k\text{-}ft}$

When a unit load at D; A_y = +1.0^k; V_b =0 ^{k} ; M_b = 0$^{k\text{-}ft}$; V_c =0 ^{k} ; M_c =0 ^{k} ; V_d =0 ^{k} ; M_d =0 ^{k}



When a unit load at left of *d*;

$$\sum M_A = 1\times 12 - R_C \sin 45^0 \times 20 - R_C \cos 45^0 \times 30 = 0;$$

$$R_C = 0.34^k; \quad A_x = 0.24^k; A_y = 1 - R_C \cos 45^0 = 0.76^k,$$

A_y = +0.76^k; V_b =0 ^{k} ; M_b = 0$^{k\text{-}ft}$; V_c = -0.24 ^{k} ; M_c = - 1.92$^{k/}$; V_d = -0.24 ^{k} ; M_d = +4.34 ^{k}

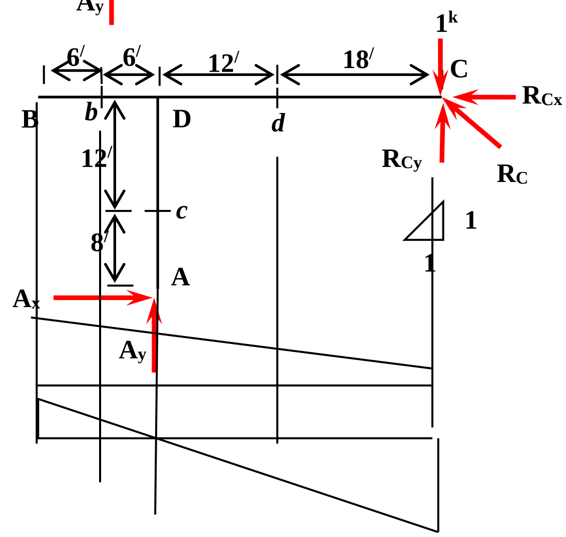
When a unit load at right of *d*;
V_d = +0.76 ^{k} ; M_d = +4.34 ^{k}

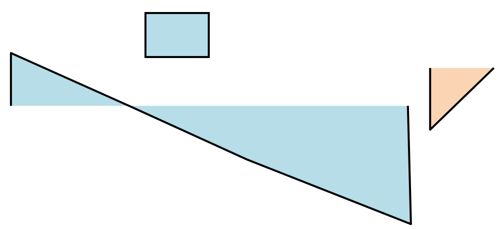
When a unit at C

$$\sum M_A = 1\times 30 - R_C \sin 45^0 \times 20 - R_C \cos 45^0 \times 30 = 0;$$

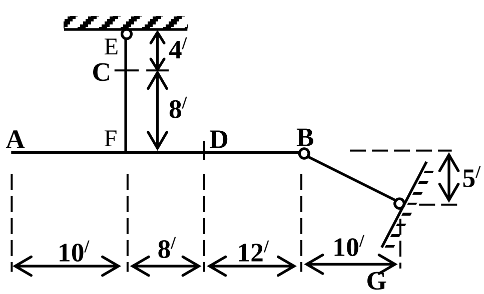
$$R_C = 0.849^k; \quad A_x = 0.6^k; A_y = 1 - R_C \cos 45^0 = 0.4^k,$$

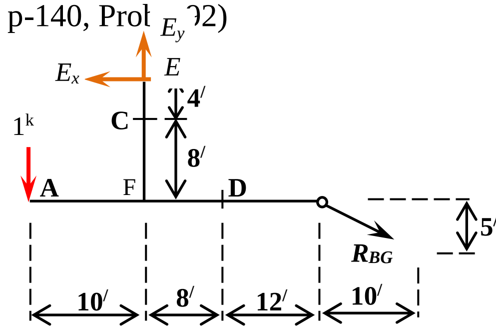
A_y = +0.4^k; V_b =0 ^{k} ; M_b = 0$^{k\text{-}ft}$; V_c = -0.4 ^{k} ; M_c = - 4.8$^{k/}$; V_d = +0.4 ^{k} ; M_d = +7.2 ^{k}





5. Draw the influence lines for shear and moment at C and D in the beam shown as a unit load moves from A to B. (Shedd & Vawter, p-140, Prob 2)





Prob. 5

<u>When 1^k at A</u>

$$\sum M_E = 0; \quad -1\times 10 + R_{BG}\frac{5}{\sqrt{10^2+5^2}}\times 20 - R_{BG}\frac{10}{\sqrt{10^2+5^2}}\times 12 = 0$$

$R_B = 5.59k$, $R_{BGx} = -5.0k$, $R_{By} = -2.5k$; $V_C = -5.0k$, $V_D = +2.5k$, $M_C = 20k\ ft$,
$M_D = 30k\ ft$,

<u>When 1^k at F</u>

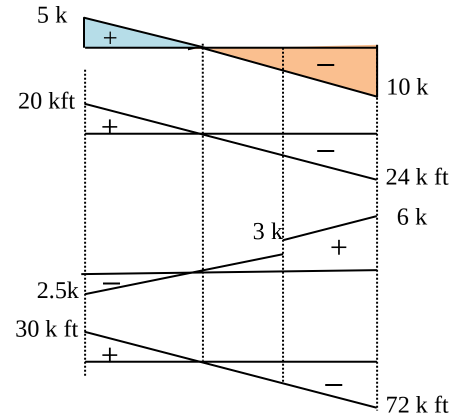
$R_B = 0.0$, $R_{Bx} = 0.0k$, $R_{By} = 0.0k$; $V_C = 0k$, $V_D = 0.0k$, $M_C = 0k\ ft$, $M_D = 0k\ ft$,

<u>When 1^k at left of D</u>

$R_B = 4.472k$, $R_{Bx} = -4k$, $R_{By} = -2k$; $V_D = 2k$, $M_D = -24k\ ft$,

<u>When 1^k at right of D</u>

$R_B = 4.472k$, $R_{Bx} = -4k$, $R_{By} = -2k$; $V_D = 3k$, $M_D = -24k\ ft$,



<u>When 1^k at A</u>

$R_B = 5.59k$, $R_{Bx} = 5.0k$, $R_{By} = 2.5k$; $V_C = 5.0k$,

$V_D = -2.5k$, $M_C = 20k\ ft$, $M_D = 30k\ ft$,

<u>When 1^k at F</u>

$R_B = 0.0$, $R_{Bx} = 0.0k$, $R_{By} = 0.0k$; $V_C = 0.0k$,

$V_D = 0.0k$, $M_C = 0k\ ft$, $M_D = 0k\ ft$,

<u>When 1^k at left of B</u>

$R_B = 4.472k$, $R_{Bx} = -4k$, $R_{By} = -2k$; $V_D = 2k$, $M_D = -24k\ ft$,

<u>When 1^k at left of B</u>

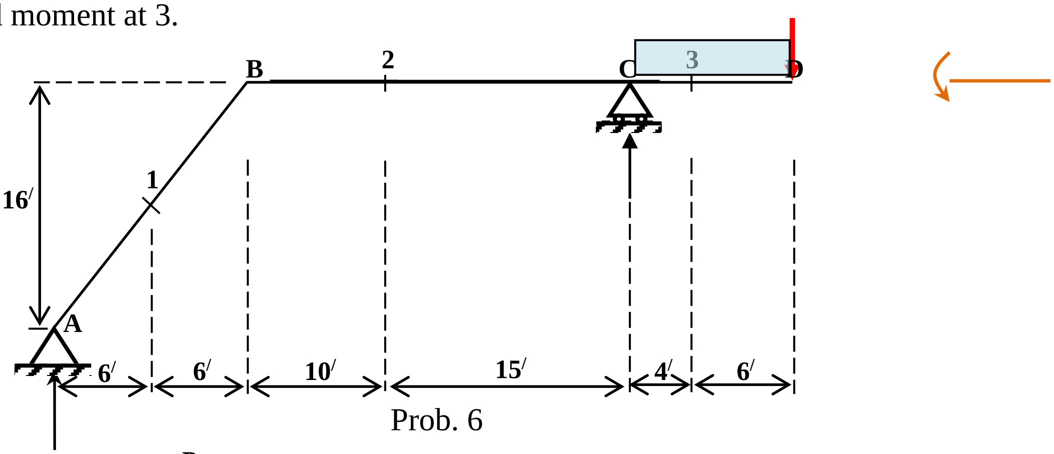
$R_B = 4.472k$, $R_{Bx} = -4k$, $R_{By} = -2k$; $V_D = 3k$, $M_D = -24k\ ft$,

<u>When 1^k at B</u>

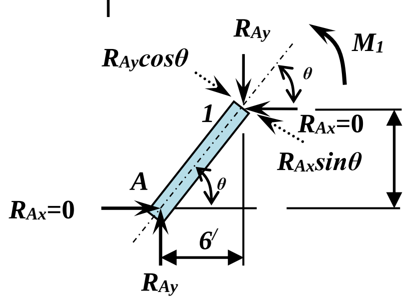
$R_B = 11.18k$, $R_{Bx} = -10k$, $R_{By} = -5.0k$; $V_C = -10k$, $V_D = 6k$, $M_C = -40k\ ft$,
$M_D = -72k\ ft$,

6. Draw the following influence lines for the structure shown. In all cases the load moves from B to D. (Shedd & Vawter, p-140, Prob.- 93)

(i) Reaction at C, (ii) Shear and moment at 1, (iii) Shear and moment at 2. (iv) Shear and moment at 3.



Prob. 6



$V_1 = R_{Ay}\cos\theta - R_{Ax}\sin\theta = R_{Ay}\cos\theta;$ $M_1 = R_{Ay}*6' - R_{Ax}*6' = 6R_{Ay}$

~~When 1^k at A~~

~~$R_{Ax} = 0.0^k, R_{Ay} = 1.0^k$, $V_1 = V_2 = V_3 = 0$, $M_1 = M_2 = M_3 = 0$~~

When 1^k at B

$R_{Ax} = 0.0^k, R_{Ay} = 0.68^k$, $R_C = 0.32^k$, $V_1 = R_{ay}\cos\theta = 0.68*(0.6) = 0.41^k$, $V_2 = -0.32^k$, $V_3 = 0$, $M_1 = 0.68x6= 4.08$ k-ft, $M_2 = 0.32x15 = 4.8$ k-ft, $M_3 = 0$

When 1^k at just left of section 2

$R_{Ax} = 0.0^k, R_{Ay} = 0.405^k$, $R_C = 0.595^k$, $V_1 = R_{ay}\cos\theta = 0.41*(0.6) = 0.24^k$, $V_2 = -0.59^k$, $V_3 = 0$, $M_1 = 0.405x6= 2.43$ k-ft, $M_2 = 0.405x22 = 0.595x15= 8.92$ k-ft, $M_3 = 0$

When 1^k at just right of section 2

$R_{Ay} = 0.405^k$, $R_C = 0.595^k$, $V_2 = +0.41^k$, $V_3 = 0$, $M_1 = 0.41x6= 2.46$ k-ft, $M_2 = 0.405x22 = 0.595x15= 8.92$ k-ft, $M_3 = 0$

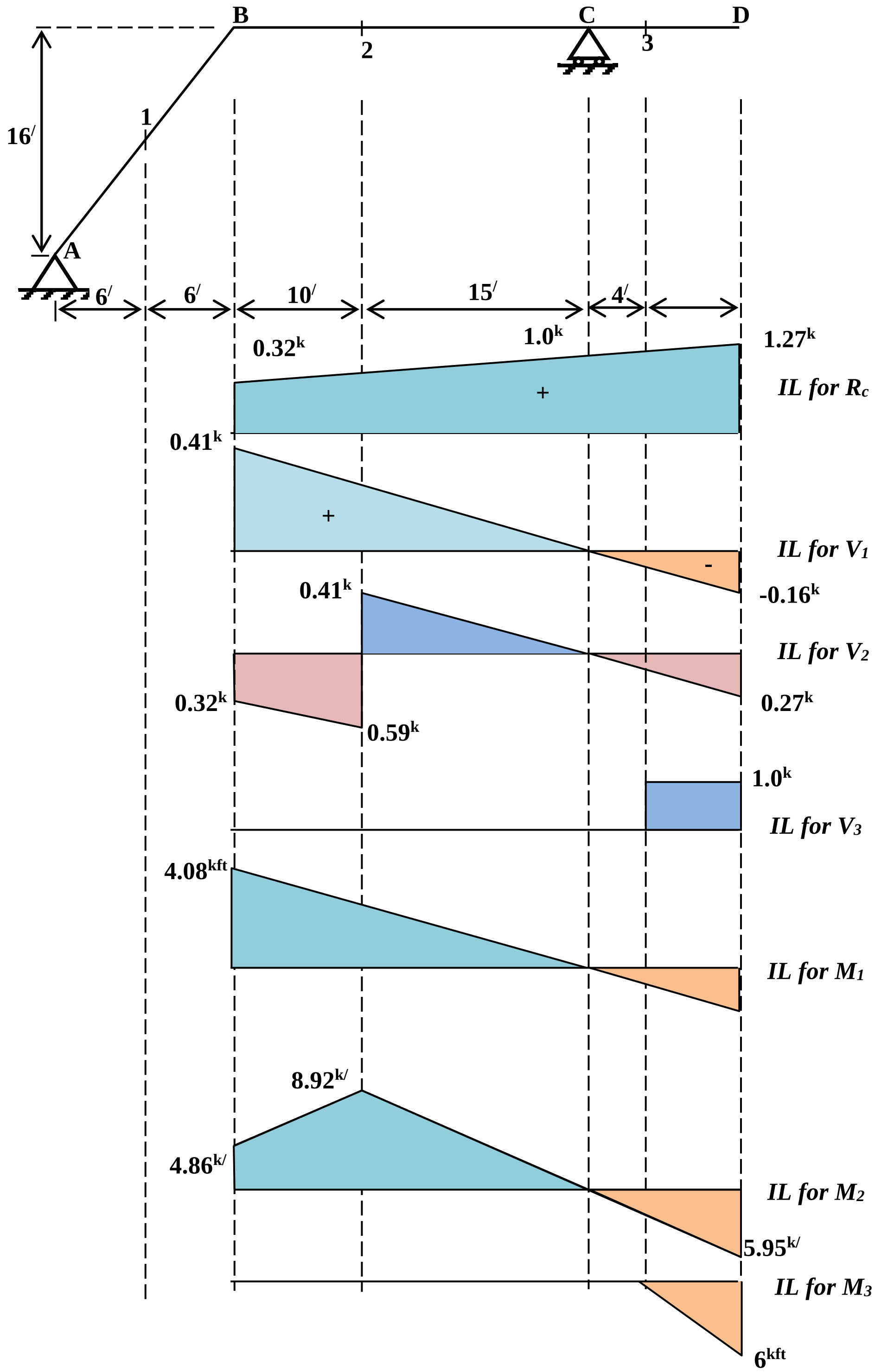
When 1^k at C

$R_C = 1.0^k$, All other values are zero.

When 1^k at just left of section 3, $V_3 = 0$, When 1^k at just right of section 3, $V_3 = 1$

When 1^k at D

$R_{Ay} = -0.27^k$, $R_C = 1.27^k$, $V_1 = R_{ay}\cos\theta = -0.27*(0.6) = -0.162^k$, $V_2 = -0.27^k$, $V_3 = 1$, $M_1 = -0.27x6= -1.63$ k-ft, $M_2 = -0.27x22 = -5.94$ k-ft, $M_3 = -6$ k-ft

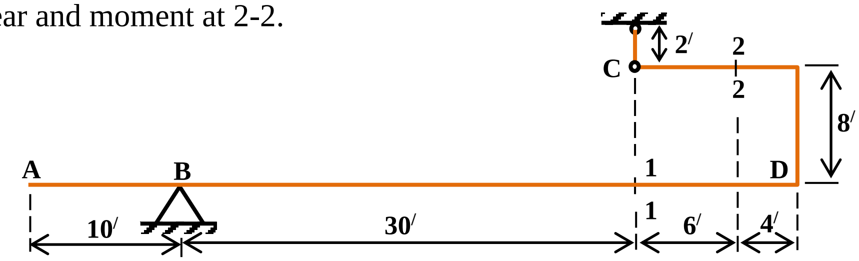


B
C
D
2
3
1
16/
A
6/
6/
10/
15/
4/
0.32k
1.0k
1.27k
+
IL for Rc
0.41k
+
IL for V1
-
-0.16k
0.41k
IL for V2
0.32k
0.27k
0.59k
1.0k
IL for V3
4.08kft
IL for M1
8.92k/
4.86k/
IL for M2
5.95k/
IL for M3
6kft

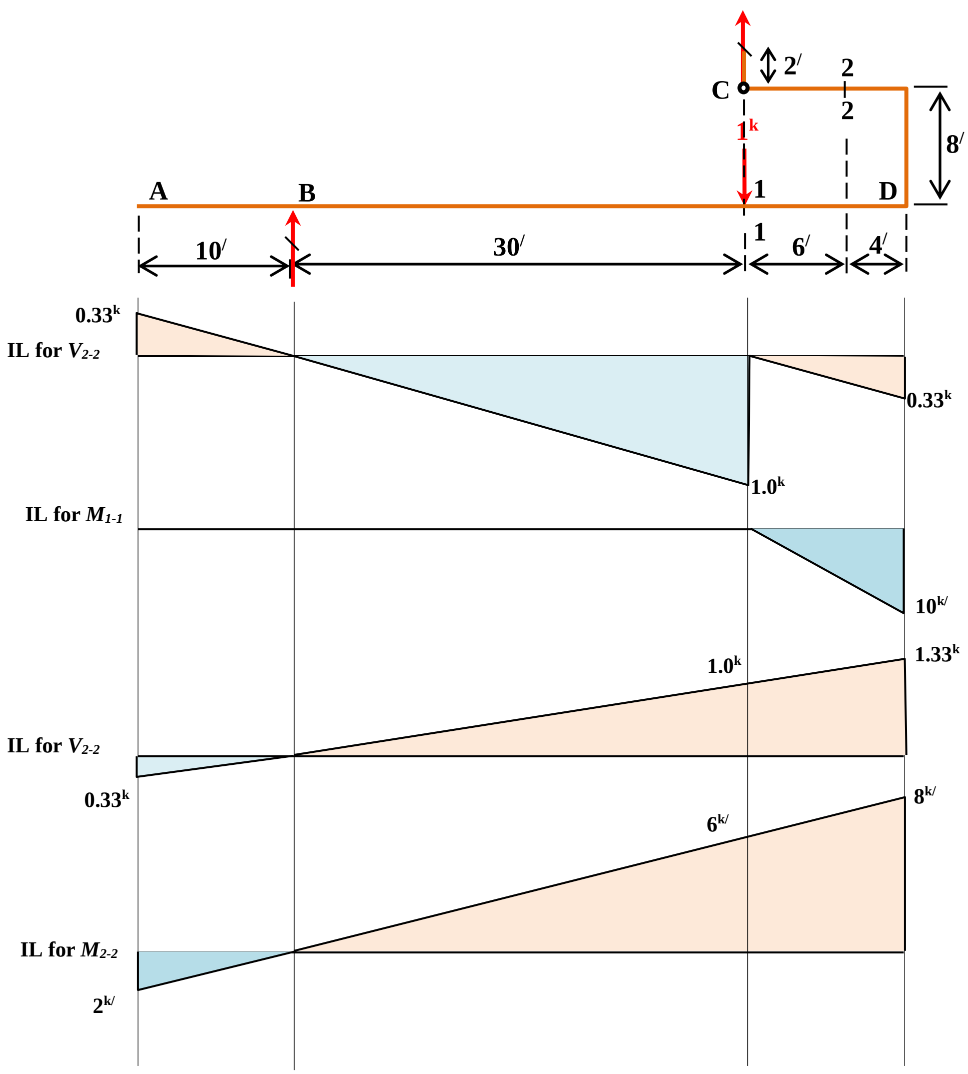
7. As a unit load moves from A to D, draw the influence lines for: (Shedd & Vawter, p-141, Prob.- 96)

(i) Shear and moment at 1-1.

(ii) Shear and moment at 2-2.

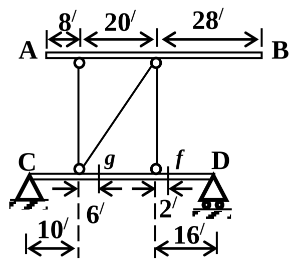


Prob. 7



8.(i) Draw the influence lines for shear and moment at *f*, in the beam CD of the frame shown, as a unit load moves from A to B.

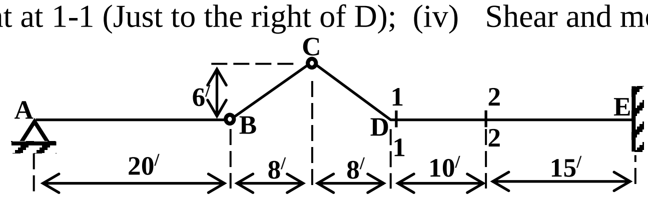
(ii) Draw the influence lines for shear and moment at *g* in the same beam for the same movement of the unit load. (Shedd & Vawter, p-141, Prob.- 97)



Prob. 8

9. As a unit load moves from A to B and from D to E on the following structure, draw the influence lines for:

(i) Vertical component of Reaction at support A; (ii) Reaction in the member BC; (iii) Shear and moment at 1-1 (Just to the right of D); (iv) Shear and moment at 2-2.



Prob. 9

<u>When 1k at A</u>

R_A = 1k; F_{BC} = 0.0; V_{1-1} = 0.0; V_{2-2} = 0.0; M_{1-1} = 0.0; M_{2-2} = 0.0

<u>When 1k at B</u>

R_A = -1.33k; F_{BC} = 1.66k; V_{1-1} = -1.0; V_{2-2} = -1.0; M_{1-1} = -16.0 k-ft; M_{2-2} = -26.0 k-ft

<u>When 1k at D</u>

R_A = 0.0k; F_{BC} = 0.0k; V_{1-1} = -1.0; V_{2-2} = -1.0; M_{1-1} = 0.0 k-ft; M_{2-2} = -10.0 k-ft

<u>When 1k at right of 1-1</u>

R_A = 0.0k; F_{BC} = 0.0k; V_{1-1} = 0.0; V_{2-2} = -1.0; M_{1-1} = 0.0 k-ft; M_{2-2} = -10.0 k-ft

<u>When 1k at left of 2-2</u>

R_A = 0.0k; F_{BC} = 0.0k; V_{1-1} = 0.0; V_{2-2} = -1.0; M_{1-1} = 0.0 k-ft; M_{2-2} = 0.0 k-ft

<u>When 1k at left of 2-2</u>

R_A = 0.0k; F_{BC} = 0.0k; V_{1-1} = 0.0; V_{2-2} = 0.0; M_{1-1} = 0.0 k-ft; M_{2-2} = 0.0 k-ft

<u>When 1k at 5ft from A</u>

$R_A = 0.821^k$

<u>When 1k at 10ft from A</u>

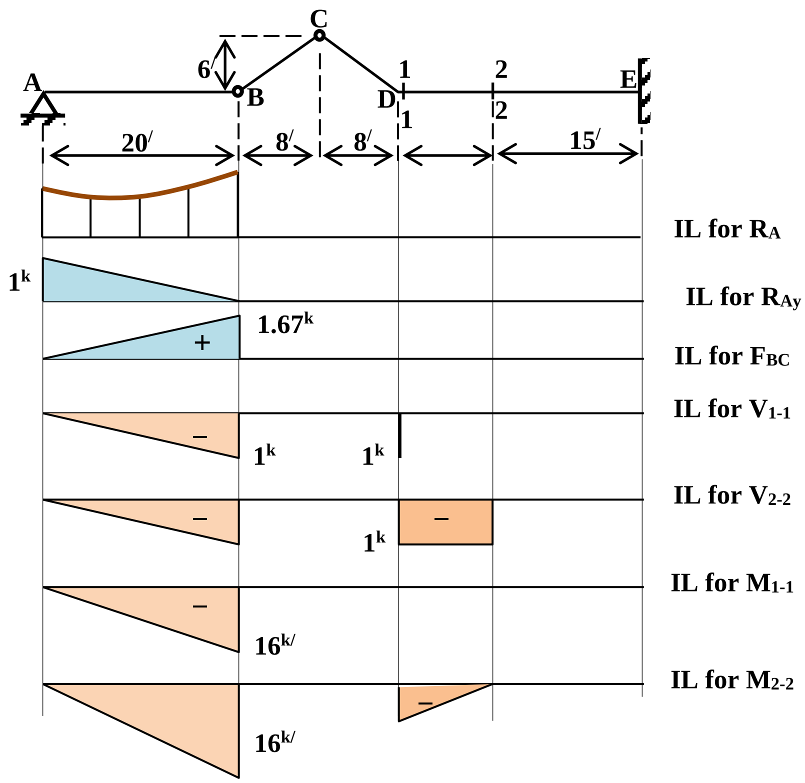
$R_A = 0.8333^k$

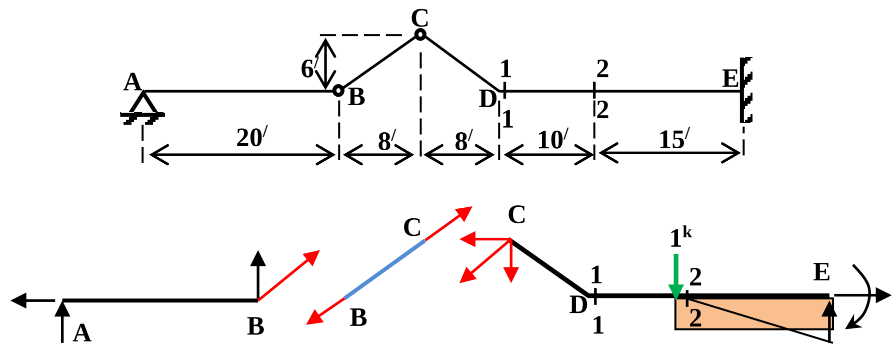
<u>When 1k at 15ft from A</u>

$R_A = 1.031^k$

<u>When 1k at B</u>

$R_A = 1.333^k$

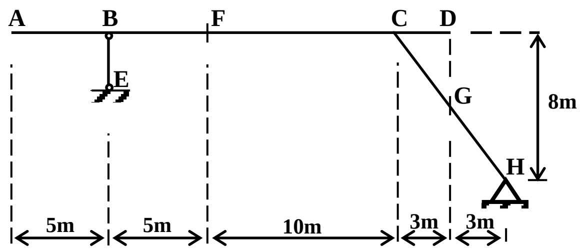




10. As a unit load moves from A to D on the following structure, draw the influence lines for:

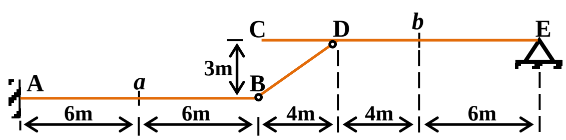
(i) Reaction in the member BE.

(ii) Shear and moment at F.
(iii) Shear and moment at G.



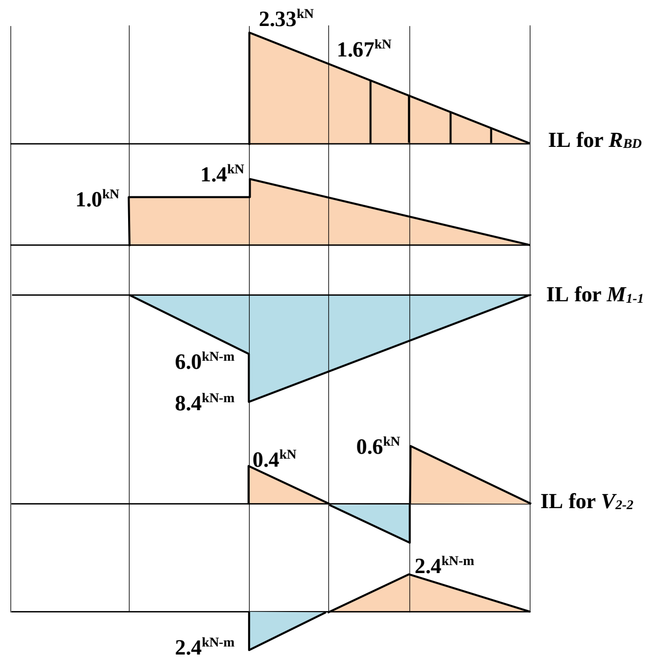
Prob. 10

11. Draw the influence lines for R_{BD}, M_A, V_a, V_b, M_a and M_b as a unit load moves from A to B and from C to E.

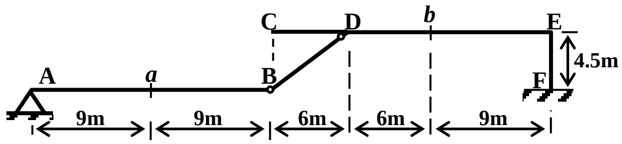


Prob. 11

When 1^k at B, $R_{BD} = 0$
When 1^k at C, $R_{BD} = 2.33^{kN}$
When 1^k at D, $R_{BD} = 1.67^{kN}$
When 1^k at 2m from D, $R_{BD} = 1.33^{kN}$
When 1^k at 4m from D, $R_{BD} = 1.0^{kN}$
When 1^k at 6m from D, $R_{BD} = 0.67^{kN}$
When 1^k at 8m from D, $R_{BD} = 0.33^{kN}$

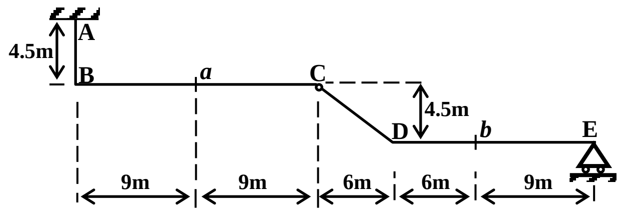


12. Draw the influence lines for R_{BD}, M_F, V_a, V_b, M_a and M_b as a unit load moves from A to B and from C to E.



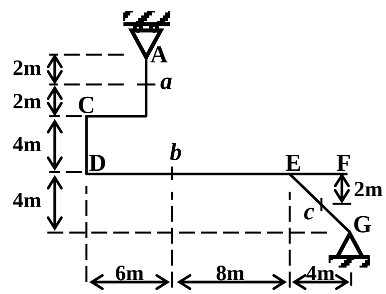
Prob. 12

13. Draw the influence lines for M_A, V_a, V_b, M_a and M_b as a unit load moves from B to C and from D to E.



Prob. 13

14. Draw the influence lines for V_a, V_b, V_c, M_a, M_b and M_c as a unit load moves from D to F.



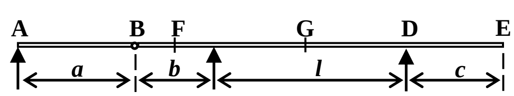
Prob. 14

15. As a unit load moves from A to E on the following structure, draw the influence lines for: (Vazirani & Ratwani, Vol-I, p-502)

(i) Reactions R_A, R_B, R_C, and R_D.

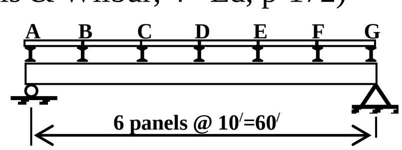
(ii) Shear and moment at F.

(iii) Shear and moment at G.



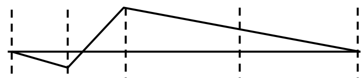
Prob. 15

16. For the girder shown, construct the influence lines for (i) shear in panel BC and (ii) moment at E. (Norris & Wilbur, 4th Ed, p-172)

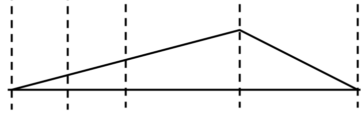


Prob. 16

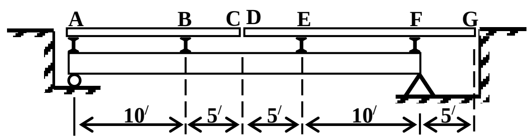
V_B = - 1/6 k, V_C = +2/3 k



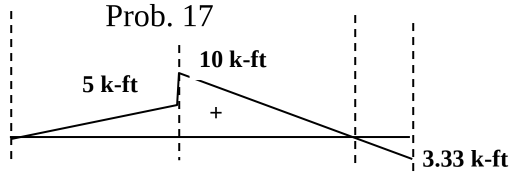
M_E = +13.33 k-ft



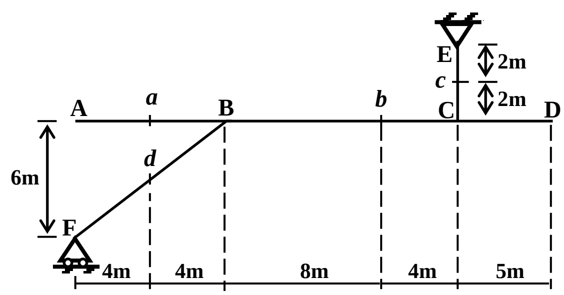
17. Note the unusual stringer arrangement for this girder. Construct the influence lines for the bending moment in the girder at E. (Norris & Wilbur, 4th Ed, p-173)



Prob. 17

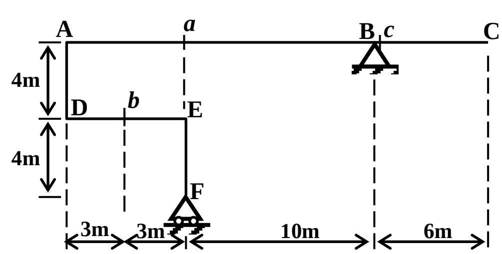


18. As a unit load moves from A to D on the following structure, draw the influence lines for shear and moment at sections *a*, *b*, *c*, and *d*.



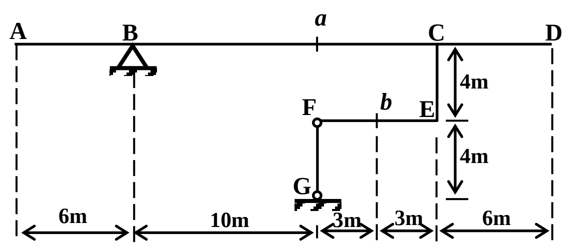
Prob. 18

19. As a unit load moves from A to D on the following structure, draw the influence lines for shear and moment at sections *a*, *b*, and *c*(just to the right of B).



Prob. 19

20. As a unit load moves from A to D on the following structure, draw the influence lines for shear and moment at sections *a*, and *b*. Also, draw the influence lines for reaction in member FG.



Prob. 20

21. As a unit load moves from A to D and E to F on the following structure, draw the influence lines for shear and moment at sections *a*, and *b*. Also, draw the influence lines for reaction in member FG.