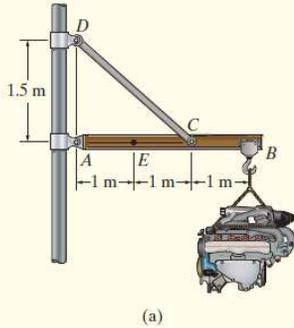
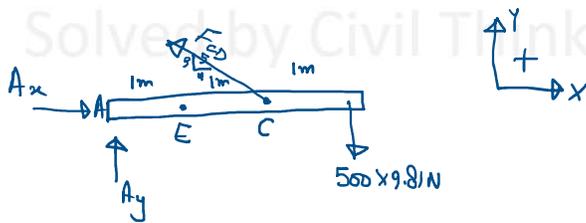


Internal Loading in beams

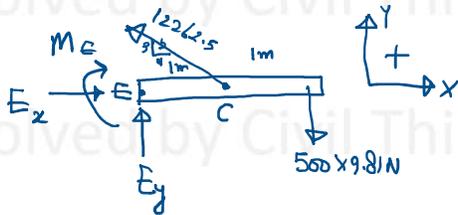
The 500-kg engine is suspended from the crane boom in Fig. 1-5a. Determine the resultant internal loadings acting on the cross section of the boom at point E.



Courtesy: Mechanics of Materials, Tenth Edition in SI Units, R. C. Hibbeler



$$\begin{aligned} \sum M_A = 0: \\ -(500 \times 9.81) \times 3\text{m} + \left(F_{CD} \times \frac{3}{5} \times 2\text{m} \right) &= 0 \\ \Rightarrow F_{CD} &= 12262.5 \text{ N} \end{aligned}$$



$$\sum F_y = 0: E_y - (500 \times 9.81 \text{ N}) + \left(12262.5 \times \frac{3}{5} \right) = 0$$

$$\Rightarrow E_y = -2452.5 \text{ N} = 2452.5 \text{ N} (\downarrow)$$

$$\sum F_x = 0:$$

$$E_x - 12262.5 \times \frac{4}{5} = 0 \Rightarrow E_x = 9810 \text{ N} (\rightarrow)$$

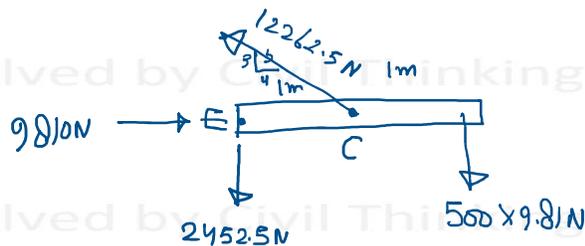
$$\sum M_E = 0:$$

$$-(500 \times 9.81) \times 2\text{m} + \left(12262.5 \times \frac{3}{5} \times 1\text{m} \right) - M_E = 0$$

Torque

$$-(500 \times 9.81 \times 2\text{m}) + (12262.5 \times \frac{3}{5} \times 1\text{m}) - M_e = 0$$
$$\Rightarrow M_e = -2452.5 \text{ Nm} = \textcircled{+} 2452.5 \text{ Nm}$$

Summary of internal forces:



This problem was solved by Civil Thinking (<https://civilthinking.com>)

If you need solutions of **Strength of Materials** questions or any other **Civil Engineering** subject questions, contact us at:

solutions@civilthinking.com

Or submit your problem directly here:

<https://civilthinking.com/getproblemsolutions>

Other Subjects We Cover:

- Structural Analysis
- Fluid Mechanics
- Geotechnical Engineering
- Transportation Engineering
- Construction Management
- Finite Element Analysis (FEA)
- Engineering Software (ANSYS, ETABS, MATLAB, Revit)

Let us help you solve your engineering challenges! 🚀

NOTE:

The solution provided in this document is the intellectual property of Civil Thinking and is protected by copyright. Any reproduction, distribution, or publication of this content, in whole or in part, is strictly prohibited without prior written permission from <https://civilthinking.com>.