"O'zbekiston Temir Yo'llari"
Davlat Aksionerlik Temir Yo'l Kompaniyasi
Toshkent Temir Yo'l Muhandislari Instituti

« Qurilish mehanikasi»
kafedrasi

Materiallar qarshiligi fanidan

1-LOYIHA
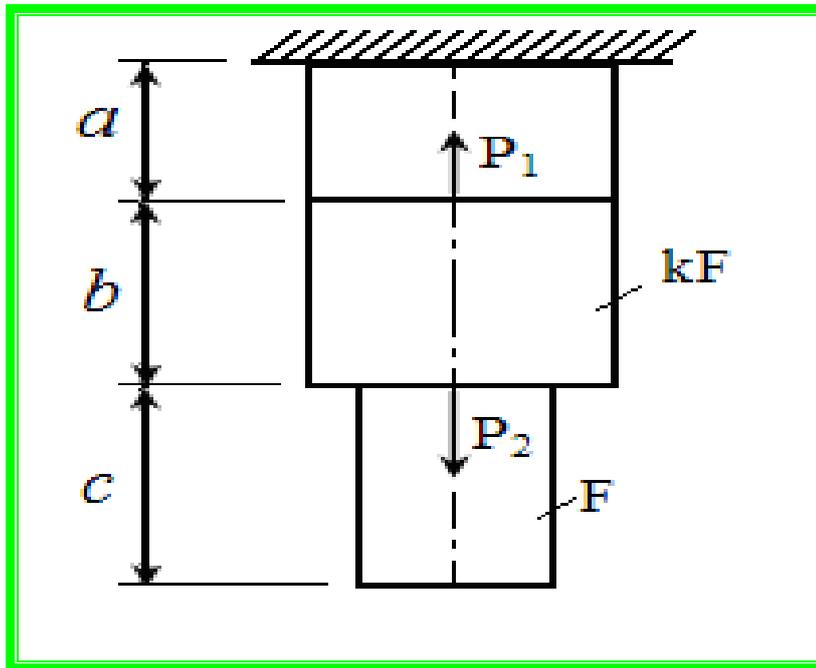# HISOBLASH ISHI

Cho'zilish va siqilishga hisoblash.

Bajardi: BIK-4 гуруҳ
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Berilgan miqdorlar.

Variant nomeri	a m	b m	c m	F sm^2	k -	P$_1$ kN	P$_2$ kN	q$_1$ kN/m	q$_2$ kN/m	P kN	Δ Mm	γ kN/m^2
16-4	1.5	2.0	2.5	20	2.0	1.8	0.5	10	15	150	0.05	78

1-Masala.

1-Masala. Statik aniq bruslarni hisoblash.

Sterjenning o'z og'irligi (G) ni hisobga olib bo'ylama kuch (N) va normal kuchlanish (σ) epyuralari qurilsin. Sterjen materialining solishtirma og'irligi γ=78kN/m^3 (St 3). Echish:
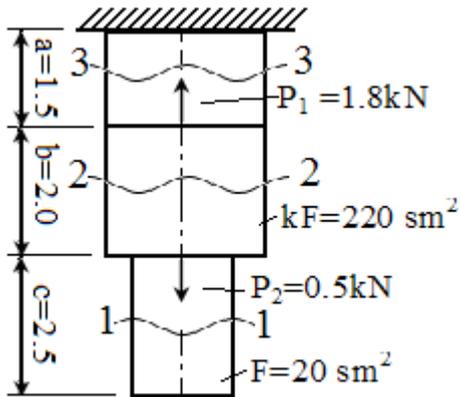
1.1. Sterjenning har bir uchastkasi og'irligini hisoblaymiz.

$$G_1 = \gamma \cdot F \cdot c = 78 \cdot 20 \cdot 10^{-4} \cdot 2,5 = 0,39 \text{ kN.}$$
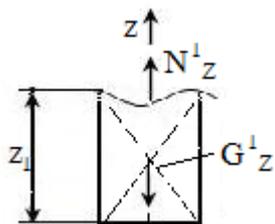
$$G_2 = \gamma \cdot k \cdot F \cdot b = 78 \cdot 2 \cdot 20 \cdot 10^{-4} \cdot 2 = 0,624 \text{ kN.}$$

$$G_3 = \gamma \cdot k \cdot F \cdot a = 78 \cdot 2 \cdot 20 \cdot 10^{-4} \cdot 1,5 = 0,468 \text{ kN.}$$

1.2. Bo'ylama kuch va normal kuchlanish epyurasini quramiz.

Har bir uchastkaning ixtiyoriy kundalang kesimi uchun N_1 va σ_1 tenglamalarini tuzamiz.

1-uchastka (1-1 kesim uchun):

$0 \leq z_1 \leq c = 2,5$ *m;*

$\Sigma z = 0$, $\quad N_I(z_1) - G_I(z_1) = 0;$ bundan

$N_I(z_1) = G_I(z_1) = \gamma \cdot F \cdot z_1;$ $\quad \sigma_1(z_1) = N_1(z_1)/F;$

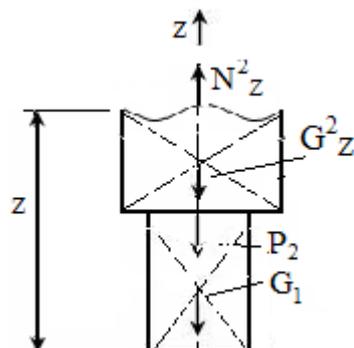$z_1=0$ da $N_I(0) = G_I(0) = \gamma \cdot F \cdot 0 = 0;$ $\sigma_1(0) = N_1(0)/F = 0;$

$z_1 = 2.5$ m da

$$N_I(2.5m) = G_I(2.5m) = 78 \cdot 20 \cdot 10^{-4} \cdot 2.5 = 0.39 kN;$$

$\sigma_1(2.5m) = N_1(2.5m)/F = 0.39/20 \cdot 10^{-4} = 195 kN/m^2;$

2- uchastka (2-2 kesim bo'yicha) :

$c=2,5$ *m* $\leq z_2 \leq (c+b) = 4,5$*m* ;

$\Sigma z = 0$,

$$N_{II}(z_2) - P_2 - G_1 - G_{II}(z_2 - c) = 0;$$

Bundan $\quad N_{II}(z_2) = P_2 + G_1 + G_{II}(z_2 - c) =$

$$= 0.30 + 0.50 + \gamma \cdot k \cdot F \cdot (z_2 - c) = 0.89 + \gamma \cdot k \cdot F \cdot (z_2 - c);$$

$z_2 = c + b = 2.5 + 2 = 4.5m$ da

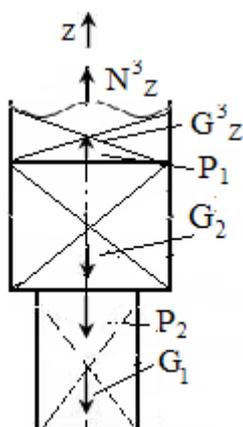$$N_{II}(4.5m) = 0.89 + 78 \cdot 2 \cdot 20 \cdot 20^{-4}(4.5 - 2.5) =$$

$$= 0.89 + 0.624 = 1.514 kN;$$

$$N_{(4.5)}^2 = 0.39 + 0.5 + 78 \cdot 2 \cdot 20 \cdot 20^{-4}(4.5 - 2.5) =$$

$$= 0.89 + 0.624 = 1.514 kN$$

$$\sigma_{(4.5)}^2 = N_{(4.5)}^2 / kF = 1.514 / 2 \cdot 20 \cdot 10^{-4} = 378.5 kN/m^2,$$

3. uchastka (1-1 kesim bo'yicha)

$(c+b) = 4.5 \le z_3 \le (c+b+a) = 4.5 + 1.5 = 6m$

$\Sigma z = 0$

$$N_{(z)}^3 + P_1 - P_2 - G_z^3 - G_2 - G_1 = 0, \text{ bundan}$$

$z_1 = 2.5m$ da

$$N_z^3 = -P_1 + P_2 + G_1 + G_2 + \gamma \cdot k \cdot F(z_3 - 4.5) = -1.8 + 0.5 +$$

$$+ 0.39 + 0.624 + \gamma \cdot k \cdot F(z_3 - 4.5) = -0.286 + \gamma \cdot k \cdot F(z_3 - 4.5)$$
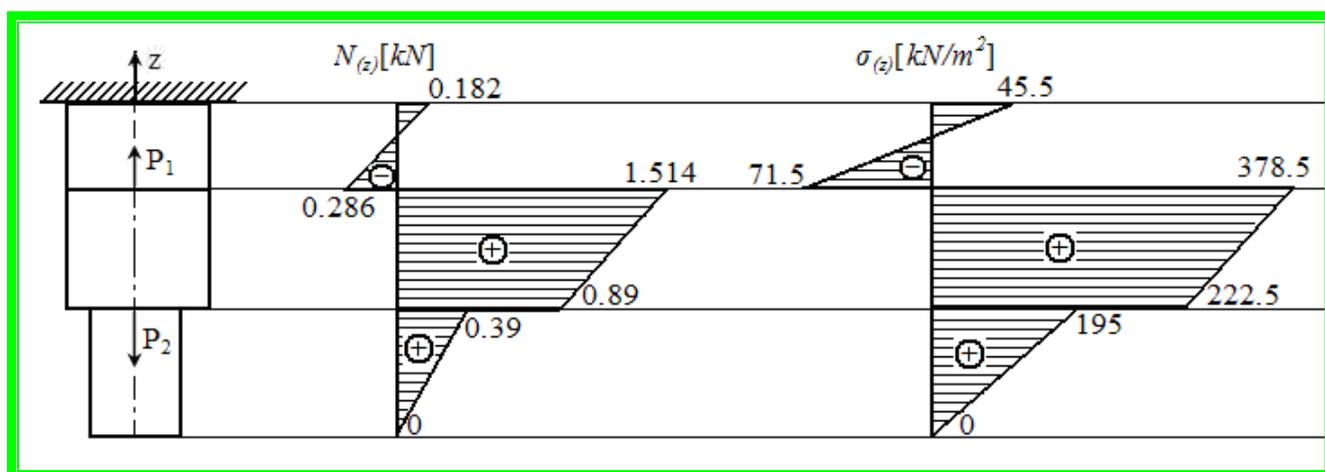
$z_3 = c + b = 4.5m$ da

$$N_{(4.5)}^3 = -0.286 \, kN$$

$$\sigma_{(4.5)}^3 = -N_{(4.5)}^3 / k \cdot F = -0.286 / 2 \cdot 20 \cdot 10^{-4} = -71.5 \, kN/m^2$$

$$N_{(6)}^3 = -0.286 + 78 \cdot 2 \cdot 20 \cdot 10^{-4} \cdot 1.5 = 0.182 \, kN$$

$$\sigma_{(6)}^3 = N_{(6)}^3 / k \cdot F = 0.182 / 2 \cdot 20 \cdot 10^{-4} = 45.5 \, kN/m^2$$

Olingan miqdorlarga asosan $N_{(z)}$ va $\sigma_{(z)}$ epyuralarini chizamiz.

Sterjenning absolyut uzayishini aniqlaymiz. $\Delta l = \Delta l_1 + \Delta l_2 + \Delta l_3$.

Har bir uchastkaning absolyut uzayishini Guk qonuniga asosan aniqlaymiz.

$$\Delta l_1 = G^1_{(z)} \cdot c / 2EF = 0.39 \cdot 2.5 / 2 \cdot 2 \cdot 10^8 - 20 \cdot 10^{-4} = 0.00000121875m = 0.000121875sm$$

$$\Delta l_2 = P_2 \cdot b / EkF + \left(G^3_z + G^2_z\right) \cdot b / 2E \cdot k \cdot F = 0.5 \cdot 2 / 2 \cdot 10^8 \cdot 2 \cdot 20 \cdot 10^{-4} +$$

$$+ (0.39 + 0.624) \cdot 2 / 2 \cdot 2 \cdot 10^8 \cdot 2 \cdot 20 \cdot 10^{-4} = 0.0000025175m = 0.00025175sm$$

$$\Delta l_3 = \frac{\left(-P_1 + P_2\right) \cdot a}{EkF} + \frac{\left(G^1_z + G^2_z + G^3_z\right) \cdot a}{2 \cdot EkF} = \frac{(-1.8 + 0.5) \cdot 1.5}{2 \cdot 10^8 \cdot 2 \cdot 20 \cdot 10^{-4}} + \frac{(0.39 + 0.624 + 0.468) \cdot 1.5}{2 \cdot 2 \cdot 10^8 \cdot 2 \cdot 20 \cdot 10^{-4}} =$$

$$- 0.0000024375 + 0.00000138937 = -0.00000104813m = -0.000104813sm$$

$\Delta l = \Delta l_1 + \Delta l_2 + \Delta l_3$ ga asosan

$$\Delta l = 0.000121875 + 0.00025175 - 0.000104813 = 0.000268812sm$$