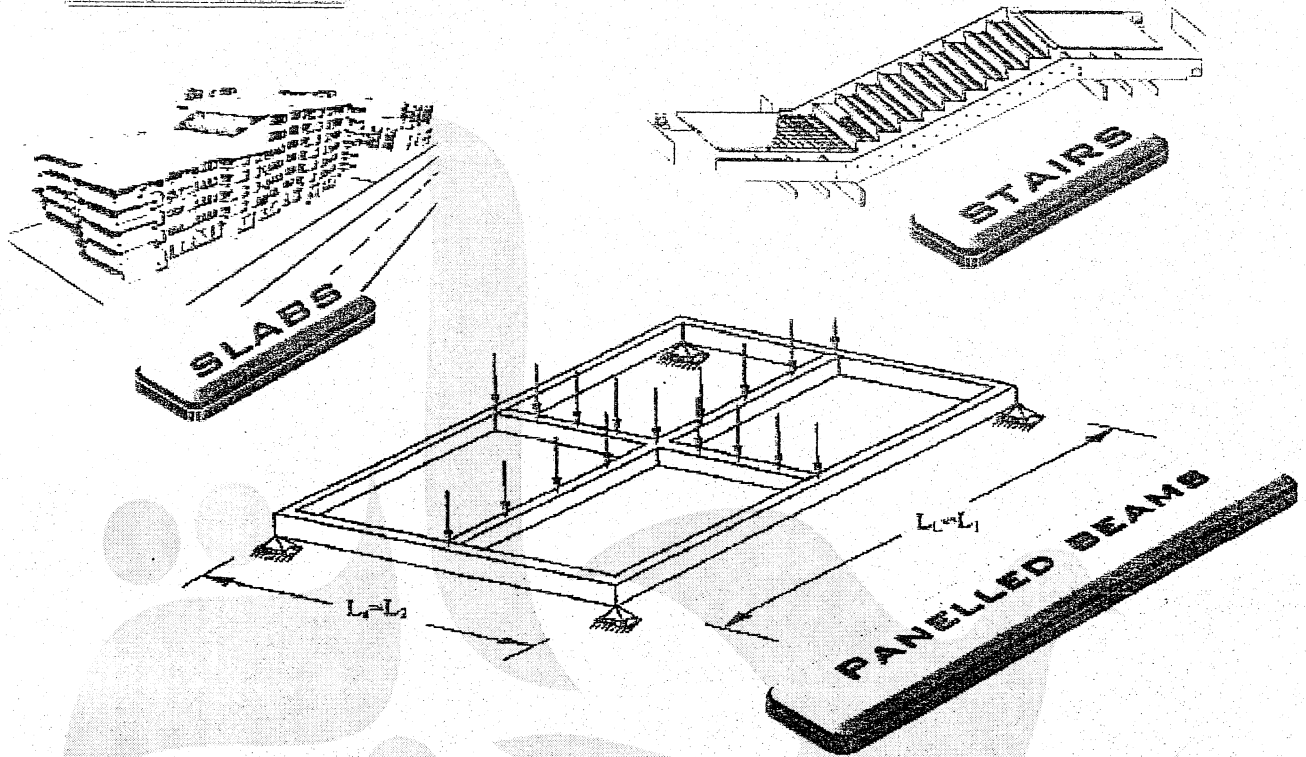


1, 00

Reinforced Concrete

2012 - 2013



3rd YEAR CIVIL ENGINEERING

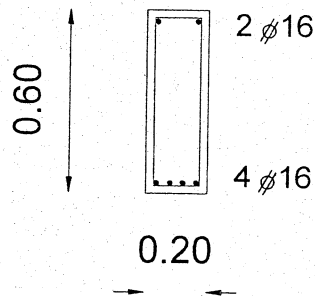


NO : 23

Sheet # 9

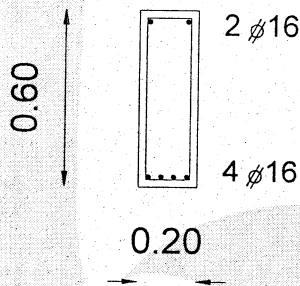
Analysis of M,P sections

1- For the following section you are asked to Draw the Interaction diagram

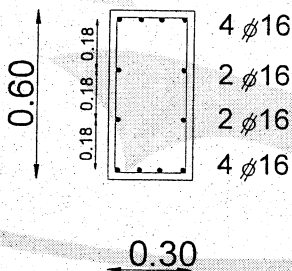


2- For the following section you are asked to Check the section in the following condition:

- 1) If $N = 900 \text{ K.N}$ find the corresponding moment and check the answer using the Interaction Diagram
- 2) If $M = 150 \text{ K.N}$ find the corresponding Force and check the answer using the Interaction Diagram



3- For the following section you are asked to find the Normal and Moment for the balanced stage



تعديل المسائل لشيت 9

فصل 9-10 : حل المسألة بحديد $f_y = 240/360$

فصل 15-16 : حل المسألة بحديد $f_y = 400/600$

فصل 13-14 : حل المسألة بحديد $f_{cu} = 40 \text{ N/mm}^2$

فصل 1-2 : حل المسألة الأولى بقطر 18mm بدا من 16mm

فصل 7-8 : : حل المسألة الأولى حيث $h = 700 \text{ mm}$

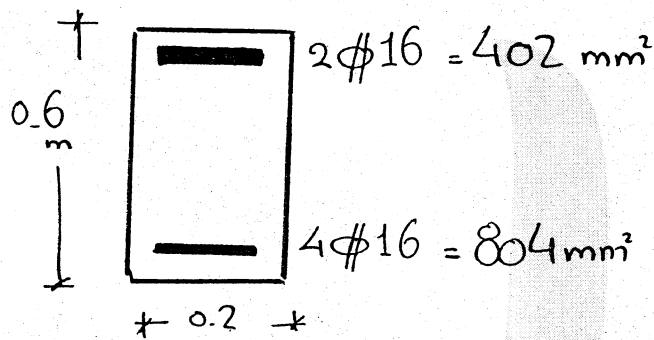
فصل 5-6 : : حل المسألة الثانية حيث $b = 250 \text{ mm}$

فصل 3-4 : حل المسألة بخرسانة $f_{cu} = 30 \text{ N/mm}^2$

فصل 11-12 حل المسألة الثانية حيث $h = 650 \text{ mm}$

Sheet 9

السؤال الأول :



مطلوب رسم
« Interaction Diagram »

تفقد المسألة، لاخيرة في ورق
الشرح مع تغيير الأرقام ...

point 1

assume $e = 0.0$

« Column » ← القلج

$$P_u = 0.35 f_{cu} A_c + 0.67 f_y (A_s + A_s')$$

$$P_u = 0.35 \times 25 \times (200 \times 600) + 0.67 \times 360 (804 + 402)$$

$$= 1340 \text{ kN}$$

ديه احداثيات
اول نقطة ... ($M = 0.0 \rightarrow P = 1340$)

Point 2

افتراض أن التلح عليه تحصيل e_{min}

$$e_{min} = 0.05t = 0.05(600) = 30^{mm}$$

ديه إجابات ثلاث
نقطة - - -

$$M_{min} = P \times e_{min} = 1340 \times \frac{30}{1000} = 40.2^{KN.m}$$

($M = 40.2^{KN.m}$ و $P = 1340^{KN}$)

Point 3

تفترض أن العنصر عليه $P = 0.0$ و $M = ??$ سؤال كمر

$$\textcircled{1} C_c = 0.67 \times \frac{f_{cu}}{\gamma_c} \times a \times b$$

$$= 0.67 \times \frac{25}{1.5} \times 0.8 \times 2 \times 200$$

$$C_c = 1786 Z$$

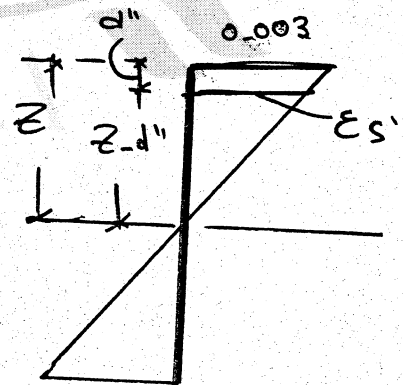
$$\textcircled{2} T = A_s \times f_y / \gamma_s$$

$$= 804 \times \frac{360}{1.15} = 251686.9^N$$

$$\textcircled{3} \frac{0.003}{Z} = \frac{\epsilon_s'}{Z - d''}$$

$$\epsilon_s' = 0.003 \left(\frac{Z - d''}{Z} \right)$$

$$F_s' = \epsilon_s' \times E_s = 600 \left(\frac{Z - d''}{Z} \right)$$



$$C_s = A_s' \times F_s'$$

$$= 402 \left(600 \frac{Z - d''}{Z} \right) = 241200 \left(\frac{Z - d''}{Z} \right)$$

3.

ايجاد \bar{z} بمعادلة الاستراني ..

$$C_c + C_s = T$$

$$1786 \bar{z} + 241200 \left(\frac{\bar{z} - 50}{50} \right) = 251686.9$$

خدا لا يكم $\bar{z} = 133 \text{ mm} \Rightarrow a = 0.8 \bar{z} = 106 \text{ mm}$
 $a_{\min} = 0.1d = 55 \text{ mm}$

$$\therefore M = C_c \left(d - \frac{a}{2} \right) + C_s (d - d'')$$

$$= 1786 \times 133 \left(550 - \frac{106}{2} \right)$$

$$+ 241200 \left(\frac{133 - 50}{133} \right) [550 - 50]$$

$$= 193 \text{ kN.m}$$

دالة احيات التفتة $(p = 0.0 \rightarrow M = 193)$

point 4

افتحص ان الفتح Balanced

$$M_b \neq P_b$$

$$1. Z_b$$

$$* Z_b = \frac{600}{600 + f_y / \gamma_s} (d) = \frac{600}{600 + \frac{360}{1.15}} (SSO) = 361 \text{ mm}$$

$$* a_b = 0.8 Z_b = 289 \text{ mm}$$

2 - احسب القوى الداخلية

$$* C_c = 0.67 \frac{P_u}{\gamma_c} * a * b = 0.67 * \frac{25}{1.5} * 289 * 200 = 645433 \text{ N}$$

$$* T = A_s * f_y / \gamma_s = 804 * \frac{360}{1.15} = 251686 \text{ N}$$

$$* C_s = A_s' * f_y / \gamma_s = 402 * \frac{360}{1.15} = 125843 \text{ N}$$

3 - احسب M_b و P_b

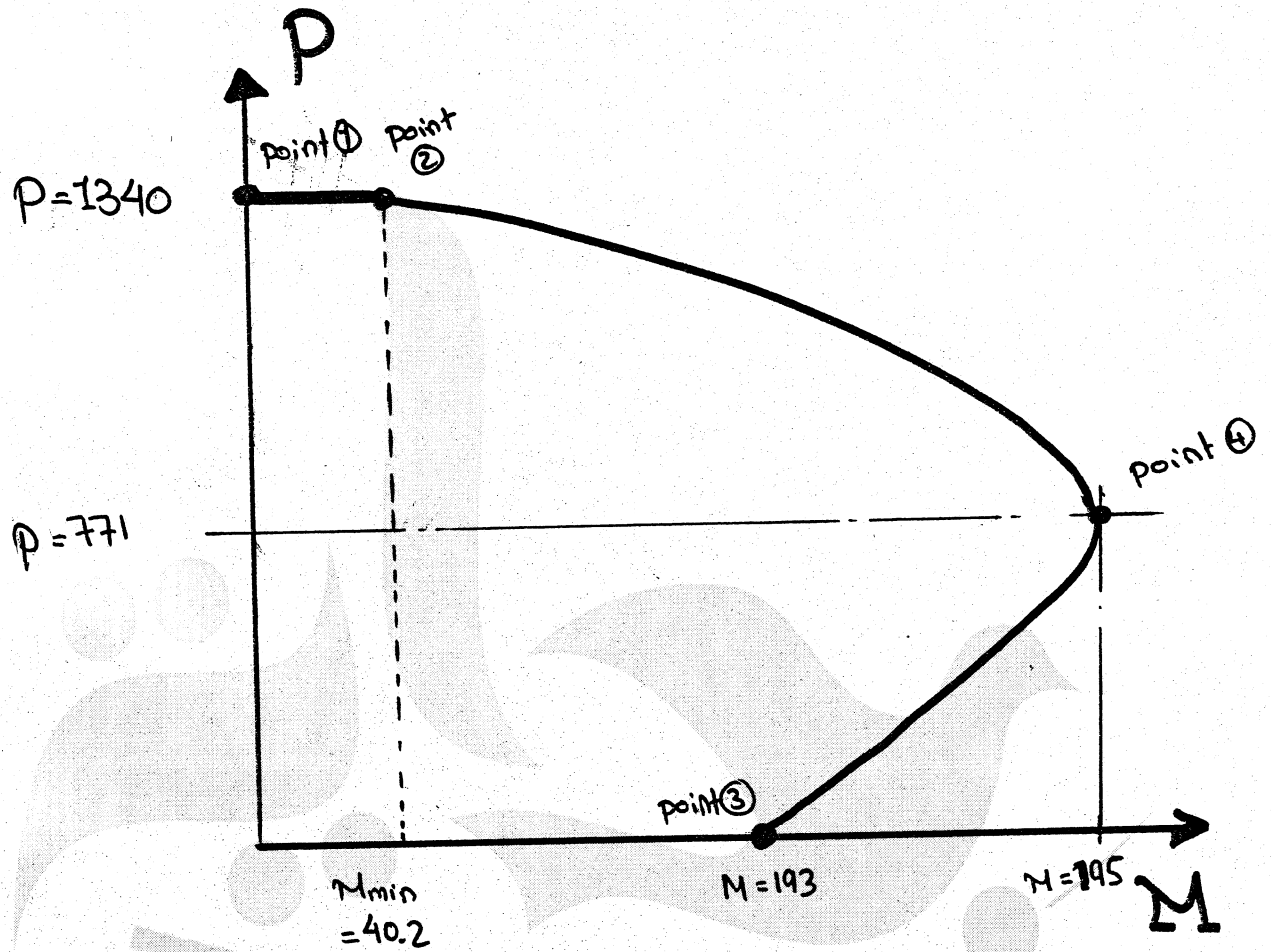
$$P_b = C_c + C_s - T = 645433 + 125843 - 251686 = 771 \text{ kN}$$

$$M = C_c \left(\frac{t}{2} - \frac{a}{2} \right) + C_s \left(\frac{t}{2} - d'' \right) + T \left(\frac{t}{2} - d' \right) = 195 \text{ kN.m}$$

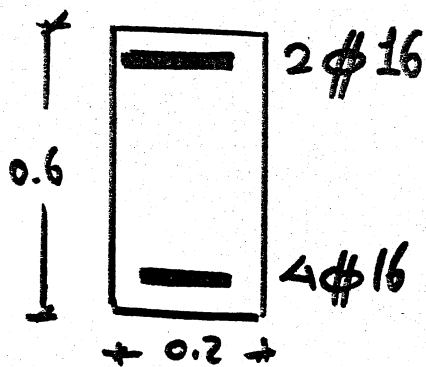
ديك اعداد
تقريبية

$$(M_b = 195 \text{ و } P_b = 771)$$

رسم شكل NID
بتوجيه لنتقال على المحاور



المسألة الثانية :



if $N = 900$
Find M

نرى المسألة قبل الاختيار في ورق
الشح تماعاً.

* احسب P_b وقارن P اعطاه بواحد نوع التلح.

$$Z_b = \frac{600}{600 + f_y / \sigma_s} (d) = \frac{600}{600 + \frac{360}{1.15}} (550) = 361.4 \text{ mm}$$

$$\begin{aligned} \therefore G_c &= 0.67 \frac{P_u}{\sigma_c} \times a \times b \\ &= 0.67 \times \frac{25}{1.5} \times (0.8 \times 361.4) (200) = 645 \text{ kN} \end{aligned}$$

$$\begin{aligned} \therefore T &= A_s \times f_y / \sigma_s \\ &= 804 \times \frac{360}{1.15} = 251 \text{ kN} \end{aligned}$$

$\sigma_s > \sigma_y$
من استجابة ...

$$\begin{aligned} G_s &= A_s' \times f_y / \sigma_s \\ &= 402 \times \frac{360}{1.15} = 125.5 \text{ kN} \end{aligned}$$

$$\Rightarrow P_{ub} = C_c + C_s - T$$

$$= 645 + 125.5 - 251 = 519.5 \text{ KN}$$

وتميزان P_u المعطاه $P_b <$

أي أن التطاق
Small ecc.

ويتم إعاده الحد على أن القاطع Small

بغرض $e/t = 0.2$ → فرض ثابت

$$\phi_c = 1.5 \left(\frac{7}{6} - \frac{e/t}{3} \right) = 1.65$$

$$\phi_s = 1.15 \left(\frac{7}{6} - \frac{e/t}{3} \right) = 1.265$$

(١١) احسب القوى الداخلية

- $C_c = 0.67 \frac{P_u}{\phi_c} \times a \times b$

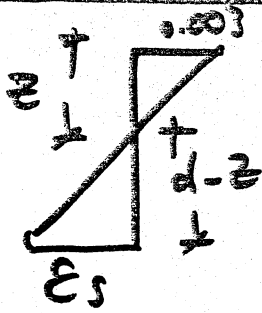
$$= 0.67 \times \frac{25}{1.5} \times (0.8 \text{ Z})(200) = 1786.6 \text{ Z}$$

- assume $\phi_s' > \phi_y$

$$C_s = A_s' \times F_y / \phi_s$$

$$402 \times \frac{360}{1.15} = 125843 \text{ N}$$

-8-



دیتہ ہوگا ϵ_s بالتشابه ۱

$$\epsilon_s = 0.003 \left(\frac{d-z}{z} \right)$$

$$= F_s = \epsilon_s * E_s = 600 \left(\frac{d-z}{z} \right)$$

$$= T = A_s * f_s$$

$$= 804 + 600 \left(\frac{d-z}{z} \right) = 482400 \left(\frac{550-z}{z} \right)$$

* نتہا حساب

$$P_u = C_c + C_s - T$$

$$900 \times 1000 = 1786.6 z + 125843 - 482400 \left(\frac{550-z}{z} \right)$$

$$z = 475.5 \text{ mm}$$

$$a = 380.4$$

← کہہ دانت معاك (z) تعرف حساب كل حاجه

$$C_c = 1786.6 z = 849528.3 = 849.5 \text{ kN}$$

$$T = 482400 \left(\frac{550-z}{z} \right) = 75581.07 = 75.5 \text{ kN}$$

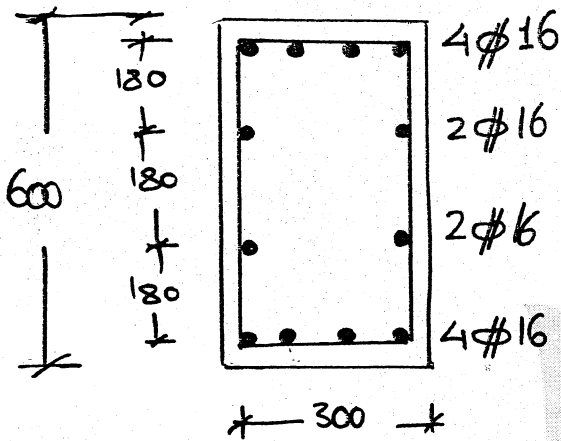
$$M_u = C_c \left(\frac{t}{2} - \frac{a}{2} \right) + C_s \left(\frac{t}{2} - d' \right) + T \left(\frac{t}{2} - d' \right)$$

$$= 143 \text{ kN.m}$$

-9-

[Signature]

المسألة الثالثة :



$$P \text{ fin } M_b \text{ و } P_b$$

Balanced

$$d' = 30 \text{ mm}$$

عطى

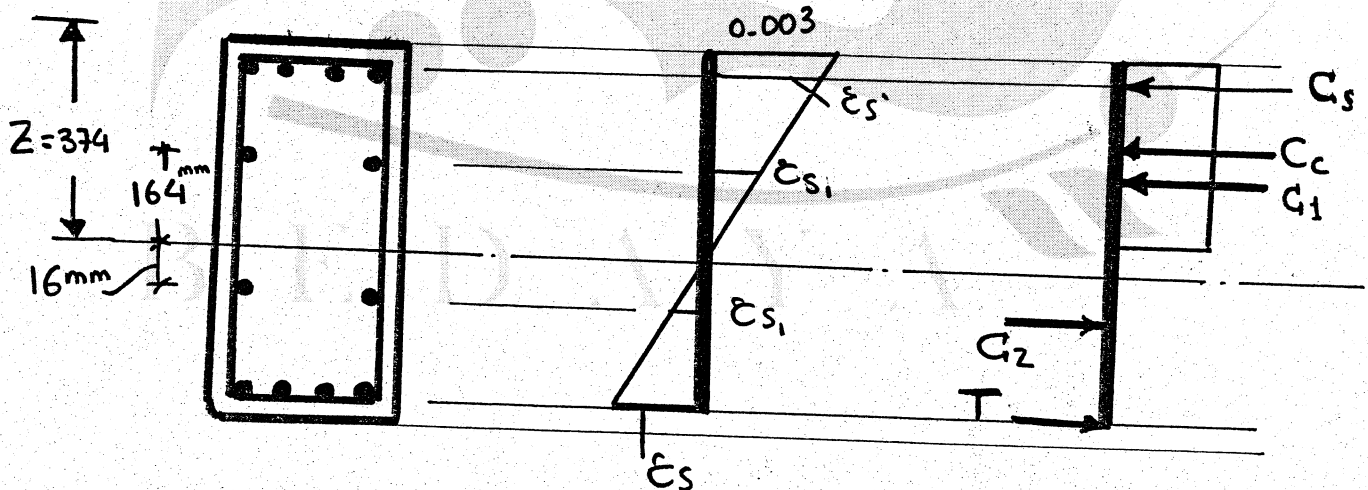
$$Z = Z_b =$$

١- مكان محور الخمول

Balanced

$$\frac{600}{600 + f_y / \sigma_c} (d) = \frac{600}{600 + \frac{360}{1.15}} (570)$$

$$= 374.5 \text{ mm}$$



٢- احسب القوى الداخلية

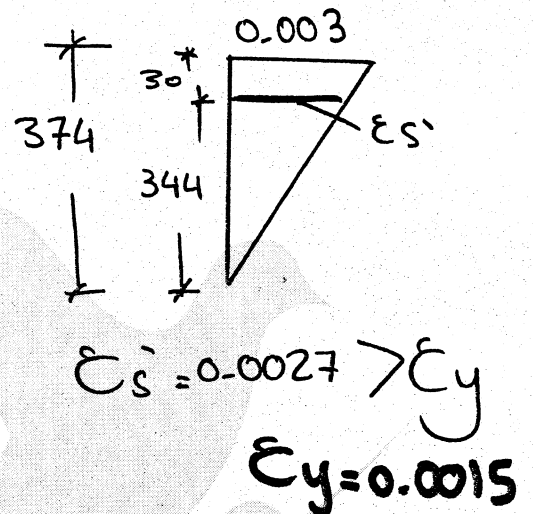
$$C_c + C_s + G_1 + G_2 + T$$

القوى الداخلية

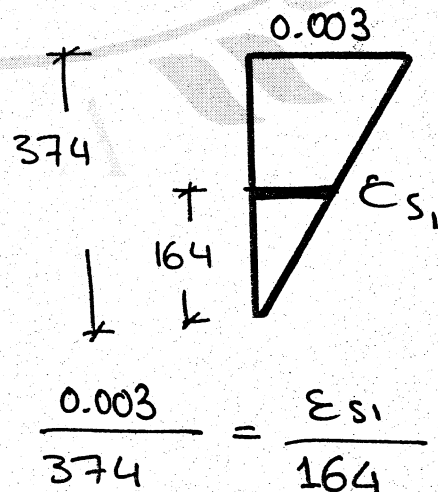
$$\begin{aligned}
 * C_c &= 0.67 f_{cu} / \gamma_c + a * b \\
 &= 0.67 * \frac{25}{1.5} + (0.8 * 374.5)(300) \\
 &= 968.5 \text{ kN}
 \end{aligned}$$

$$\begin{aligned}
 * T &= A_s * f_y / \gamma_s \\
 &= 804 * \frac{360}{1.15} = 251686.9 \text{ N}
 \end{aligned}$$

$$\begin{aligned}
 * C_s &= A_s * f_y / \gamma_s \\
 804 * \frac{360}{1.15} &= 251686.9 \text{ N}
 \end{aligned}$$



$$\begin{aligned}
 * C_1 &= A_{s1} * f_{s1} \\
 &= \left(2 * \frac{\pi}{4} * 16^2\right)(260) \\
 &= 104520 \text{ N}
 \end{aligned}$$

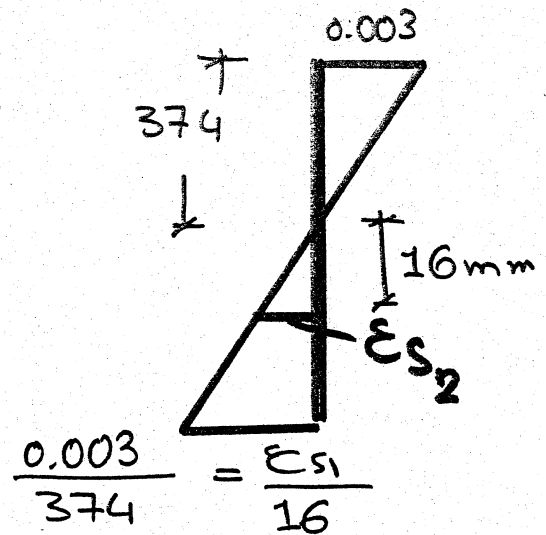


$$\begin{aligned}
 \epsilon_{s1} &= 0.0013 < \epsilon_y \\
 f_{s1} &= \epsilon_{s1} * E_s \\
 &= 260 \text{ N/mm}^2
 \end{aligned}$$

$$* C_2 = A s_2 * F_s$$

$$= 402 * 32.6$$

$$= 9504.8 \text{ N}$$



$$\epsilon_{s2} = 0.0001 < \epsilon_y$$

$$F_{s2} = \epsilon_{s2} * E_s$$

$$= 23.6 \text{ N/mm}^2$$

$$\therefore M_b \neq P_b \text{ ملاحظه 3}$$

$$* \frac{P}{b} = C_c + \cancel{C_s} + C_1 - C_2 - \cancel{T}$$

$$= 968.5 \times 10^3 + 104520 - 9504.8$$

$$= 1065 \text{ kN}$$

$$* M_b = C_c \left(\frac{t}{2} - \frac{a}{2} \right) + C'_s \left(\frac{t}{2} - d' \right)$$

$$+ T \left(\frac{t}{2} - d' \right) + C_1 (90) + C_2 (90)$$

$$= 290.8 \text{ kN.m}$$