Lecture 14

CALCULATION OF CANTINIVALE BEAMS

Plan

1. The building of diagram of shearing forces for given cantilever beam.
2. The building of diagram of bending moments for given beam.
3. The selection of cross-section for a given beam.

14.1. The building of diagram of shearing forces for given cantilever beam.

Let us consider the following problem for the cantilever beam.

So, let for the given cantilever beam (see fig. 14.1), which has the transversal section is double T beams, $[\sigma]=160$ MPa, to build diagram of Q_y and M_x.

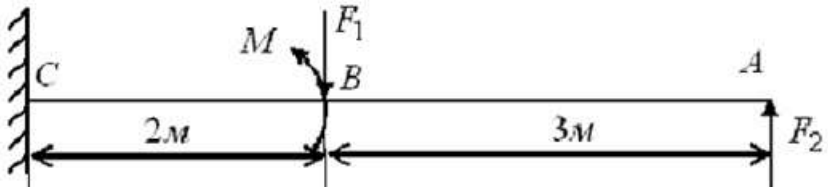

Fig. 14.1

To pick up a transversal section by assortment if $F_1 = 2$ kN, $F_2 = 1$ kN, $M = 12$ kNm.

Let us divide a beam into portions by characteristic transversal sections A, B, C (Fig. 14.1).

Let us define the value of transversal force in characteristic sections and build the diagram Q_y (Fig. 14.2):

$$Q_{y_A}^{lt} = -F_2 = -1 \text{ kN}; \quad Q_{y_B}^{rt} = -F_2 = -1 \text{ kN};$$

$$Q_{y_B}^{lt} = -F_2 + F_1 = -1 + 2 = 1 \text{ kN}.$$

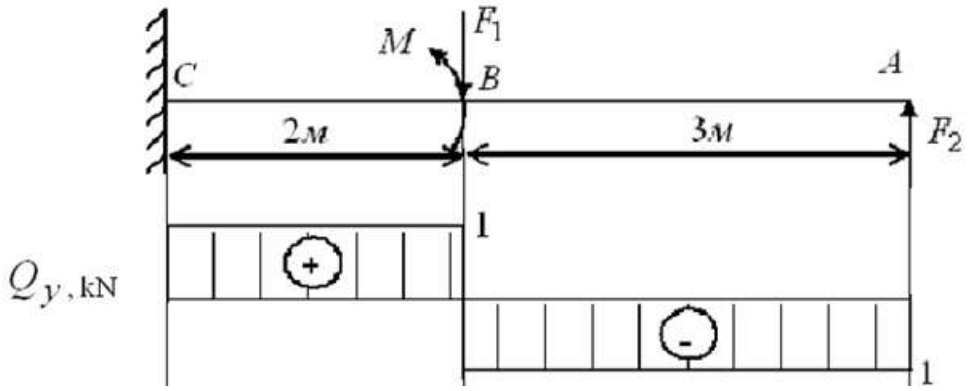

Fig. 14.2

On beginning

14.2. The building of diagram of bending movments for given beam.

Let us define the value of bending moment in characteristic sections and build the diagram M_x (Fig. 14.3):

$$M_A = 0; \qquad M_B^{rt} = F_2 \cdot AB = 1 \cdot 3 = 3 \text{ kNm};$$

$$M_B^{lt} = F_2 \cdot AB + M = 1 \cdot 3 + 12 = 15 \text{ kNm};$$

$$M_C^{rt} = F_2 \cdot AC + M - F_1 \cdot BC = 1 \cdot 5 + 12 - 2 \cdot 2 = 13 \text{ kNm}.$$

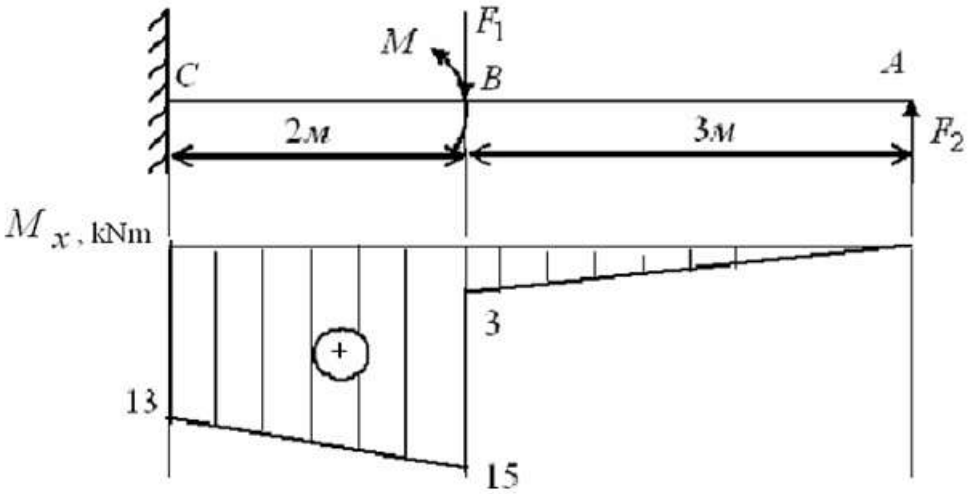

Fig. 14.3

On beginning

14.3. The selection of cross-section for for given beam.

3. From diagram M_x (Fig. 14.3):

$$M_{x_{\max}} = 15 \text{ kNm} = 15 \cdot 10^3 \text{ N} \cdot \text{m}.$$

Then from the condition of durability by normal tensions, we have:

$$W_x \geq \frac{M_{x_{\max}}}{[\sigma]} = \frac{15 \cdot 10^3}{160 \cdot 10^6} = 0{,}0938 \cdot 10^{-3} \text{ m}^3 = 93{,}8 \text{ cm}^3.$$

Double T beams № 16 was selected from the assortment of rental steel, which is $W_x = 109 \text{ cm}^3$.

On beginning