Answer on Question #64291-Engineering-Civil and Environmental Engineering

A steel bar, area 625 mm^2, is embedded in a block of concrete 100 mm x 100 mm. The length of both the steel bar and concrete block is 300 mm. Assuming a value of 210 kN/mm^2 for Young's Modulus for the steel, and 14 kN/mm^2 for the concrete, determine the load carried by the steel and the load carried by the concrete if the combined section is subject to a compressive load of 5 kN. Assume that there is no slip between the steel and concrete (the strain in both materials is equal) and that the load is applied over the entire cross section.

Solution

$$P_{st} + P_c - 5 = 0$$

$$\delta_{st} = \delta_c$$

$$\frac{P_{st}L}{625 \cdot 10^{-6}(210 \cdot 10^9)} = \frac{P_cL}{(100^2 \cdot 10^{-6} - 625 \cdot 10^{-6})(14 \cdot 10^9)}$$

$$P_{st} = P_C = 2.5\ kN.$$

Answer: $\boldsymbol{P_{st} = P_C = 2.5\ kN}$.