

# *Internal Forces of Beams with Link Members*

## *القوى الداخلية للكمرات ذات ال Links*

*نسألکم الدعاء*

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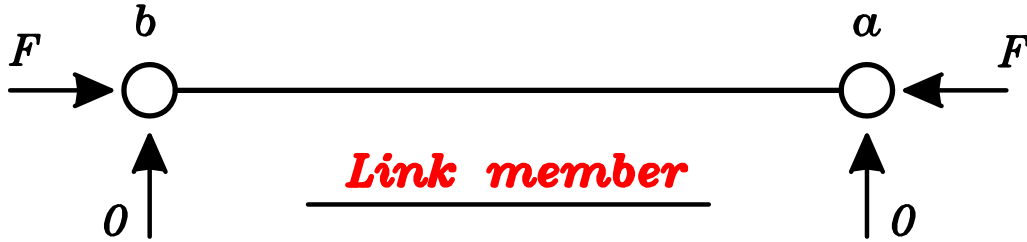
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# Introduction

في حالة وجود **Link members** في المسألة

١ - ال **Link member** هو عبارة عن **member** به **Force** واحدة

فقط في اتجاهه



لو حسبنا ال **Internal forces** عند **(a)** و **(b)** تكون كالاتي :

At point ( a ) :

At point ( b ) :

$$N = F \text{ ( Comp. )}$$



$$N = F \text{ ( Comp. )}$$



و لو كانت ال **Force** خارجة من النقطة تكون شد

$$N = F \text{ ( Tens. )}$$



$$N = F \text{ ( Tens. )}$$



$$Q = 0$$

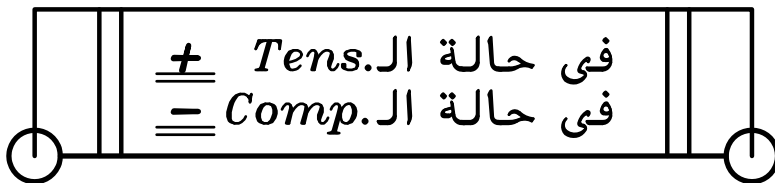
$$M = 0$$

$$Q = 0$$

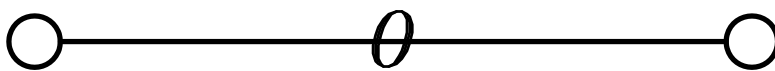
$$M = 0$$

و لذلك لو رسمنا ال **Internal forces diagrams** لل **Link member**

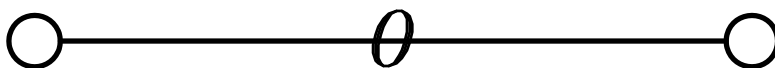
تكون كالاتي :



N.F.D



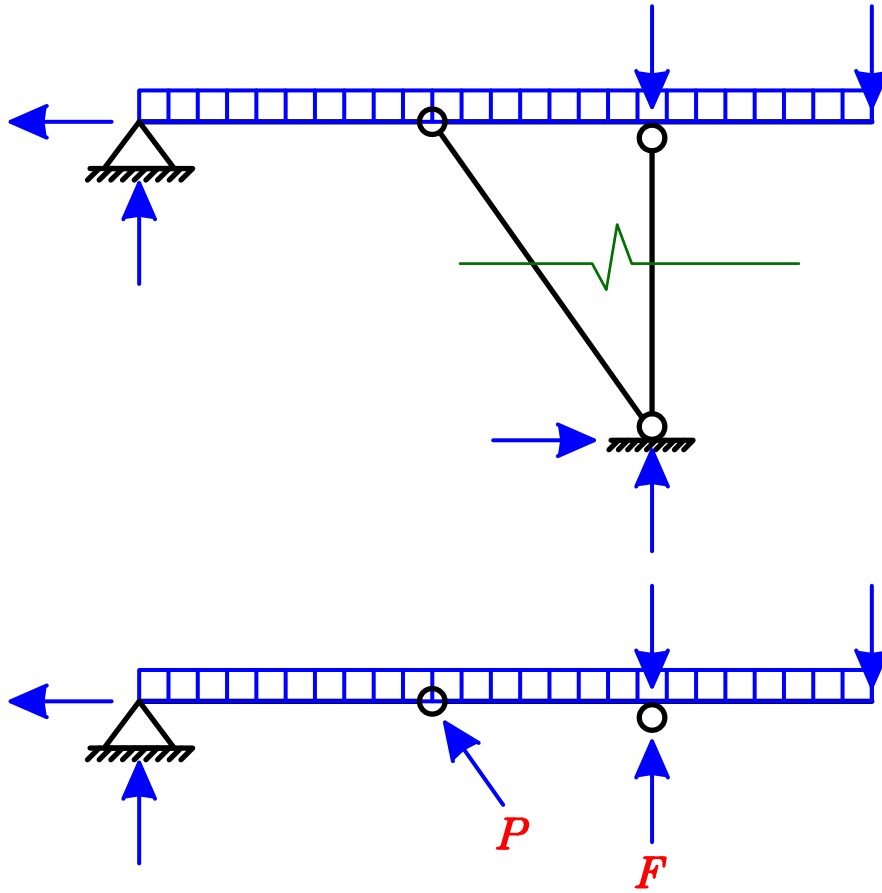
S.F.D



B.M.D

و لذلك دائما ال *Link member* يكون له *Normal force diagram* أما ال *S.F.D* و ال *B.M.D* يكونان *Zero*

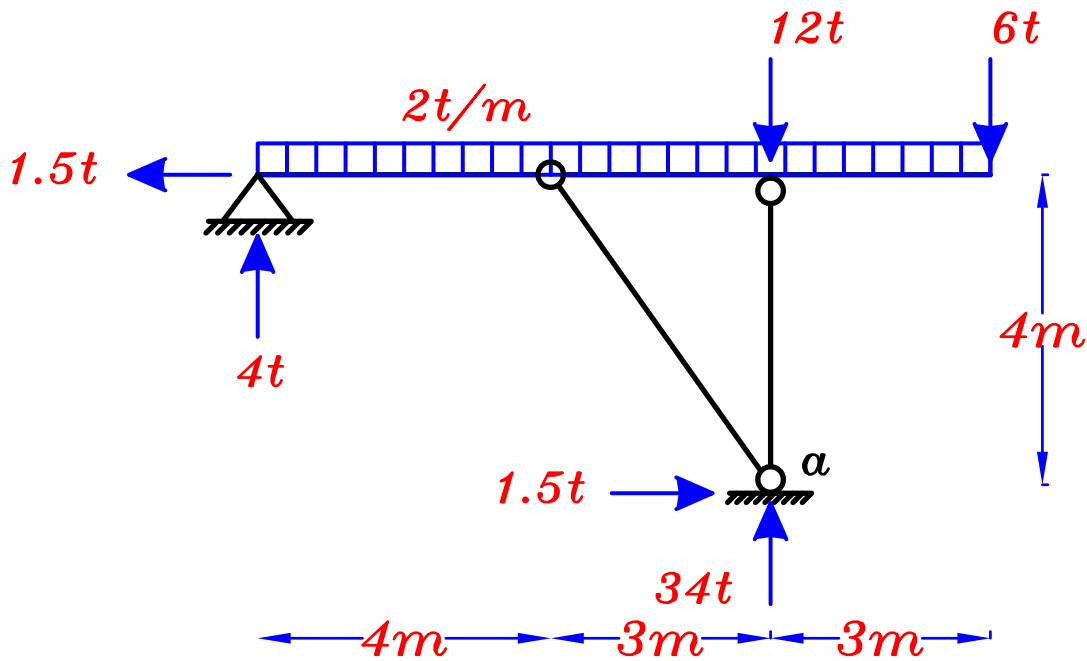
٢- لابد عند رسم ال *Internal forces diagrams* للكمرات أن نزيل ال *Link members* و نضع مكانها القوى اللي في اتجاهها



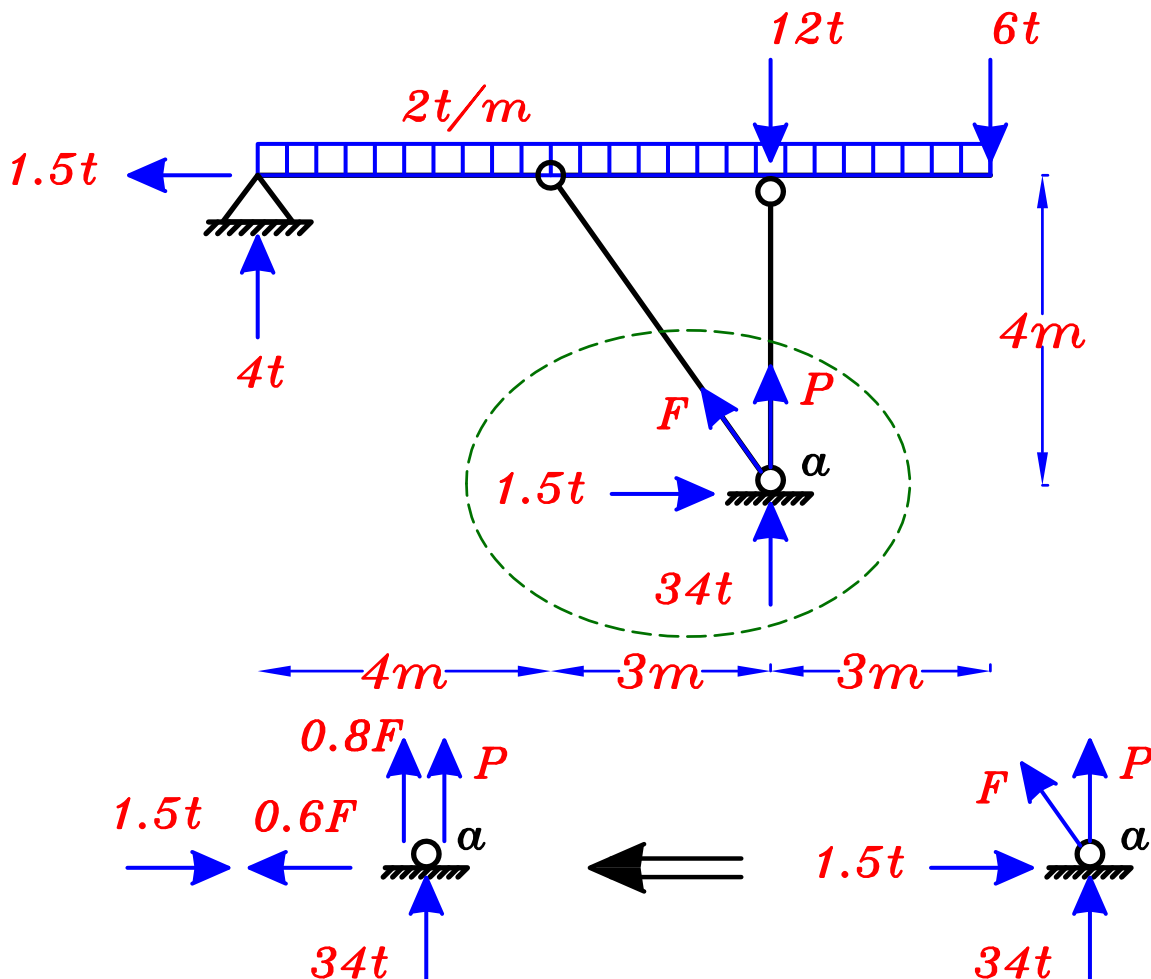
ثم نقوم برسم ال *Internal forces diagrams* للكمرات مع العلم أن ال *Link members* يرسم لها *N.F.D* فقط أما ال *S.F.D* و *B.M.D* نرسم ال *Link members* و نضع عليها *Zero*

## Example :

For the shown beam draw N.F.D , S.F.D & B.M.D.



## Equilibrium of joint (A) :



$$\Sigma X = 0$$

$$0.60F - 1.50 = 0$$

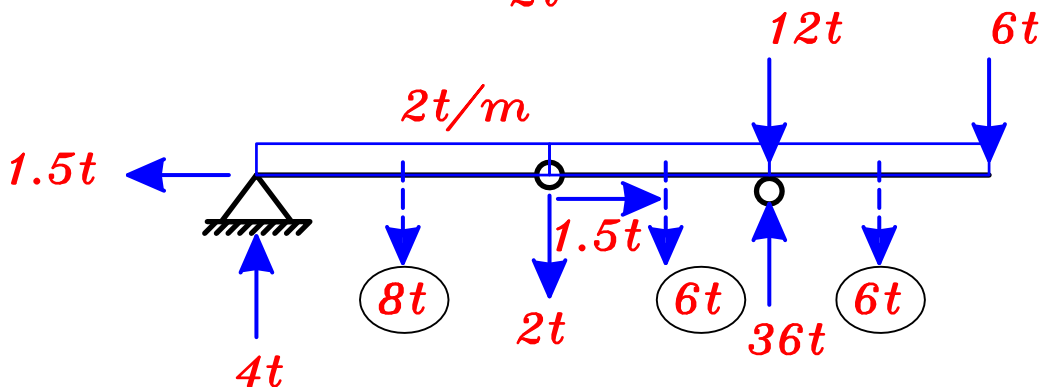
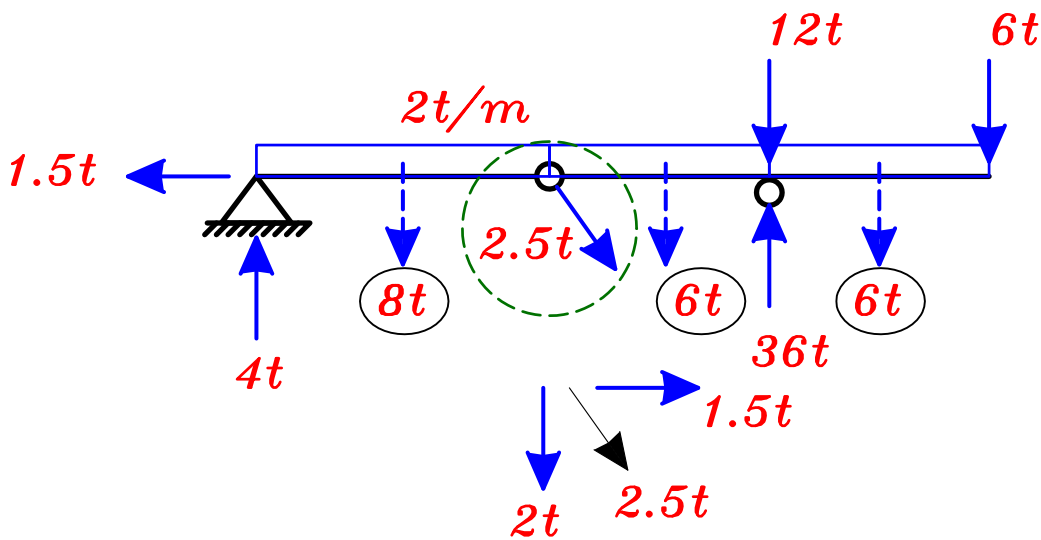
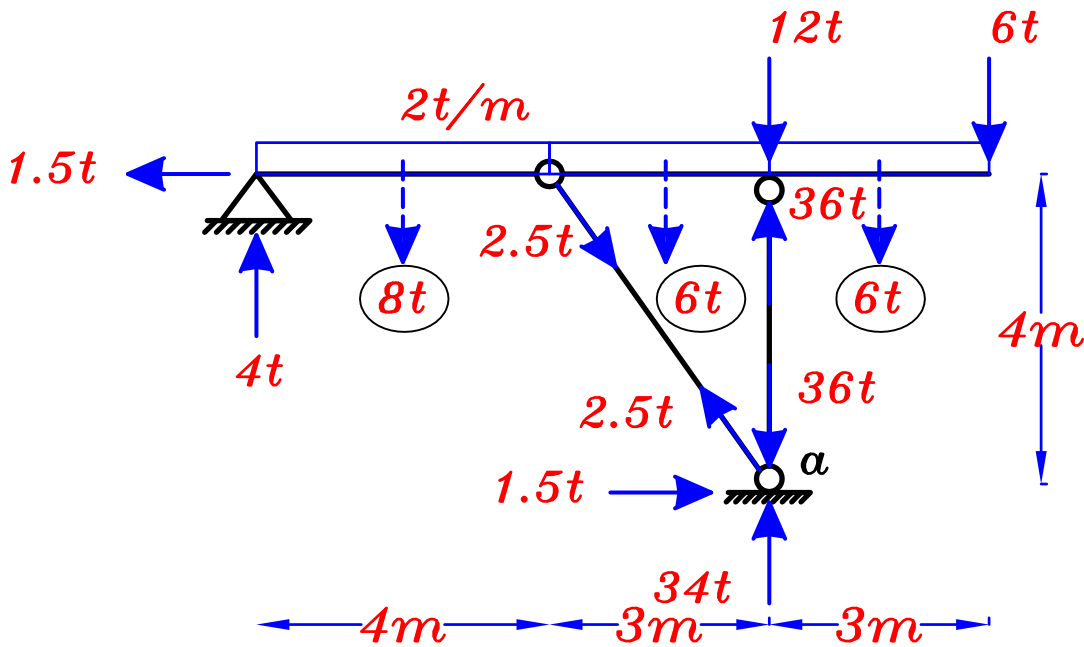
$$F = 2.5 \text{ t (Tens.)}$$

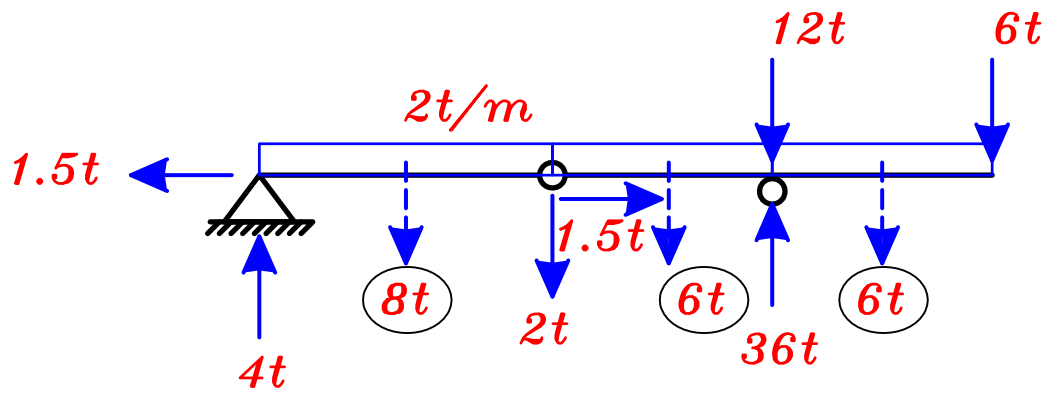
$$\Sigma Y = 0$$

$$0.80F + P + 34 = 0$$

$$0.80 \times 2.5 + P + 34 = 0$$

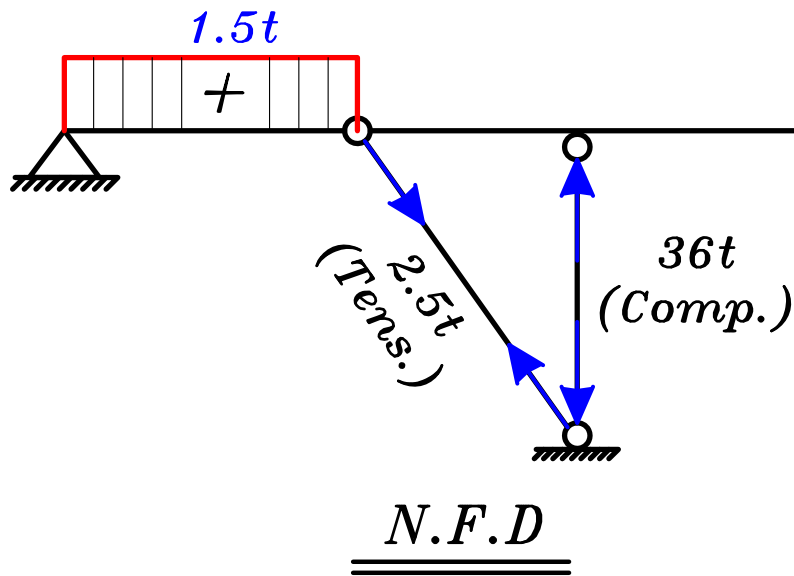
$$P = -36 \text{ t (Comp.)}$$



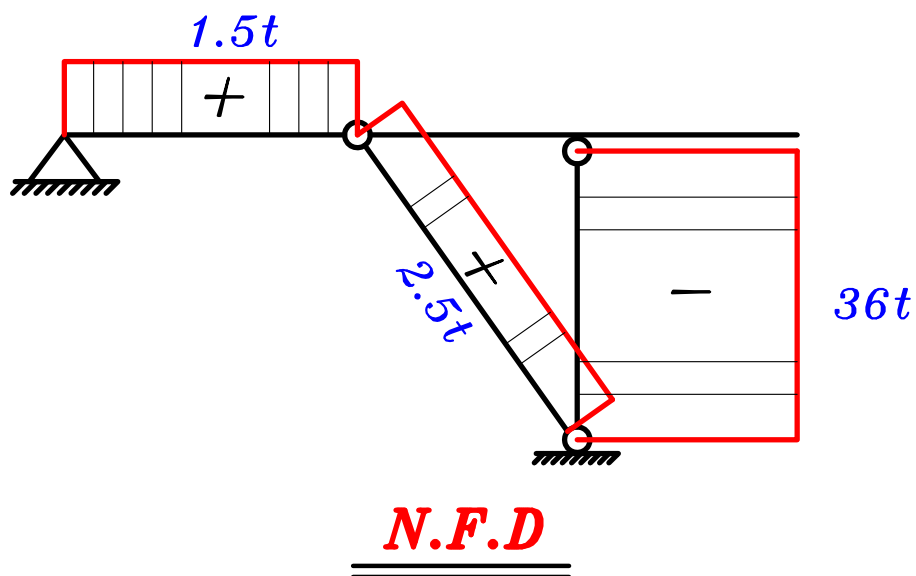


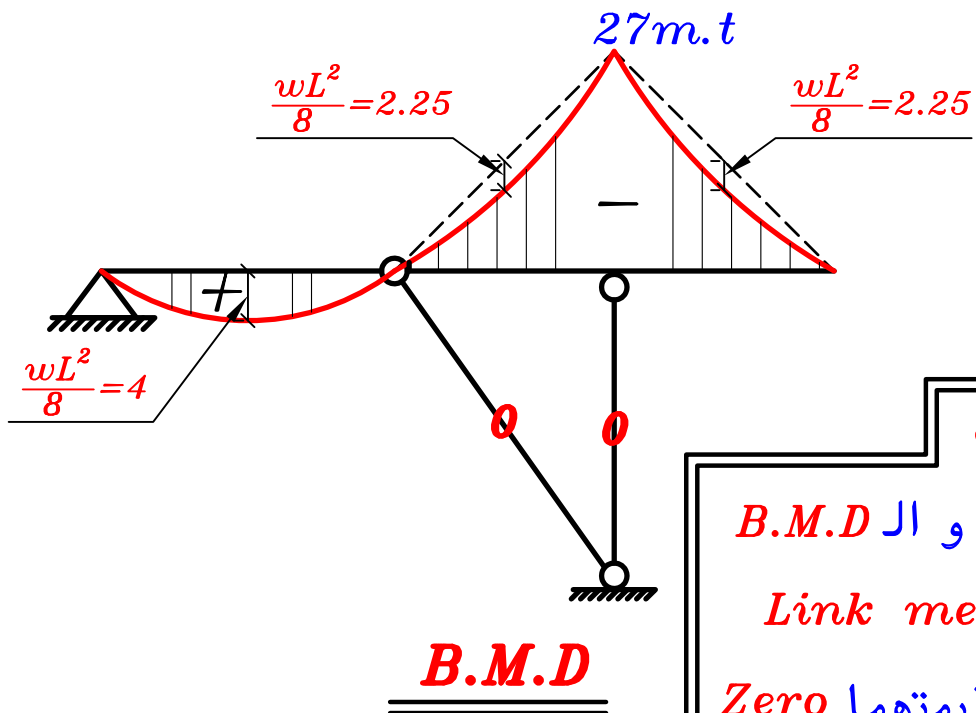
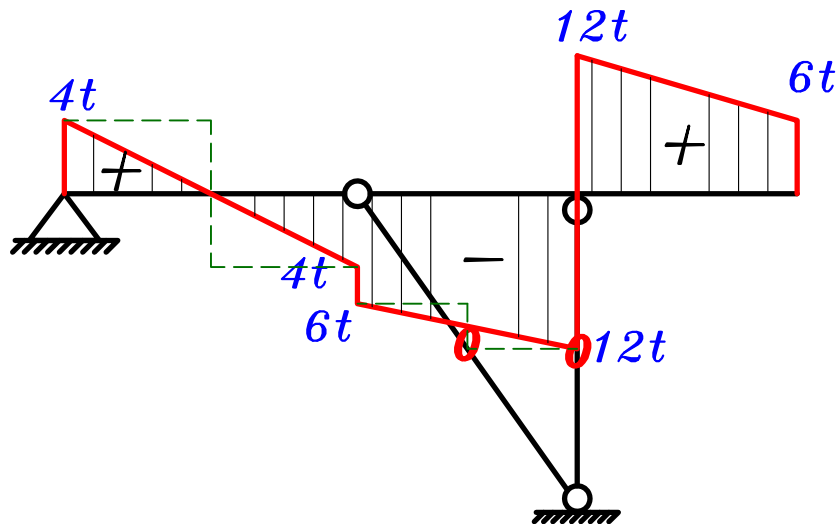
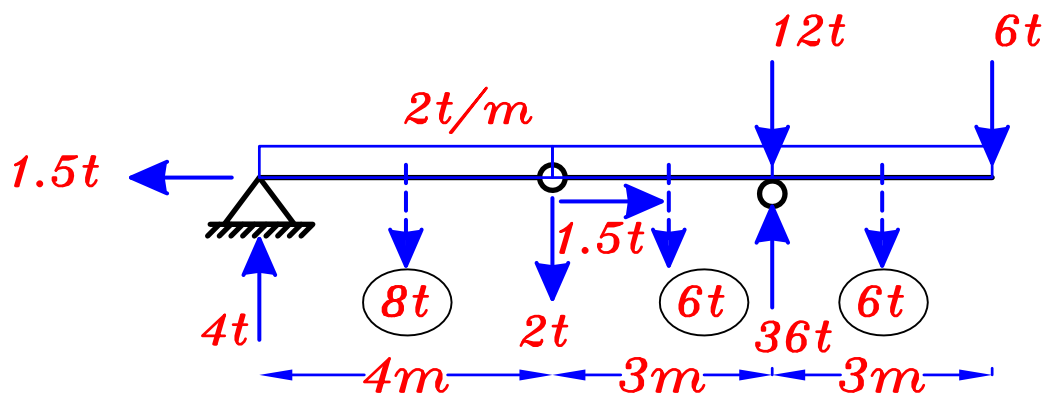
خذ بالك عند رسم ال *Internal forces diagrams*

لابد من رسم الشكل كاملا و ليس الكمرة فقط



و من الممكن رسم ال *N.F.D* على ال *Link members* بطريقة أخرى



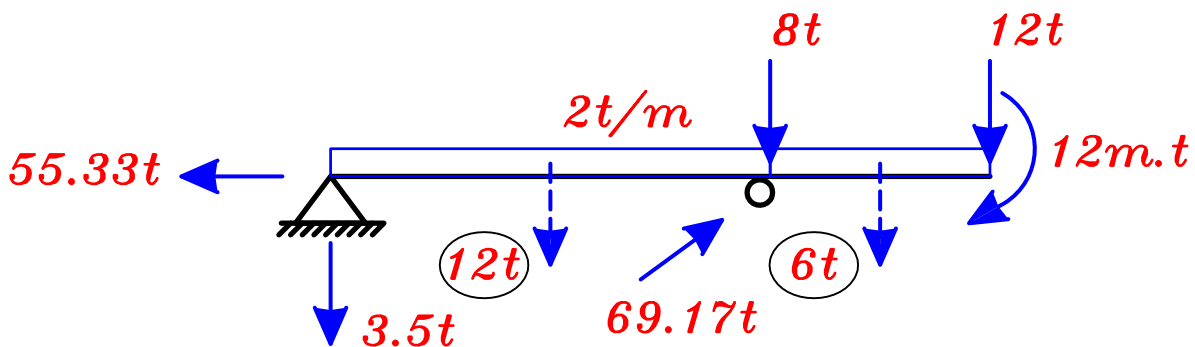
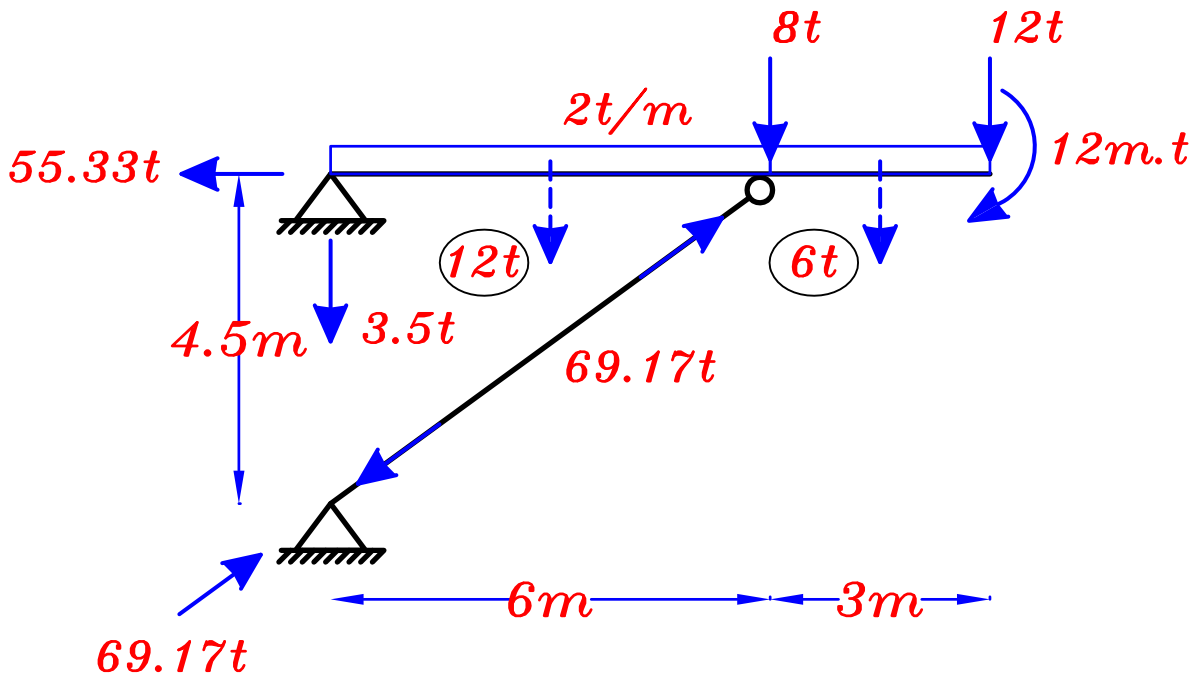
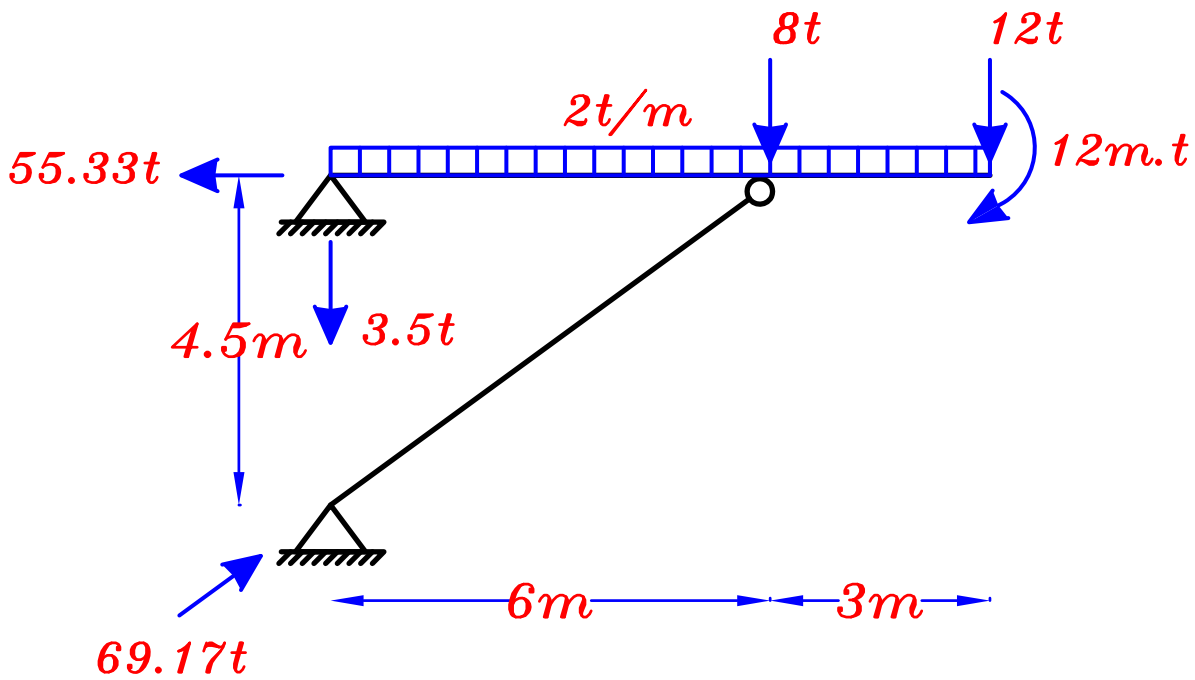


خذ بالك  
 ال S.F.D و ال B.M.D  
 لا Link member  
 يكونان قيمتهما Zero

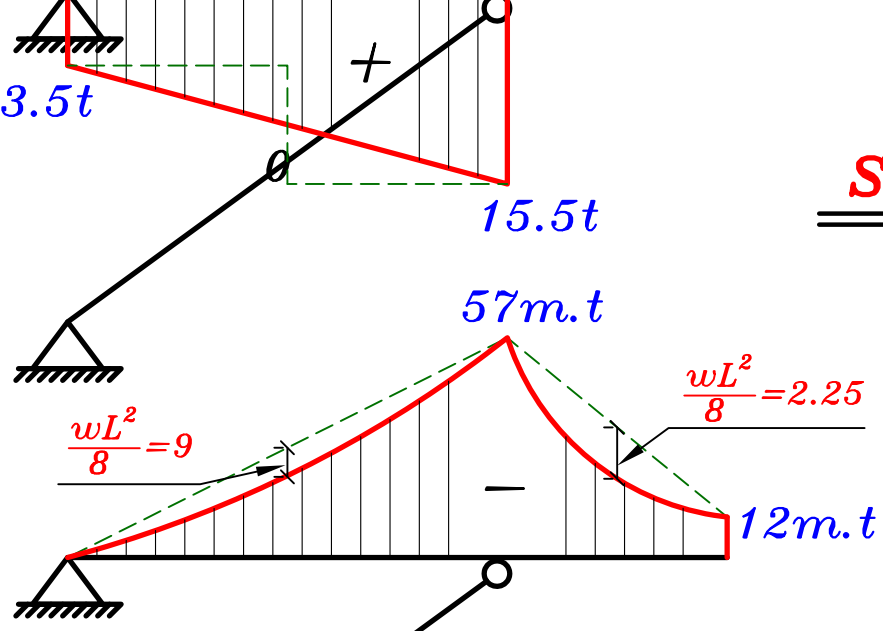
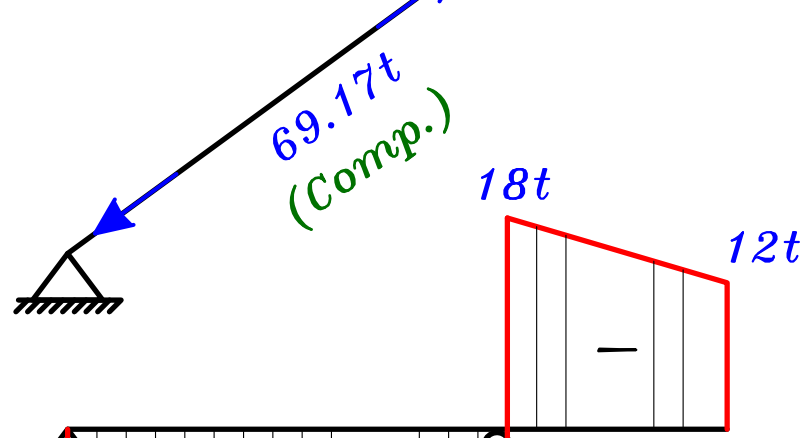
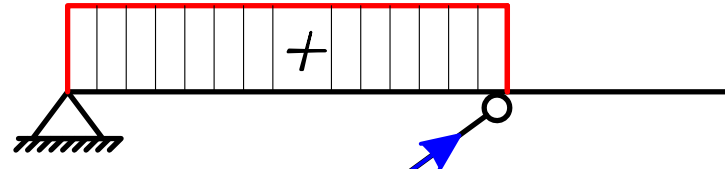
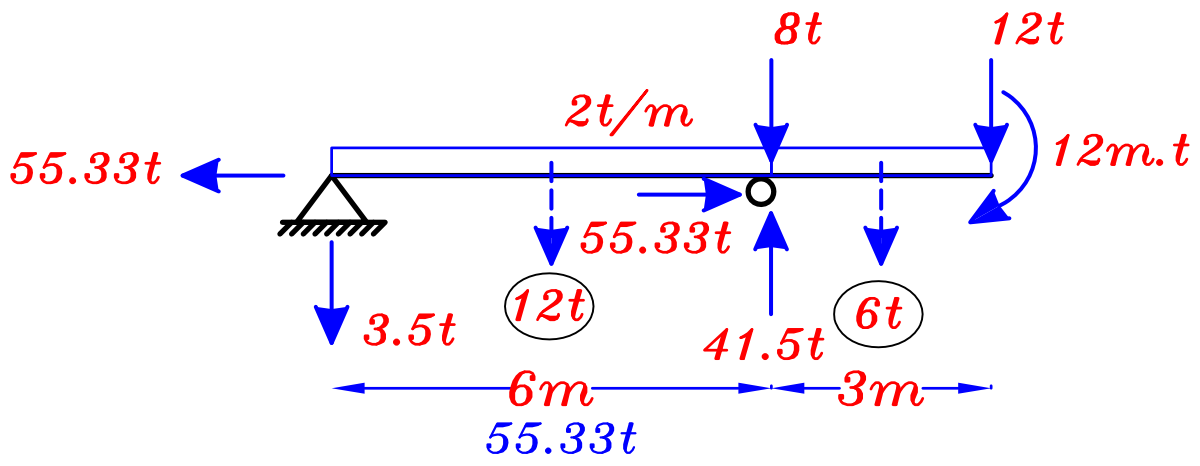
و بالتالى نرسم ال Link member و نضع عليه Zero فى ال S.F.D  
 و ال B.M.D

## Example :

For the shown beam draw N.F.D , S.F.D & B.M.D.







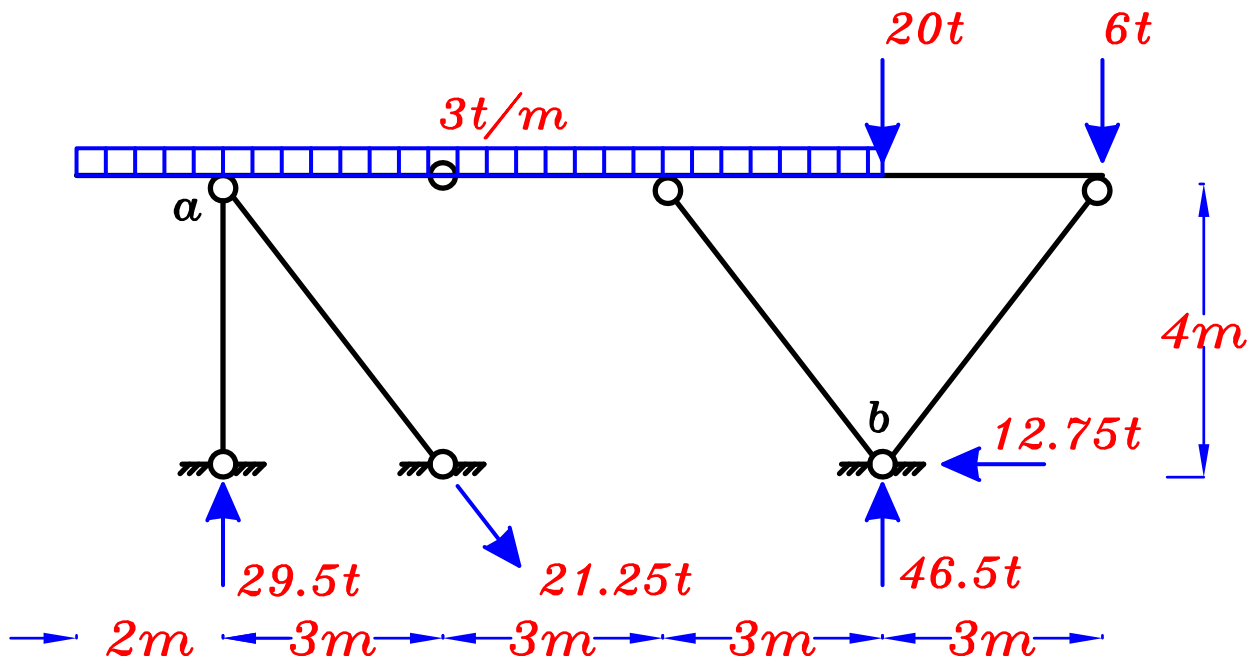
**N.F.D**

**S.F.D**

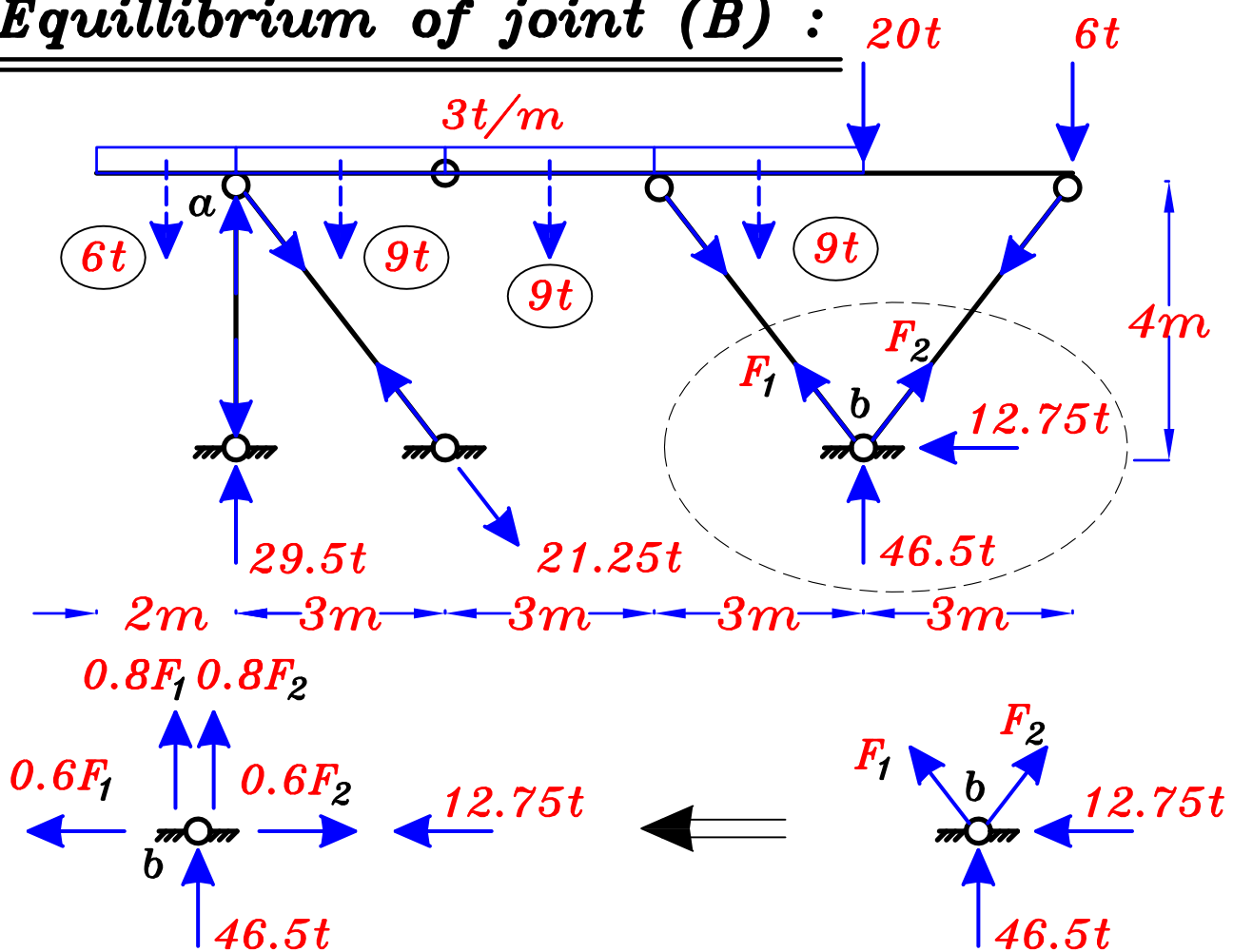
**B.M.D**

## Example :

For the shown beam draw N.F.D , S.F.D & B.M.D.



## Equilibrium of joint (B) :



$$\Sigma X = 0$$

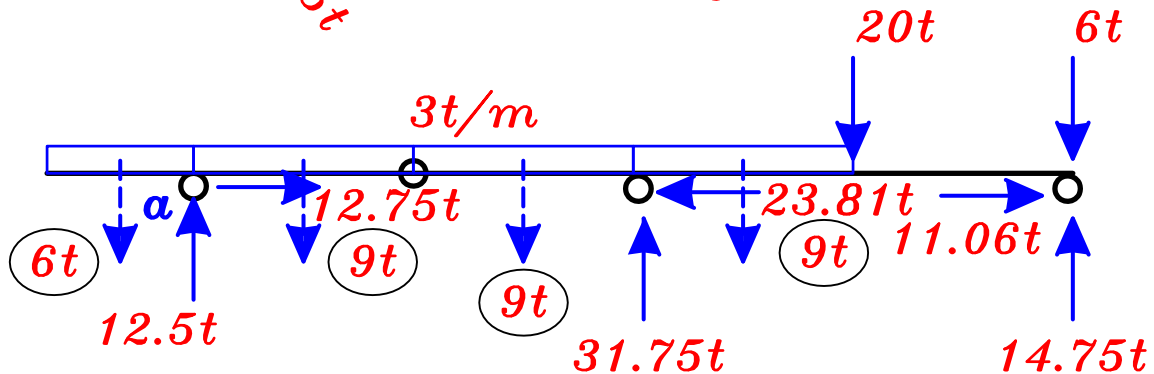
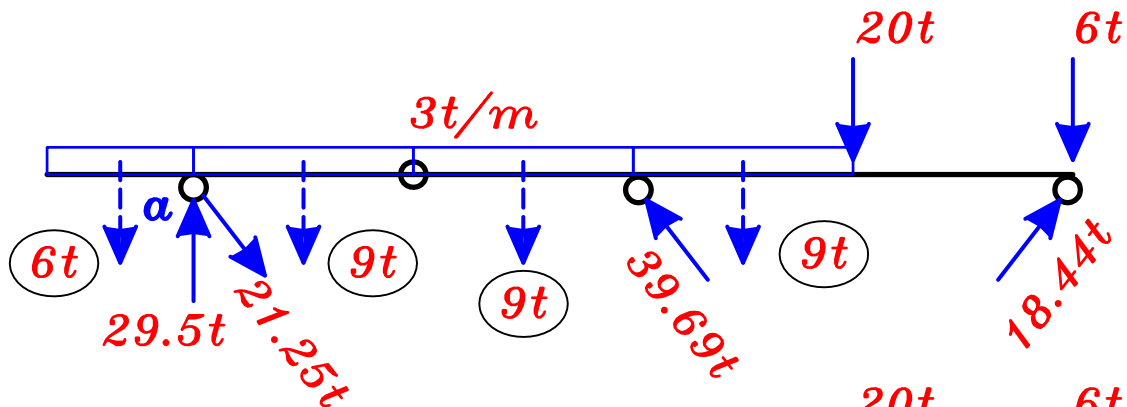
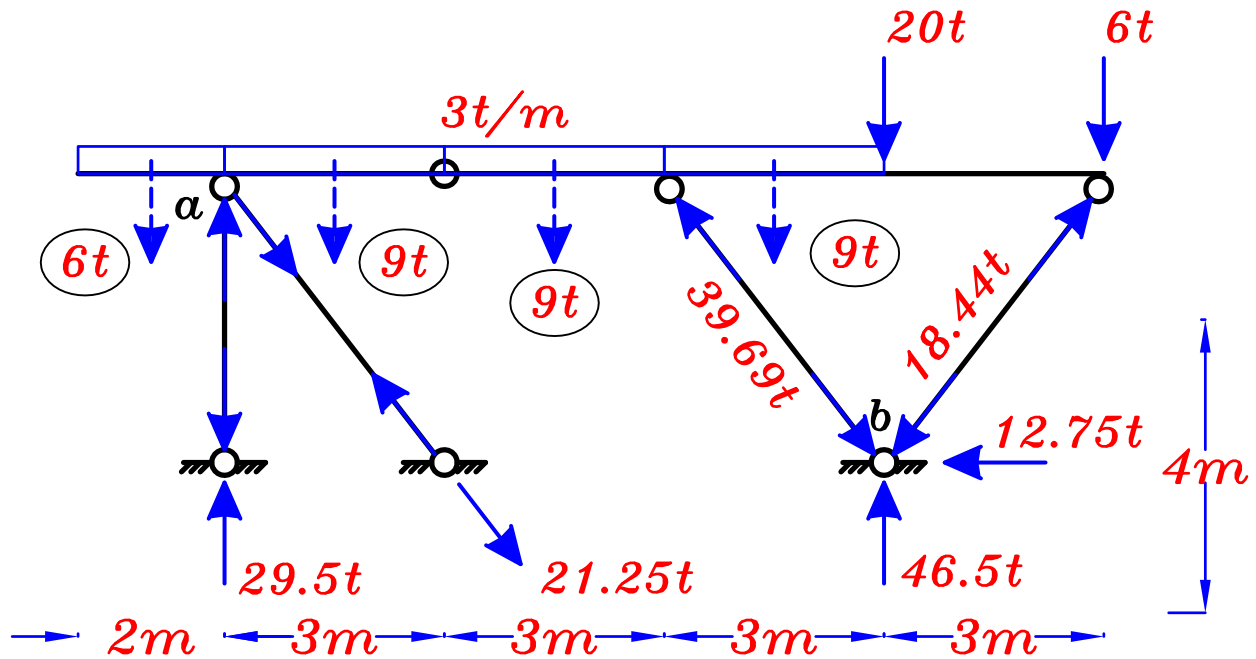
$$0.60F_1 + 12.75 - 0.60F_2 = 0 \quad \text{-----} \quad (1)$$

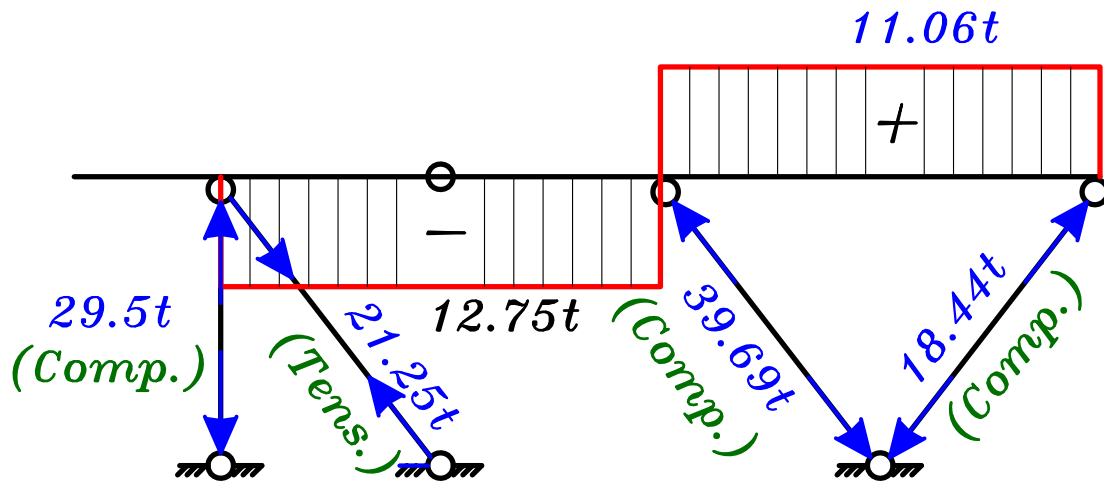
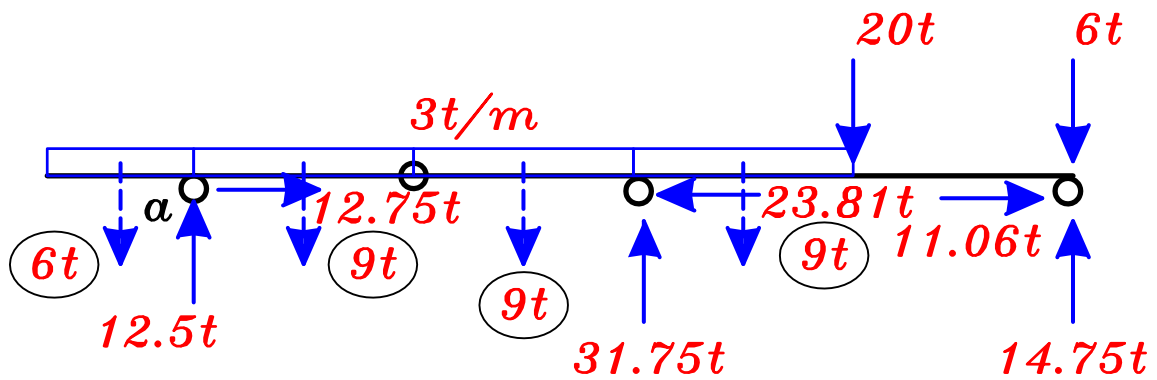
$$\Sigma Y = 0$$

$$0.80F_1 + 0.80F_2 + 46.5 = 0 \quad \text{-----} \quad (2)$$

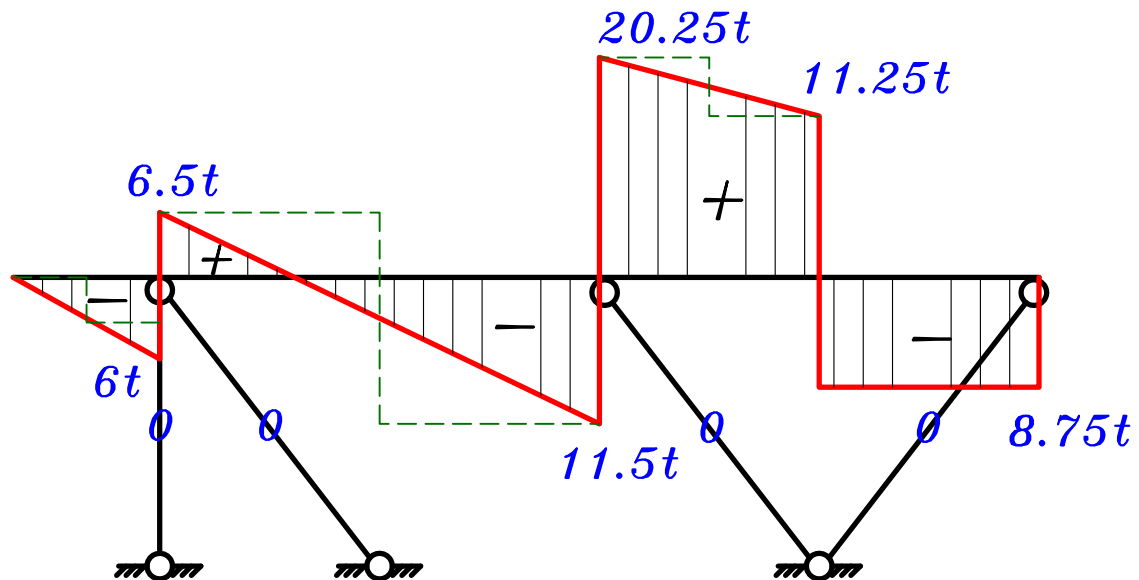
Solving the two equations :

$$F_1 = -39.69 \text{ t (Comp.)} \quad \& \quad F_2 = -18.44 \text{ t (Comp.)}$$

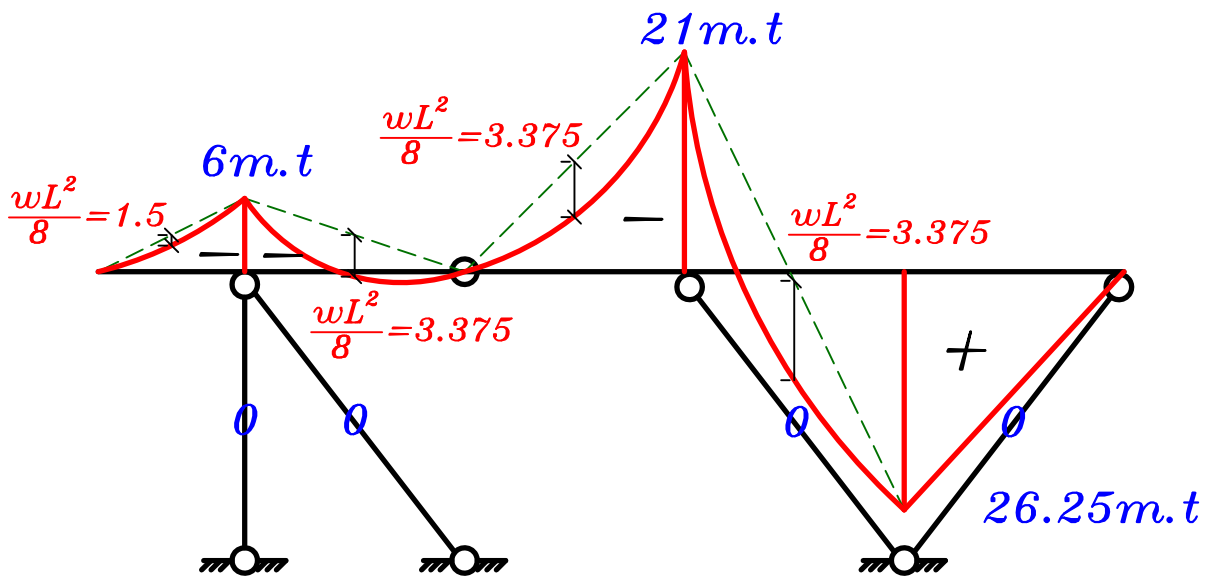
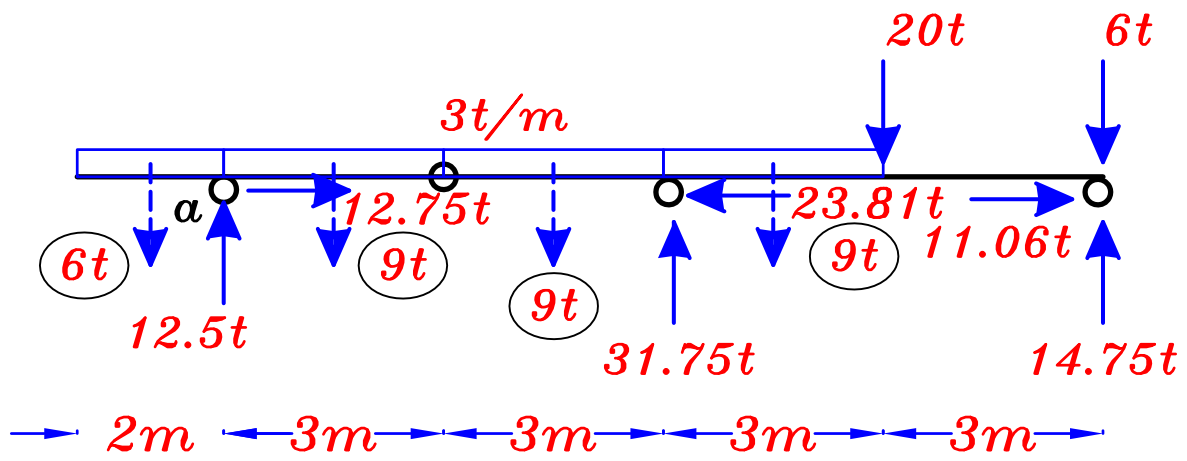




**N.F.D**



**S.F.D**



**B.M.D**

## Example :

For the shown beam draw N.F.D , S.F.D & B.M.D.

