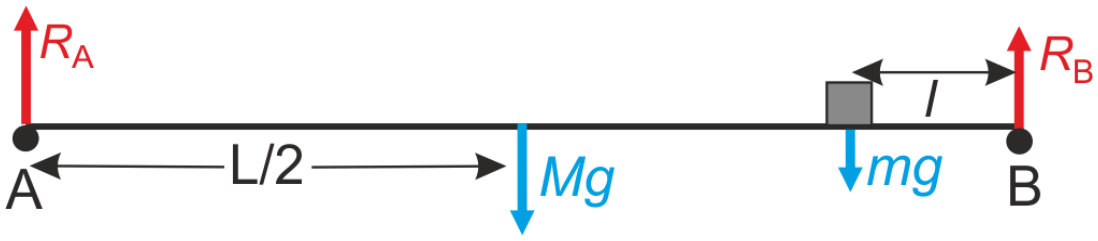
Answer on Question #74114 Physics / Other

A uniform bridge, $L = 0.043$ km $= 43$ m long and weighing $M = 7.5 \times 10^6$ kg, is supported by two pillars from each end. If a $m = 3.6 \times 10^4$ kg truck is parked $l = 0.015$ km $= 15$ m from the right pillar how much force does each pillar exert.

Solution:



At the equilibrium the total moment about points A and B is zero.

Moment equilibrium about the point A requires

$$Mg\frac{1}{2} + mg(L - l) - R_B L = 0$$

So

$$R_B = \frac{Mg}{2} + mg\left(1 - \frac{l}{L}\right) = \frac{7.5 \times 10^6 \times 9.8}{2} + 3.6 \times 10^4 \times 9.8\left(1 - \frac{15}{43}\right) = 3.69 \times 10^7 \text{ N}$$

Moment equilibrium about the point B requires

$$Mg\frac{L}{2} + mgl - R_A L = 0$$

So

$$R_A = \frac{Mg}{2} + mg\frac{l}{2} = \frac{7.5 \times 10^6 \times 9.8}{2} + 3.6 \times 10^4 \times 9.8 \times \frac{15}{43} = 3.68 \times 10^7 \text{ N}$$

Answer:

$R_B = 3.69 \times 10^7$ N

$R_A = 3.68 \times 10^7$ N