4-34. The concrete column is reinforced using four steel reinforcing rods, each having a diameter of 18 mm. Determine the stress in the concrete and the steel if the column is subjected to an axial load of 800 kN. \( E_{st} = 200 \text{ GPa}, \) \( E_c = 25 \text{ GPa}. \)

**Equilibrium:**

\[ +1 \Sigma F_y = 0; \quad P_{st} + P_{con} - 800 = 0 \quad [1] \]

**Compatibility:**

\[
\frac{P_{st}}{4 \left( \frac{d}{2} \right) (0.018^2) (200) (10^6)} = \frac{P_{con}}{0.3^2 - 4 \left( \frac{d}{2} \right) (0.018^2) (25) (10^6)}
\]

\[ P_{st} = 0.091513 P_{con} \quad [2] \]

Solving Eqs. [1] and [2] yields:

\[ P_{st} = 67.072 \text{ kN} \quad P_{con} = 732.928 \text{ kN} \]

**Average Normal Stress:**

\[ \sigma_{st} = \frac{67.072 \times 10^3}{4 \left( \frac{d}{2} \right) (0.018^2)} = 65.9 \text{ MPa} \quad \text{Ans} \]

\[ \sigma_{con} = \frac{732.928 \times 10^3}{0.3^2 - 4 \left( \frac{d}{2} \right) (0.018^2)} = 8.24 \text{ MPa} \quad \text{Ans} \]
4-79. Two bars, each made of a different material, are connected and placed between two walls when the temperature is $T_1 = 10^\circ C$. Determine the force exerted on the (rigid) supports when the temperature becomes $T_2 = 20^\circ C$. The material properties and cross-sectional area of each bar are given in the figure.

**Compatibility:**

\[
0 = \delta_T - \delta_F
\]

\[
0 = 12 \left(10^{-6}\right) (20 - 10)(0.3) + 21 \left(10^{-6}\right) (20 - 10)(0.3)
\]

\[
- \frac{F(0.3)}{200(10^{-6})(200)(10^9)} - \frac{F(0.3)}{450(10^{-6})(100)(10^9)}
\]

\[
F = 6988.2 \text{ N} = 6.99 \text{ kN} \quad \text{Ans}
\]