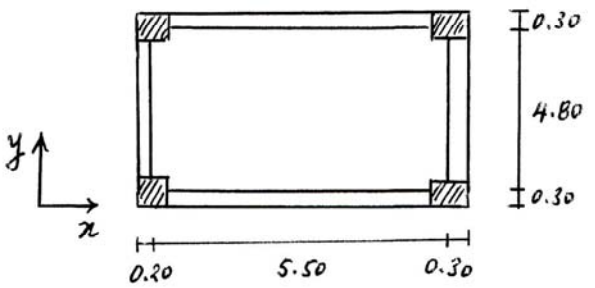
ΠΛΑΚΑ ΤΕΡΑΕΡΕΙΣΤΗ



Να υπολογιστεί η πλάκα του σχήματος

Δίδονται: Επίστρωση 0.8 kN/m²
Κινητό 3.5 kN/m²

Υλικά C20 B500C

1. Στατικό Μοντέλο, Επιλογή Διαστάσεων

§ 7.2.2 Θεωρητικά ανοίγματα

$$l_x = l_n + \min\left(\frac{1}{3}t, 0.025 l_n\right) + \min\left(\frac{1}{3}t, 0.025 l_n\right) =$$
$$= 5.50 + \min\left(\frac{1}{3}0.20, 0.025 \cdot 5.50\right) + \min\left(\frac{1}{3}0.30, 0.138\right) =$$
$$= 5.50 + 0.07 + 0.10 = 5.67$$

(0.138)

$$l_y = l_n + \min\left(\frac{1}{3}t, 0.025 l_n\right) + \min\left(\frac{1}{3}t, 0.025 l_n\right) =$$
$$= 4.80 + 0.10 + 0.10 = 5.00$$

§ 18.1.1 $l_{max}/l_{min} = 5.67/5.00 = 1.13 < 2.0 \rightarrow$ πλάκα οπλισμένη κατά 2 διευθ.

§ 18.1.3 $\min h = 70\,mm$

§ 16.2 Ελάχιστο πάχος πλάκας για αποφυγή από έλεγχο βελών κάμψεως:

$$\frac{(\alpha l)_{min}}{d} \le 30 \quad \text{όπου } \alpha = 1.0 \rightarrow d \ge \frac{1 \times 5.0}{30} = 0.167$$

Λαμβάνεται: $h = 0.20\,m$

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2. Στατική Επίλυση

$g = 0.20 \times 25 = 5\ KN/m^2$

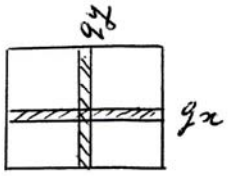
$g' = \frac{= 0.8\ KN/m^2}{5.8}$

$q = = 3.5\ KN/m^2$

φορτίο σχεδιασμού: $1.35(g+g') + 1.5q = 13.08\ KN/m^2$

α) Επίλυση με τη μέθοδο λωρίδων (Markus)

$\varepsilon = \frac{l_y}{l_x} = \frac{5.0}{5.67} = 0.89$



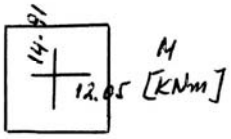
πιν. 1 → $K_x = 0.386$ $K_y = 0.614$

$V_x = V_y = 0.594$

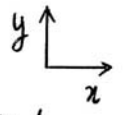
$M_x = (0.386 \times 13.08)\frac{5.67^2}{8} = 20.29\ KN/m$

$V_x M_x = 0.594 \times 20.29 = 12.05\ KNm/m$

$V_y M_y = 0.594 \times (0.614 \cdot 13.08)\frac{5.0^2}{8} = 14.91\ KNm/m$



β) Επίλυση με πίνακες Czerny

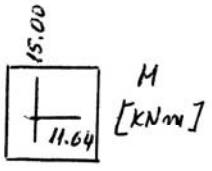


$\frac{l_y'}{l_x'} = \frac{5.67}{5.0} = 1.13$

Πιν. 1 l_{min}

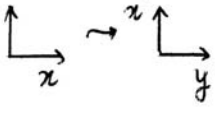
$m_{x'm} = \frac{13.08 \cdot 5.0^2}{21.8} = 15.00\ KNm/m$

$m_{y'max} = \frac{13.08 \cdot 5.0^2}{28.1} = 11.64\ KNm/m$



γ) Επίλυση με τη μέθοδο Pieper-Martens (Πρέπει: $q_d \le \frac{2}{3}(g_d + q_d)$ →

$\frac{l_{max}}{l_{min}} = \frac{l_y'}{l_x'} = \frac{5.67}{5.00} = 1.13$



→ 1,5. 3,5 ≤ 2/3 13,08

→ 5.25 ≤ 8.72)

σωστά!

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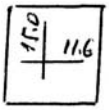
από Πιν. Ι :

$$m_{y'm} = m_{xm} = \frac{13.08 \cdot \ell^2_{min}(=5.0^2)}{f_{y'}=28.1} = 11.6 \text{ kNm/m}$$

$$m_{x'm} = m_{ym} = \frac{13.08 \cdot \ell^2_{min}(=5.0^2)}{f_{x'}=21.8} = 15.0 \text{ kNm/m}$$



M [kNm]

3. Οπλισμοί

§ 5.1 Επιπλάγια

Κατηγορία 1 : $c_{min} = 20\text{mm} - 5(\text{πλάτος}) = 15 \text{ mm}$

$c_{nom} = 15 + 5 = 20 \text{ mm}$

Άρα $d_x = 0.165$

$d_y = 0.175$

x : $\frac{M_{sd}}{bd_x^2} = \frac{12.05 \times 10^{-3}}{1.0.165^2} = 0.443 \rightarrow \rho\% = 0.105\ \%$

Αλλά § 18.1.4.1 min $A_s = 0.6\, bd / f_{yk} = 0.6/500\, bd = 0.12\ \%$

ή $= 0.15\ \%$

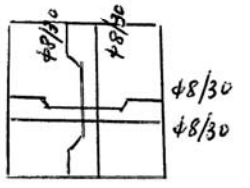
$A_s = \frac{0.12}{100} \times 100 \times 17.5 = 2.62 \text{ cm}^2/\text{m} \rightarrow \phi 8/15 (3.35 \text{ cm}^2/\text{m})$

max e = 1.5h ή 200 mm

1.5 200 = 300 ή 200 mm $\rightarrow$ 200 mm

y : $\frac{M_{sd}}{bdy^2} = \frac{14.91 \times 10^{-3}}{(1.0) \times (0.175)^2} = 0.487 \rightarrow \rho\% = 0.116\ \%$

$A_{sy} = \frac{0.15}{100} \times 100 \times 17.5 = 2.65 \text{ cm}^2/\text{m} \rightarrow \phi 8/15 (3.35 \text{ cm}^2/\text{m})$



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