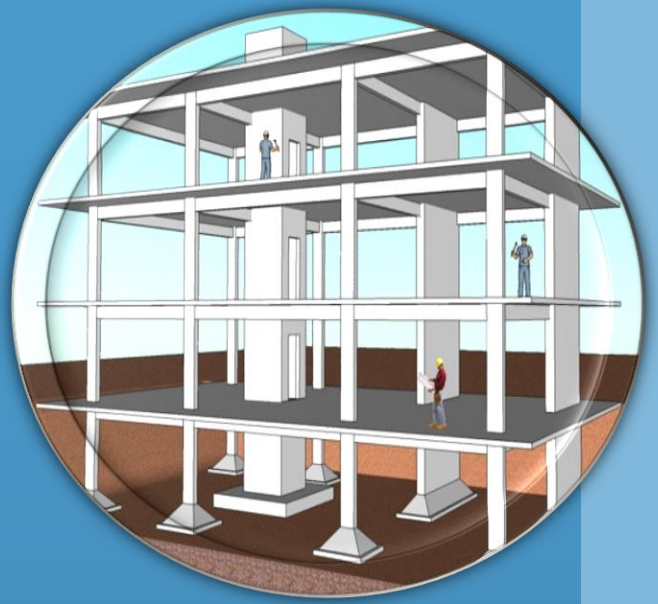
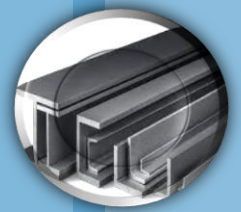
UNIVERSITY OF ZAMBIA
School of Engineering
Department of Civil & Environmental Eng.

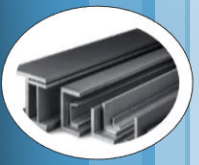


CEE 3222: THEORY OF STRUCTURES

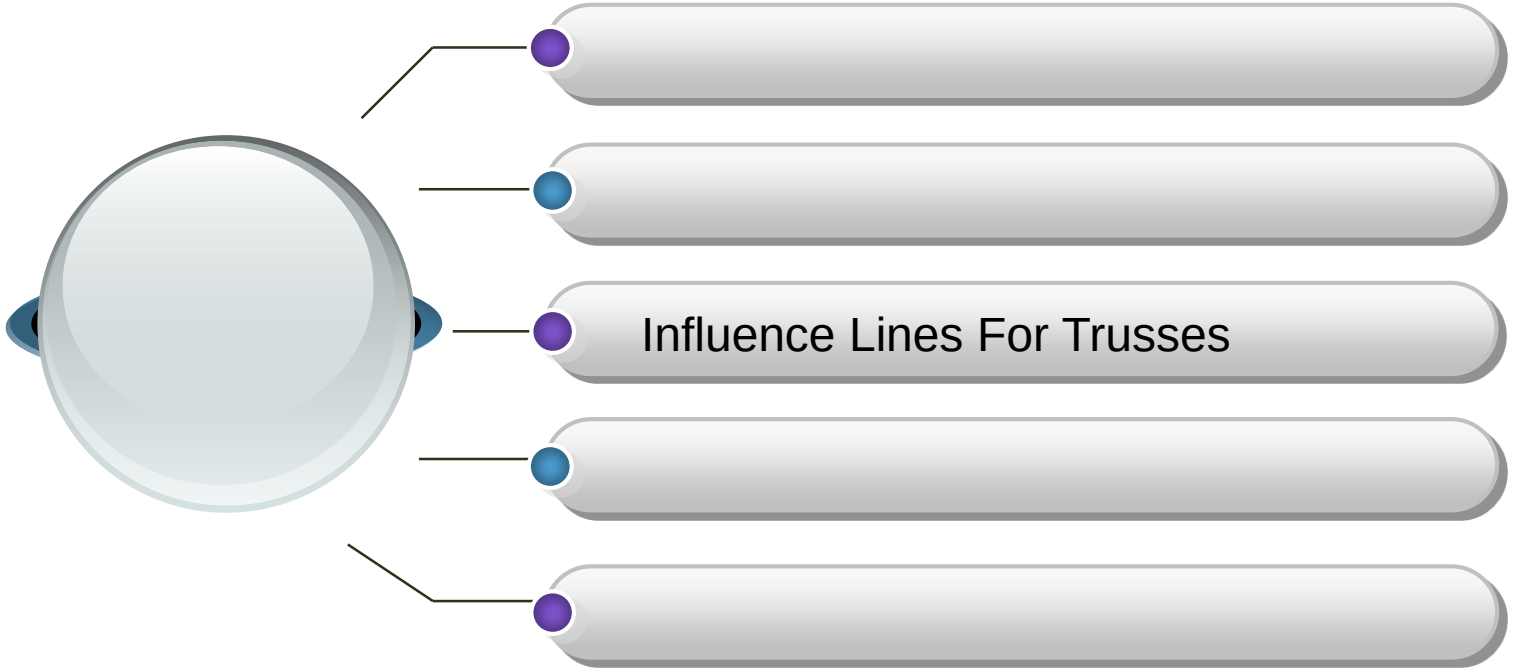
Lecture 2.3

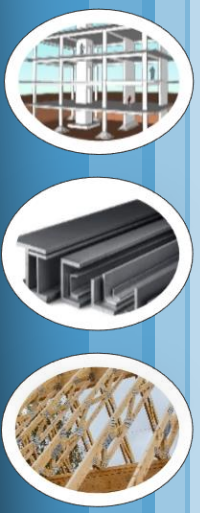
INFLUENCE LINES FOR STATICALLY DETERMINATE STRUCTURES- TRUSSES





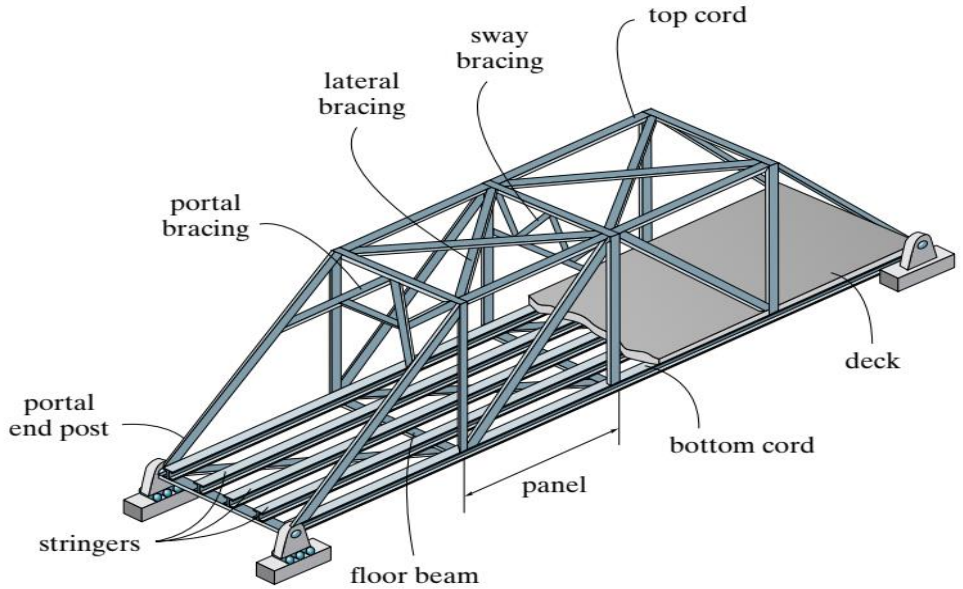
Contents





Influence Line for Trusses

- Trusses are often used as primary load-carrying elements for bridges.
- It is important to construct the influence lines for each of its members.
- As shown in the figure, the loading on the bridge deck is transmitted to stringers, which in turn transmit the loading to floor beams and then to the joints along the bottom cord of the truss.

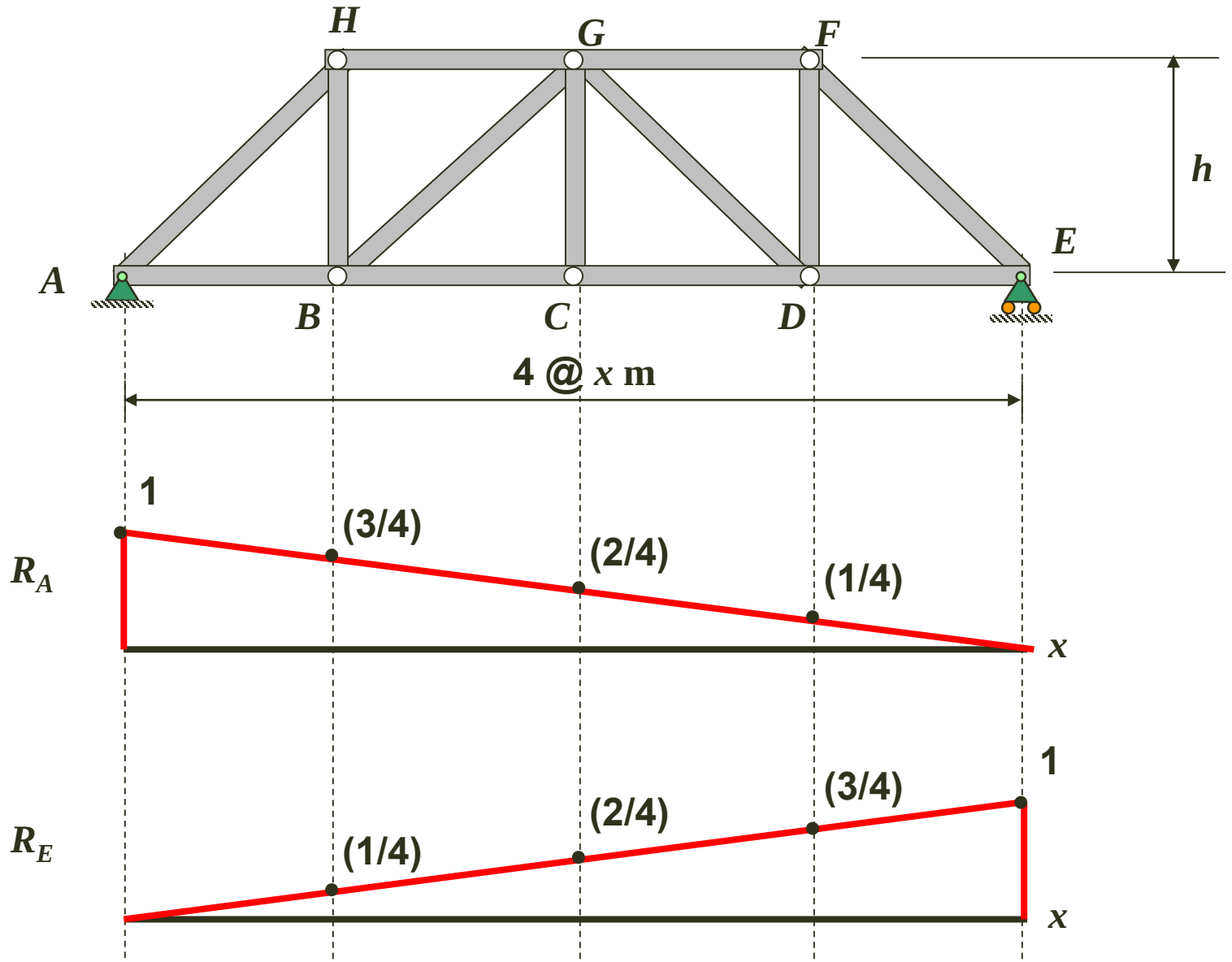


- Since the truss members are affected only by the **joint loading**, we can therefore obtain the **ordinate values of the influence line for a member by loading each joint along the deck with a unit load and then use the method of joints or the method of sections to calculate the force in the member.**

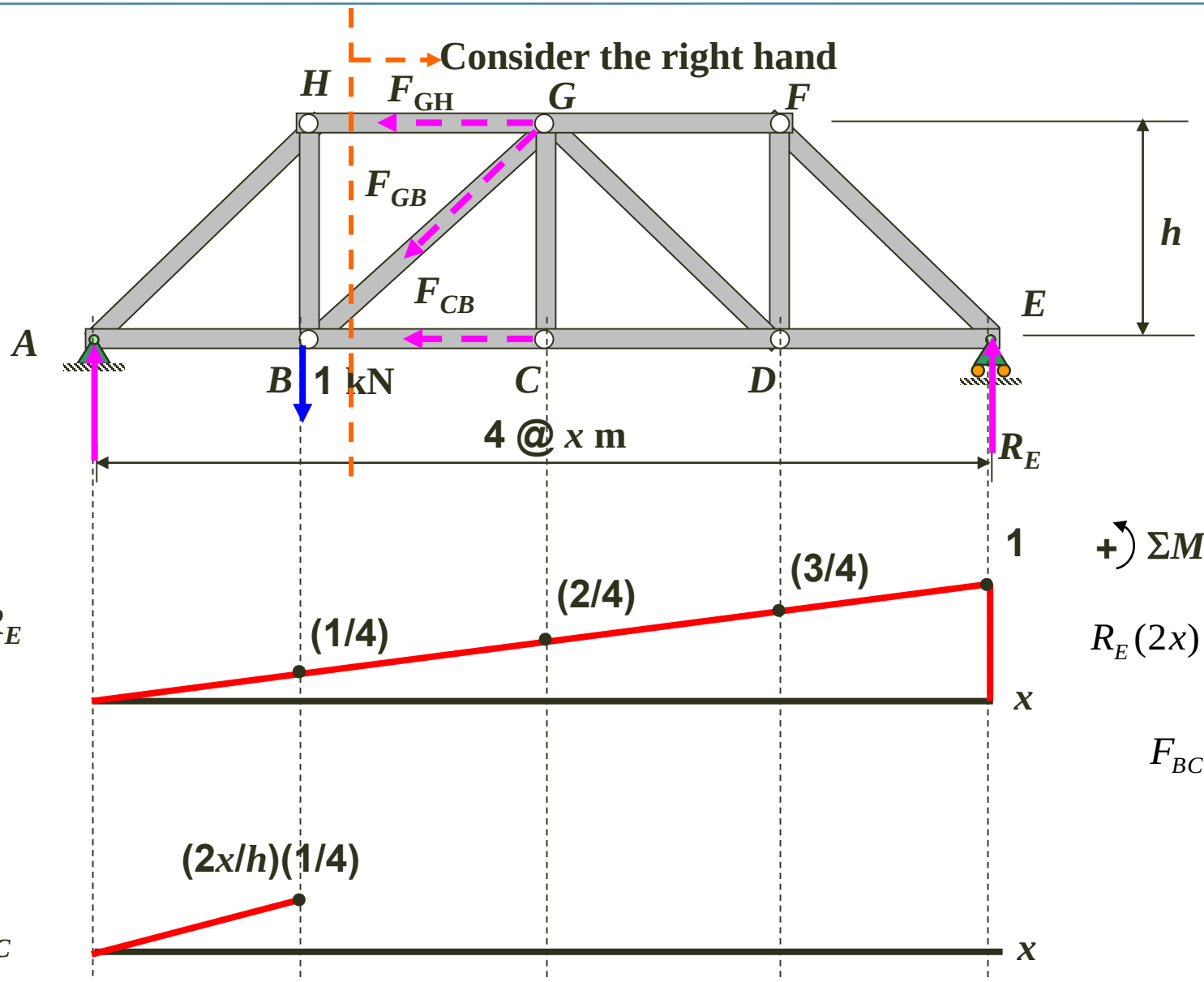
Influence Line for Trusses

- As a convention, if the member force is tensile it is considered a positive value; if it is compressive it is negative.
- The influence line for the member is constructed by plotting the data and drawing straight lines between the points.
- Since the truss members are affected only by the **joint loading**.

Influence Line for Trusses



Influence Line for Trusses

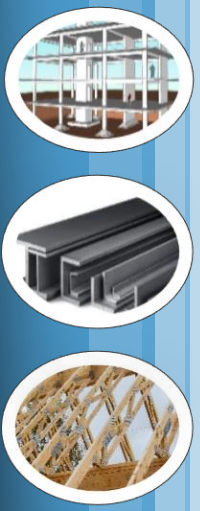


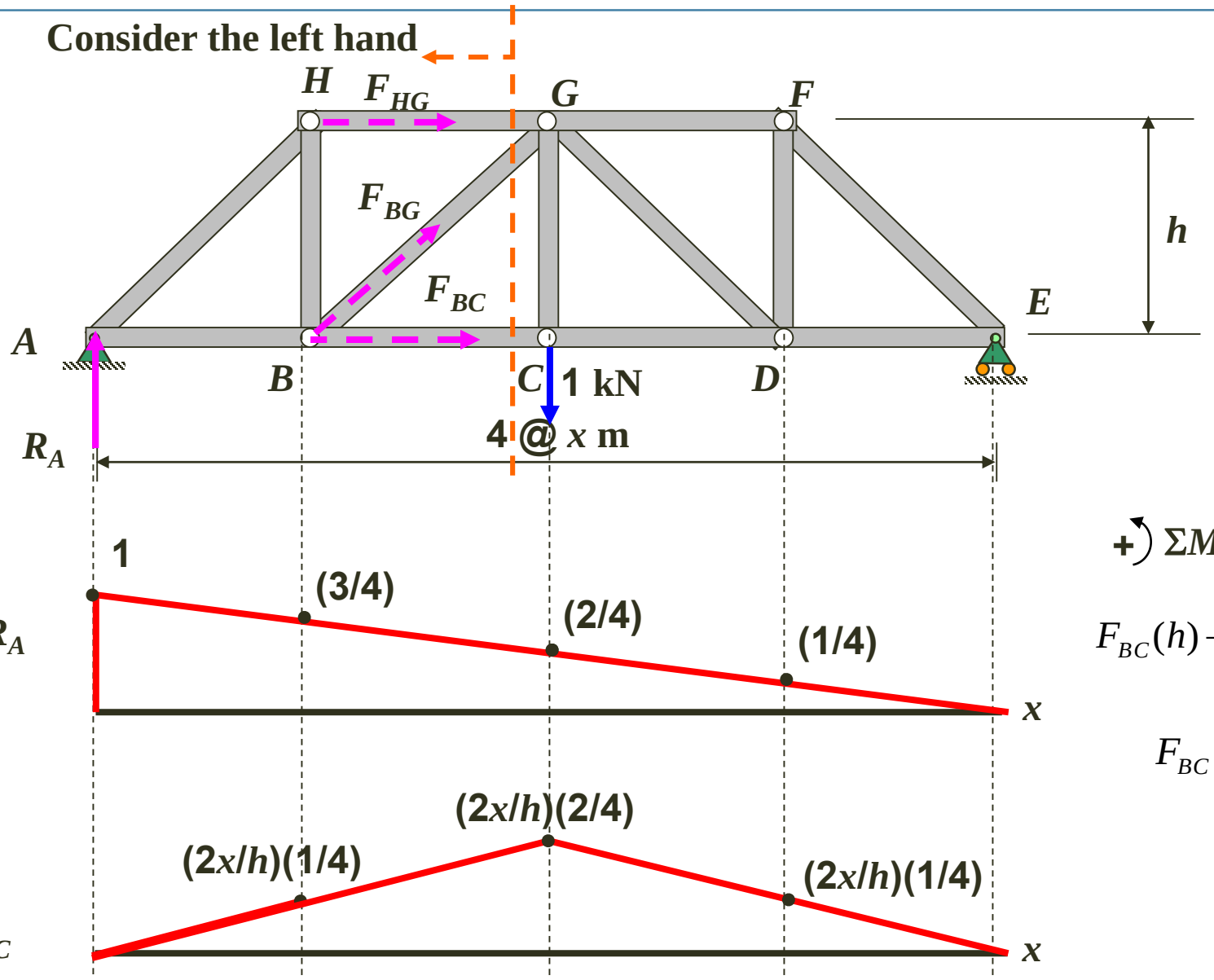
$+\circlearrowleft \Sigma M_G = 0$:

$$R_E(2x) - F_{BC}(h) = 0$$

$$F_{BC} = \frac{2x}{h} R_E$$

Influence Line for Trusses





$+\circlearrowleft \Sigma M_G = 0$:

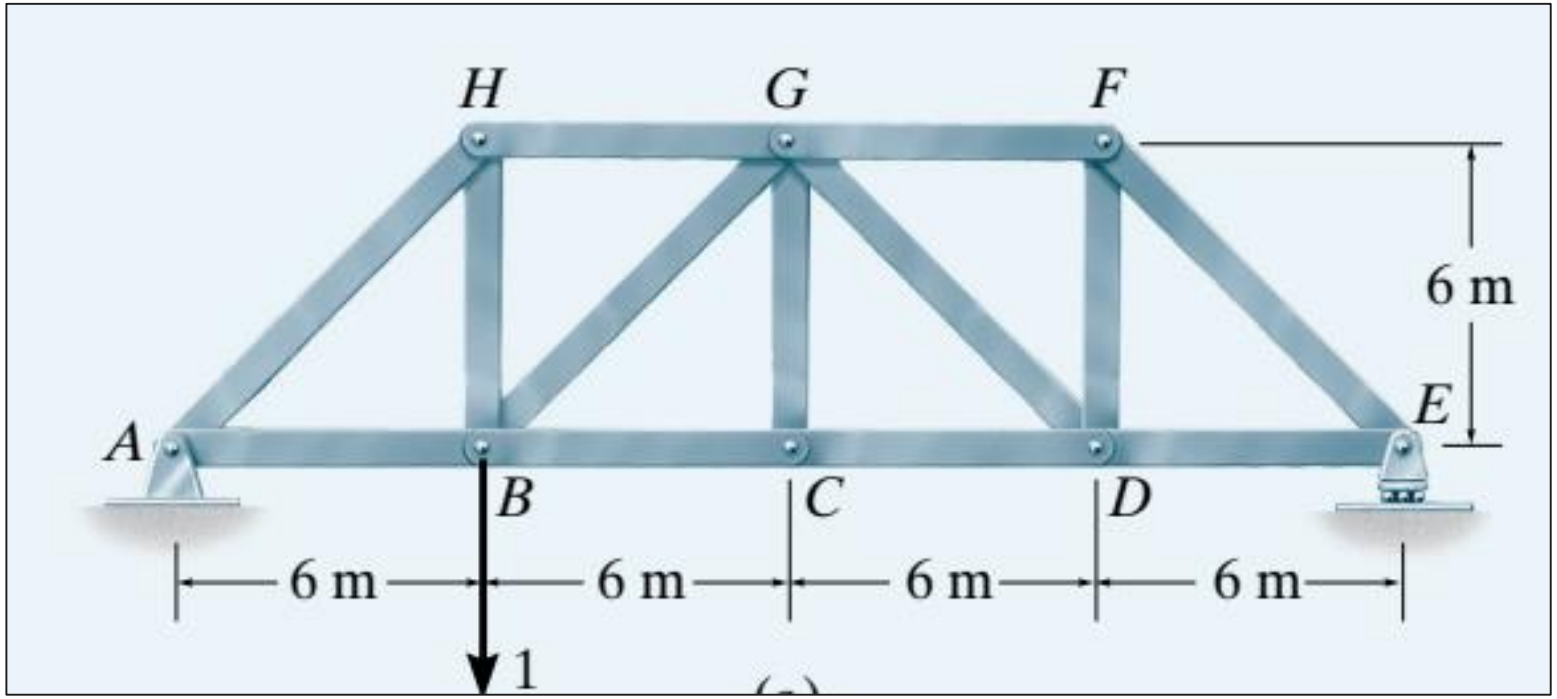
$$F_{BC}(h) - R_A(2x) = 0$$

$$F_{BC} = \frac{2x}{h} R_A$$

Influence Line for Trusses

Example 1

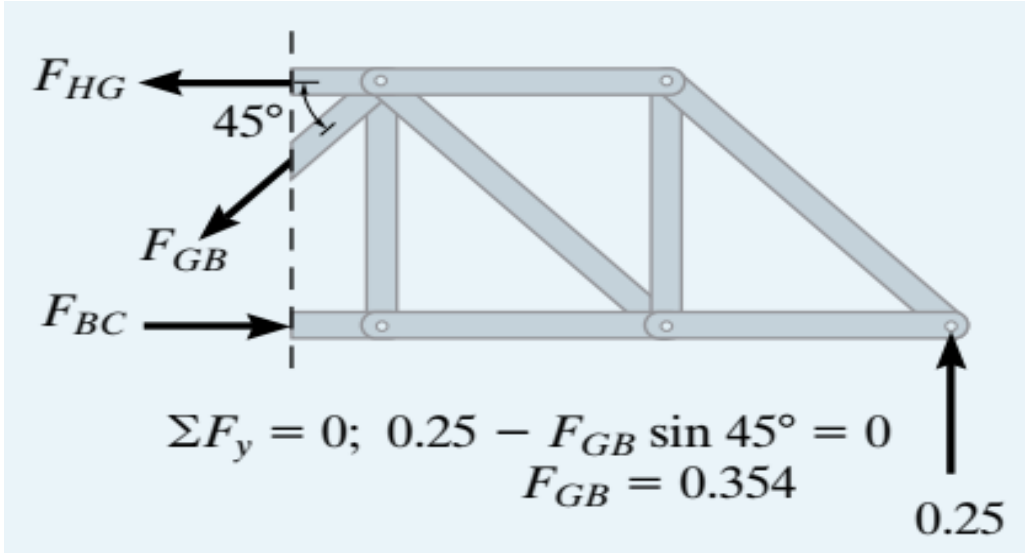
- Draw the influence line for the force in member GB of the bridge truss shown

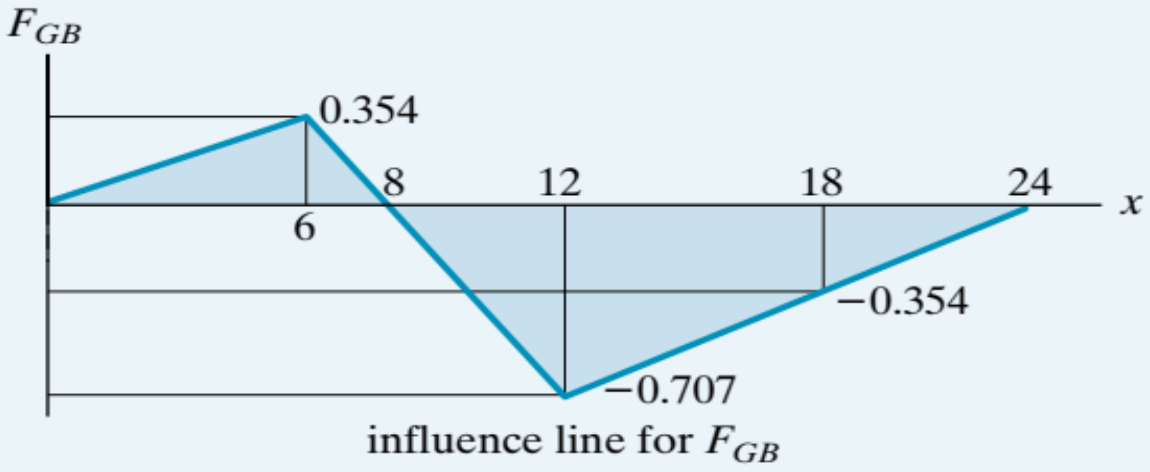


Influence Line for Trusses

Solution 1

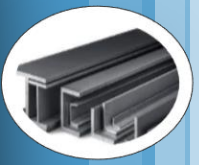
x	F_{GB}
0	0
6	0.354
12	−0.707
18	−0.354
24	0





influence line for F_{GB}

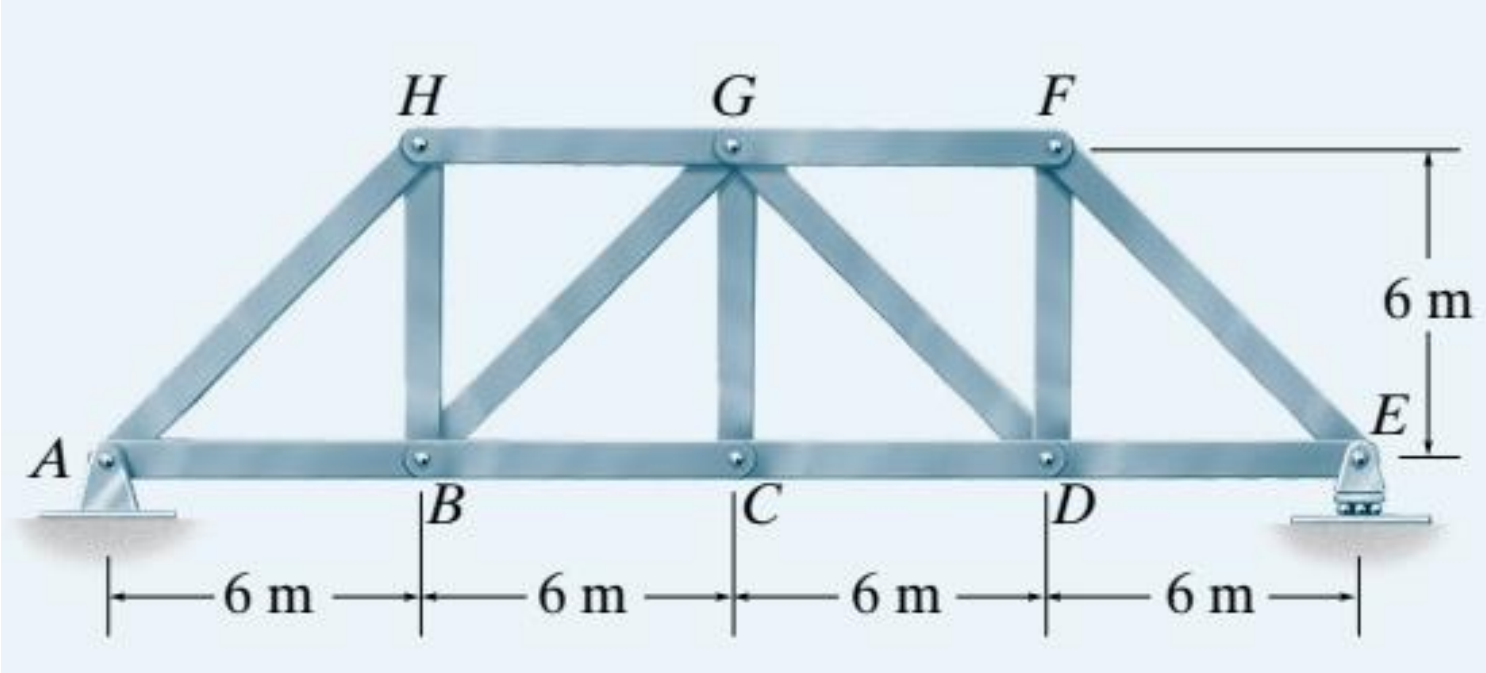
Member GB is referred to as a primary member because it has a load at all the points location of the unit load.



Influence Line for Trusses

Example 2

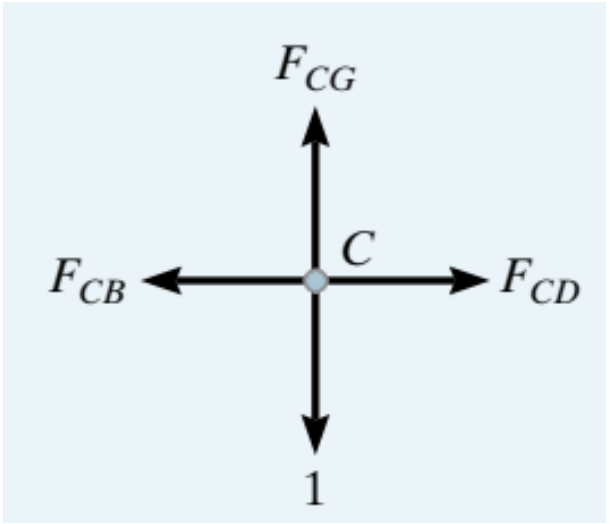
- Draw the influence line for the force in member CG of the bridge truss shown

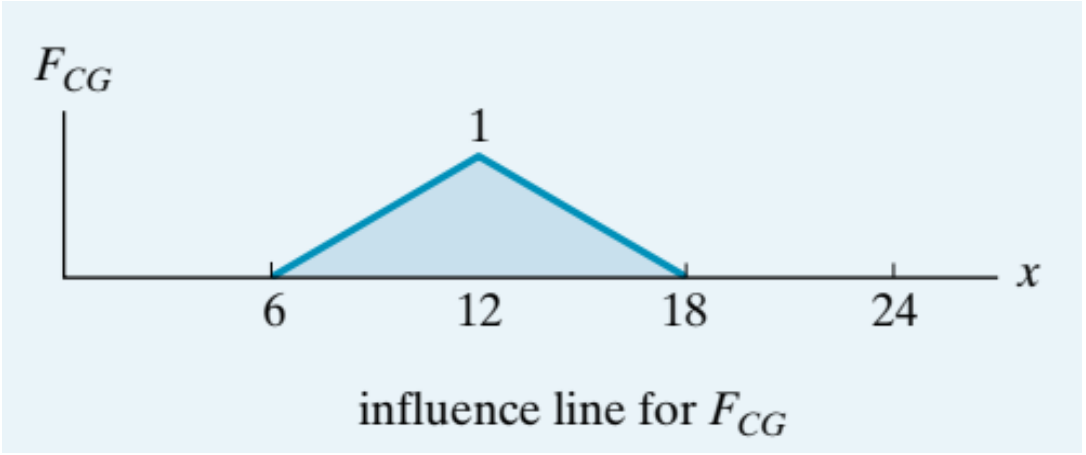


Influence Line for Trusses

Solution 2:

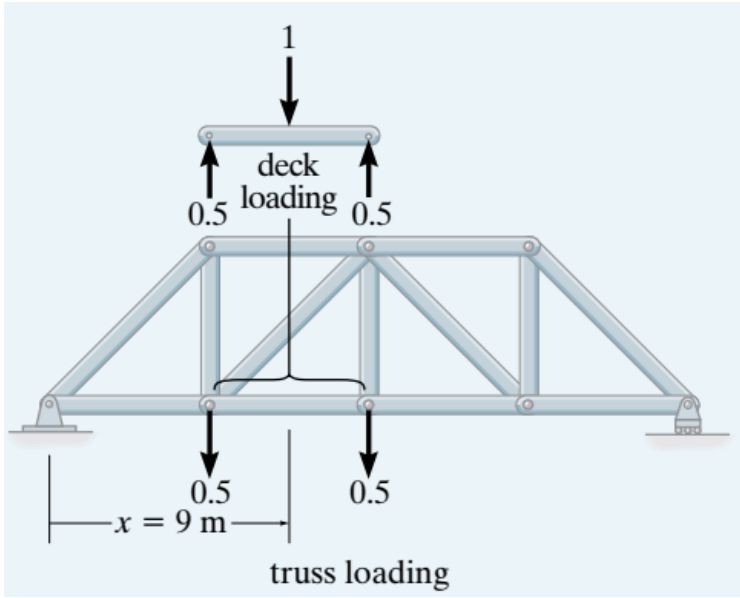
x	F_{GC}
0	0
6	0
12	1
18	0
24	0



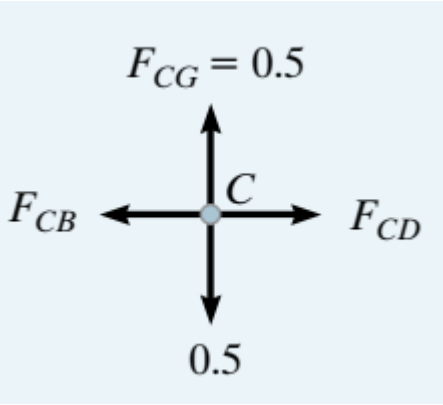


influence line for F_{CG}

Member GB is referred to as a Secondary member because it has not a load at all the points location of the unit load.

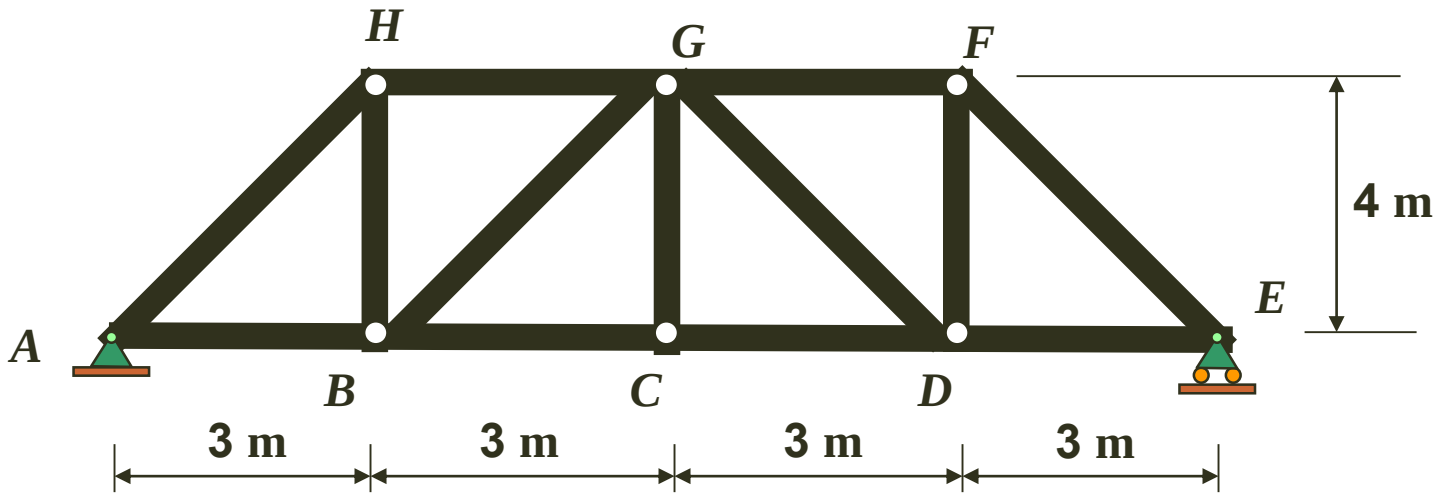


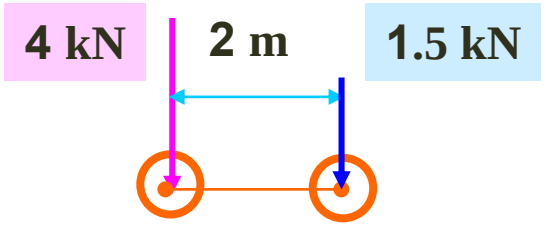
truss loading



Influence Line for Trusses

Example 3



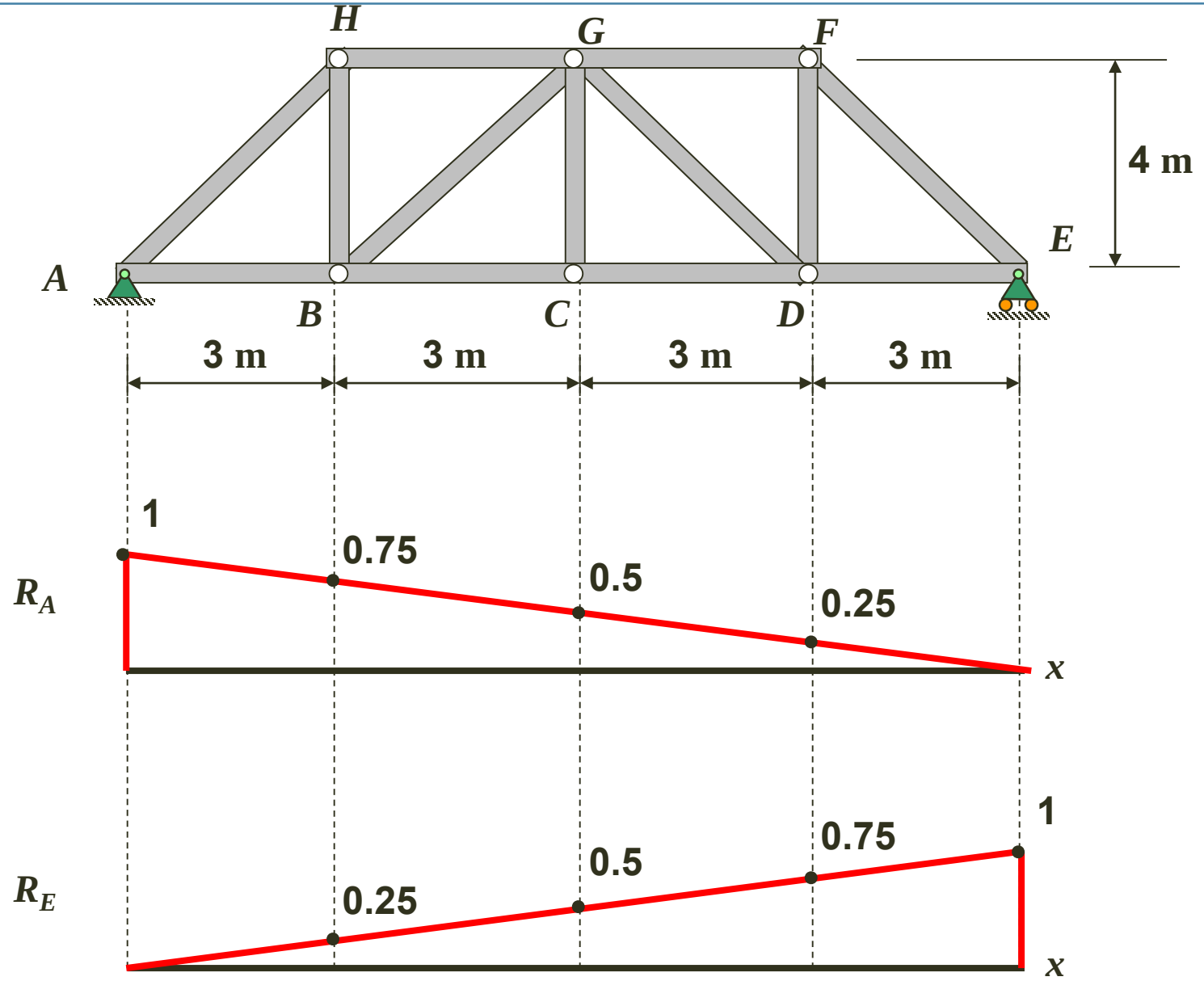


the wheel loads of the car

Determine the maximum force developed in member *BC*, *BG*, and *CG* of the truss due to the wheel loads of the car. Assume the loads are applied directly to the truss.

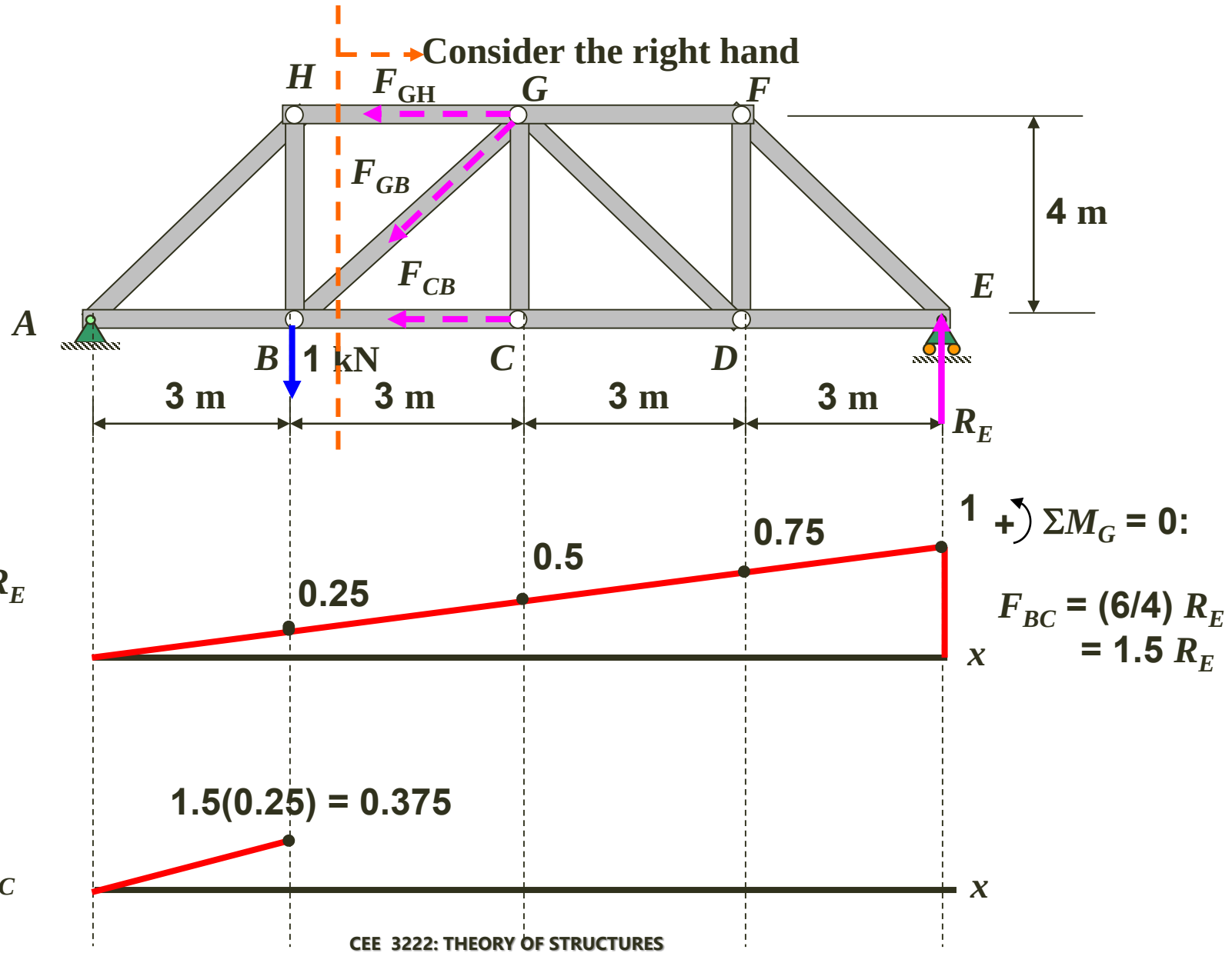
Influence Line for Trusses

Solution 3

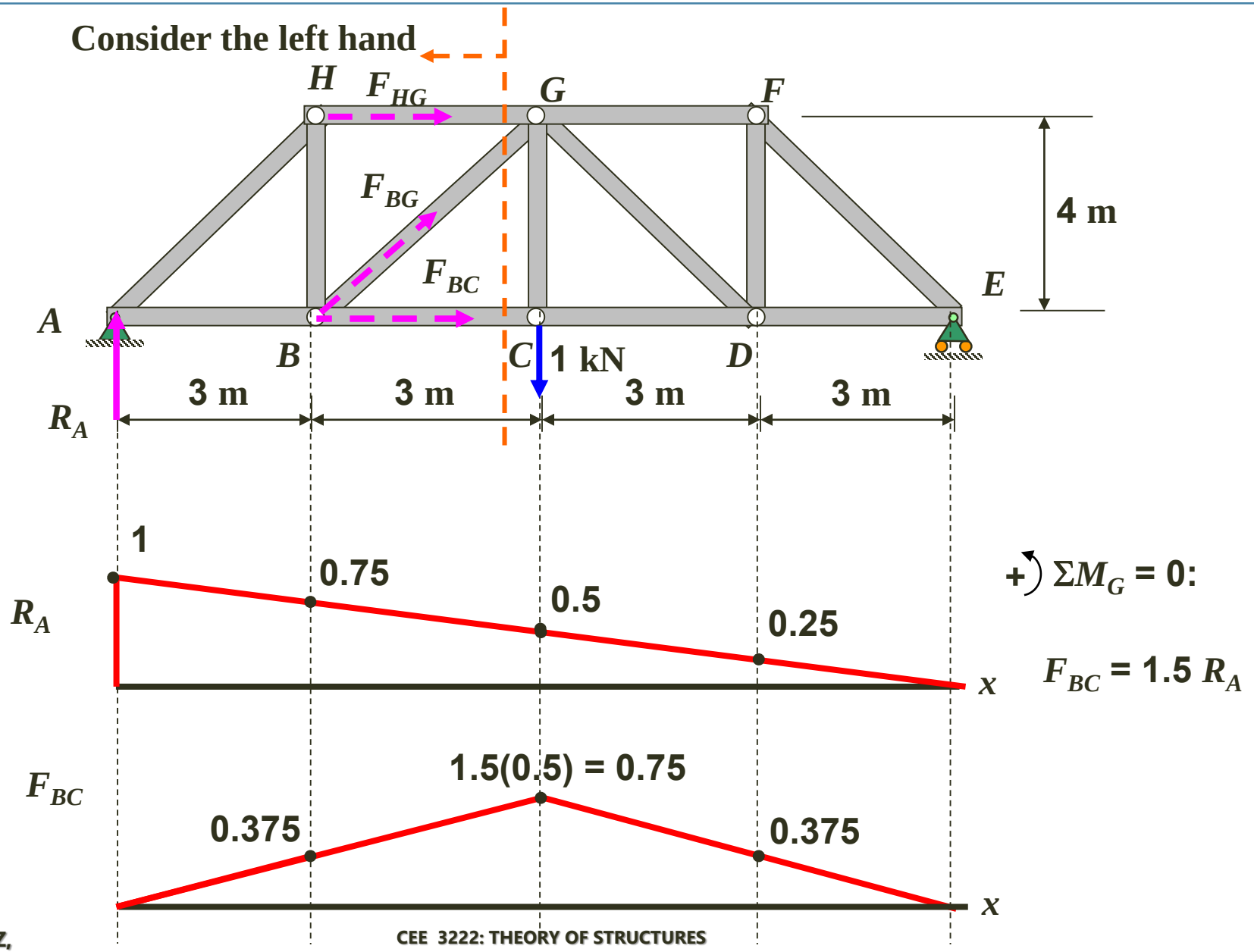


Influence Line for Trusses

Influence Line for F_{BC}

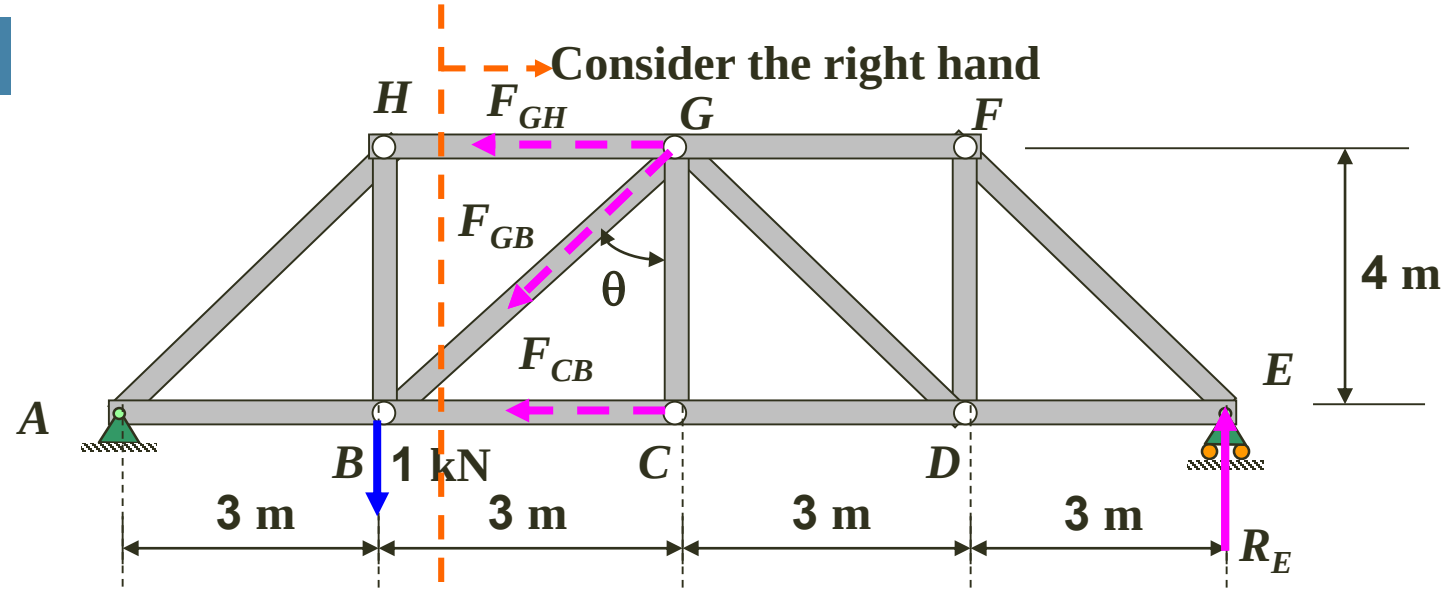


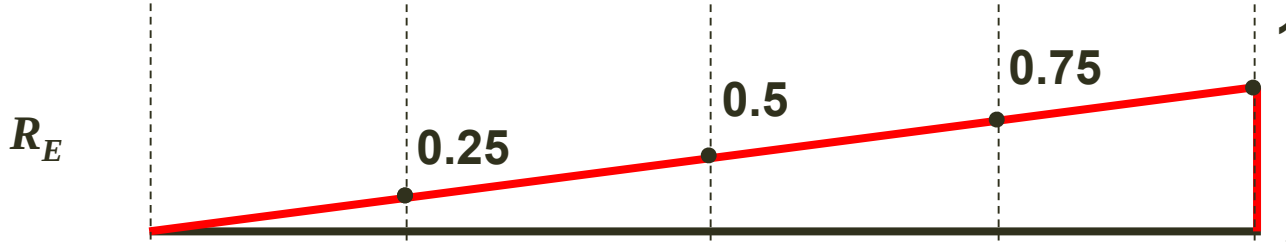
Influence Line for Trusses



Influence Line for Trusses

Influence Line for F_{BG}



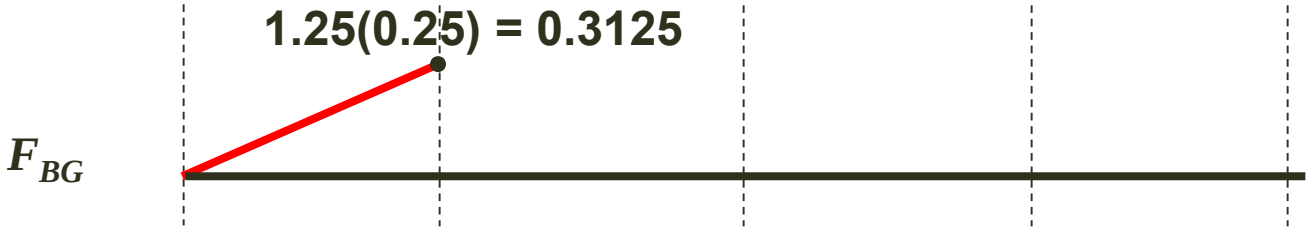


$\Sigma F_y = 0$;

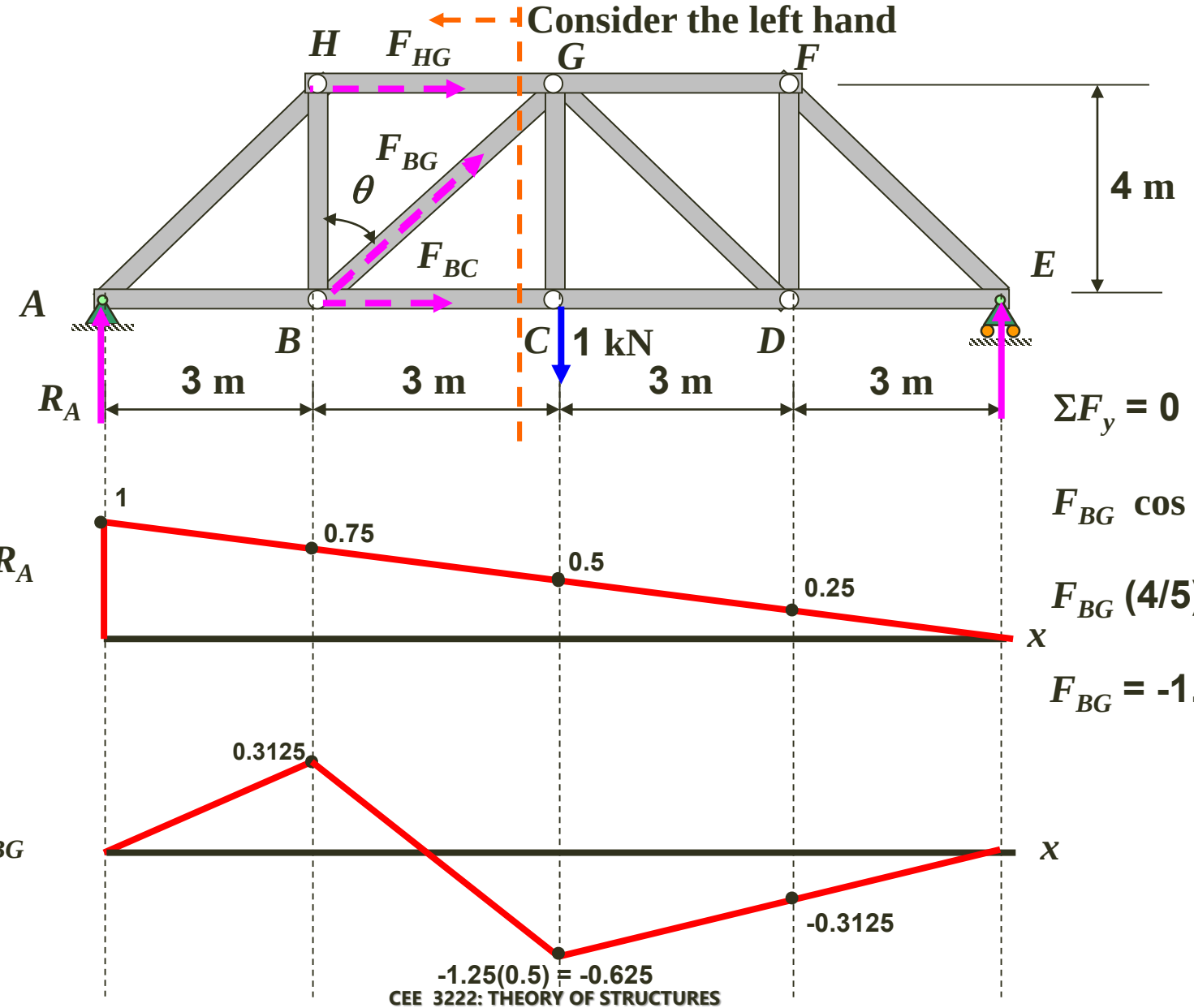
$F_{BG} \cos\theta = R_E$

$F_{BG}\,(4/5) = R_E$

$x\ F_{BG} = 1.25\ R_E$



Influence Line for Trusses



$\Sigma F_y = 0$;

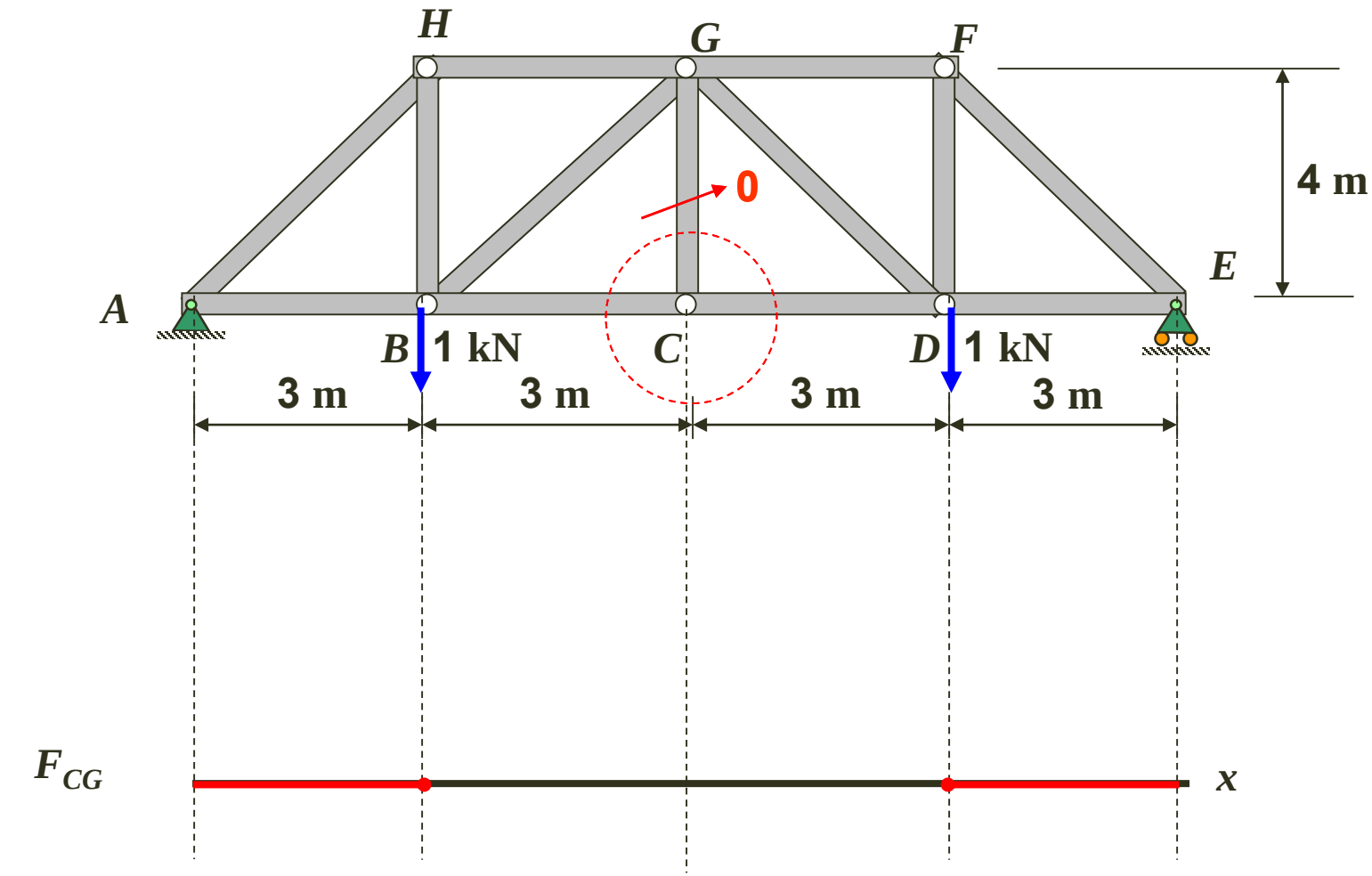
$F_{BG} \cos\theta + R_A = 0$

$F_{BG}\,(4/5) = -R_A$

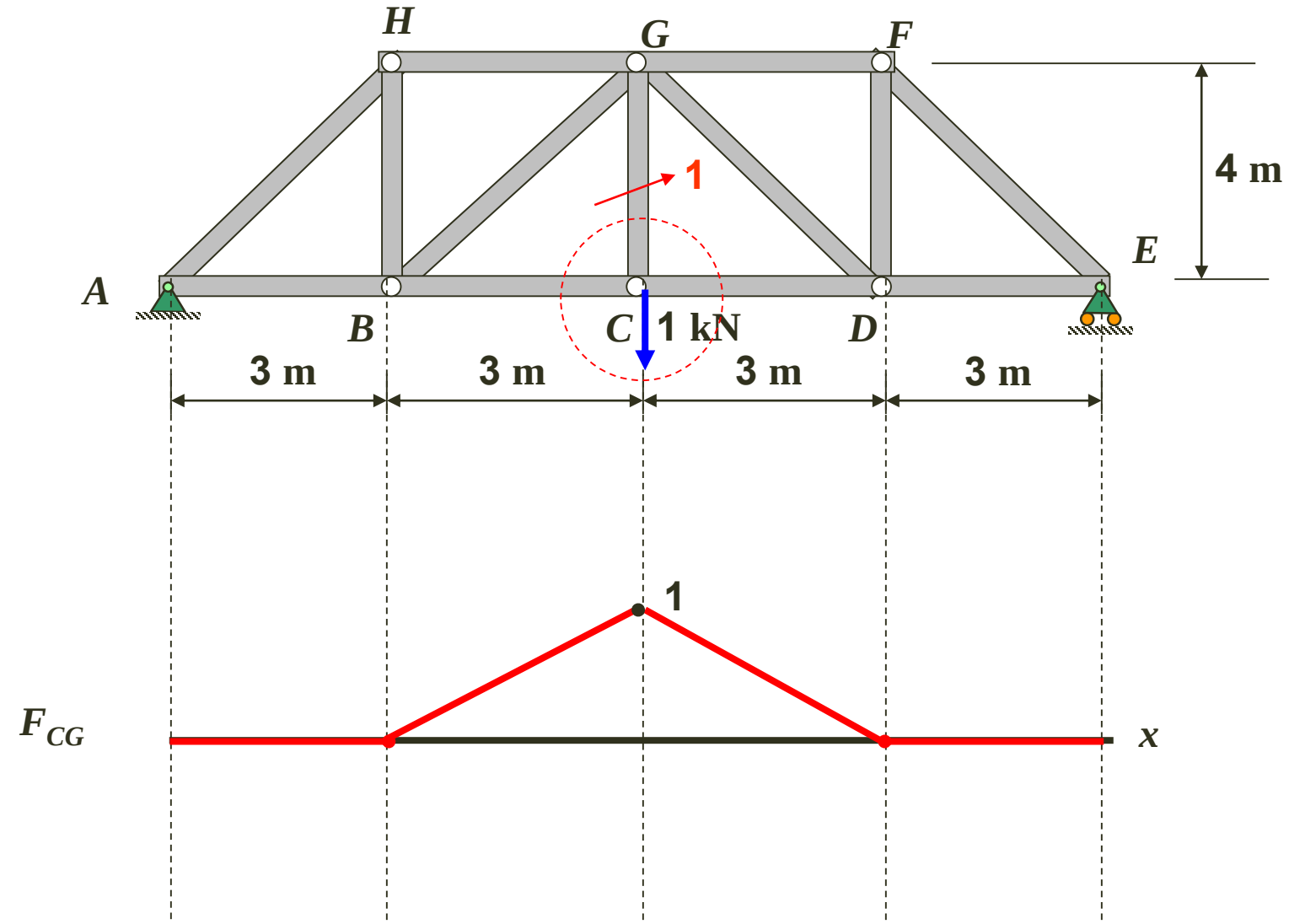
$F_{BG} = -1.25\,R_A$

Influence Line for Trusses

Influence Line for F_{CG}

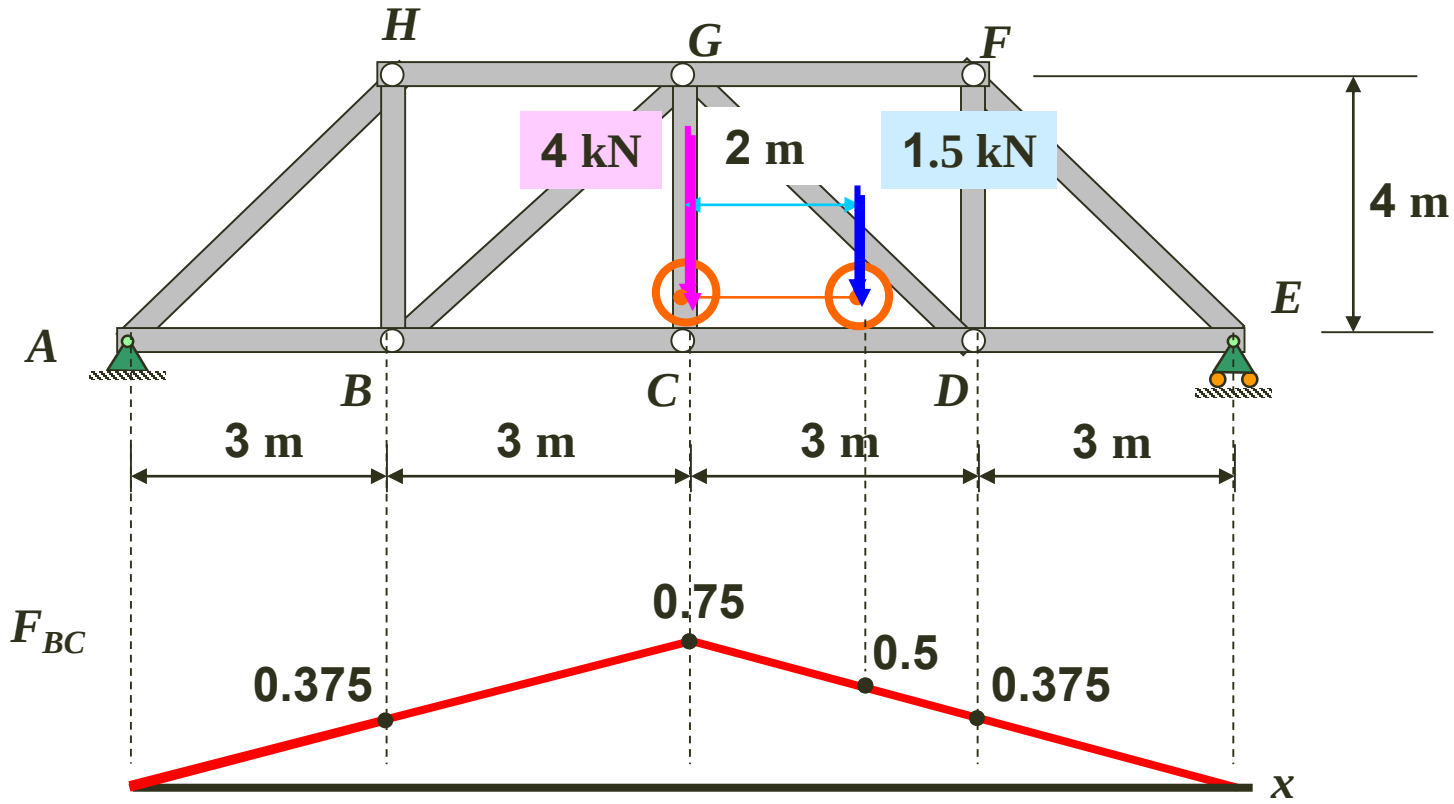


Influence Line for Trusses



Influence Line for Trusses

$(F_{BC})_{max}$ by Loads

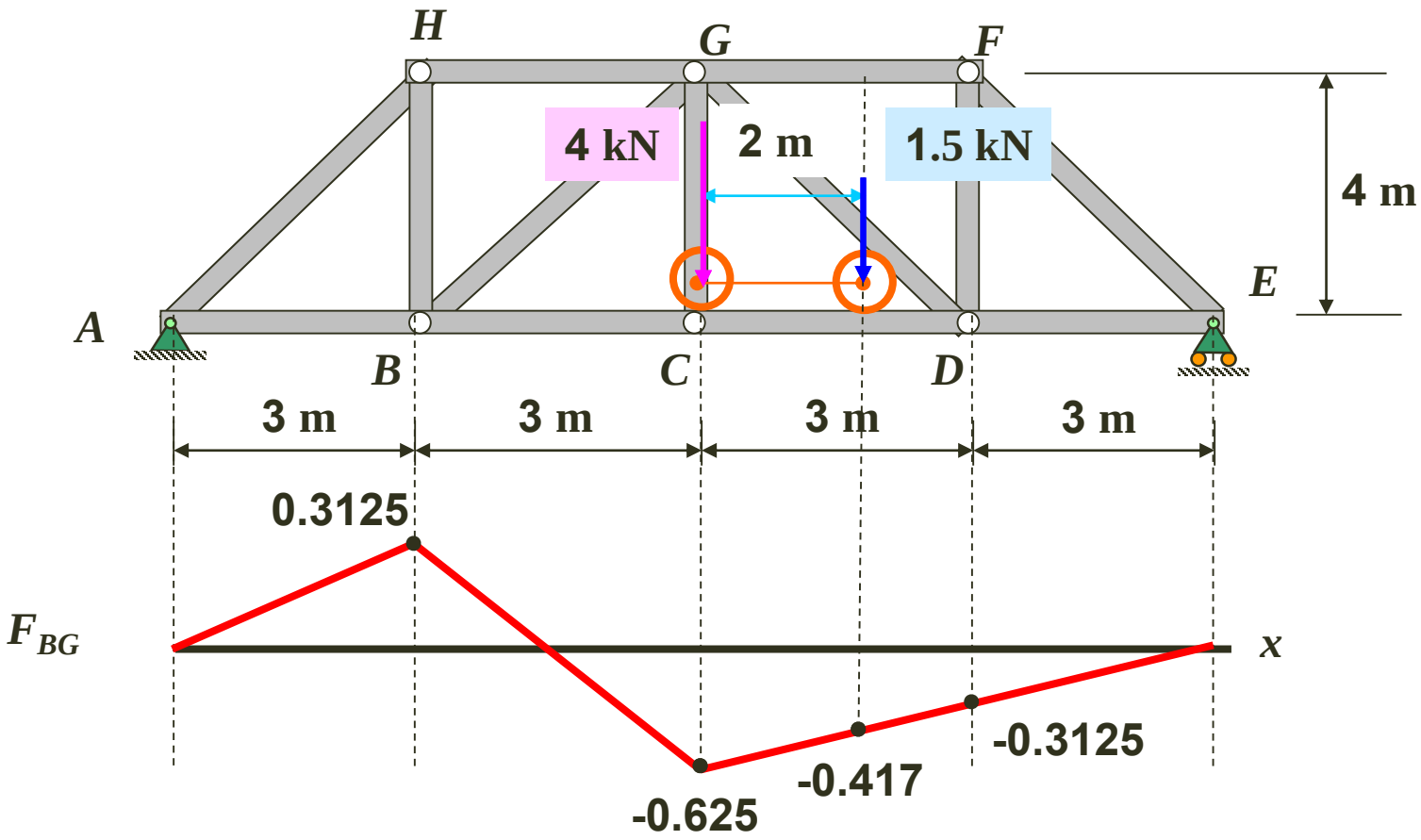


$(F_{BC})_{max}$ = (4)(0.75) + (1.5)(0.5)

= 3.75 kN #

Influence Line for Trusses

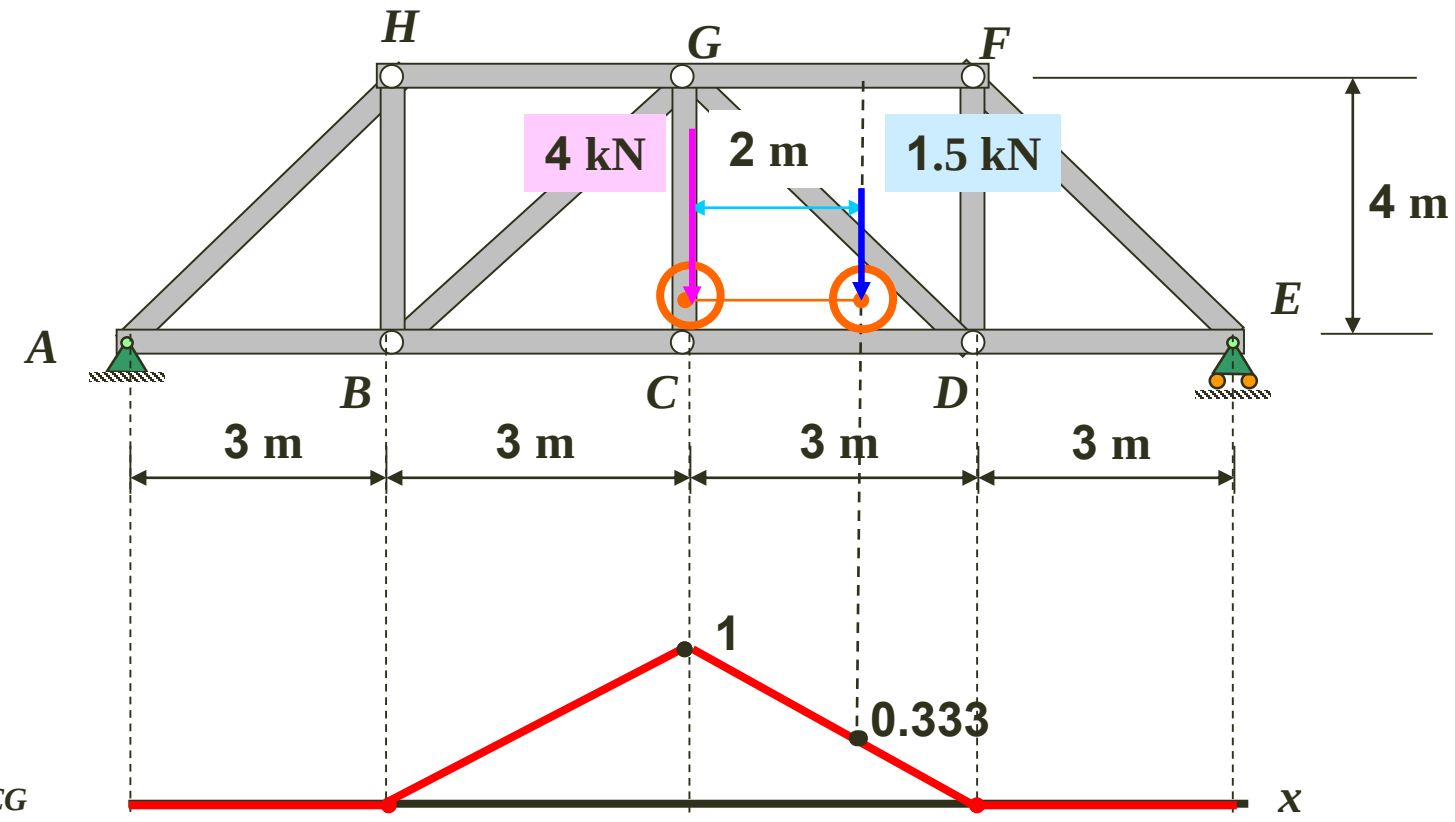
$(F_{BG})_{max}$ by Loads



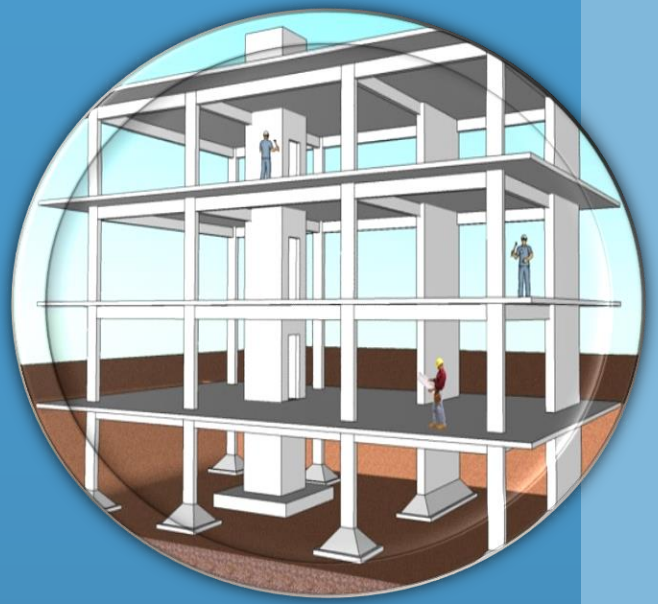
$$(F_{BG})_{max} = (4)(-0.625) + (1.5)(-0.417) = -3.126 \text{ kN } \#$$

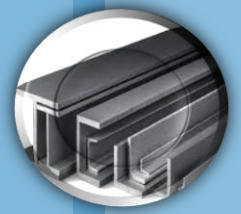
Influence Line for Trusses

$(F_{CG})_{max}$ by Loads



$$(F_{CG})_{max} = (4)(1) + (1.5)(0.333) = 4.50 \text{ kN } \#$$





Thank You!