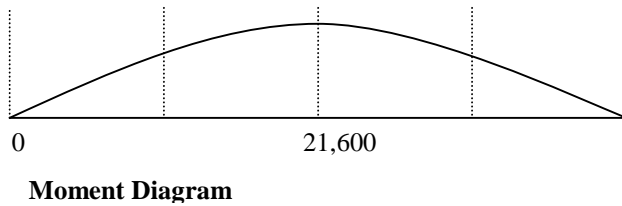
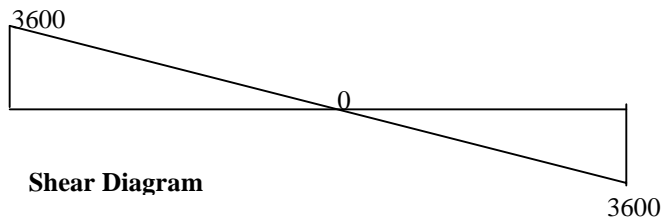


Beam Bending

Problem One

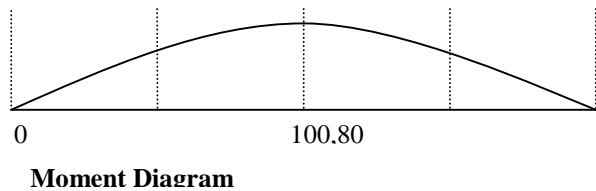
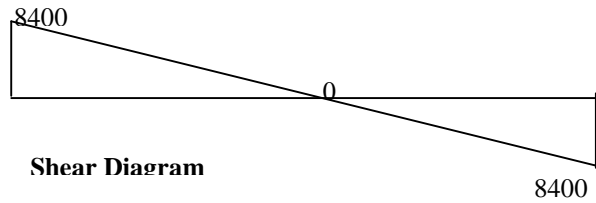
Case 1 Typical dead load

$W=(300) \times 24=7200$
 $R_a=R_b=3600$



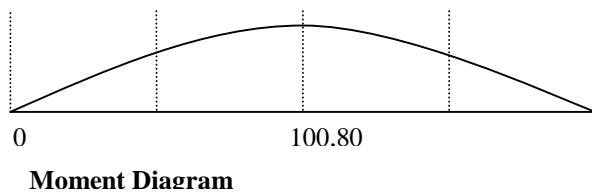
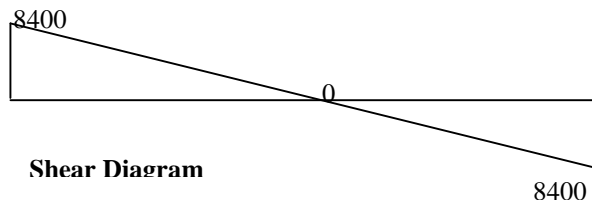
Case 2 D.L. + Uniform live load

$W=(300+400) \times 24=16,800$
 $R_a=R_b=8,400$

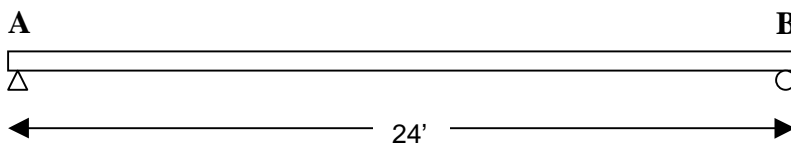


Case 3 D.L. + point load

$W=(300+400) \times 24=16,800$
 $R_a=R_b=8,400$



1) Case 4: Three point loads at 6', 12' and 18'



Take moment at A:

$$0 = R_a(0) - (2500)(6') - (2500)(12') - (2500)(18') + R_b(24')$$

$$R_b = 3750$$

$$\Sigma F = 0,$$

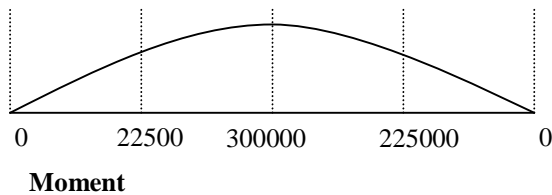
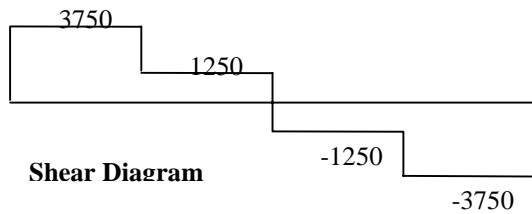
$$0 = R_a - 2500 - 2500 - 2500 + R_b$$

$$R_a = 3750$$

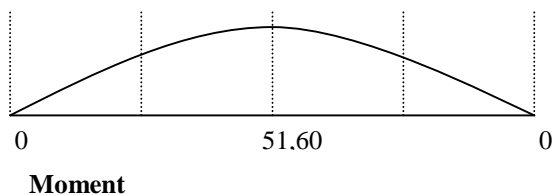
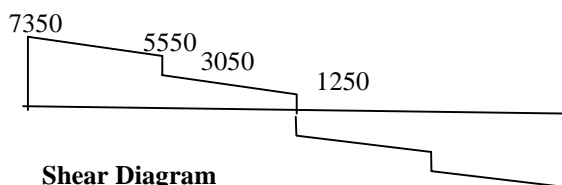
$$0 < x < 6': \quad V_e = 3750, \quad M_e = (3750)(6') = 22500$$

$$0 < x < 12': \quad V_e = 3750 - 2500 = 1250, \quad M_e = (3750)(6') + (1250)(6) = 30,000$$

By symmetry,



With dead load,



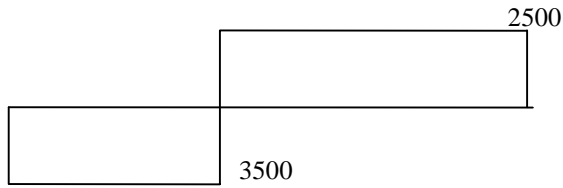
Case 5: point load at 10' from left

Take moment at A:

$$0 = R_a(0) - (600)(10') + R_b(24')$$

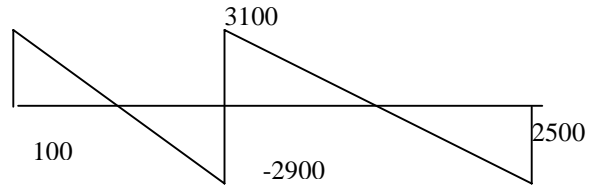
Rb=2500
Ra=3500

M at 10'=35,000

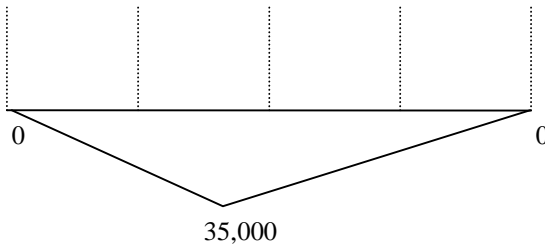


Shear Diagram

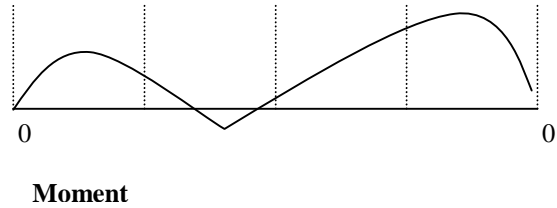
with dead load



Shear Diagram



Moment



Moment

Problem No. Two

Determine reactions: Ra=Rb=15000

Moment=(WL²)/8=37.5 kip ft

Stress:

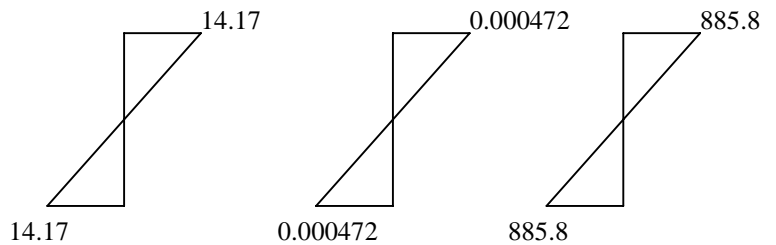
$$f = Mc/I = (37.5)(12)(4)/127$$

$$f = 14.17 \text{ kip/in}^2$$

Strain:

$$\epsilon = f/E = 14.17/30,000,000 \text{ psi}$$

$$\epsilon = 0.000472$$



At 2.5 ft,

$$M = (15000 + 7500)(2.5)/2 = 28,125$$

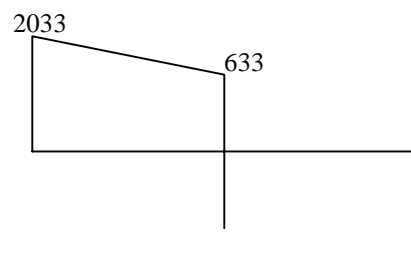
$$f = Mc/I = 885.8$$

Problem Three

Determine reactions:

ΣM at A:

$$0 = (Ra)0 - (2000)10 - (100)(24)(24/2) + Rb(24)$$



$$R_b=2,033$$

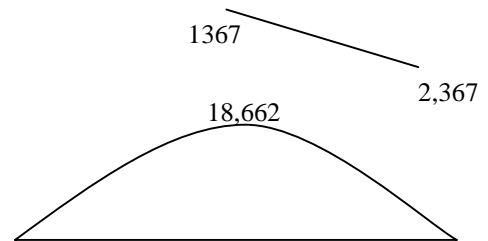
$$R_a=2,367$$

$$M=(2033+2367)(14)/2=18,662$$

$$f=24,000\text{psi}$$

$$S=M/f=(18662)(12)/24,000=9.33$$

Choose W 8 x 17



In case of Wood beam, $f=1600$ (given in table as 1600-2600, choose smaller number for safety sake),

$$I=5h^3/6, c=h/2$$

$$1600=Mc/I$$

$$h=(18,662)(12) \times 5/6 / (5 \times 1600)$$

$$h=9.16\text{in}$$