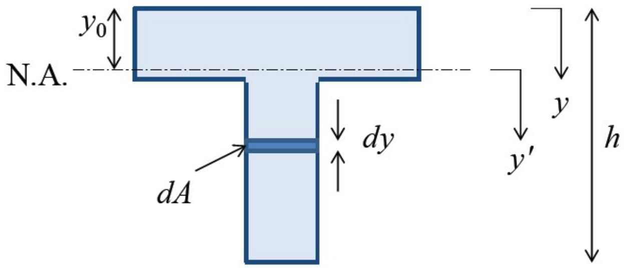
レポートの解答例
Sample Answer (10)

1.

断面の中立軸位置は，以下の式で表される. The position of neutral axis can be calculated by the following equation.



$$y_0 = \frac{\int_0^h y dA}{\int_0^h dA}$$

また，断面二次モーメントは，以下の式で表される. Then the second moment of area can be calculated by the following equation.

$$I = \int_{-y_0}^{h-y_0} y'^2 dA$$

上式を使って，補強前の断面二次モーメントは以下のように計算できる. By using the above equations, the second moment of area before the strengthening can be calculated as follows.

$$y_{01} = \frac{\int_0^h y dA}{\int_0^h dA} = \frac{\int_0^{40} y(200dy)}{\int_0^{40} 200dy} = \frac{200 \times \left(\frac{40^2}{2} - \frac{0^2}{2}\right)}{200 \times (40 - 0)} = 20mm$$

$$I_1 = \int_{-y_0}^{h-y_0} y'^2 dA = \int_{-20}^{40-20} y'^2(200dy') = 200 \times \left\{\frac{20^3}{3} - \frac{(-20)^3}{3}\right\} \approx 1.067 \times 10^6 mm^4$$

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オイラーの式より，座屈荷重は，From the Euler’s equation, buckling capacity is

$$P_{cr}=\frac{\pi^2EI}{(Kl)^2}=\frac{3.14^2\times200000\times1.067\times10^6}{(1.0\times6000)^2}\approx5.84\times10^4N=58.4kN$$

$P=100kN>P_{cr}=58.4kN$なので，座屈が生じる．Buckling occurs.

2.
1.と同様に，補強後の断面二次モーメントは以下のように計算できる．Similarly to 1., the second moment of area before the strengthening can be calculated as follows.

$$y_{02}=\frac{\int_0^h ydA}{\int_0^h dA}=\frac{\int_0^{40}y(200dy)+\int_{40}^{40+50}y(10dy)}{\int_0^{40}200dy+\int_{40}^{40+50}10dy}=22.65mm$$

$$I_2=\int_{-y_0}^{h-y_0}y'^2dA=\int_{-22.65}^{40-22.65}y'^2(200dy')+\int_{40-22.65}^{90-22.65}y'^2(10dy')=2.124\times10^6mm^4$$

オイラーの式より，座屈荷重は，From the Euler’s equation, buckling capacity is

$$P_{cr}=\frac{\pi^2EI}{(Kl)^2}=\frac{3.14^2\times200000\times2.124\times10^6}{(1.0\times6000)^2}\approx1.16\times10^5N=116kN$$

$P=100kN<P_{cr}=116kN$なので，座屈は生じない．Buckling does not occur.