Remarks: See §4.4, pages 168 till 170
See §4.5, pages 171 till 184
See §4.6, pages 184 till 186

Answers:

a. $F_\text{p} = 210$ kN
$c = 83{,}33$ mm
b. $\Delta\ell_\text{p} = 315$ mm
c. $\Delta\ell_c = -1{,}37$ mm
d. $\Delta\ell_{jack} = 316{,}37$ mm
e. $q = 3{,}89$ kN/m
f. $\Delta\ell_{\text{t; due to }q} = 0{,}69$ mm
g. $\Delta F_\text{p} = 0{,}46$ kN

Explanation:

$$A = 35\times10^3\ \text{mm}^2 \text{ and } W = \frac{I}{\frac{1}{2}h} = 1{,}458\times10^6\ \text{mm}^3$$

a. $N = \sigma_\text{NC}A_\text{b} = (-6\ \text{N/mm}^2)(35\times10^3\ \text{mm}^2) = 210\times10^3$ N
$F_\text{p} = -N = 210$ kN
Maximum bending stress: $\sigma = 6\ \text{N/mm}^2$. This gives:
$$M = W\sigma = (1{,}458\times10^6\ \text{mm}^3)(6\ \text{N/mm}^2) = 8{,}75\times10^6\ \text{Nmm}\ (\frown)$$
$$e_{z;\text{p}} = \frac{M_z}{N} = \frac{-8{,}75\times10^6\ \text{Nmm}}{-210\times10^3\ \text{N}} = 41{,}67\ \text{mm}$$
$$c = \tfrac{1}{2}h - e = 83{,}33\ \text{mm}$$

b. $(EA)_\text{p} = (200\times10^2\ \text{N/mm}^2)(200\ \text{mm}^2) = 4\times10^6$ N
$$\Delta\ell_\text{p} = \frac{F_\text{p}\ell}{(EA)_\text{p}} = \frac{(210\times10^3\ \text{N})(6000\ \text{mm})}{4\times10^6\ \text{N}} = 315\ \text{mm}$$

c. At the height of the pre-stressing: $\sigma = -8\ \text{N/mm}^2$
$$\Delta\ell_c = \frac{\sigma}{E_c}\ell = \frac{-8\ \text{N/mm}^2}{35\times10^3\ \text{N/mm}^2}\times(6000\ \text{mm}) = -1{,}37\ \text{mm}$$

d. $\Delta\ell_{jack} = \Delta\ell_\text{p} - \Delta\ell_c = (315\ \text{mm}) - (-1{,}37\ \text{mm}) = 316{,}37$ mm

e. The maximum bending stress due to q should be:
$$\sigma^{(M)}_{\text{max; due to }q} = \frac{\frac{1}{8}q\ell^2}{W} \le 12\ \text{N/mm}^2$$
$$q \le \frac{8\times(12\ \text{N/mm}^2)(1{,}458\times10^6\ \text{mm}^3)M_q}{(6000\ \text{mm})^2} = 3{,}89\ \text{N/mm}$$

f. At the height of the pre-stressing the concrete stress due to q is :
$$\sigma_{\text{due }q} = \frac{41{,}67\ \text{mm}}{125\ \text{mm}}\times(12\ \text{N/mm}^2) = 4\ \text{N/mm}^2$$; This gives:
$$\Delta\ell_{\text{c; due to }q} = \frac{\sigma_{\text{due to }q}}{E_c}\ell = \frac{4\ \text{N/mm}^2}{35\times10^3\ \text{N/mm}^2}\times(6000\ \text{mm}) = 0{,}69\ \text{mm}$$

g. $$\Delta F_\text{p} = (EA)_\text{p}\frac{\Delta\ell_{\text{c; due to }q}}{\ell} = (4\times10^3\ \text{kN})\frac{0{,}69\ \text{mm}}{6000\ \text{mm}} = 0{,}46\ \text{kN}\ \ (0{,}22\%)$$