

ОБЪЕКТ: КАНАЛИЗАЦИОННА ПОМПЕНА
СТАНЦИЯ - Ф. III УМЕН.

СТАТИЧЕСКИ ИЗЧИСЛЕНИЯ

Напо̀варване

Покрив:

- | | н | г | н |
|-------------|-------------------------|---------------|-------------------------|
| - мазилка: | $0,02 \times 18 = 0,36$ | $\times 1,35$ | $= 0,49 \text{ кN/m}^2$ |
| - с. тегло: | $0,20 \times 25 = 5,00$ | $\times 1,20$ | $= 6,00 \text{ кN/m}^2$ |
| - финиш: | $0,05 \times 22 = 1,10$ | $\times 1,35$ | $= 1,49 \text{ кN/m}^2$ |

$$\sum s_i = 7,98 \text{ кN/m}^2$$

Полезни по̀варн:

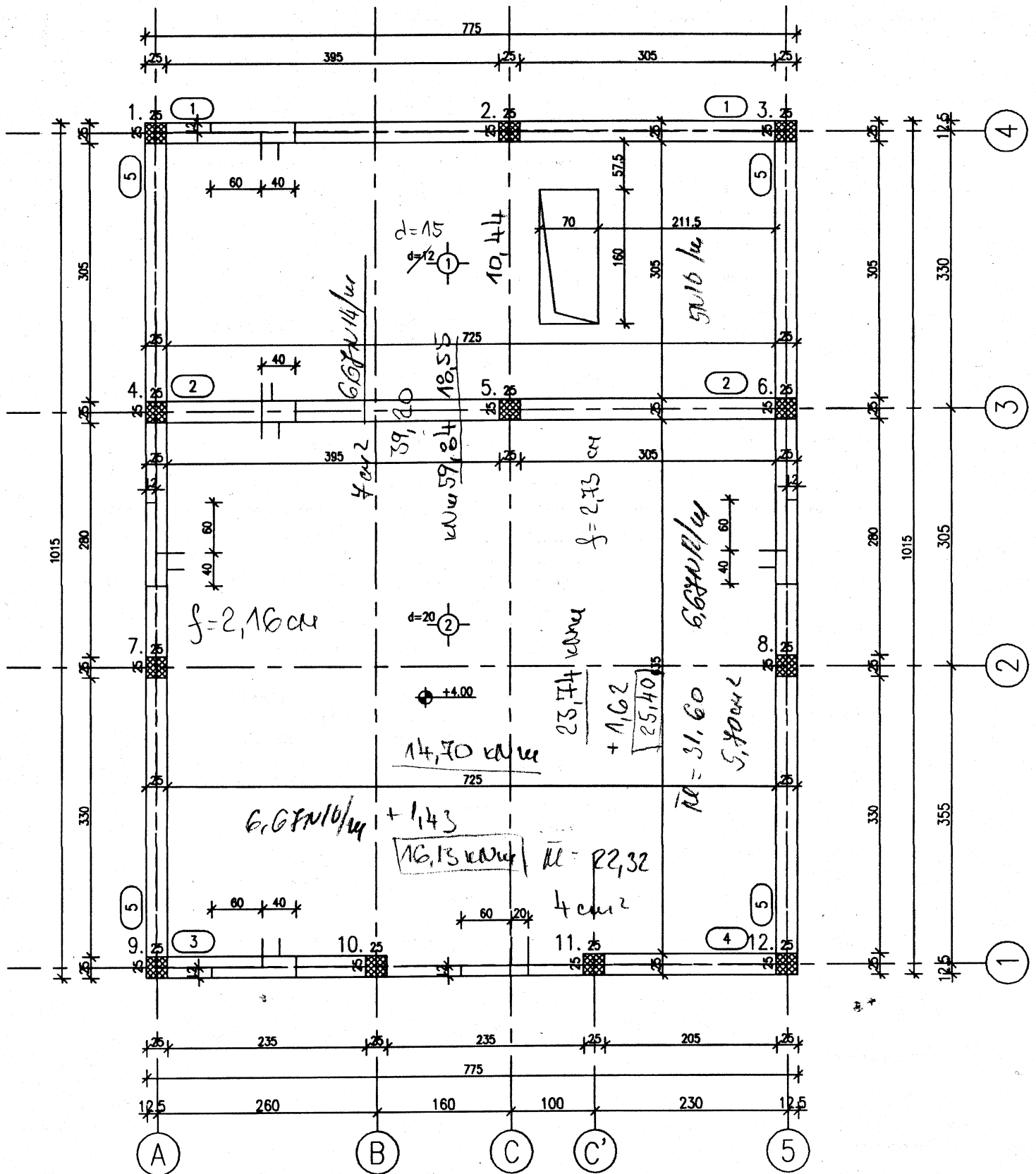
$$V = 3,00 \times 1,3 = 3,9 \text{ кN/m}^2$$

Снег:

$$S = 1,54 \times 1,40 = 2,16 \text{ кN/m}^2$$

$$\underline{q_0 = 13,63 \text{ кN/m}^2}$$

13,63



ГРЕДН

Нагроварване:

25/40

с.т. с.т.с. гредз: $0,25 \times 0,40 \times 25 \times 1,2 = 3,00 \text{ kcal/m}^2$

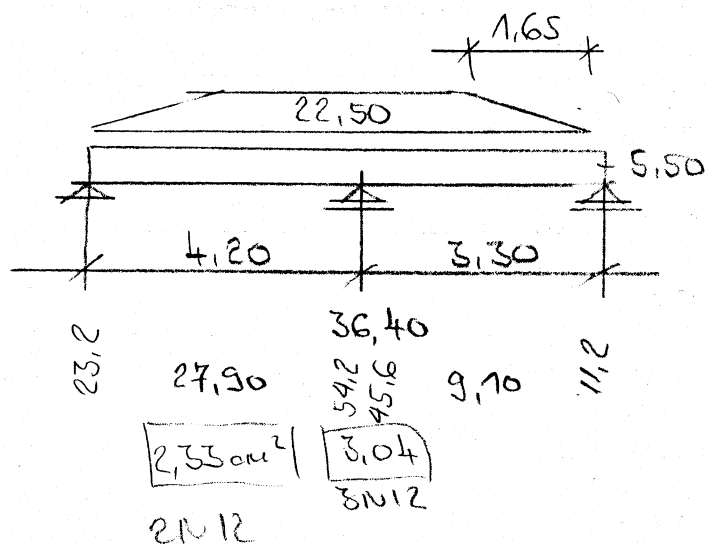
мазаника: $2 \times (0,02 \times 0,30 \times 18 \times 1,35) = 0,29 \text{ kcal/m}^2$

$$\Sigma q = 3,30 \text{ kcal/m}^2$$

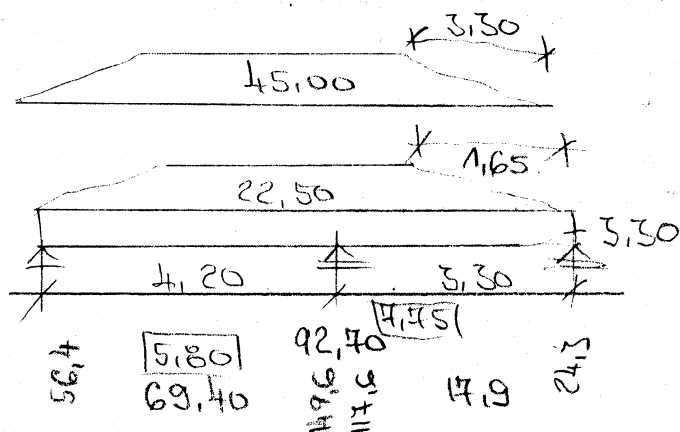
бофз: $0,12 \times 0,60 \times 25 \times 1,2 = 2,16 \text{ kcal/m}^2$

пyxлeн зuд: $0,25 \times 3,60 \times 18 \times 1,2 = 19,44 \text{ kcal/m}^2$

ГРЕД 1.

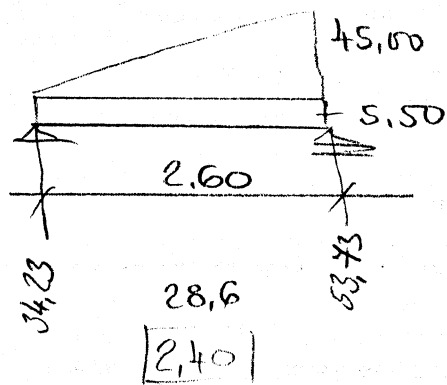


ГРЕД 2

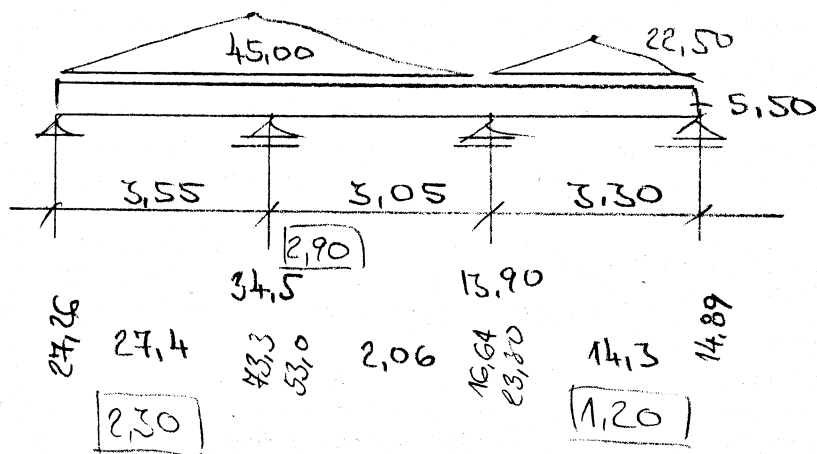


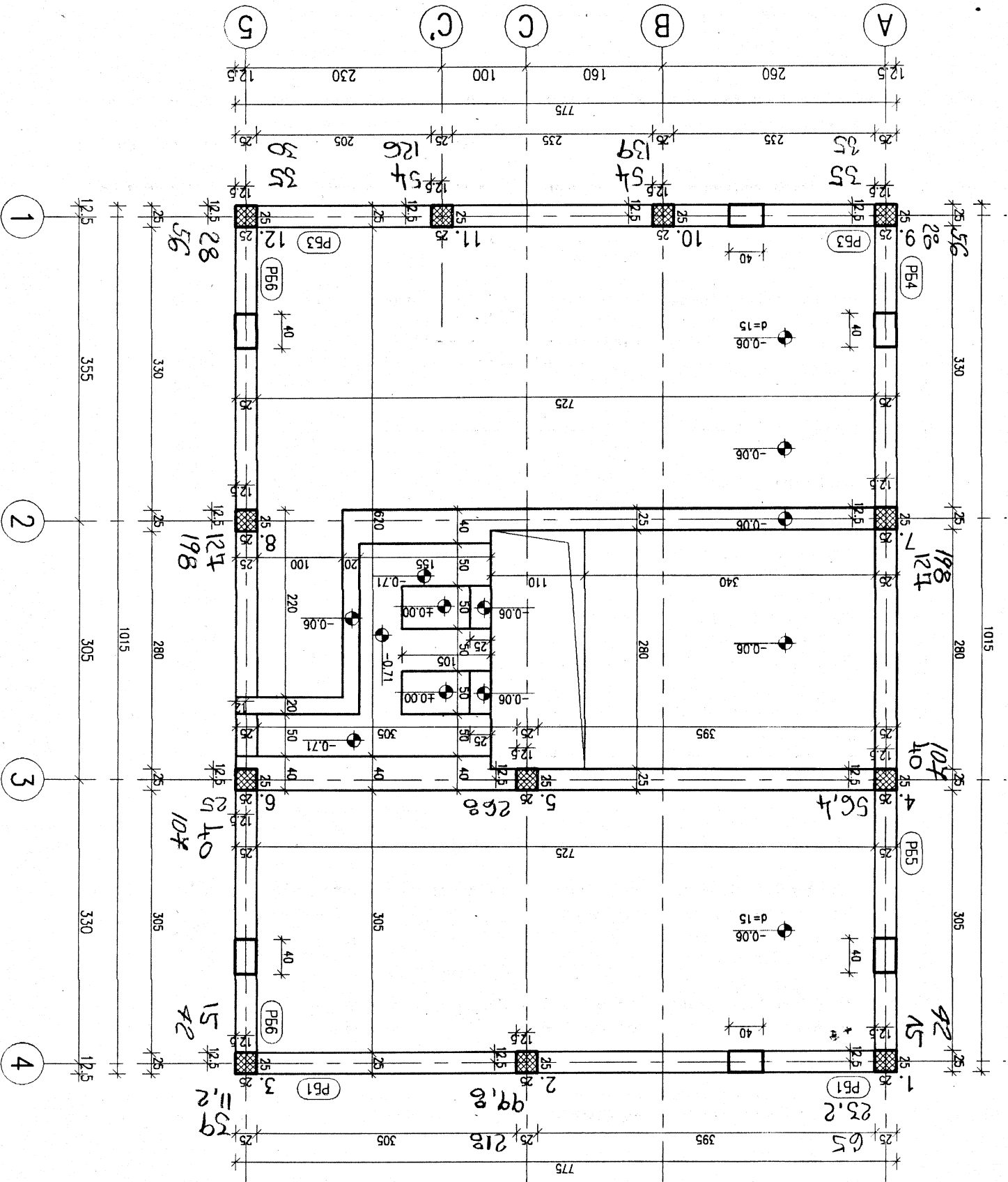
с.т.р. $\Phi 8/20/10$

Пр. 3; 4

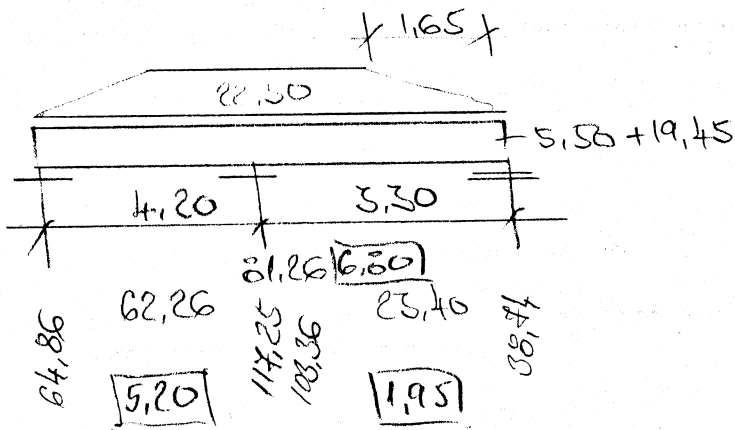


Прекз 5.

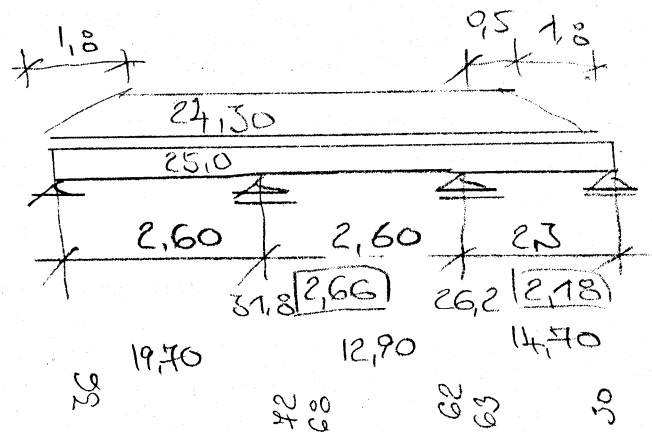




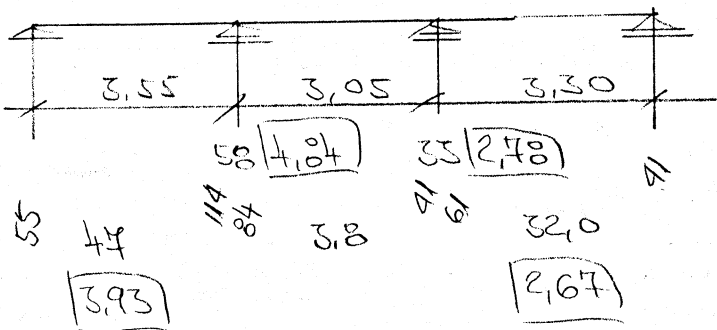
P51:



P53



P56



$$W = 32,5 \text{ t} \rightarrow a \geq 1,63 \text{ m} \Rightarrow a = 1,65 \text{ m}$$

$$n = 41,5 \text{ t/m} / \text{m}^1 \rightarrow \text{SN } 10 / \text{m}$$

Земетръс съгласно НАРЕДБА № РД-02-20-2 от 27 януари 2012 г. за проектиране на сгради и съоръжения в земетръсни райони

За района – $K_c=0,10$

Area: 78.6625

Perimeter: 35.8000

Bounding box: X: 31117.0318 -- 31124.7818

Y: 12444.9402 -- 12455.0902

Centroid: X: 31120.9068

Y: 12450.0152

Moments of inertia: X: 12192914533.4068

Y: 76185484432.8443

Product of inertia: XY: 30478238861.9257

Radii of gyration: X: 12450.0155

Y: 31120.9069

Principal moments and X-Y directions about centroid:

I: 675.3340 along [1.0000 0.0000]

J: 393.7222 along [0.0000 1.0000]

Centroid: X: 3.875

Y: 5.075

$I+J=1070 \text{ tm}^2$

$k_c \times g \times r \times c = 0.10 \times 9.81 \times 0.3 \times 1.2 = 0.35316$

CONSTRAINT COORDINATES AND MASSES

CONS 1 ===== TYPE = DIAPH, NORMAL DIRECTION = U3

LOCAL COORDINATE SYSTEM FOR CONSTRAINT MASTER						
GLOBAL	U1	U2	U3	R1	R2	R3
X	1.000000	.000000	.000000	1.000000	.000000	.000000
Y	.000000	1.000000	.000000	.000000	1.000000	.000000
Z	.000000	.000000	1.000000	.000000	.000000	1.000000

TRANSLATIONAL MASS AND MASS MOMENTS OF INERTIA					
U1	U2	U3	R1	R2	R3
95.000000	95.000000	.000000	.000000	.000000	1285.000

CENTER OF MASS			
GLOBAL	U1	U2	U3
X	3.875000	3.875000	3.853571
Y	5.075000	5.075000	4.767857
Z	3.300000	3.300000	3.300000

DISPLACEMENT DEGREES OF FREEDOM

(A) = Active DOF, equilibrium equation
 (-) = Restrained DOF, reaction computed
 (+) = Constrained DOF
 (>) = External substructure DOF
 () = Null DOF

JOINTS		UX	UY	UZ	RX	RY	RZ
1		+	+				+
2		+	+	-			+
3 TO	14	+	+	A	A	A	+
15 TO	26	-	-	-	-	-	-

CONSTRAINTS	U1	U2	U3	R1	R2	R3
1	A	A				A

ASSEMBLED JOINT MASSES

IN GLOBAL COORDINATES

JOINT	UX	UY	UZ	RX	RY	RZ
1	95.000000	95.000000	.000000	.000000	.000000	1285.000

TOTAL ASSEMBLED JOINT MASSES

IN GLOBAL COORDINATES

	UX	UY	UZ	RX	RY	RZ
TOTAL	95.000000	95.000000	.000000	.000000	.000000	1285.000

TOTAL ACCELERATED MASS AND LOCATION

TOTAL MASS ACTIVATED BY ACCELERATION LOADS, IN GLOBAL COORDINATES

	UX	UY	UZ
MASS	95.000000	95.000000	.000000
X-LOC	3.875000	3.875000	.000000
Y-LOC	5.075000	5.075000	.000000
Z-LOC	3.300000	3.300000	.000000

MODAL PERIODS AND FREQUENCIES

MODE	PERIOD (TIME)	FREQUENCY (CYC/TIME)	FREQUENCY (RAD/TIME)	EIGENVALUE (RAD/TIME)**2
1	0.358761	2.787370	17.513562	306.724871
2	0.343808	2.908604	18.275296	333.986462

3 0.240657 4.155288 26.108443 681.650813

MODAL PARTICIPATION FACTORS

FOR UNIT ACCELERATION LOADS IN GLOBAL COORDINATES

MODE	PERIOD	UX	UY	UZ
1	0.358761	-0.153216	9.744513	.000000
2	0.343808	-9.706036	-0.165617	.000000
3	0.240657	0.877152	-0.130509	.000000

MODAL PARTICIPATING MASS RATIOS

MODE	PERIOD	INDIVIDUAL MODE (PERCENT)			CUMULATIVE SUM (PERCENT)		
		UX	UY	UZ	UX	UY	UZ
1	0.358761	0.0247	99.9532	0.0000	0.0247	99.9532	0.0000
2	0.343808	99.1654	0.0289	0.0000	99.1901	99.9821	0.0000
3	0.240657	0.8099	0.0179	0.0000	100.0000	100.0000	0.0000

MODAL LOAD PARTICIPATION RATIOS

LOAD, ACC, OR LINK/DEF (TYPE)		STATIC (NAME)		STATIC (PERCENT)	DYNAMIC (PERCENT)	EFFECTIVE PERIOD
LOAD	LG1			0.2592 ->	0.0000<- (*) SEE NOTE	0.017425
LOAD	TRIBUTAR			0.2605 ->	0.0000<- (*) SEE NOTE	0.017485
LOAD	SPEC2			0.0000	0.0000	-INFINITY-
ACC	UX			100.0000	100.0000	0.343462
ACC	UY			100.0000	100.0000	0.358749
ACC	UZ			0.0000	0.0000	-INFINITY-
ACC	RX			100.0000	100.0000	0.358749
ACC	RY			100.0000	100.0000	0.343462
ACC	RZ			87.3363	100.0000	0.876273

(*) NOTE: DYNAMIC LOAD PARTICIPATION RATIO EXCLUDES LOAD APPLIED TO NON-MASS DEGREES OF FREEDOM

GLOBAL FORCE BALANCE

TOTAL FORCE AND MOMENT AT THE ORIGIN, IN GLOBAL COORDINATES

LOADLG1	-----						
	FX	FY	FZ	MX	MY	MZ	
APPLIED	.000000	.000000	-1255.650	-6256.305	4708.688	.000000	
INERTIA	.000000	.000000	.000000	.000000	.000000	.000000	
REACTNS	-6.18E-13	1.07E-12	1255.650	6256.305	-4708.688	3.89E-12	
CONSTRS	4.89E-13	-8.73E-13	.000000	2.88E-12	1.61E-12	1.04E-11	
TOTAL	-1.29E-13	1.99E-13	-2.27E-13	-1.67E-12	7.03E-13	1.43E-11	

LOADTRIBUTAR	-----						
	FX	FY	FZ	MX	MY	MZ	
APPLIED	.000000	.000000	-74.250000	-367.537500	278.437500	.000000	
INERTIA	.000000	.000000	.000000	.000000	.000000	.000000	
REACTNS	-3.74E-14	6.43E-14	74.250000	367.537500	-278.437500	2.57E-13	
CONSTRS	2.85E-14	-5.98E-14	.000000	1.97E-13	9.38E-14	-9.46E-13	
TOTAL	-8.89E-15	4.47E-15	-1.42E-14	-1.44E-13	-1.99E-14	-6.89E-13	

GLOBAL FORCE BALANCE

TOTAL FORCE AND MOMENT AT THE ORIGIN, IN GLOBAL COORDINATES

LOADSPEC2	-----						
	FX	FY	FZ	MX	MY	MZ	
APPLIED	.000000	.000000	.000000	.000000	.000000	.000000	
INERTIA	.000000	.000000	.000000	.000000	.000000	.000000	
REACTNS	.000000	.000000	.000000	.000000	.000000	.000000	
CONSTRS	.000000	.000000	.000000	.000000	.000000	.000000	
TOTAL	.000000	.000000	.000000	.000000	.000000	.000000	

MODE 1 -----

	FX	FY	FZ	MX	MY	MZ
APPLIED	.000000	.000000	.000000	.000000	.000000	.000000
INERTIA	-46.995063	2988.885	.000000	-9863.319	-155.083709	11983.850
REACTNS	46.995063	-2988.885	-8.53E-14	9863.319	155.083709	-11983.850
CONSTRS	4.69E-12	-8.17E-11	.000000	2.68E-10	1.55E-11	5.37E-09
TOTAL	3.35E-11	7.75E-11	-8.53E-14	-2.58E-10	1.10E-10	-1.63E-09

MODE 2 -----

	FX	FY	FZ	MX	MY	MZ
APPLIED	.000000	.000000	.000000	.000000	.000000	.000000
INERTIA	-3241.685	-55.313985	.000000	182.536149	-10697.559	17311.876
REACTNS	3241.685	55.313985	.000000	-182.536149	10697.559	-17311.876
CONSTRS	-1.06E-10	2.11E-10	.000000	-6.97E-10	-3.51E-10	-1.41E-09
TOTAL	8.10E-11	1.19E-11	.000000	-3.88E-11	2.67E-10	-5.93E-09

MODE 3 -----

	FX	FY	FZ	MX	MY	MZ
APPLIED	.000000	.000000	.000000	.000000	.000000	.000000
INERTIA	597.911311	-88.961786	.000000	293.573893	1973.107	20954.590
REACTNS	-597.911311	88.961786	-1.14E-13	-293.573893	-1973.107	-20954.590
CONSTRS	-1.12E-09	2.06E-09	.000000	-6.81E-09	-3.70E-09	-1.17E-09
TOTAL	-9.98E-11	1.75E-11	-1.14E-13	-5.84E-11	-3.30E-10	-4.33E-09

GLOBAL FORCE BALANCE

TOTAL FORCE AND MOMENT AT THE ORIGIN, IN GLOBAL COORDINATES

SPECSPEC2 -----

	FX	FY	FZ	MX	MY	MZ
APPLIED	.000000	.000000	.000000	.000000	.000000	.000000
INERTIA	83.210286	83.868182	.000000	276.765000	274.593945	557.700009
REACTNS	83.210286	83.868182	2.40E-15	276.765000	274.593945	557.700009
CONSTRS	3.02E-12	6.34E-12	.000000	2.09E-11	9.98E-12	1.55E-10
TOTAL	2.28E-12	2.20E-12	2.40E-15	7.31E-12	7.53E-12	1.59E-10

Story	Diaphragm	Load	UX	UY	UZ	RX	RY	RZ	Point	X	Y	Z
STORY1 D1	SPEC2	0.0026	0.0029	0.0000	0.00000	0.00000	0.00007	166	3.875	5.075	3.300	
STORY1 D1	COMB1	0.0002	0.0001	0.0000	0.00000	0.00000	-0.00001	166	3.875	5.075	3.300	
STORY1 D1	COMB2 MAX		0.0028	0.0030	0.0000	0.00000	0.00000	0.00006	166	3.875	5.075	
	3.300											
STORY1 D1	COMB2 MIN		-0.0024	-0.0028	0.0000	0.00000	0.00000	-0.00008	166	3.875	5.075	
	3.300											

Носимоспособност на правоъгълно стоманобетонено сечение - нецентричен натиск/опън

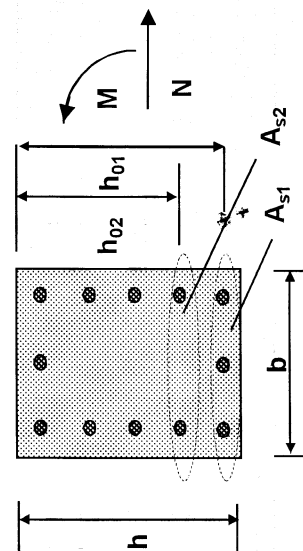
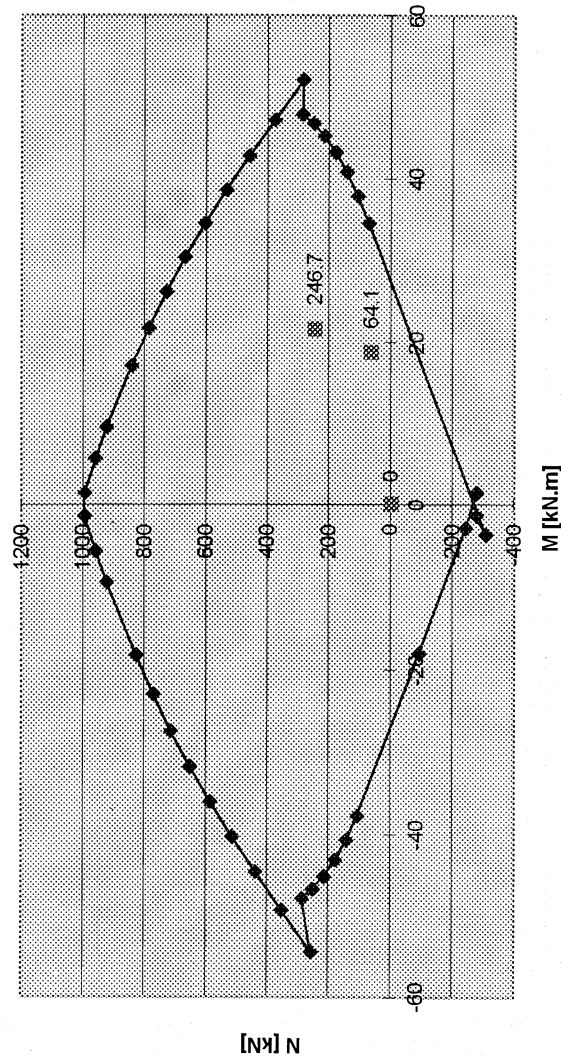
b=	25 [cm]	As1=	3.08 [cm ²]	h01=	21.5 [cm]	2	14	3.08
h=	25 [cm]	As2=	0 [cm ²]	h02=	0 [cm]	4	14	6.15
Rs=	45 kN/cm ²	As3=	0 [cm ²]	h03=	0 [cm]	8	16	16.08
Rb=	1.15 kN/cm ²	As4=	0 [cm ²]	h04=	0 [cm]	8	20	25.12
Es=	20000 kN/cm ²	As5=	3.08 [cm ²]	h05=	2.5 [cm]	8	25	39.25
Eb=	3000 kN/cm ²							

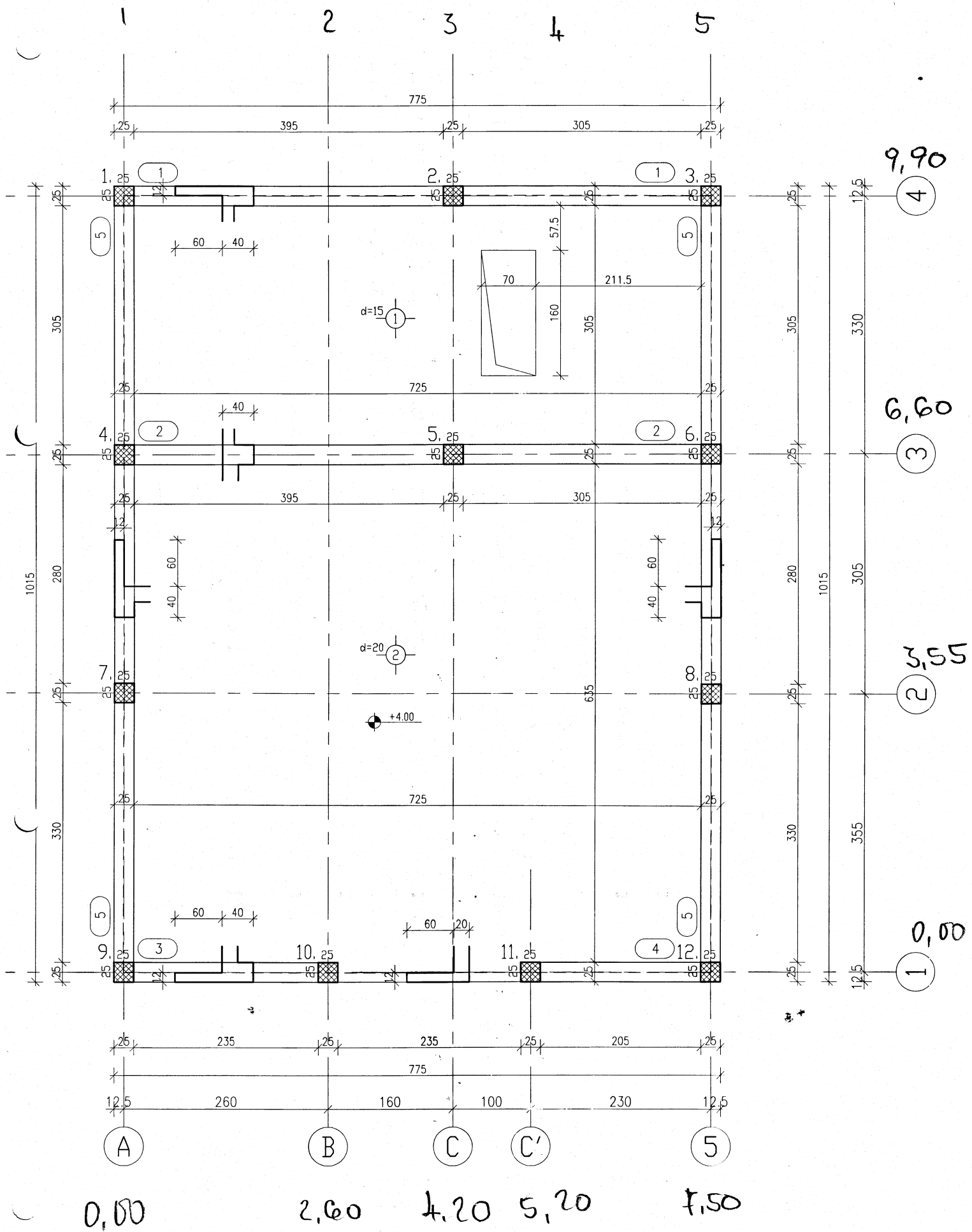
gamma_b=0.85 (Yes-1, No-0)= 1 mu = 0.009856 (0.01<?<0.04)

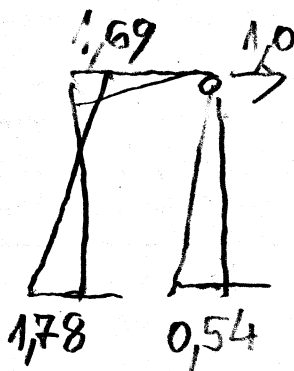
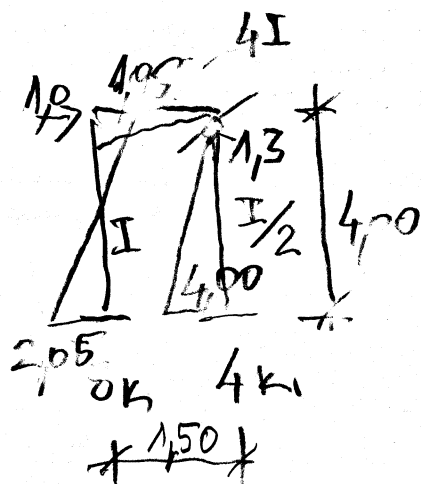
L=	4 [m]	k=	1	L0=	4 [m]	w=	0.758	ksiR=	0.47734
----	-------	----	---	-----	-------	----	-------	-------	---------

	M kNm	Mg kNm	N kN	Ng kN
1	0	0	0	0
2	17.73	0	64.1	0
3	18.77	0	246.7	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0
10	0	0	0	0

N-M envelope Line







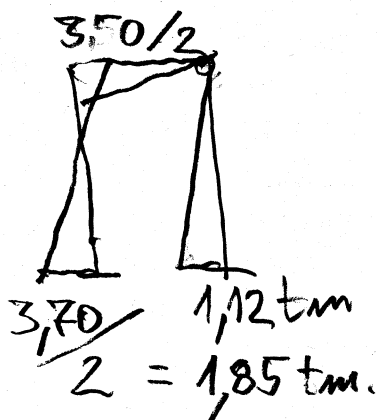
$$EIS = 2,08$$

$$\frac{2K + 1}{Q} = \frac{96}{24} = 24$$

$$T = 2n \sqrt{\frac{1}{g}} = 2 \cdot 1 \sqrt{\frac{1}{208 \cdot 24}} = 0,55; \phi = 24$$

$$E = 1,2 \cdot 0,32 \cdot 0,10 \cdot 24 \cdot 17 \cdot 240 = 2074 \text{ t}$$

$$\delta = \frac{2074 \cdot 2,08}{\frac{0,25^4}{12} \cdot 3 \cdot 10^6} = 0,0045 \text{ m} = 0,45 \text{ cm} \approx \frac{1}{905}$$

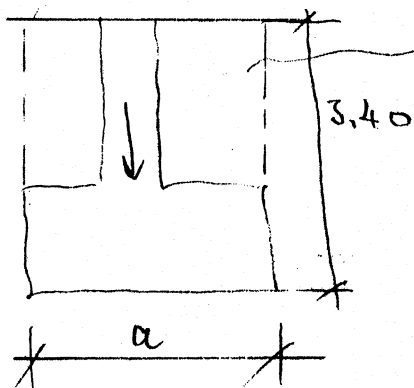


исчисление на ед. φ при:

$$\frac{\Delta h}{d} = \tan(\varphi - \Delta \varphi) \Rightarrow \frac{\Delta h}{2,50} = \tan 17,2^\circ \Rightarrow 0,80 = \Delta h$$

$$K_\phi = -3,40$$

$$\gamma = 20 \text{ кВ/м}^3; R_0 = 0,020 \text{ кВ/см}^3$$



$$P = a^2 \times 3,40 \times 20 = a^2 \times 68$$

$$V = 20,0 - 7,80 = 12,2 \text{ т/м}^2$$

$$N = 200 \text{ кВ} = 20 \text{ т}; a^2 \geq \frac{20}{12,2}; a \geq 1,28$$

$$\rightarrow K = 2,6 \text{ кВ/м}^3 \rightarrow N 10/20$$