

STATIČKI PRORAČUN
UZ PROJEKAT PRIZEMNE POMOĆNE STAMBENE ZGRADE I
KULE SA VIDIKOVCEM
PROFESORA MILUTINOVIĆ VELJKA, U PIPERIMA

OVLAŠĆENI PROJEKTANT

Osnovni podaci o modelu

Datoteka: KCS pip mala 1.2.twp
Datum proračuna: 28.12.2010

Način proračuna: 3D model

- ☒ Teorija I-og reda ☒ Modalna analiza ☐ Stabilnost
☐ Teorija II-og reda ☒ Seizmički proračun ☐ Faze građenja
☐ Nelinearan proračun

Veličina modela

Broj čvorova: 1503
Broj pločastih elemenata: 1278
Broj grednih elemenata: 332
Broj graničnih elemenata: 2424
Broj osnovnih slučajeva opterećenja: 5
Broj kombinacija opterećenja: 2

Jedinice mera

Dužina: m [cm,mm]
Sila: kN
Temperatura: Celsius

Ulazni podaci - Konstrukcija

Šema nivoa

Naziv	z [m]	h [m]
Krov kule	8.65	2.75
Vidikovac	5.90	2.75
Krov kuće	3.15	1.35
St greda	1.80	1.80
Prizemlje	0.00	0.80
Temelji	-0.80	

Tabela materijala

No	Naziv materijala	E[kN/m2]	μ	γ[kN/m3]	αt[1/C]	Em[kN/m2]	μm
1	Beton MB 30	3.150e+7	0.20	25.00	1.000e-5	3.150e+7	0.20
2	Opeka	5.800e+6	0.20	16.50	1.000e-5	3.150e+7	0.20

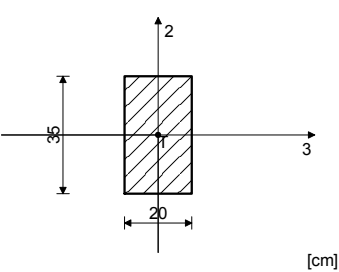
Setovi ploča

No	d[m]	e[m]	Materijal	Tip proračuna	Ortotropija	E2[kN/m2]	G[kN/m2]	α
<1>	0.120	0.060	1	Tanka ploča	Izotropna			
<2>	0.200	0.100	2	Tanka ploča	Izotropna			
<3>	0.350	0.175	1	Tanka ploča	Izotropna			

Setovi greda

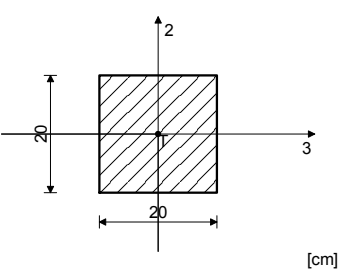
Set: 1 Presek: b/d=20/35, Fiktivna ekscentričnost

Mat.	A1	A2	A3	I1	I2	I3
1 - Beton MB 30	7.000e-2	5.833e-2	5.833e-2	6.003e-4	2.333e-4	7.146e-4



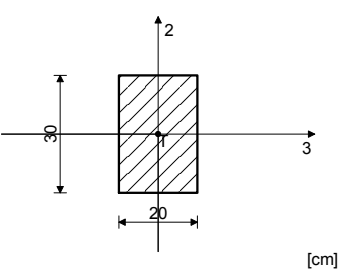
Set: 3 Presek: b/d=20/20, Fiktivna ekscentričnost

Mat.	A1	A2	A3	I1	I2	I3
1 - Beton MB 30	4.000e-2	3.333e-2	3.333e-2	2.253e-4	1.333e-4	1.333e-4

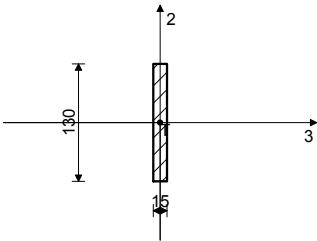


Set: 4 Presek: b/d=20/30, Fiktivna ekscentričnost

Mat.	A1	A2	A3	I1	I2	I3
1 - Beton MB 30	6.000e-2	5.000e-2	5.000e-2	4.695e-4	2.000e-4	4.500e-4



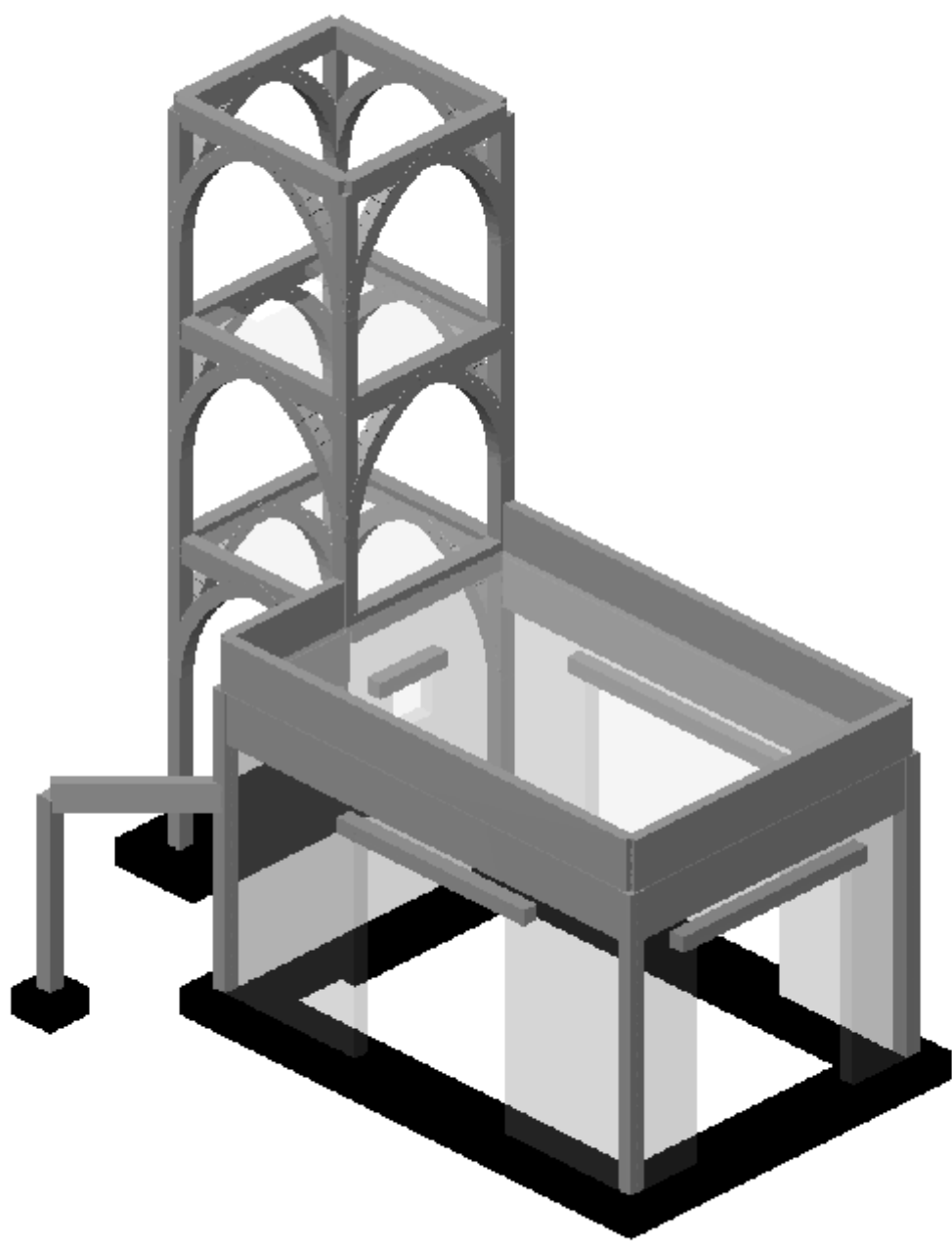
Set: 5 Presek: b/d=15/130, Fiktivna ekscentričnost						
Mat.	A1	A2	A3	I1	I2	I3
1 - Beton MB 30	1.950e-1	1.625e-1	1.625e-1	1.356e-3	3.656e-4	2.746e-2



[cm]

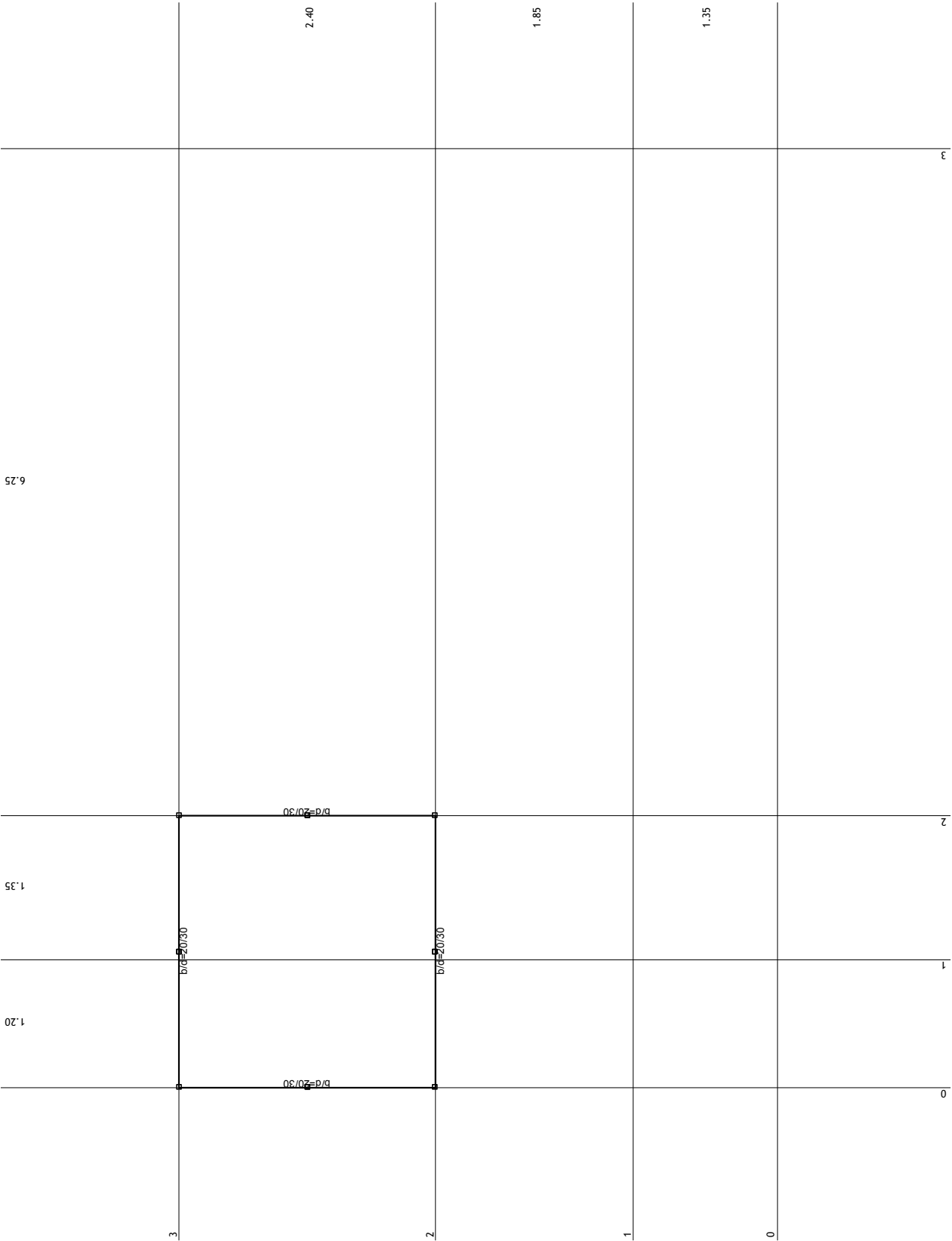
Setovi površinskih oslonaca

Set	K,R1	K,R2	K,R3
1	4.500e+3	4.500e+3	4.500e+3



Izometrija (Top)

Nivo: Krov kule [8.65 m]



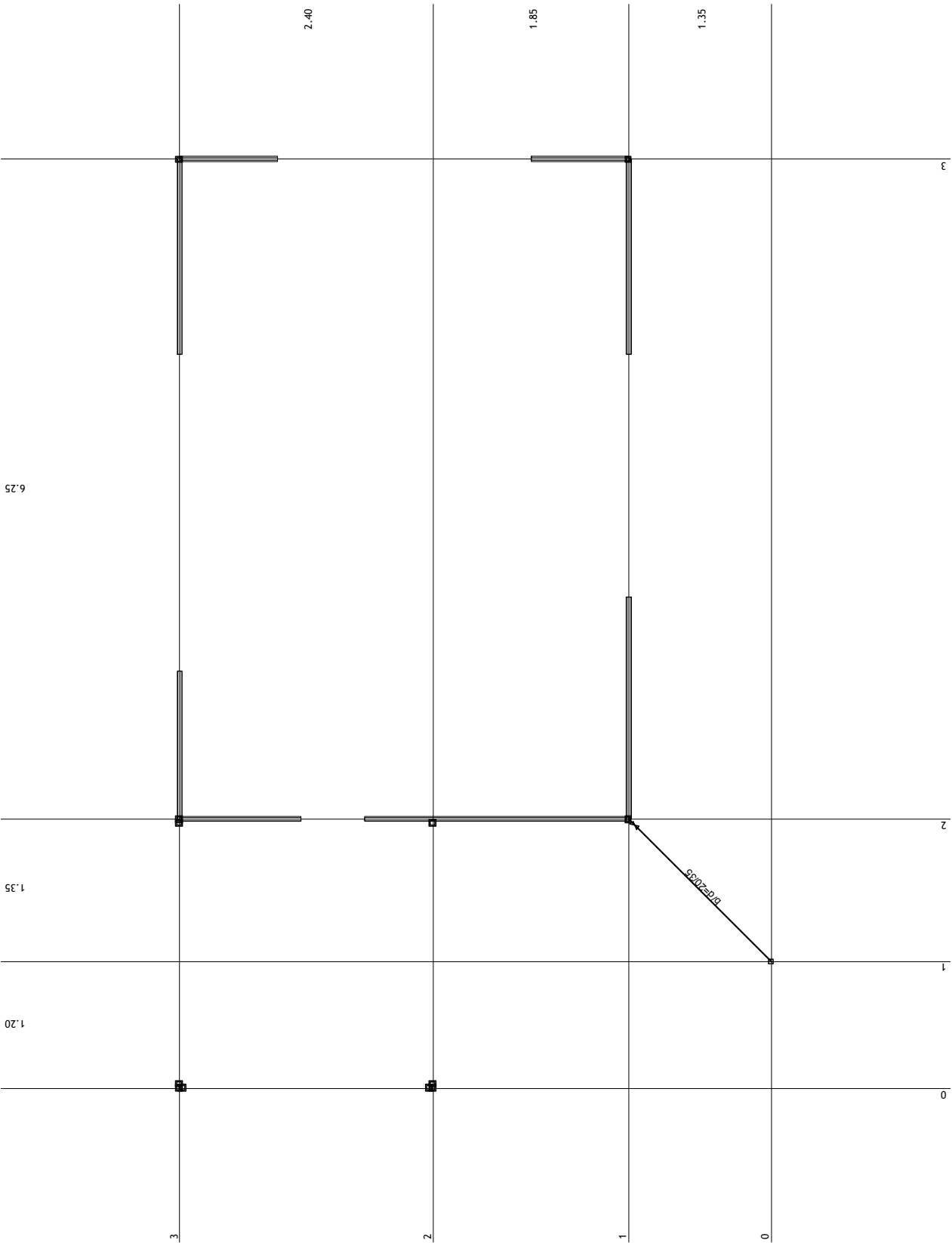
Nivo: Vidikovac [5.90 m]



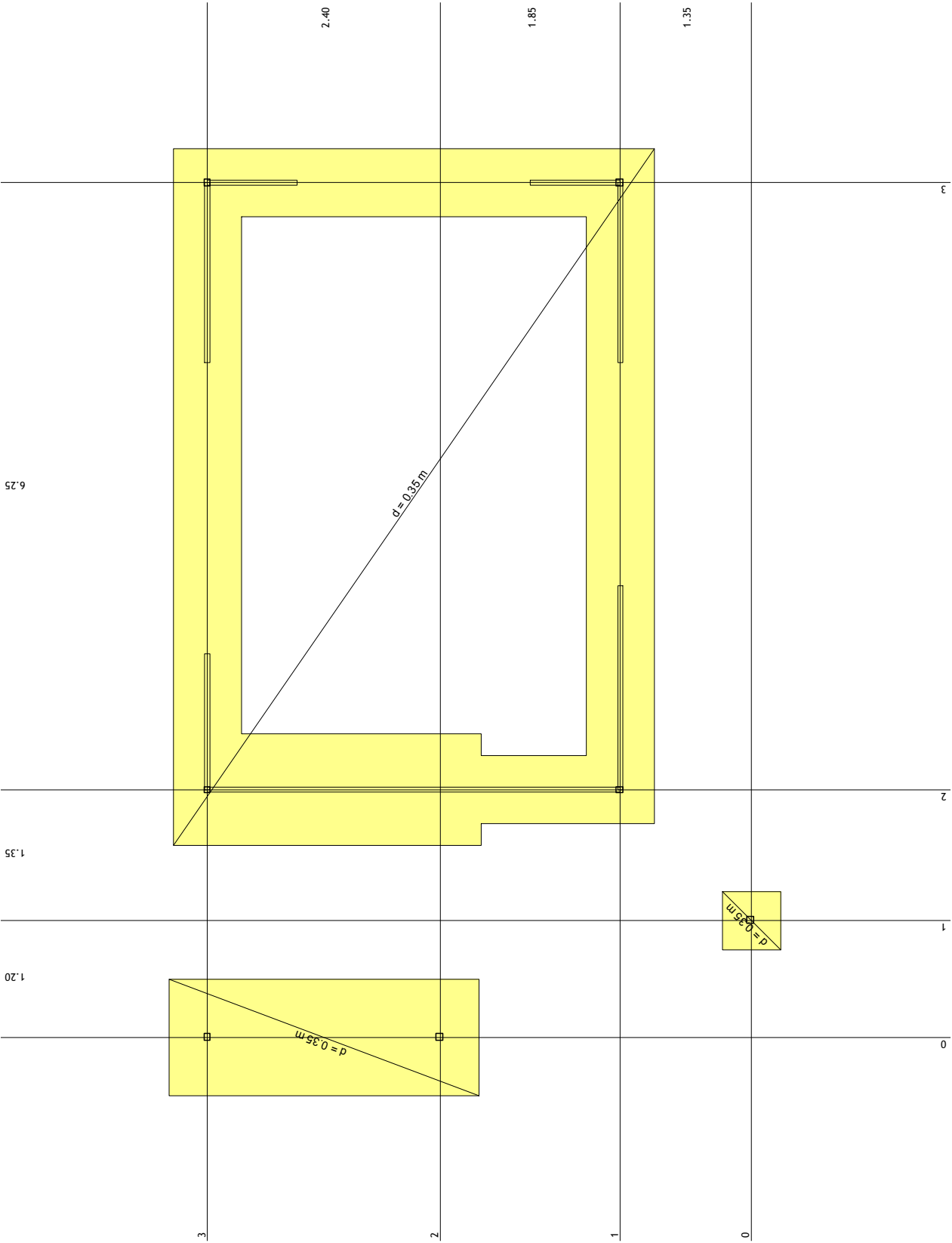
Nivo: Krov kuće [3.15 m]



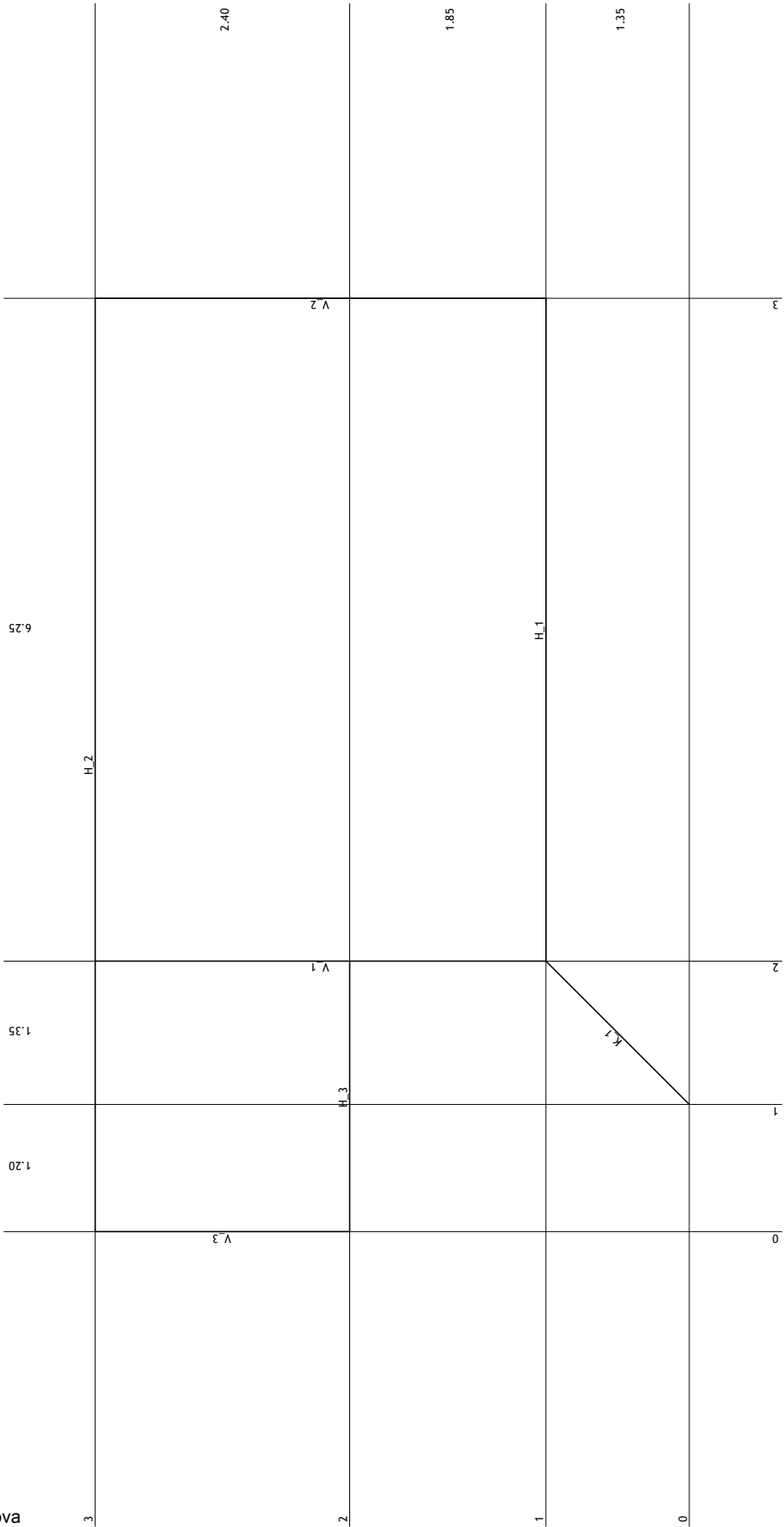
Nivo: St greda [1.80 m]

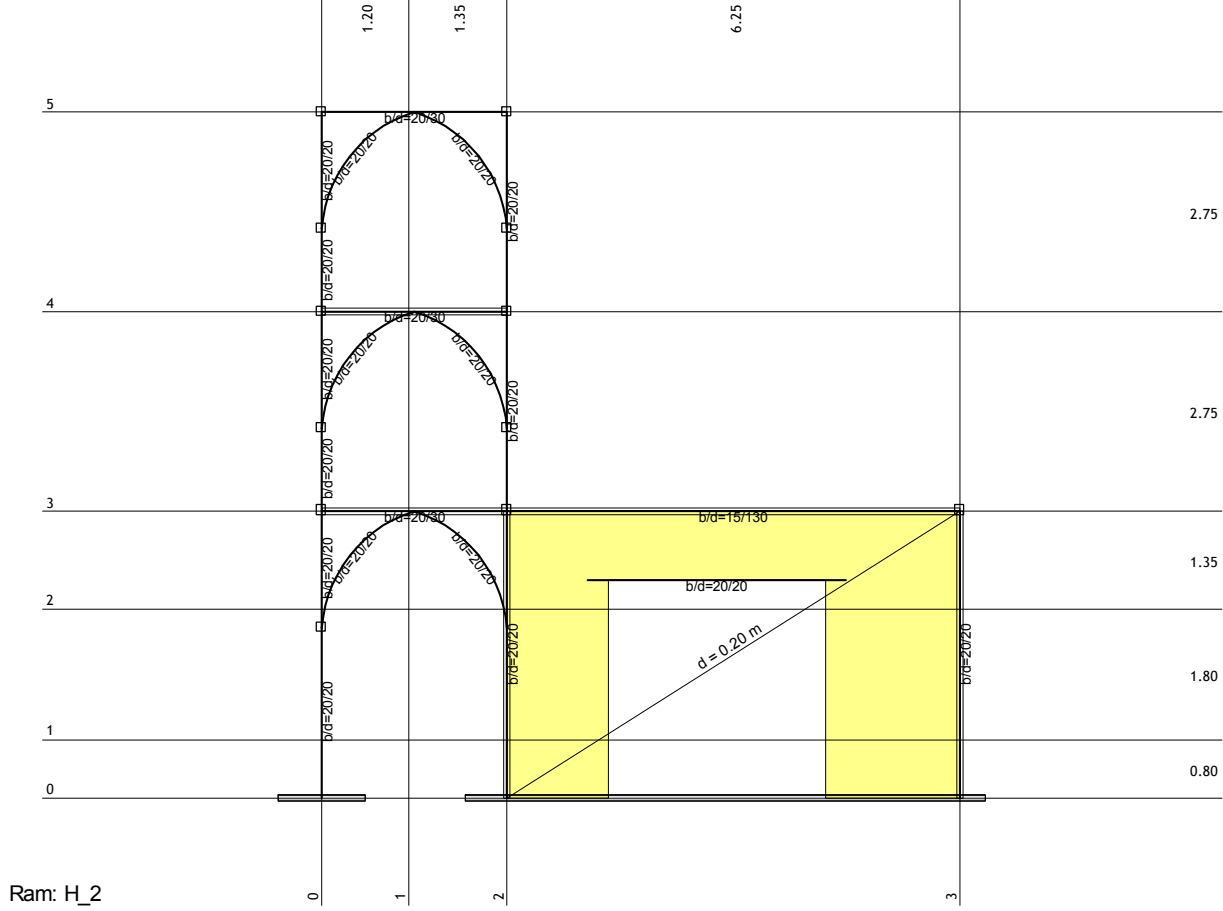
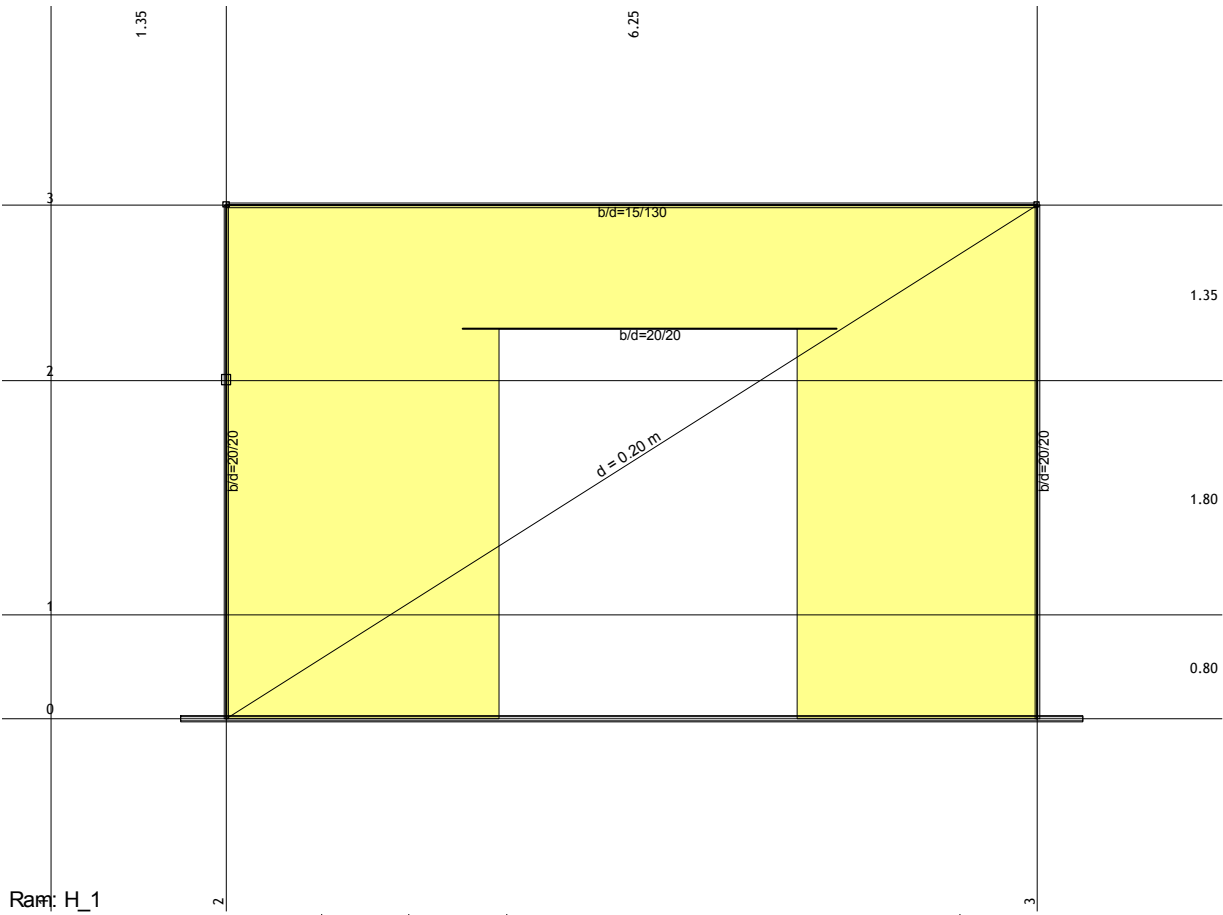


Nivo: Temelji [-0.80 m]

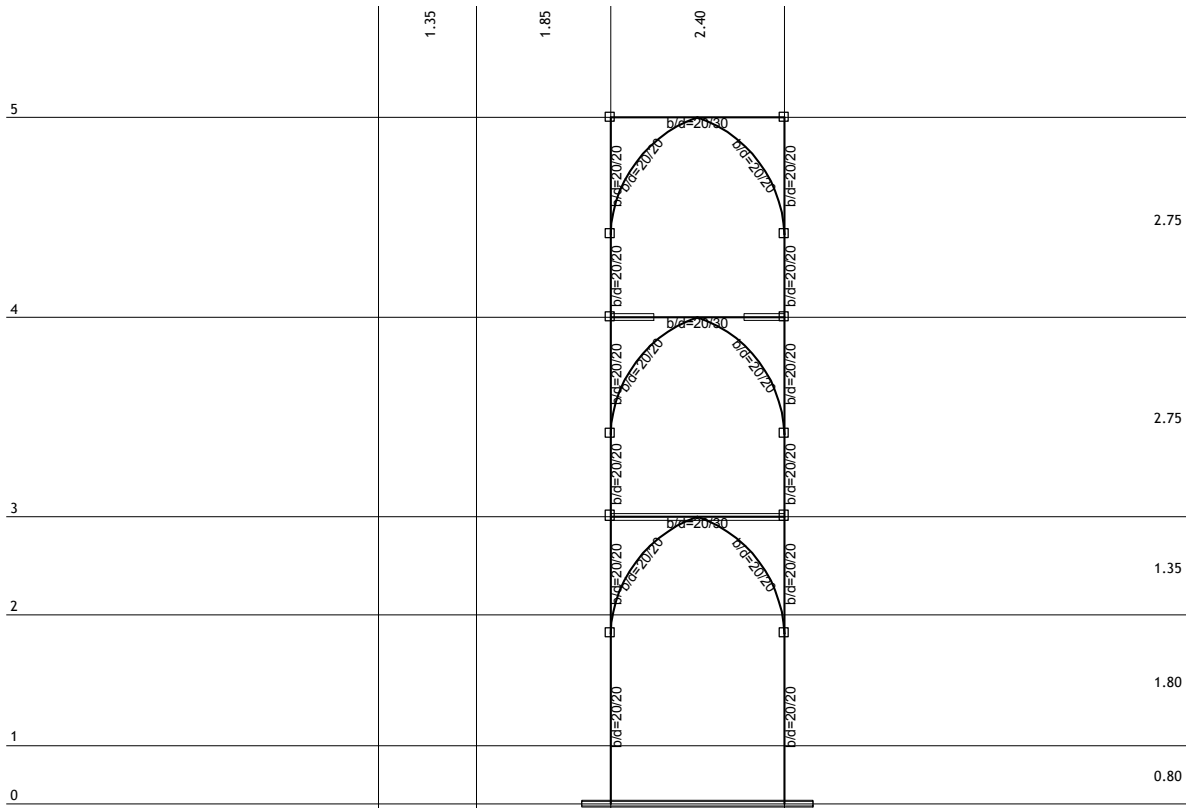


Dispozicija ramova

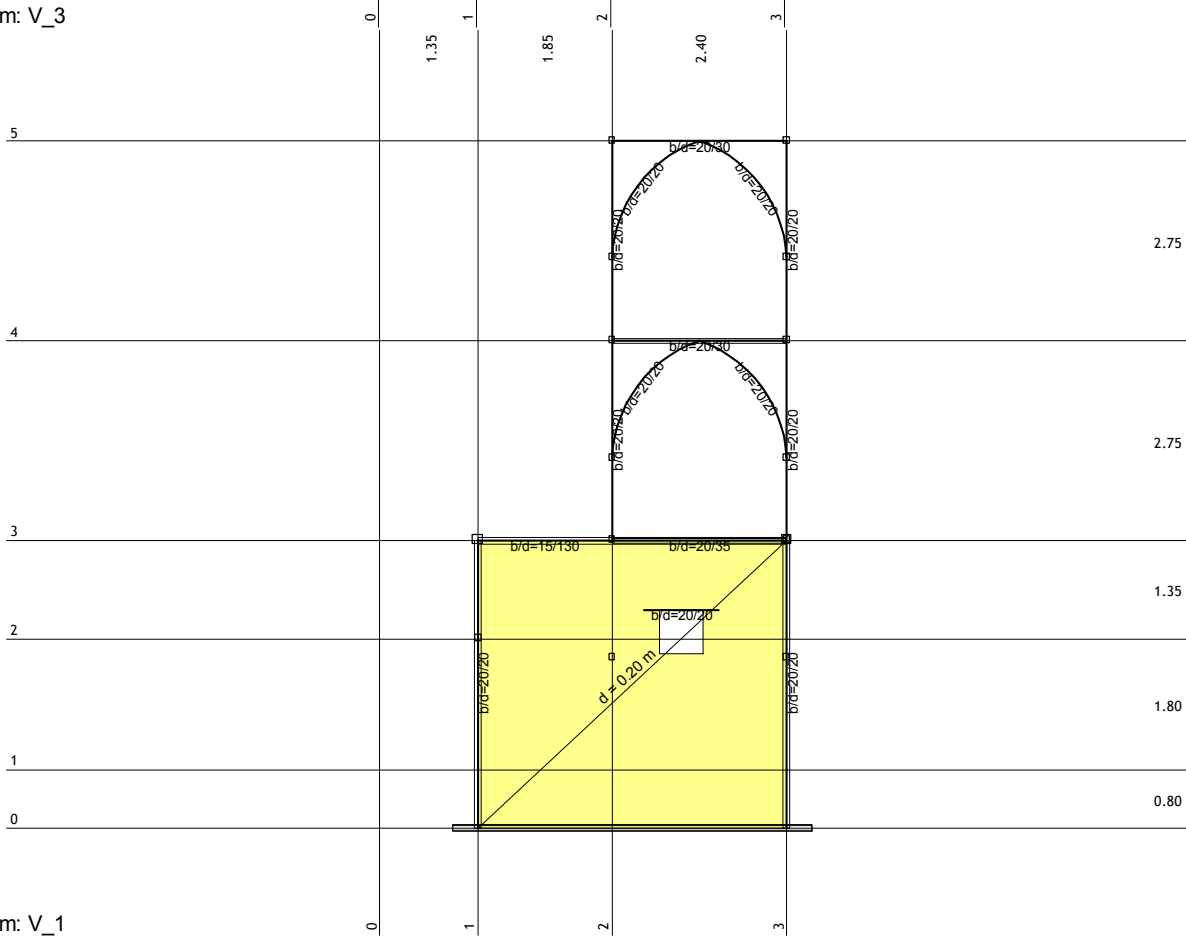


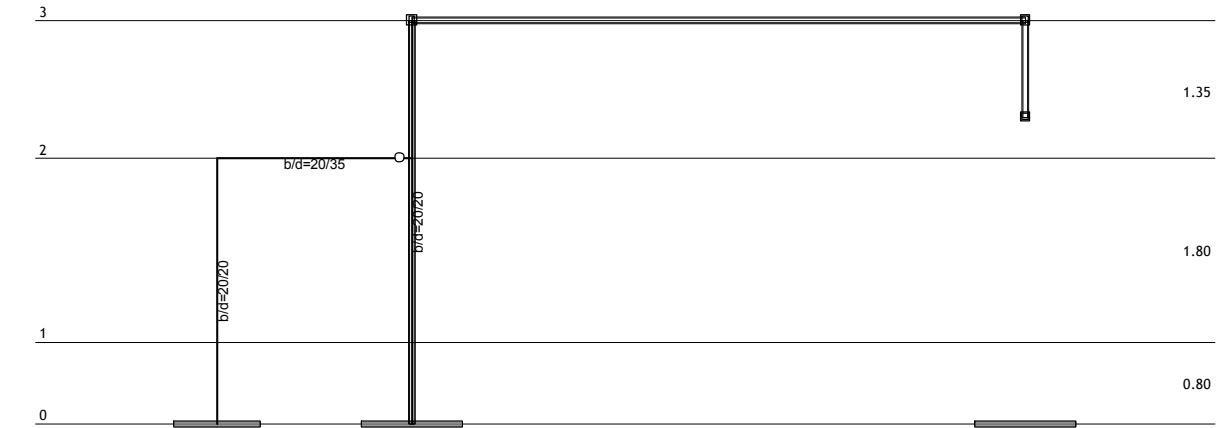
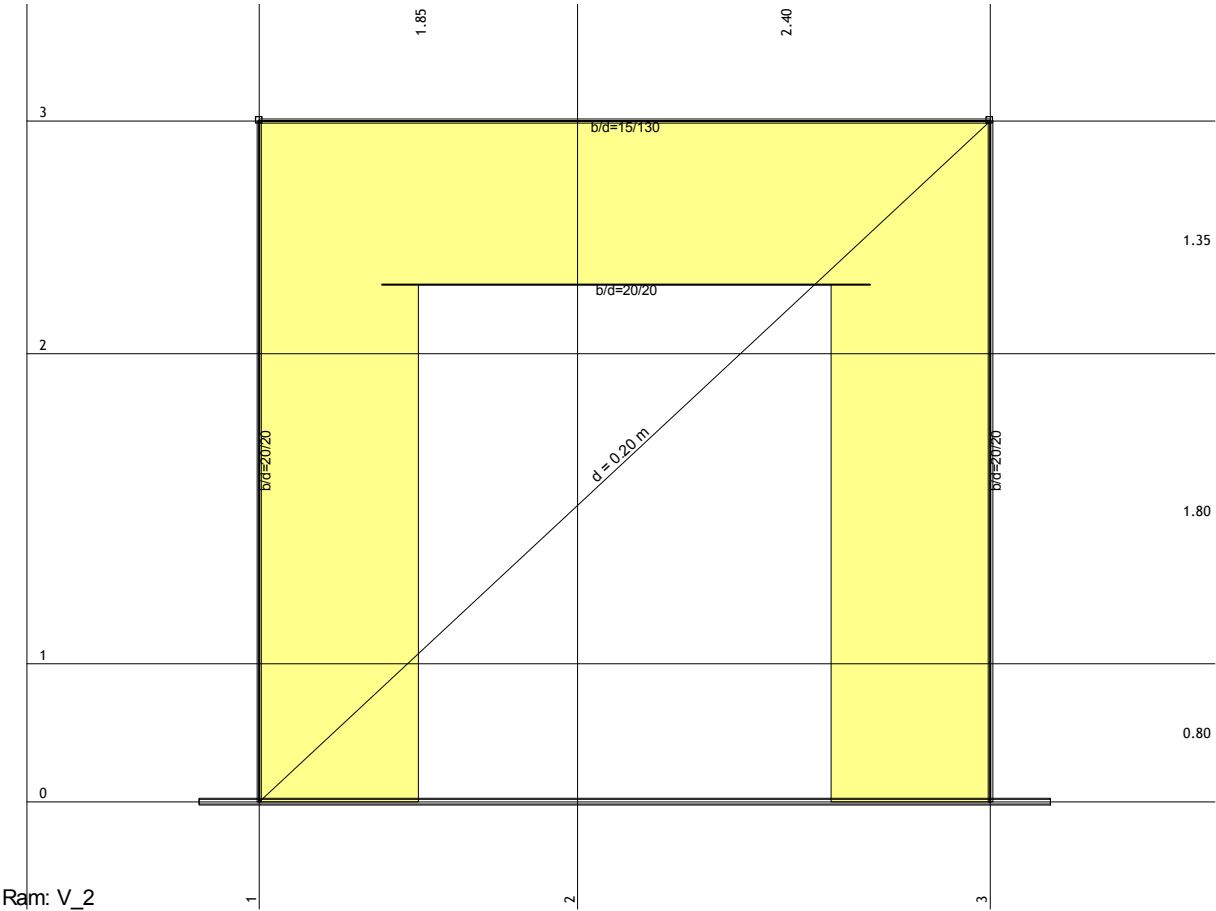


Ram: V_3



Ram: V_1

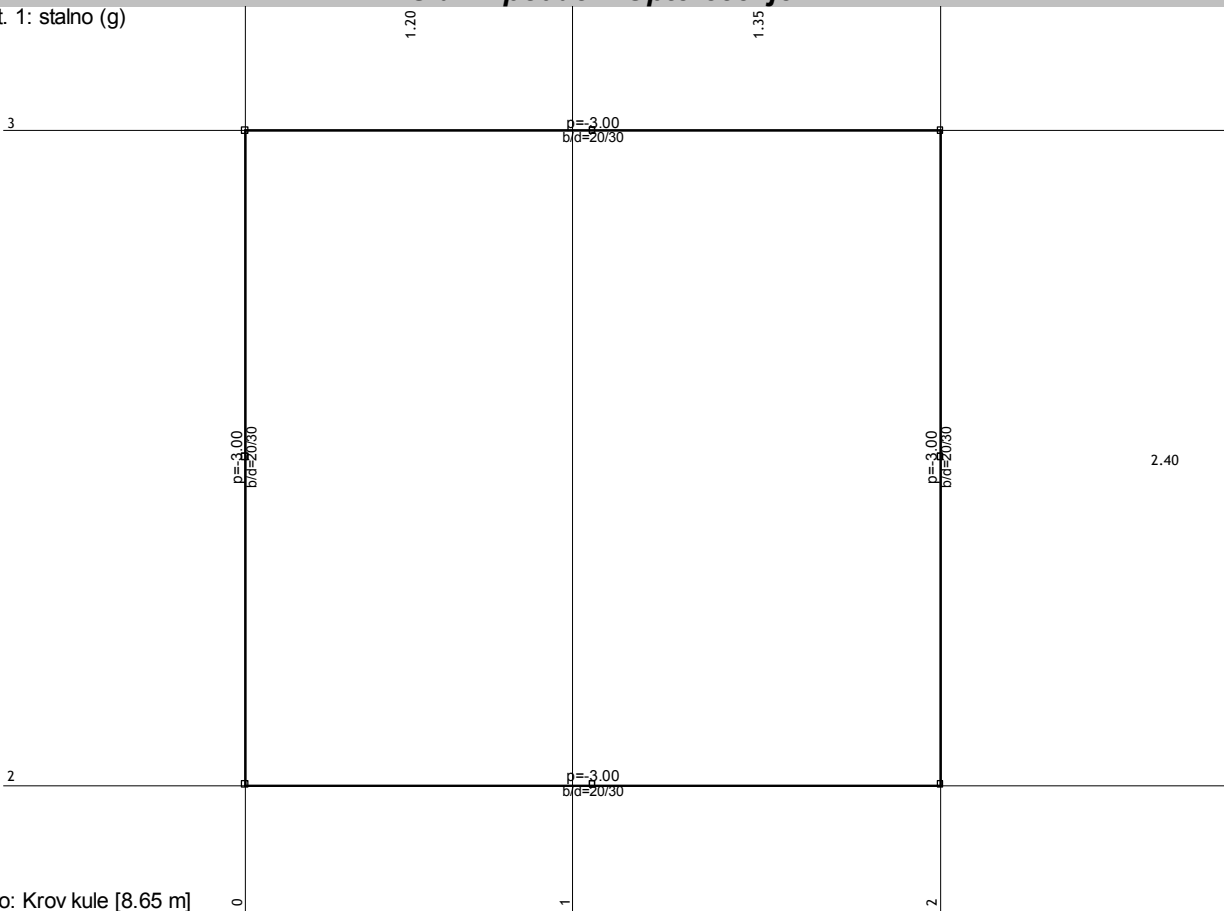




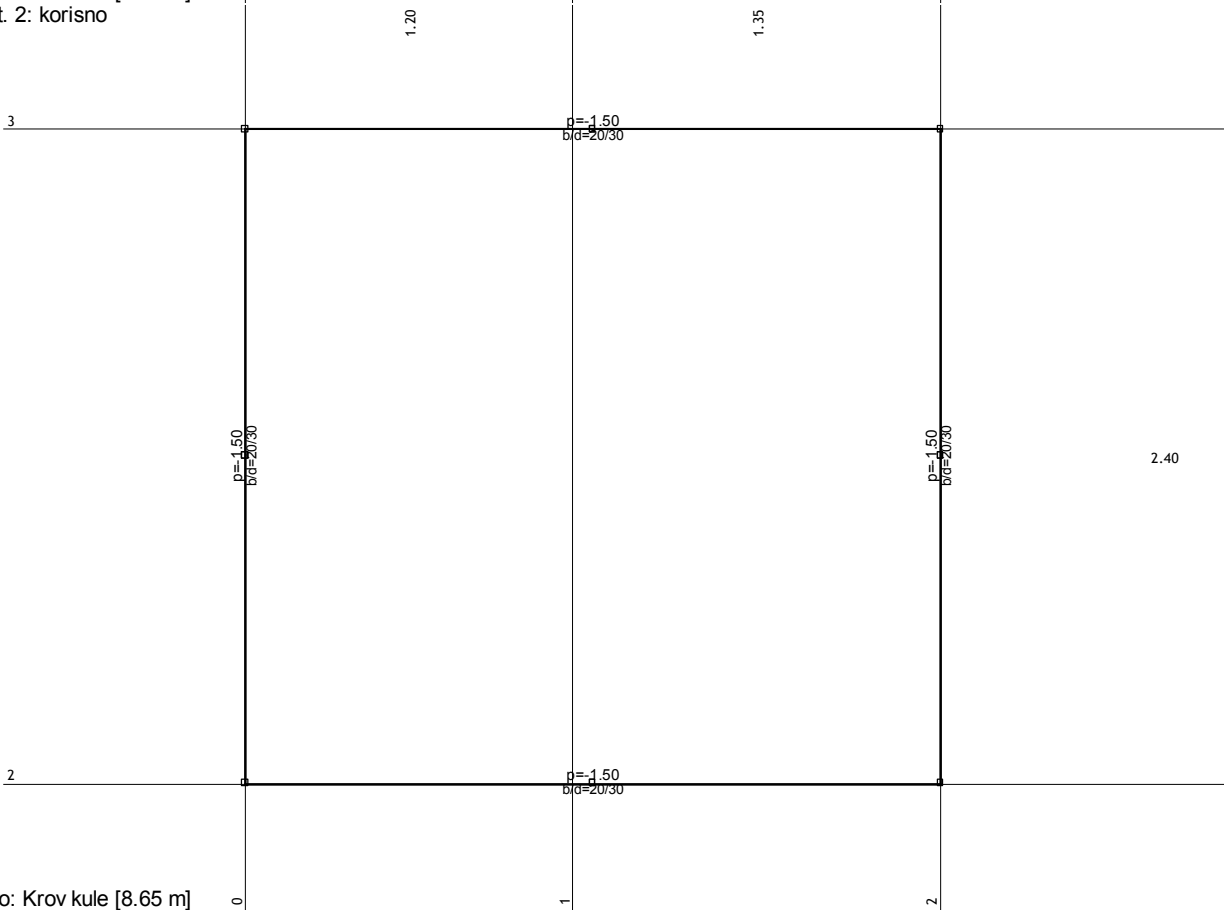
Ram: K_1

Ulazni podaci - Opterećenje

Opt. 1: stalno (g)

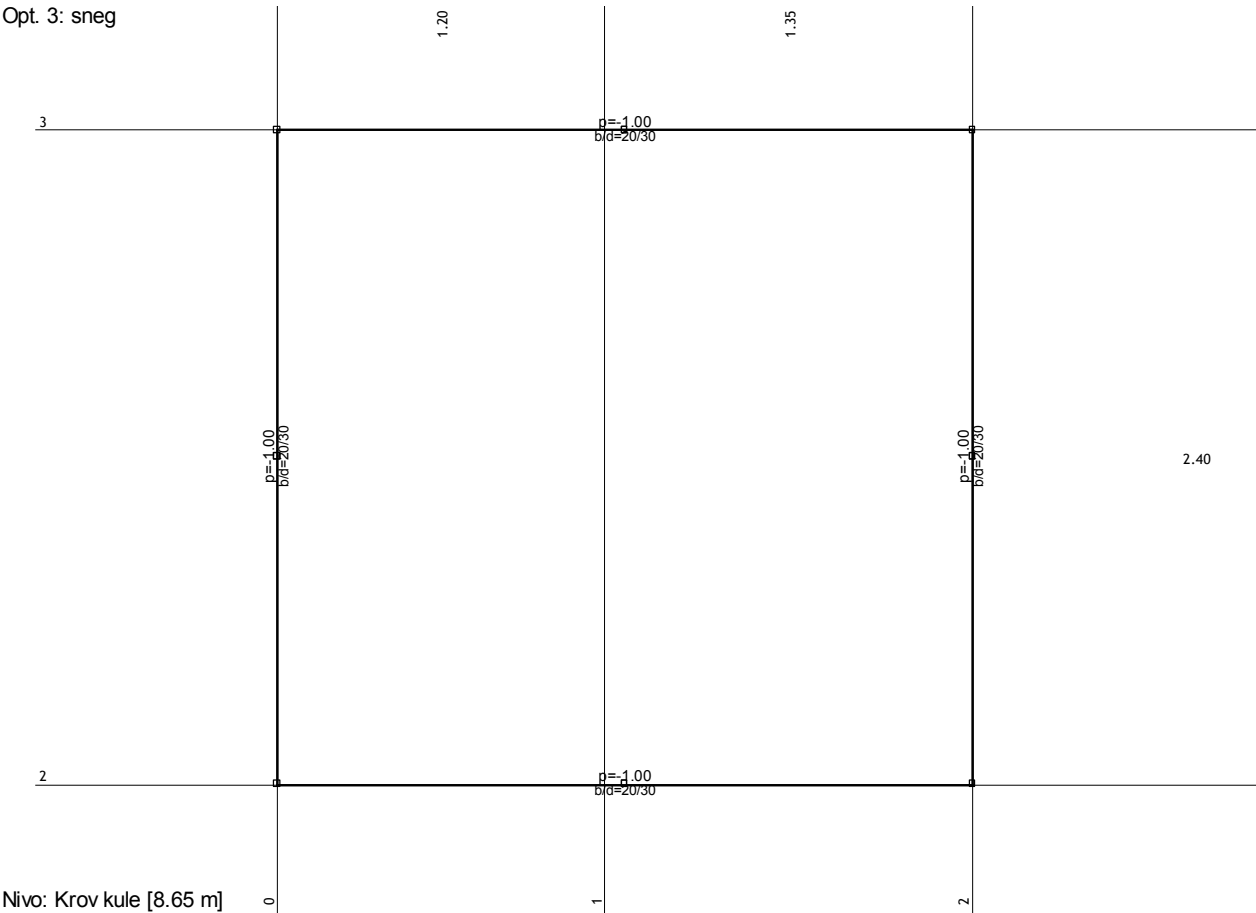


Nivo: Krov kule [8.65 m]
Opt. 2: korisno



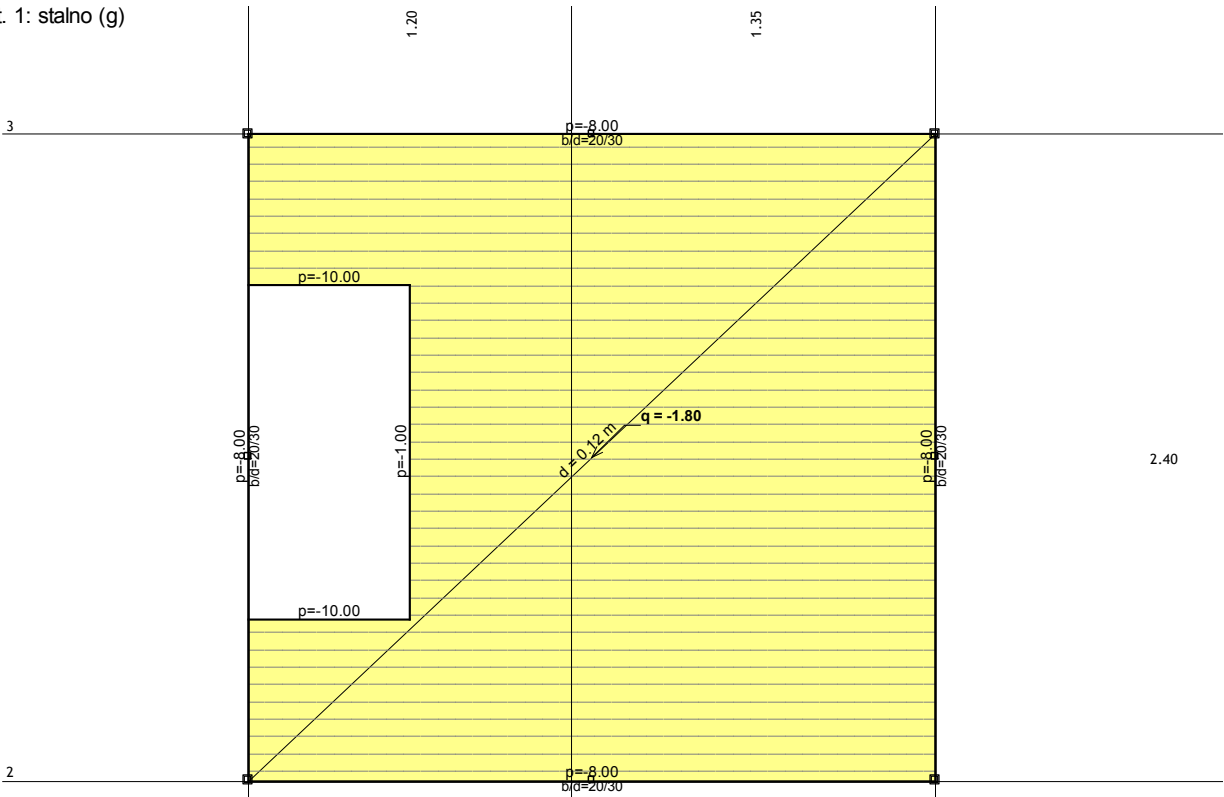
Nivo: Krov kule [8.65 m]

Opt. 3: sneg

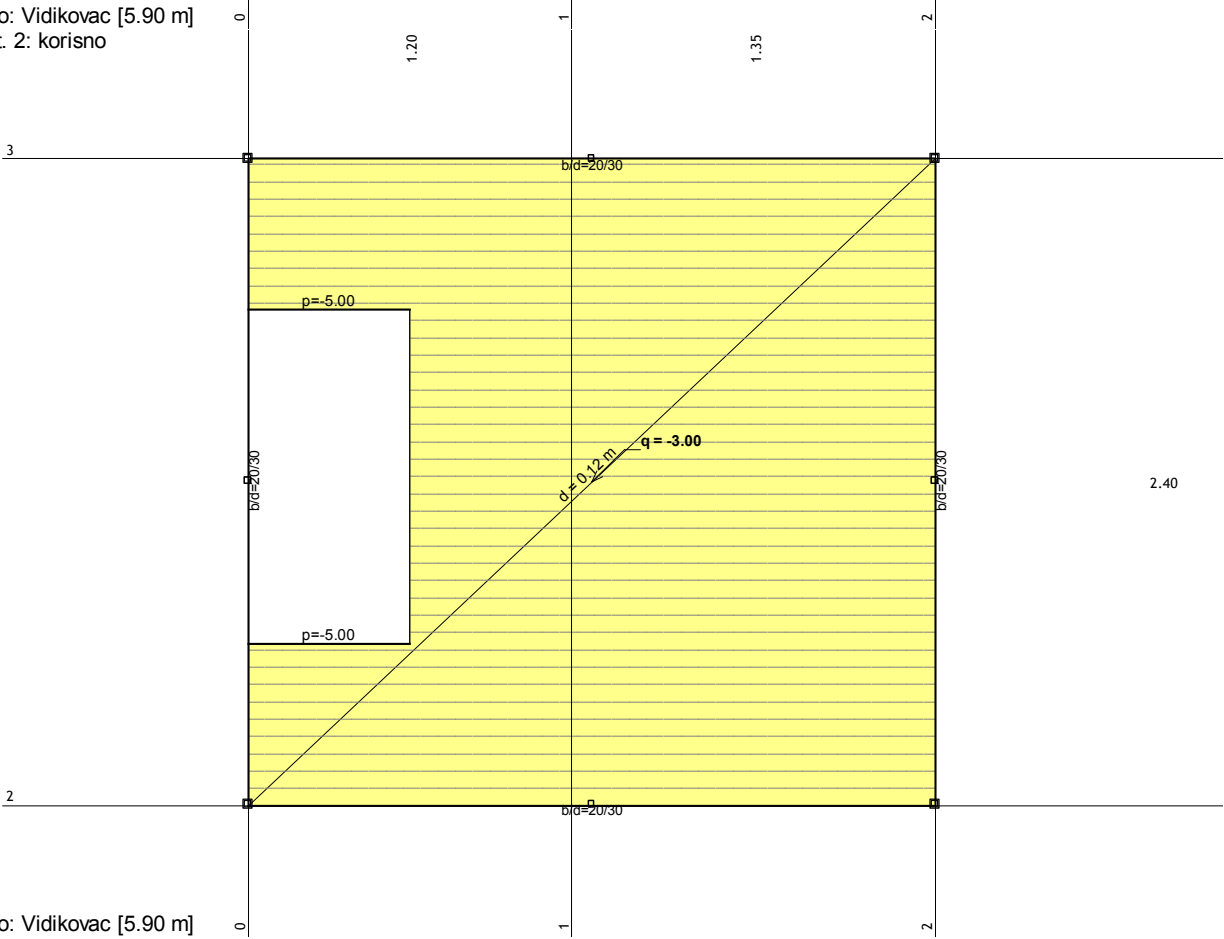


Nivo: Krov kule [8.65 m]

Opt. 1: stalno (g)

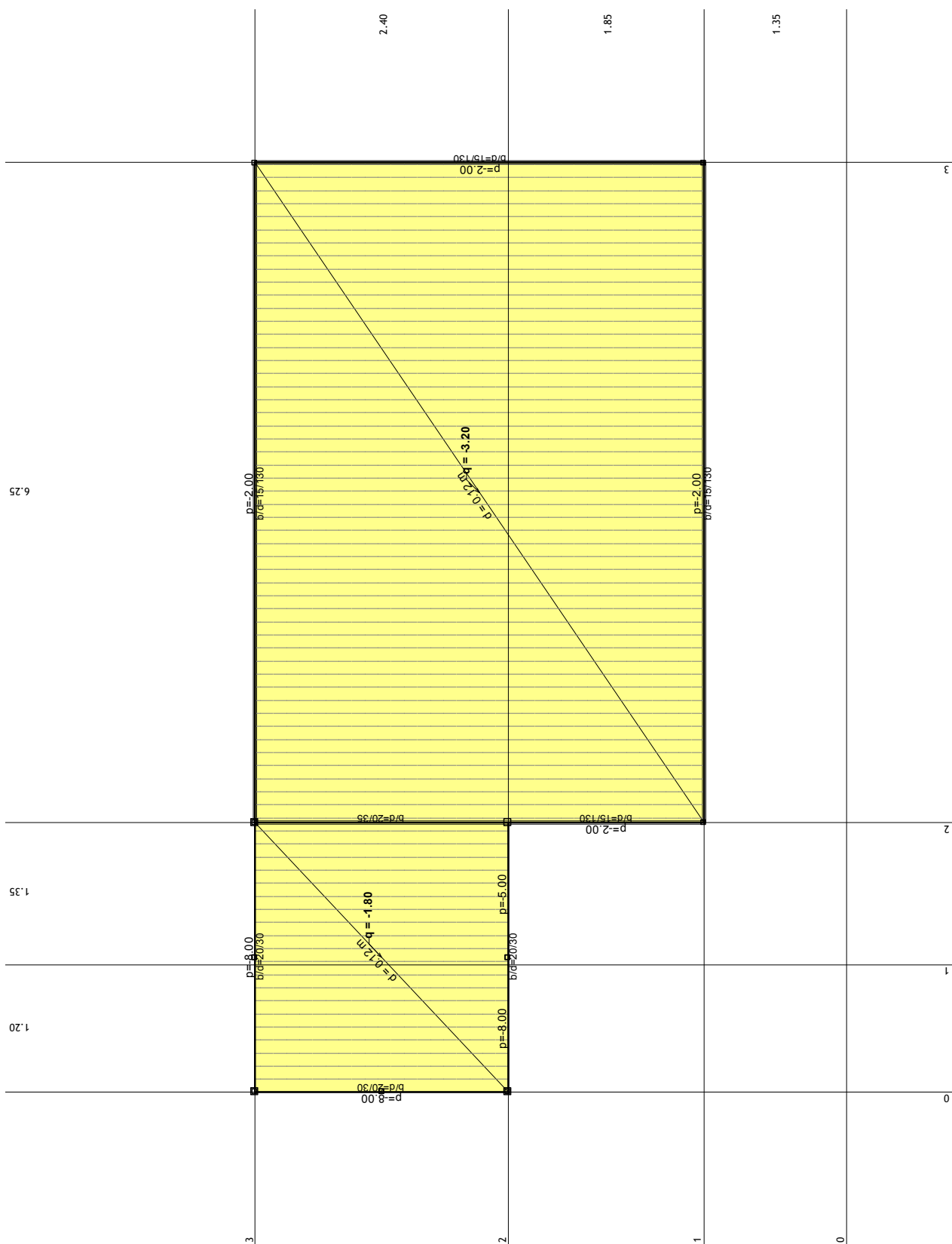


Nivo: Vidikovac [5.90 m]
Opt. 2: korisno



Nivo: Vidikovac [5.90 m]

Opt. 1: stalno (g)

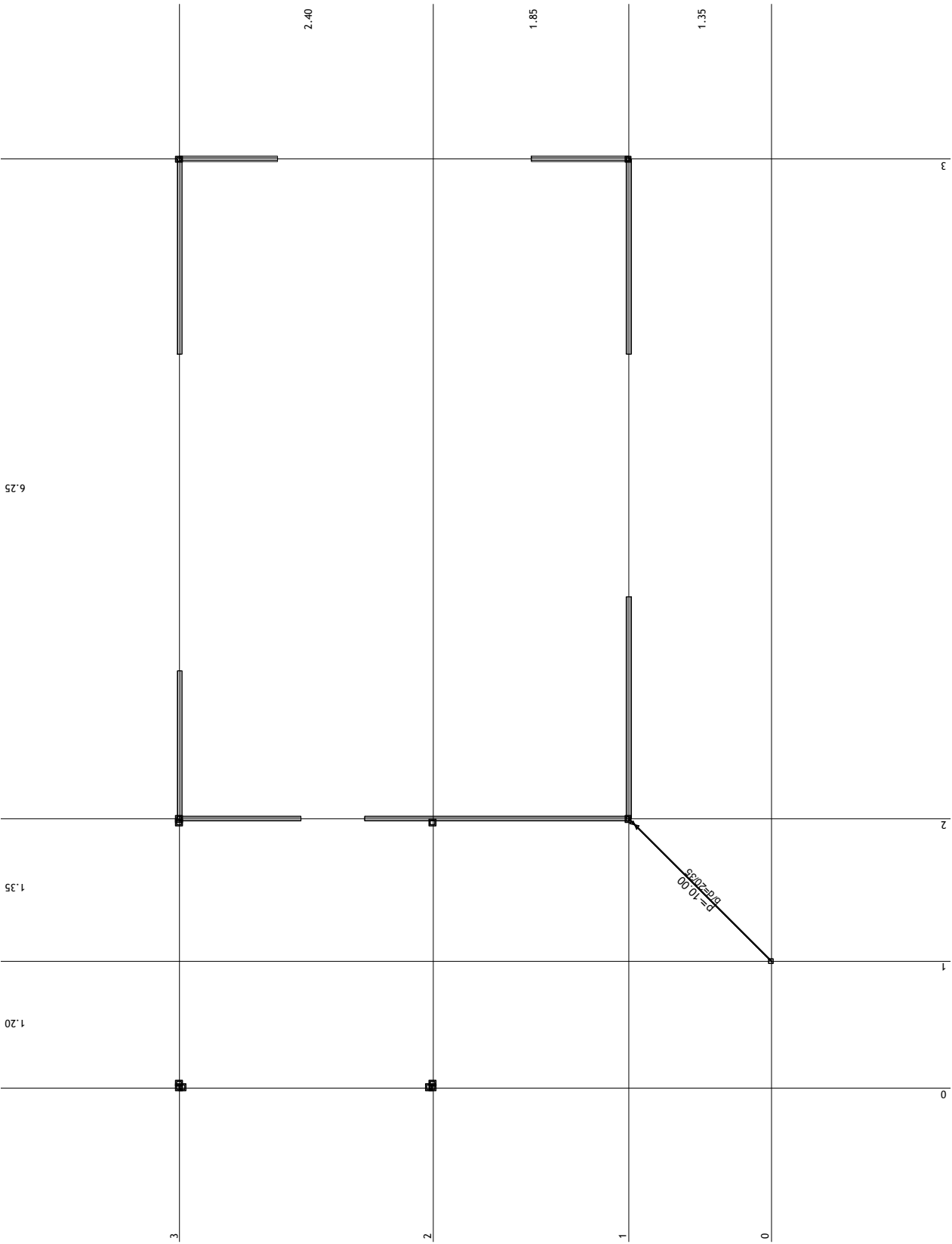


Nivo: Krov kuće [3.15 m]

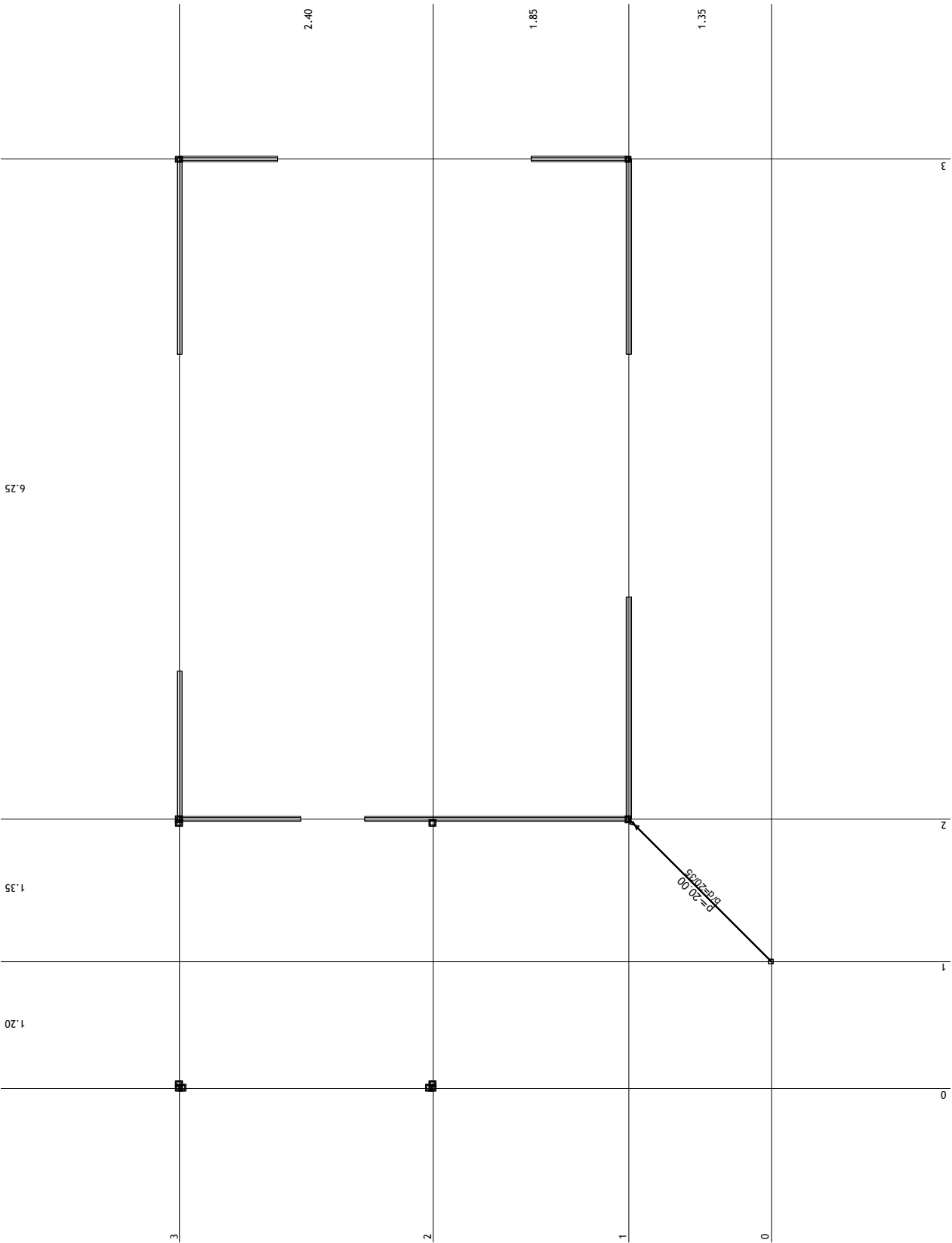




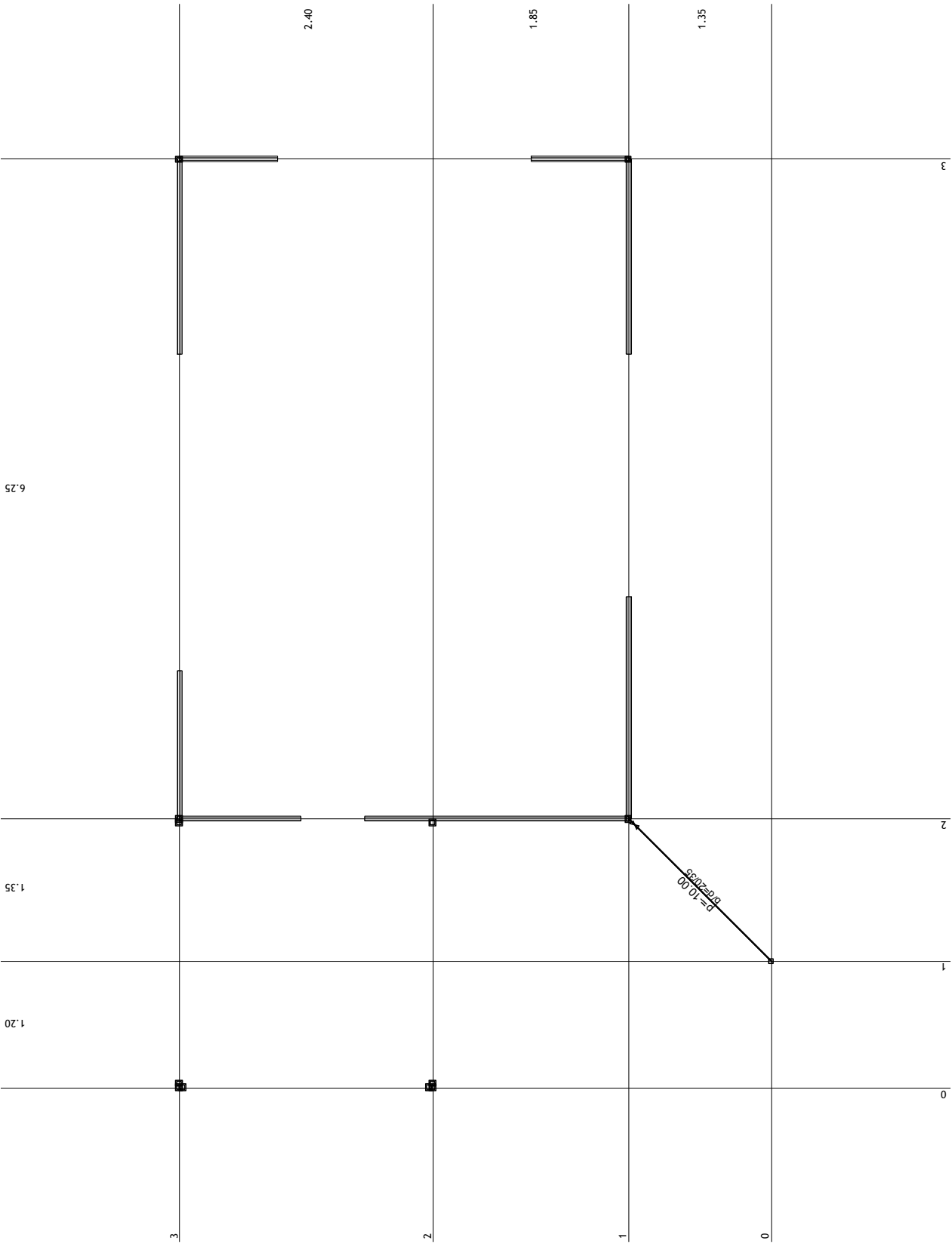
Opt. 1: stalno (g)



Nivo: St greda [1.80 m]

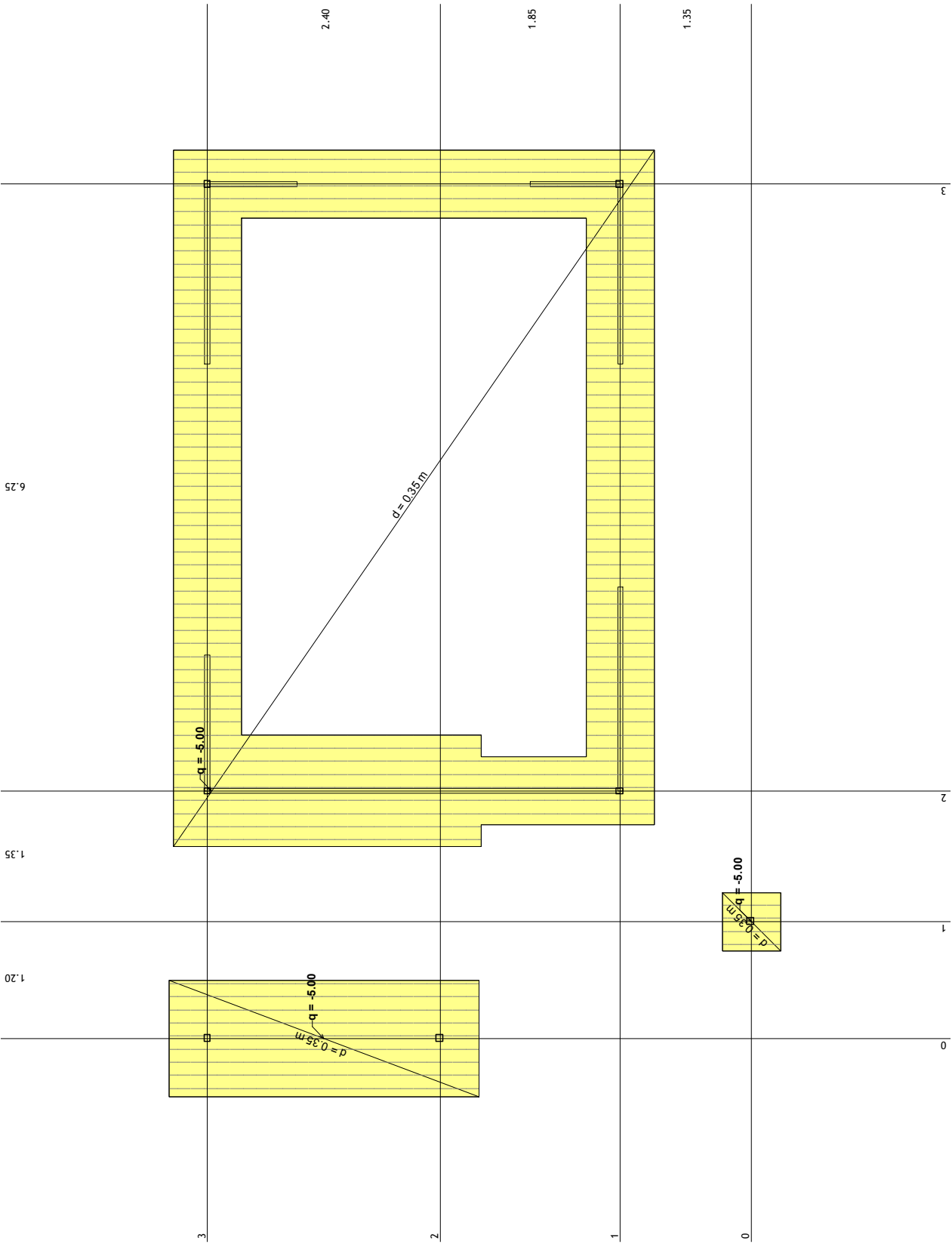


Opt. 3: sneg



Nivo: St greda [1.80 m]

Opt. 1: stalno (g)



Nivo: Temelji [-0.80 m]

Modalna analiza

Napredne opcije seizmičkog proračuna:

Ploče - redukcija krutosti na savijanje: 0.010
Multiplikator krutosti oslonaca: 10000.000
Sprečeno oscilovanje u Z pravcu

Faktori opterećenja za proračun masa

No	Naziv	Koeficijent
1	stalno (g)	1.00
2	korisno	0.50
3	sneg	0.50

Raspored masa po visini objekta

Nivo	Z [m]	X [m]	Y [m]	Masa [T]	T/m2
Krov kule	8.65	1.27	4.40	23.01	
Vidikovac	5.90	1.24	4.40	35.11	6.53
Krov kuće	3.15	4.26	3.73	80.11	2.45
St greda	1.80	4.07	3.12	36.33	
Prizemlje	0.00	5.13	3.37	18.70	
Temelji	-0.80	4.43	3.57	35.69	1.77
Ukupno:	3.04	3.57	3.75	228.96	

Položaj centara krutosti po visini objekta

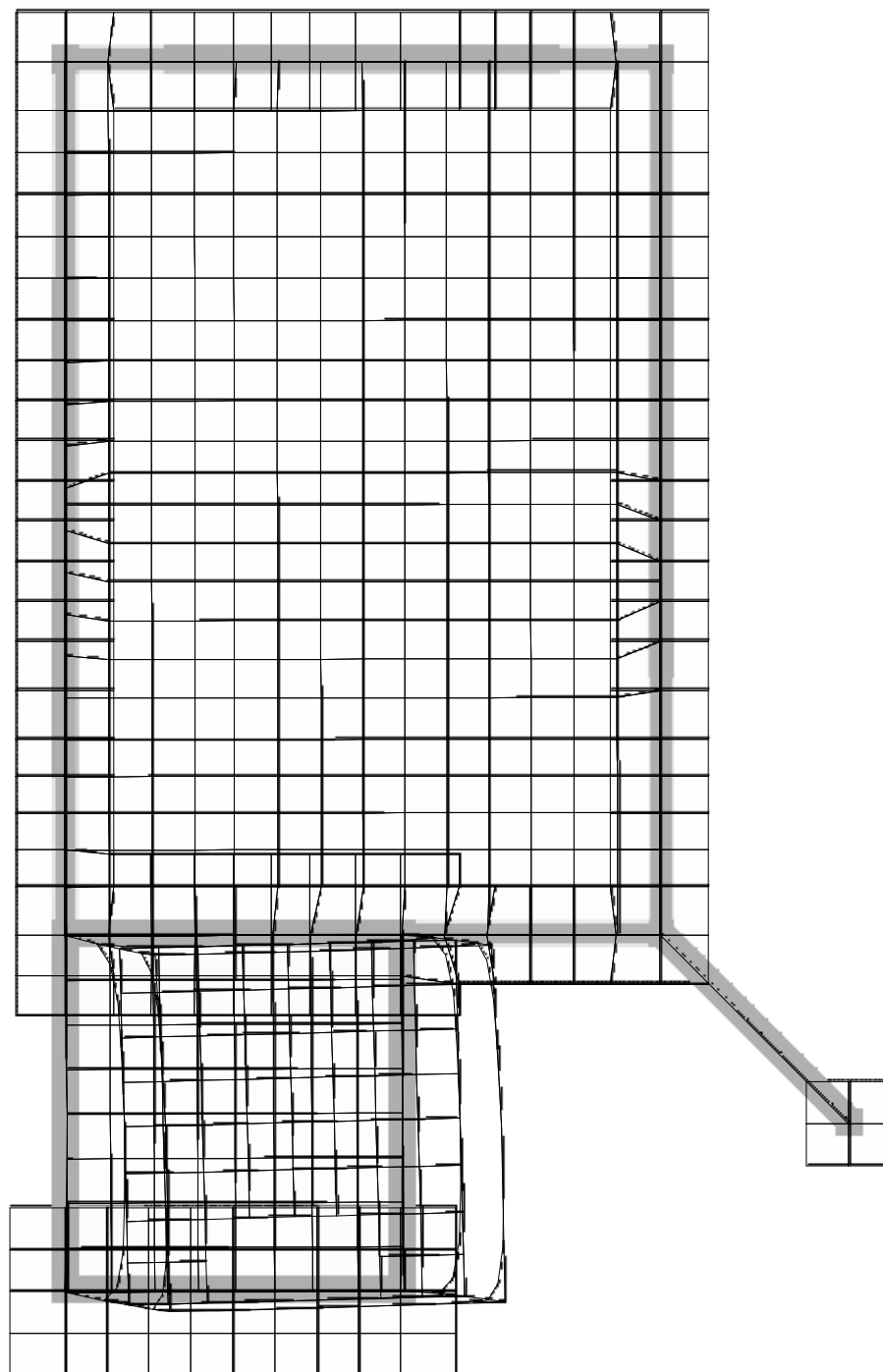
Nivo	Z [m]	X [m]	Y [m]
Krov kule	8.65	1.27	4.40
Vidikovac	5.90	1.27	4.40
Krov kuće	3.15	5.66	3.48
St greda	1.80	3.09	2.94
Prizemlje	0.00	2.69	2.92
Temelji	-0.80	2.69	2.92

Ekscentricitet po visini objekta

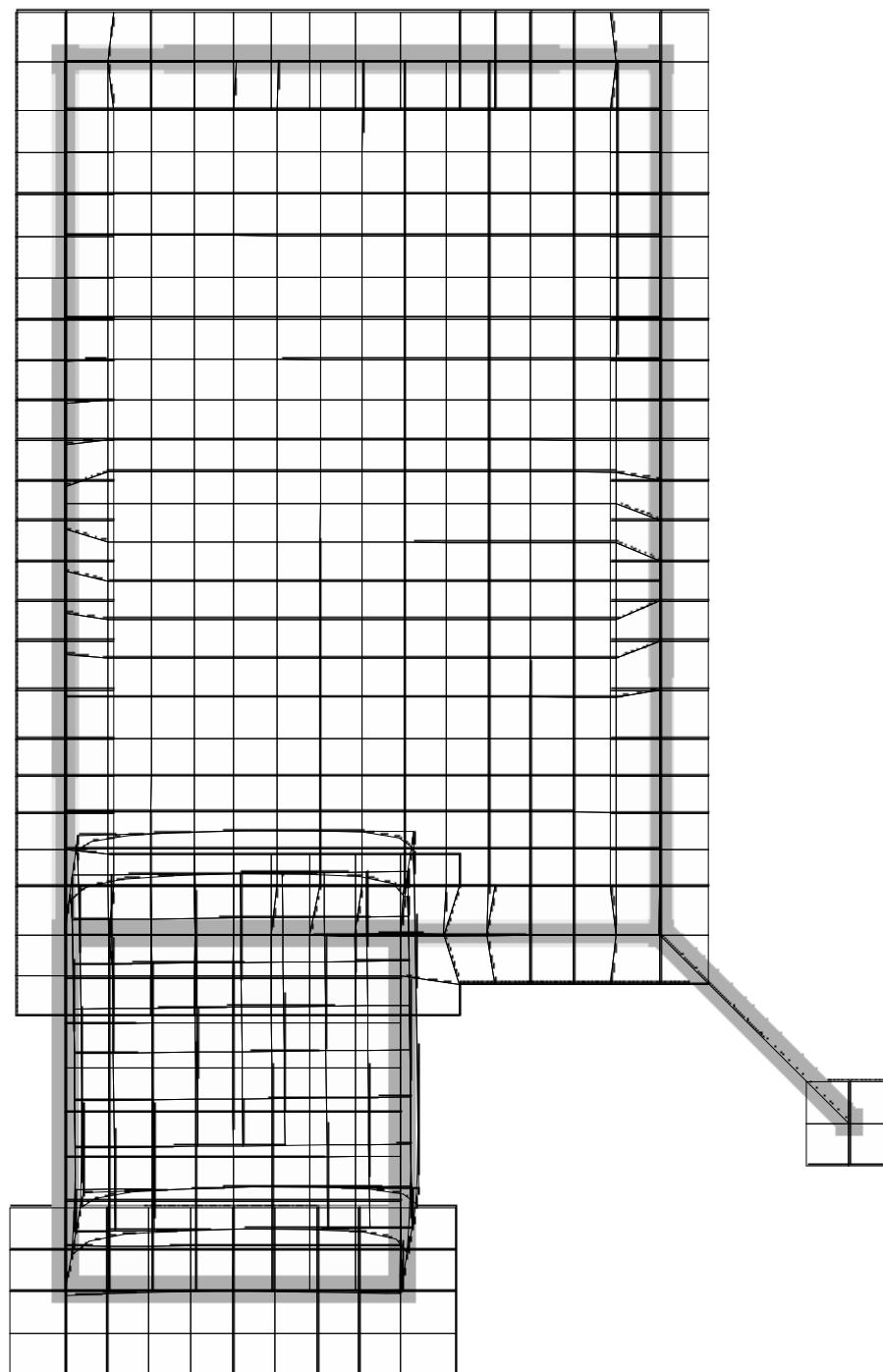
Nivo	Z [m]	eox [m]	eoy [m]
Krov kule	8.65	0.00	0.00
Vidikovac	5.90	0.03	0.00
Krov kuće	3.15	1.40	0.25
St greda	1.80	0.98	0.18
Prizemlje	0.00	2.44	0.44
Temelji	-0.80	1.74	0.65

Periodi oscilovanja konstrukcije

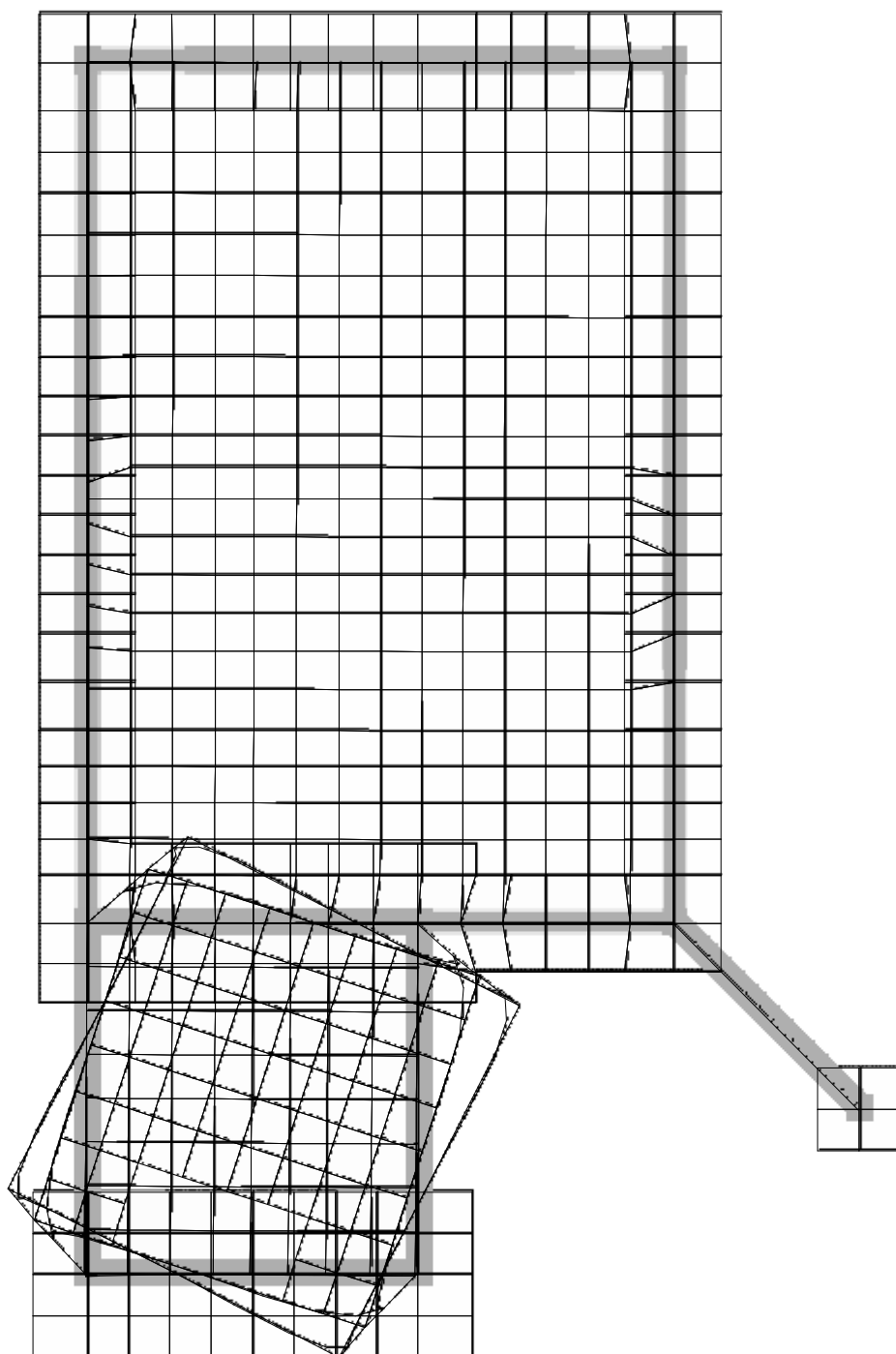
No	T [s]	f [Hz]
1	0.3352	2.9832
2	0.3320	3.0119
3	0.2506	3.9907



Izometrija (Top)
Forma oscilovanja: 1/3 [T=0.3352sec / f=2.98Hz]



Izometrija (Top)
Forma oscilovanja: 2/3 [T=0.3320sec / f=3.01Hz]



Izometrija (Top)
Forma oscilovanja: 3/3 [T=0.2506sec / f=3.99Hz]

Seizmički proračun

Seizmički proračun: JUS (Ekvivalentno statičko opterećenje)

Kategorija tla: I
Seizmička zona: IX ($K_s = 0.100$)
Kategorija objekta: II
Vrsta konstrukcije: 1
Kota ukleštenja: $Z_d = 0.00$ m
Ploče - redukcija krutosti na savijanje: 0.010
Multiplikator krutosti oslonaca: 10000.000

Ugao dejstva zemljotresa:

Naziv	T [sec]	α [°]
Sy	0.335	90.00
Sx	0.332	0.00

Raspored seizmičkih sila po visini objekta (Sy)

Nivo	Z [m]	S [kN]
Krov kule	8.65	49.81
Vidikovac	5.90	52.83
Krov kuće	3.15	64.43
St greda	1.80	16.37
Prizemlje	0.00	1.51
Temelji	-0.80	0.00
	$\Sigma=$	184.95

Raspored seizmičkih sila po visini objekta (Sx)

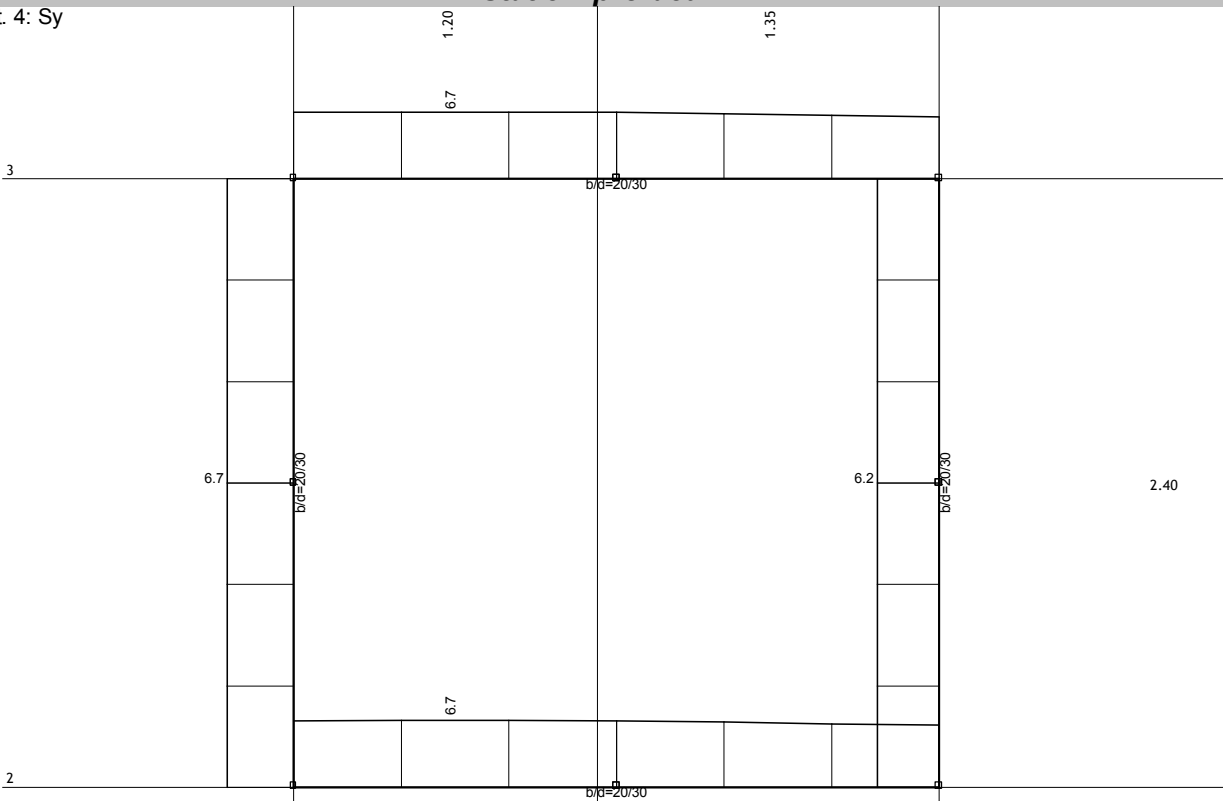
Nivo	Z [m]	S [kN]
Krov kule	8.65	49.81
Vidikovac	5.90	52.83
Krov kuće	3.15	64.43
St greda	1.80	16.37
Prizemlje	0.00	1.51
Temelji	-0.80	0.00
	$\Sigma=$	184.95

Raspored masa po visini objekta

Nivo	Z [m]	X [m]	Y [m]	Masa [T]	T/m ²
Krov kule	8.65	1.27	4.40	23.01	
Vidikovac	5.90	1.24	4.40	35.11	6.53
Krov kuće	3.15	4.26	3.73	80.11	2.45
St greda	1.80	4.07	3.12	36.33	
Prizemlje	0.00	5.13	3.37	18.70	
Temelji	-0.80	4.43	3.57	35.69	1.77
Ukupno:	3.04	3.57	3.75	228.96	

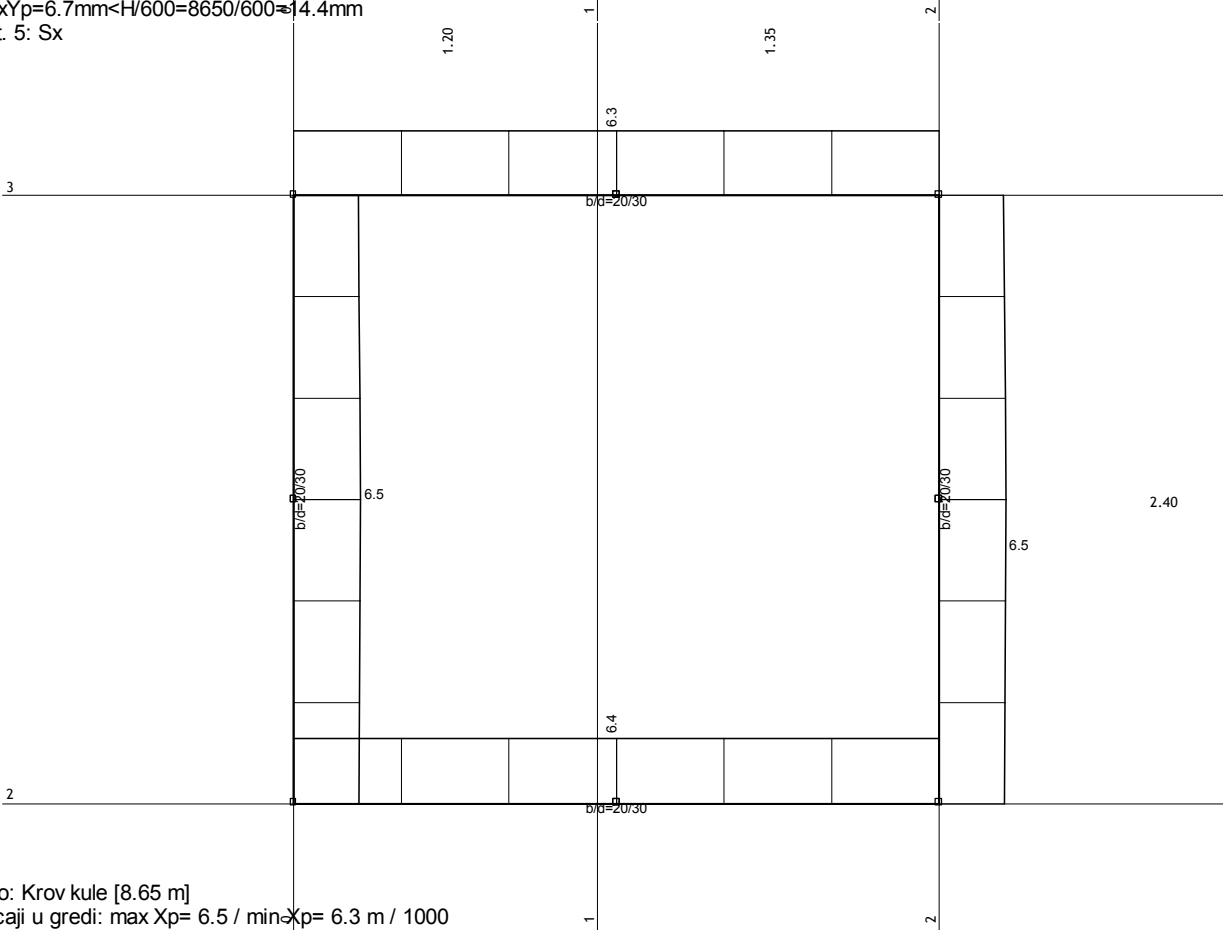
Statički proračun

Opt. 4: Sy



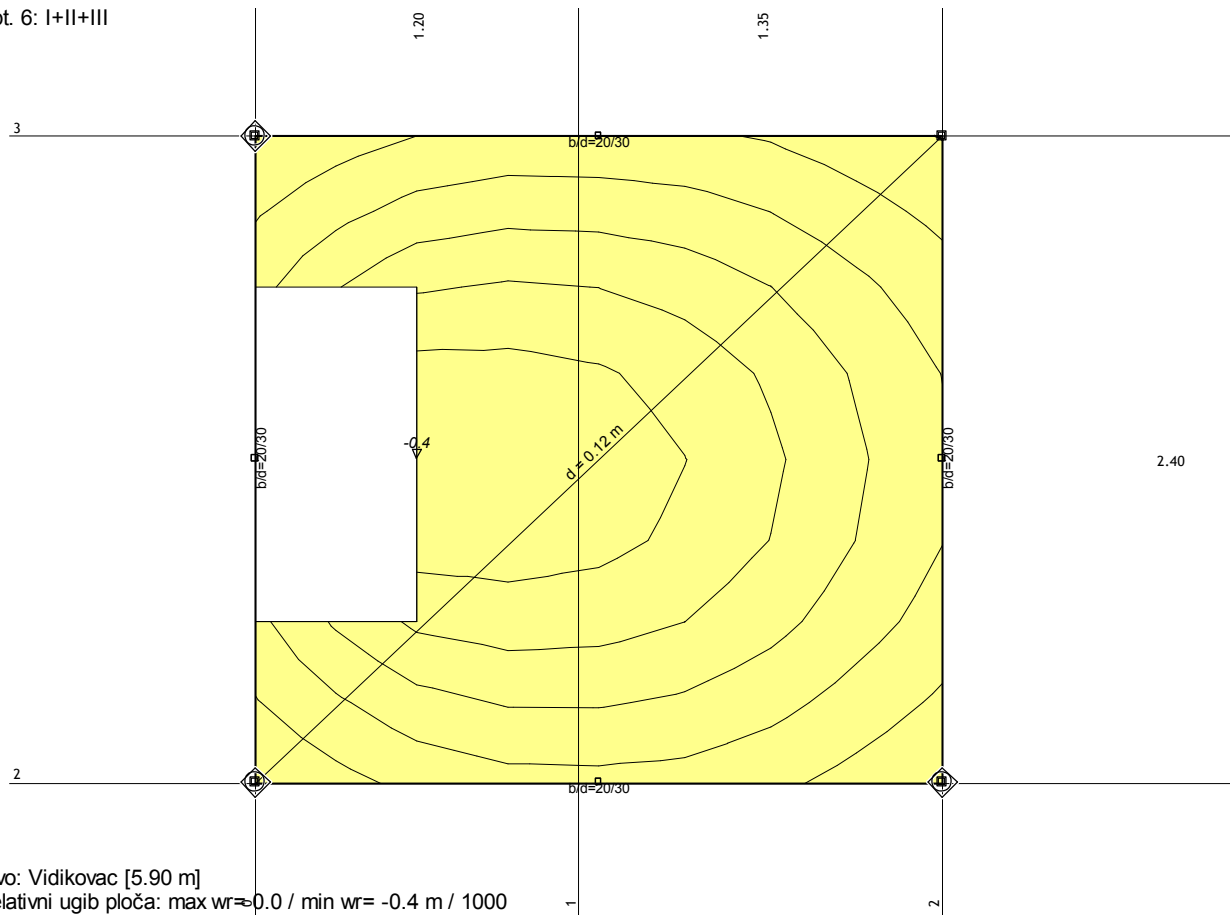
Nivo: Krov kule [8.65 m]
Utjecaji u gredi: max Yp= 6.7 / min Yp= 6.2 m / 1000
maxYp=6.7mm<H/600=8650/600=14.4mm

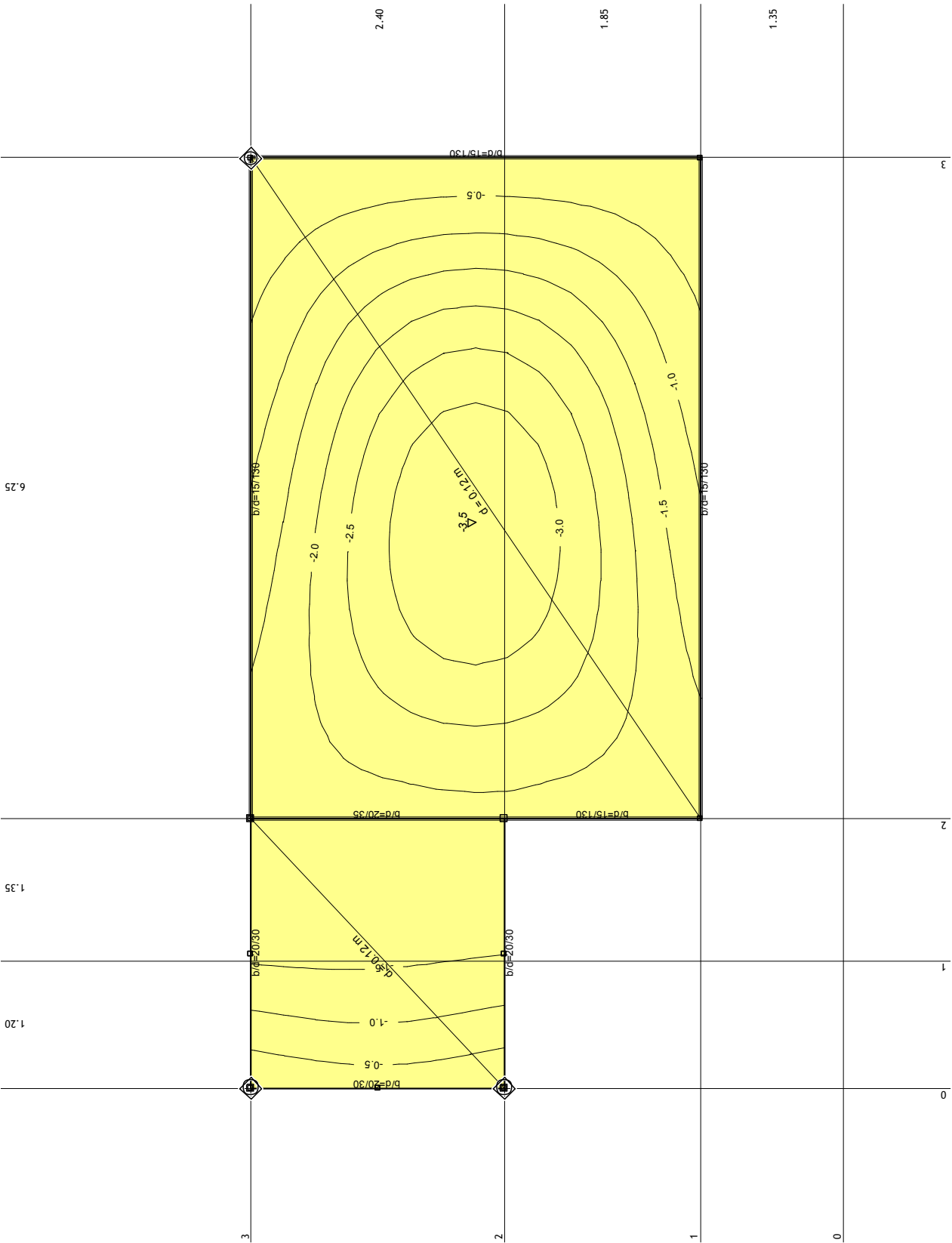
Opt. 5: Sx



Nivo: Krov kule [8.65 m]
Utjecaji u gredi: max Xp= 6.5 / min Xp= 6.3 m / 1000

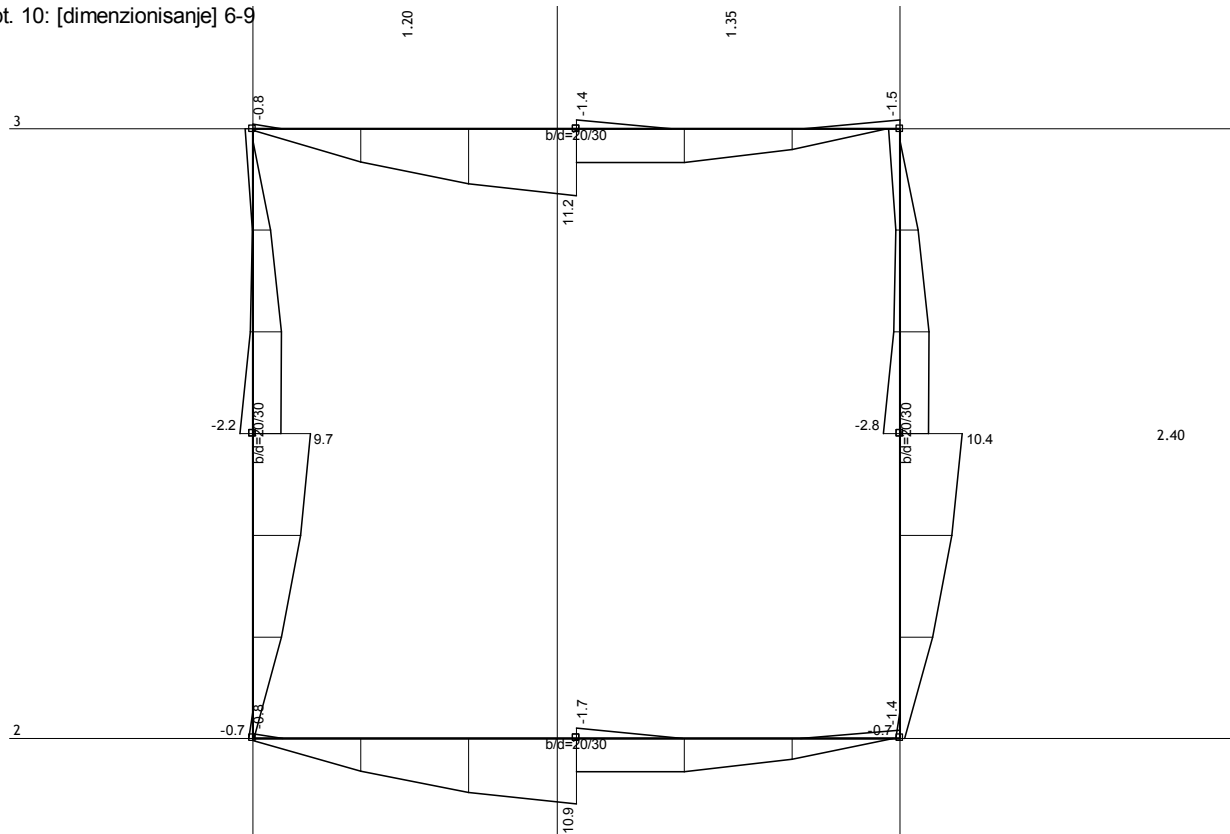
Opt. 6: I+II+III



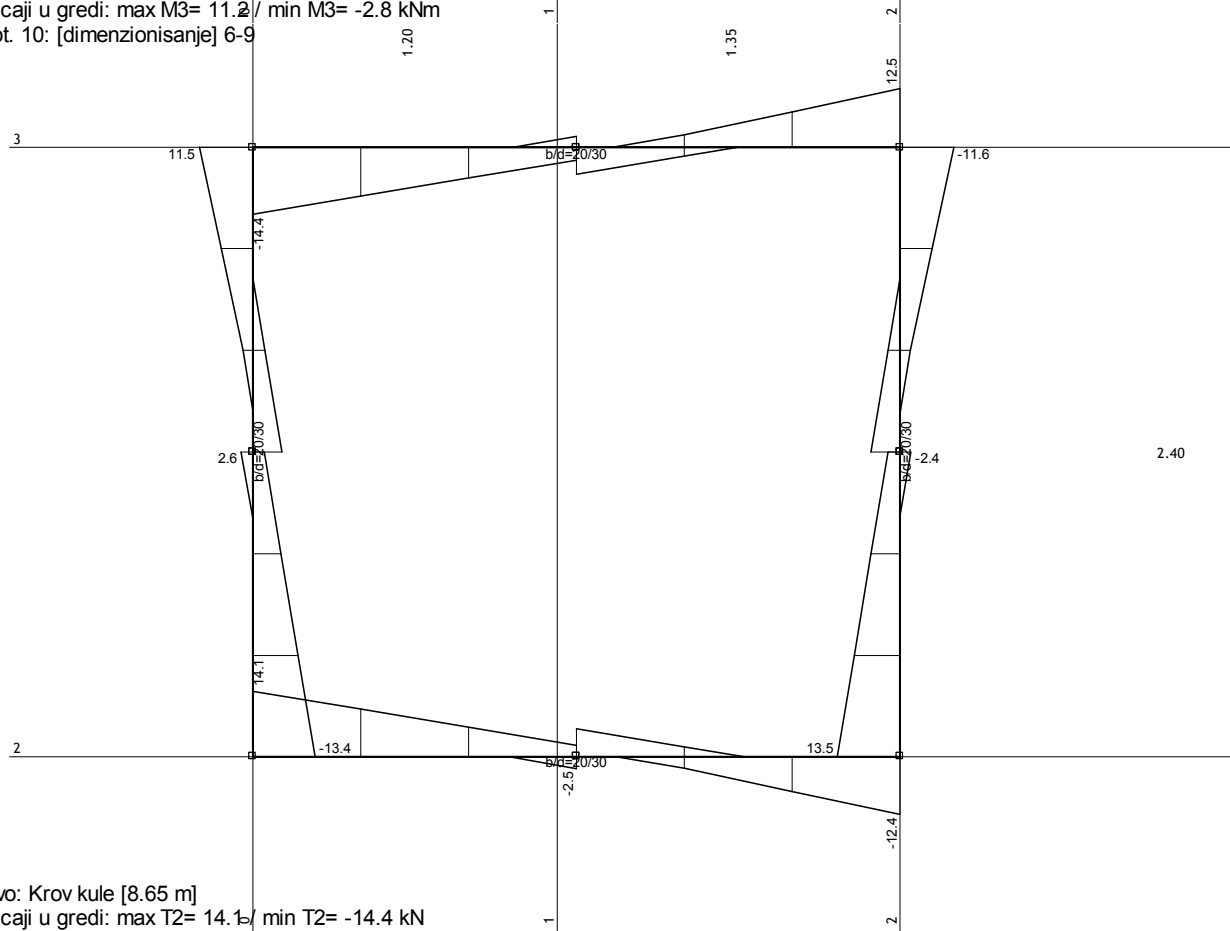


Nivo: Krov kuće [3.15 m]
Relativni ugib ploča: max $w_r = 0.0$ / min $w_r = -3.5$ m / 1000
 $\max Z_p = 3 \times 3.5 \text{ mm} = 10.5 \text{ mm} < L/300 = 4250/300 = 14.17 \text{ mm}$

Opt. 10: [dimensionisanje] 6-9

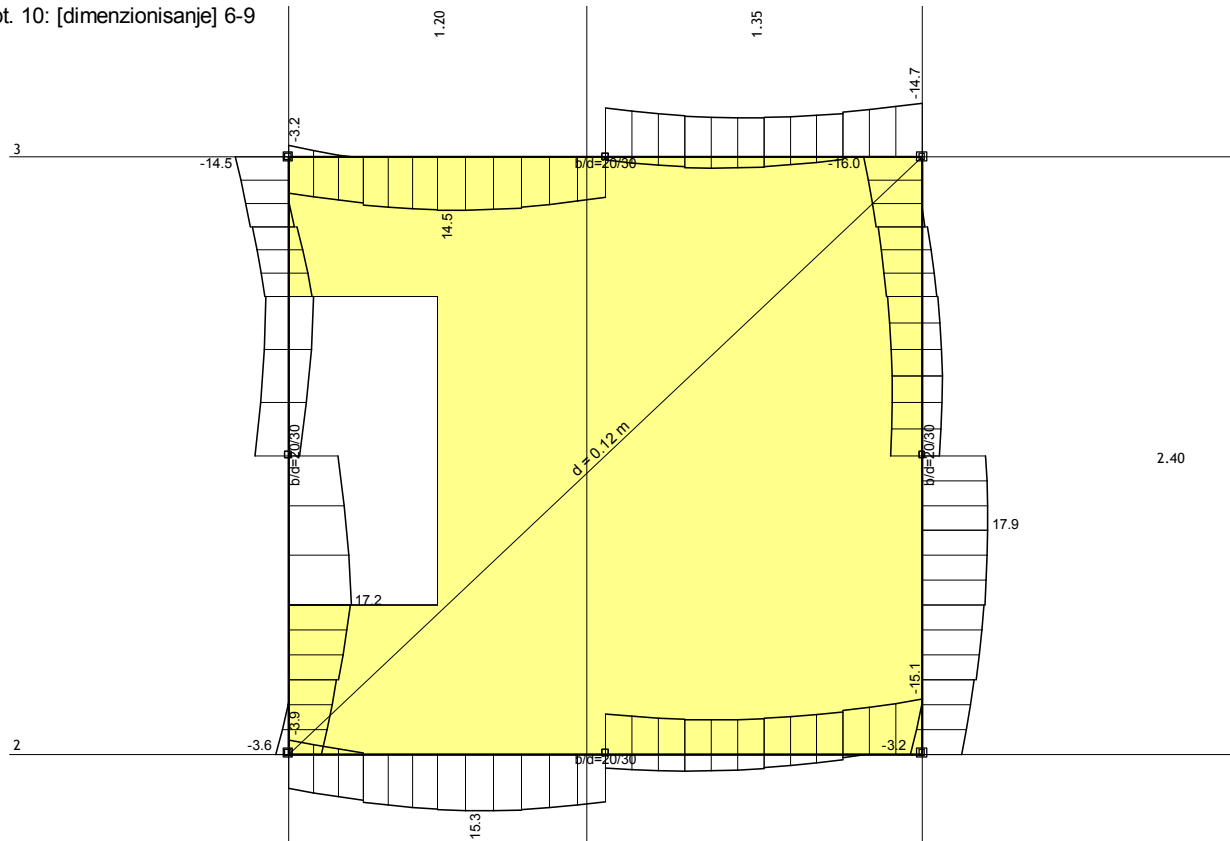


Nivo: Krov kule [8.65 m]
Uticaji u gredi: max M3= 11.2 / min M3= -2.8 kNm
Opt. 10: [dimensionisanje] 6-9

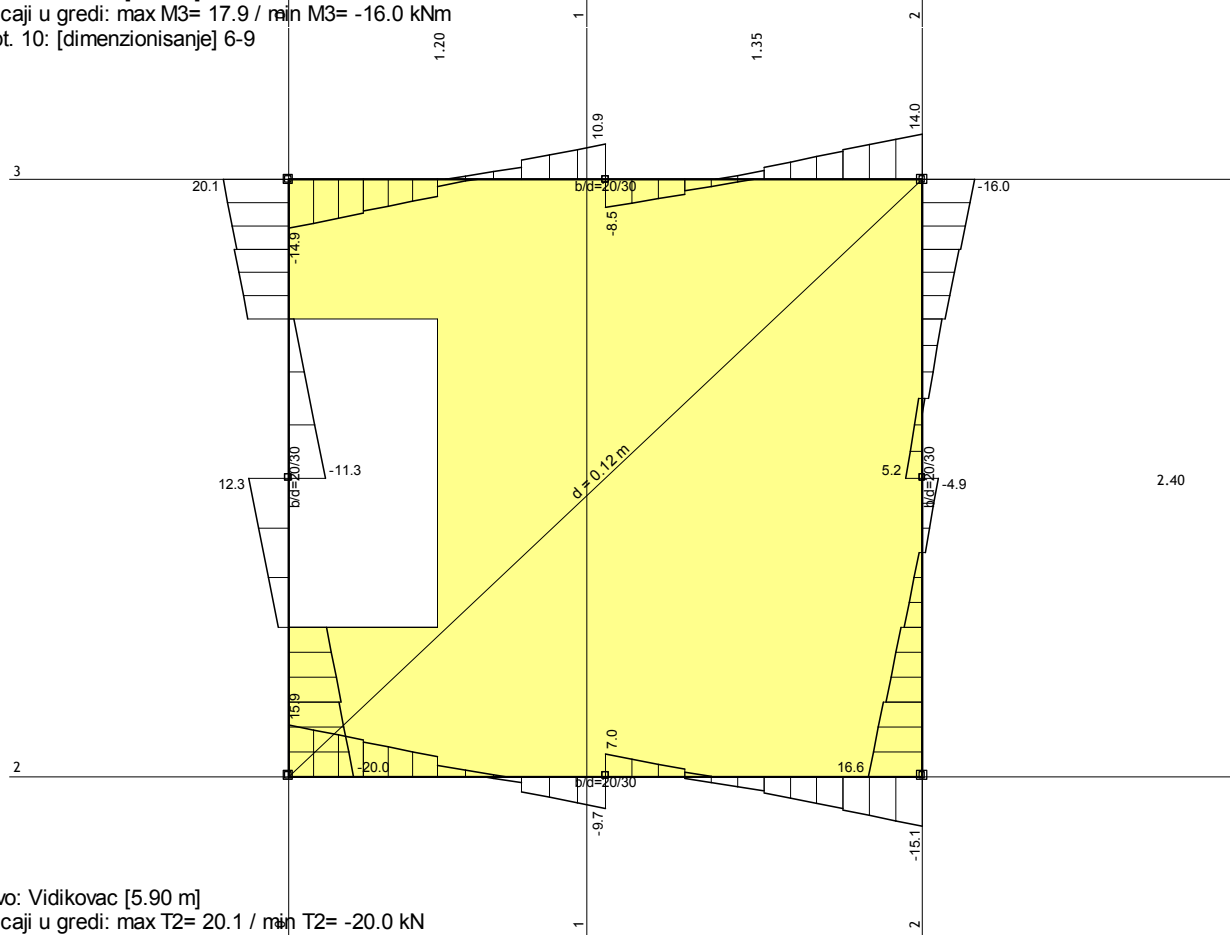


Nivo: Krov kule [8.65 m]
Uticaji u gredi: max T2= 14.1 / min T2= -14.4 kN

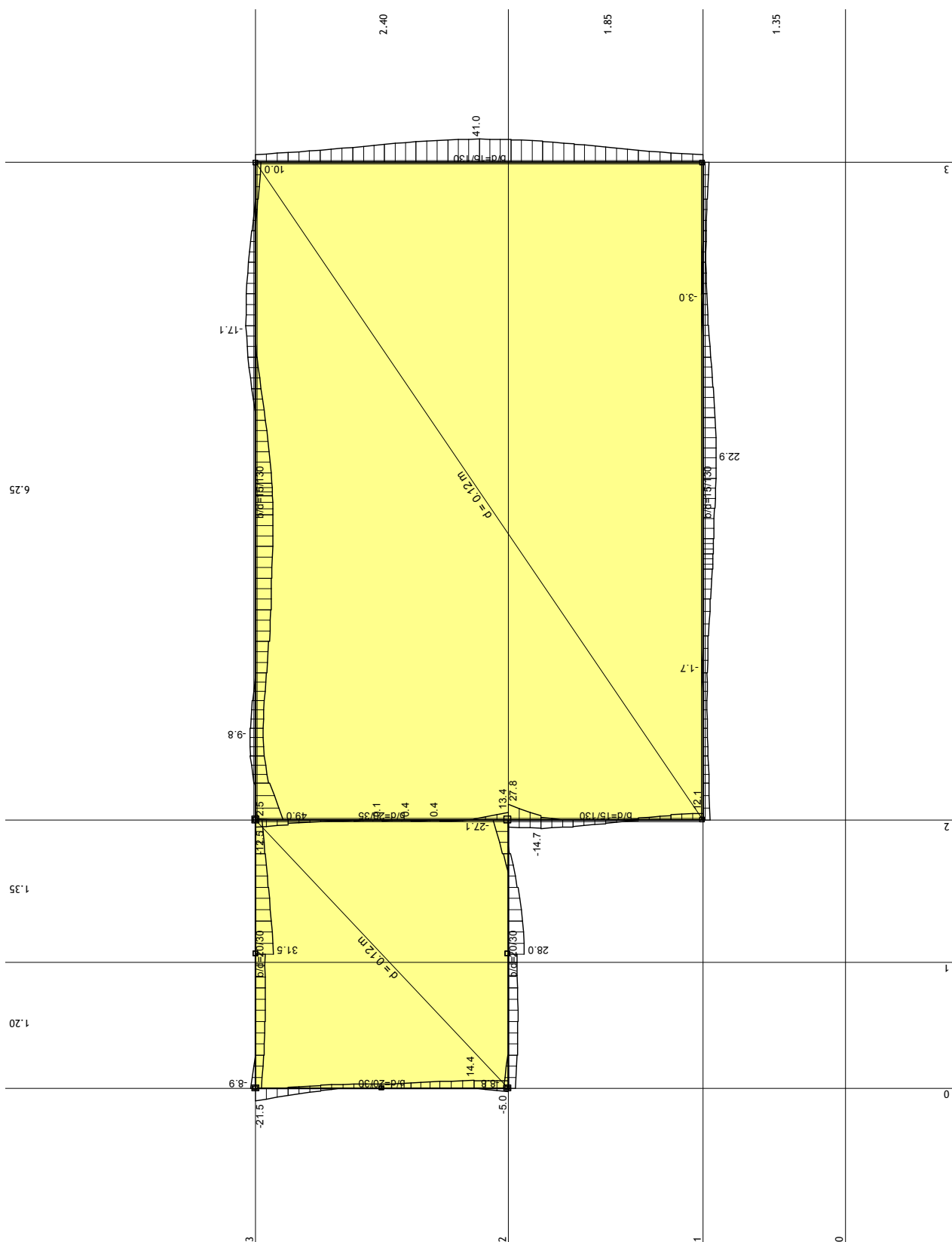
Opt. 10: [dimensionisanje] 6-9



Nivo: Vidikovac [5.90 m]
Uticaji u gredi: max M3= 17.9 / min M3= -16.0 kNm
Opt. 10: [dimensionisanje] 6-9



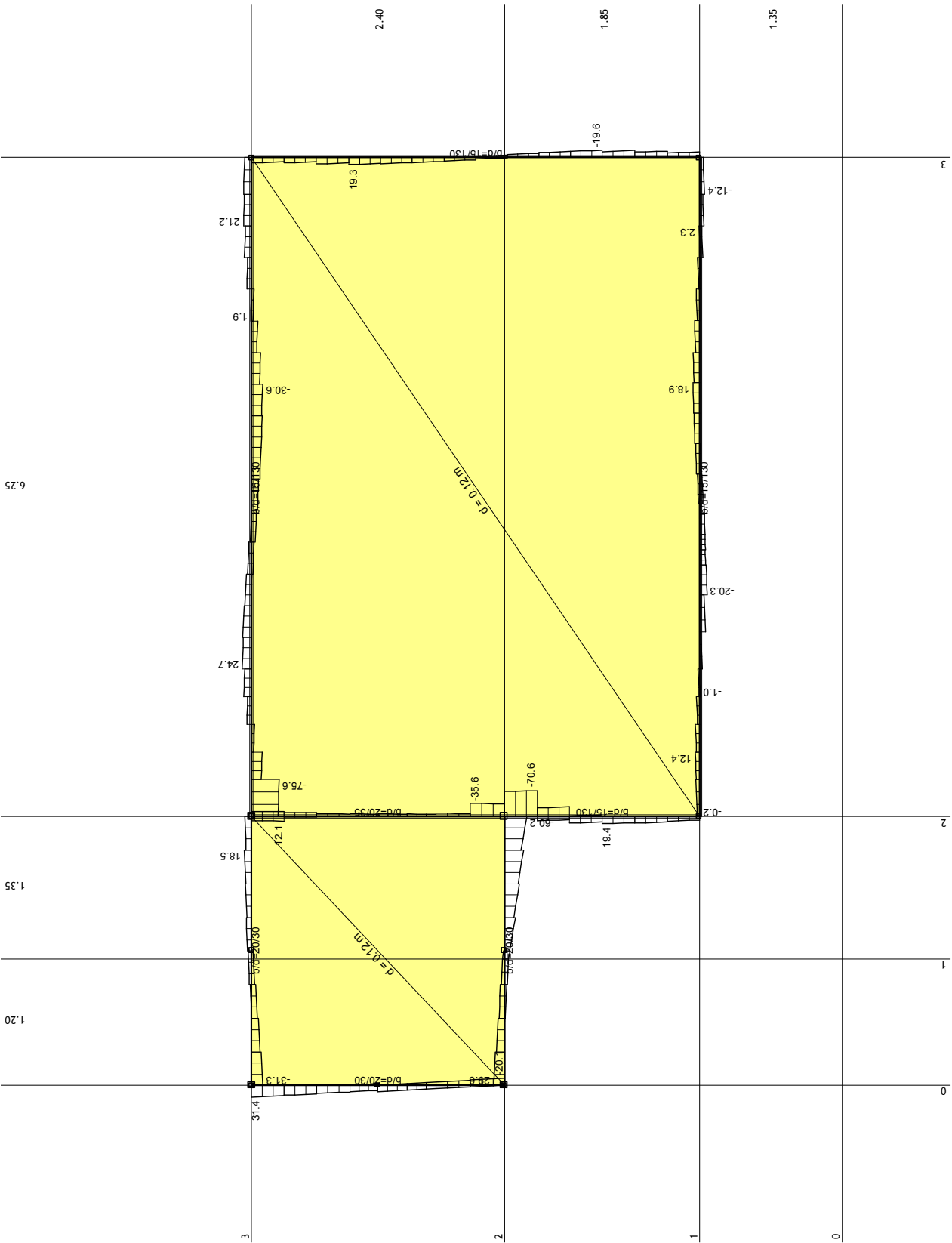
Nivo: Vidikovac [5.90 m]
Uticaji u gredi: max T2= 20.1 / min T2= -20.0 kN



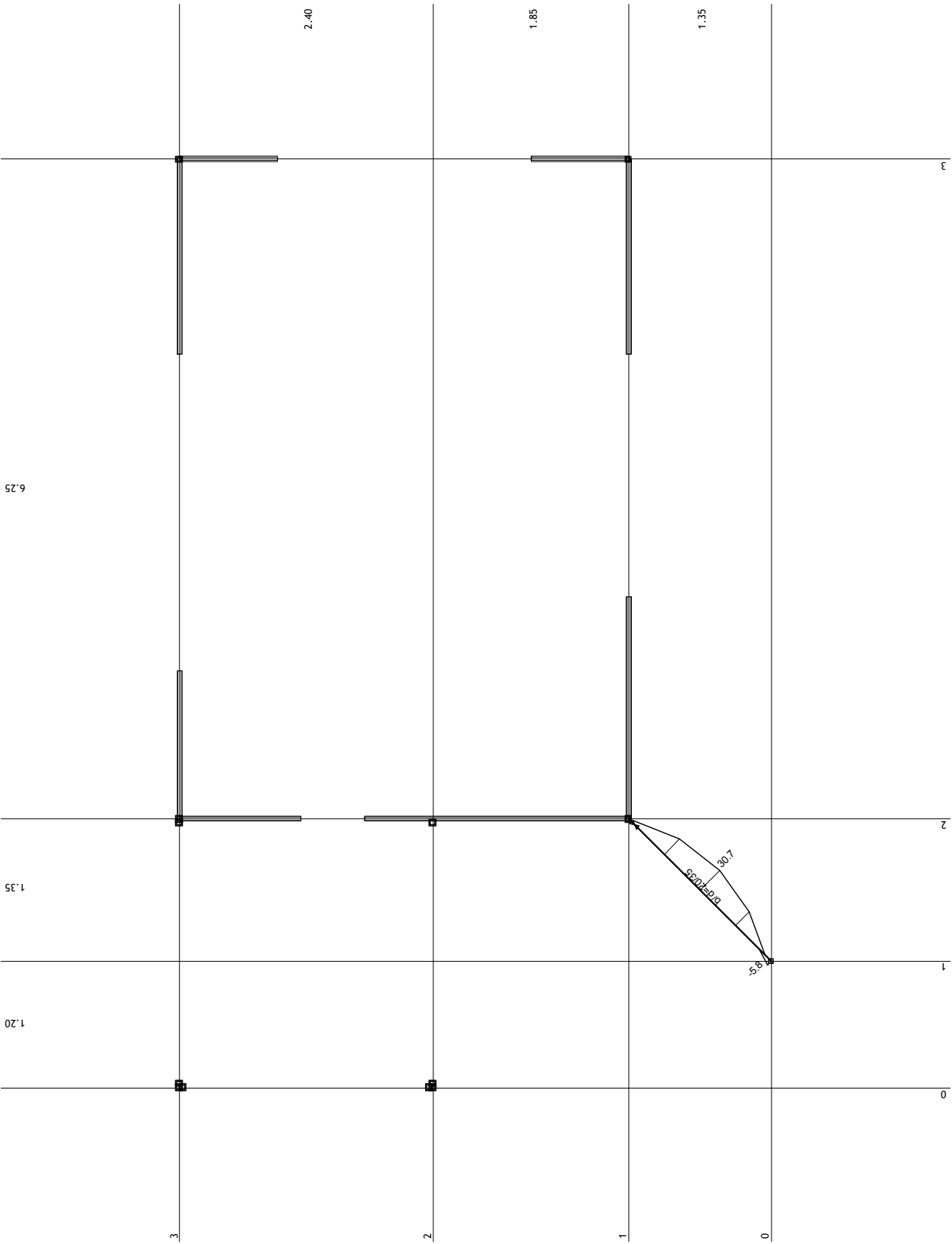
Nivo: Krov kuće [3.15 m]

Uticaji u gredi: max $M_3 = 49.0$ / min $M_3 = -27.1$ kNm

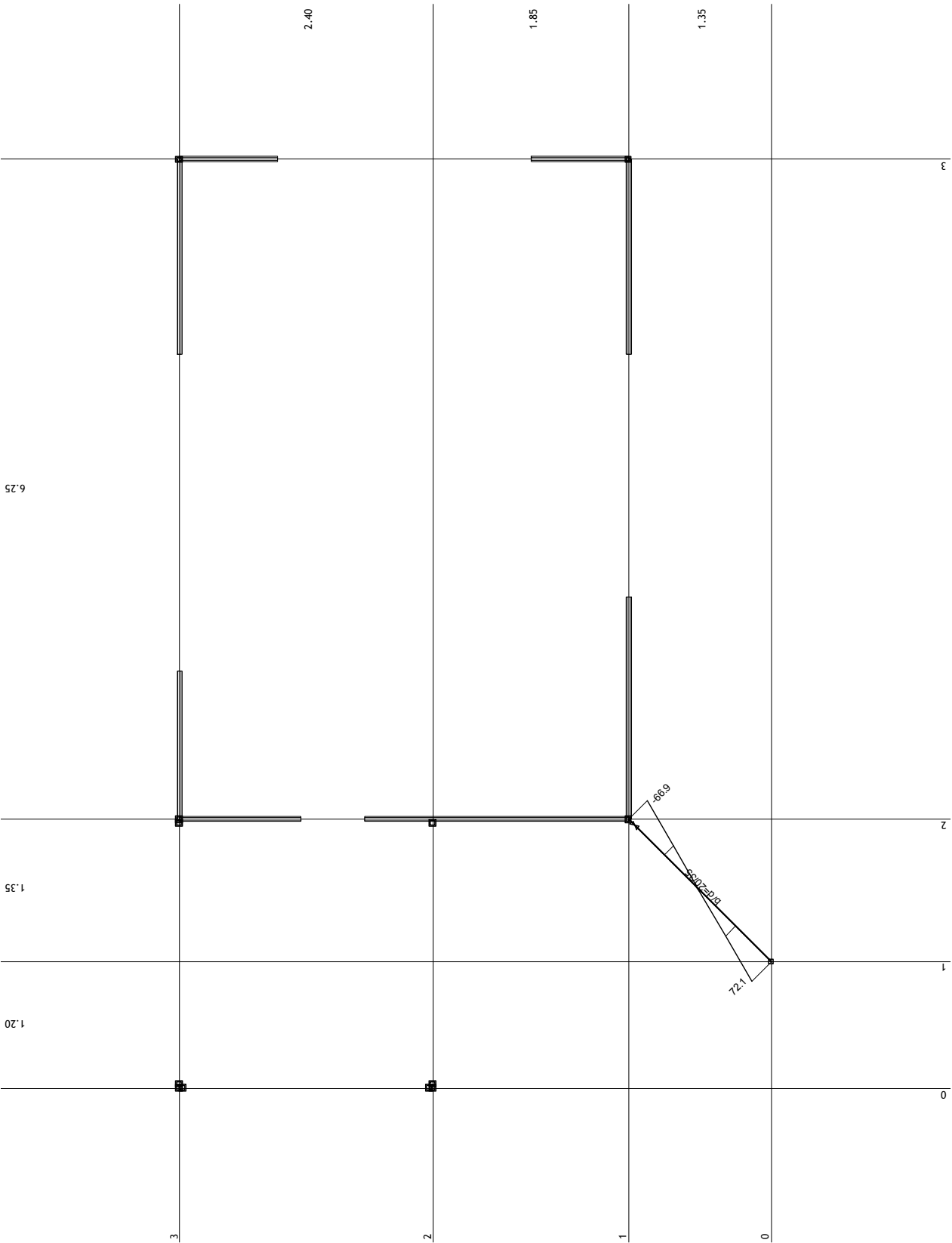
Opt. 10: [dimenzionisanje] 6-9



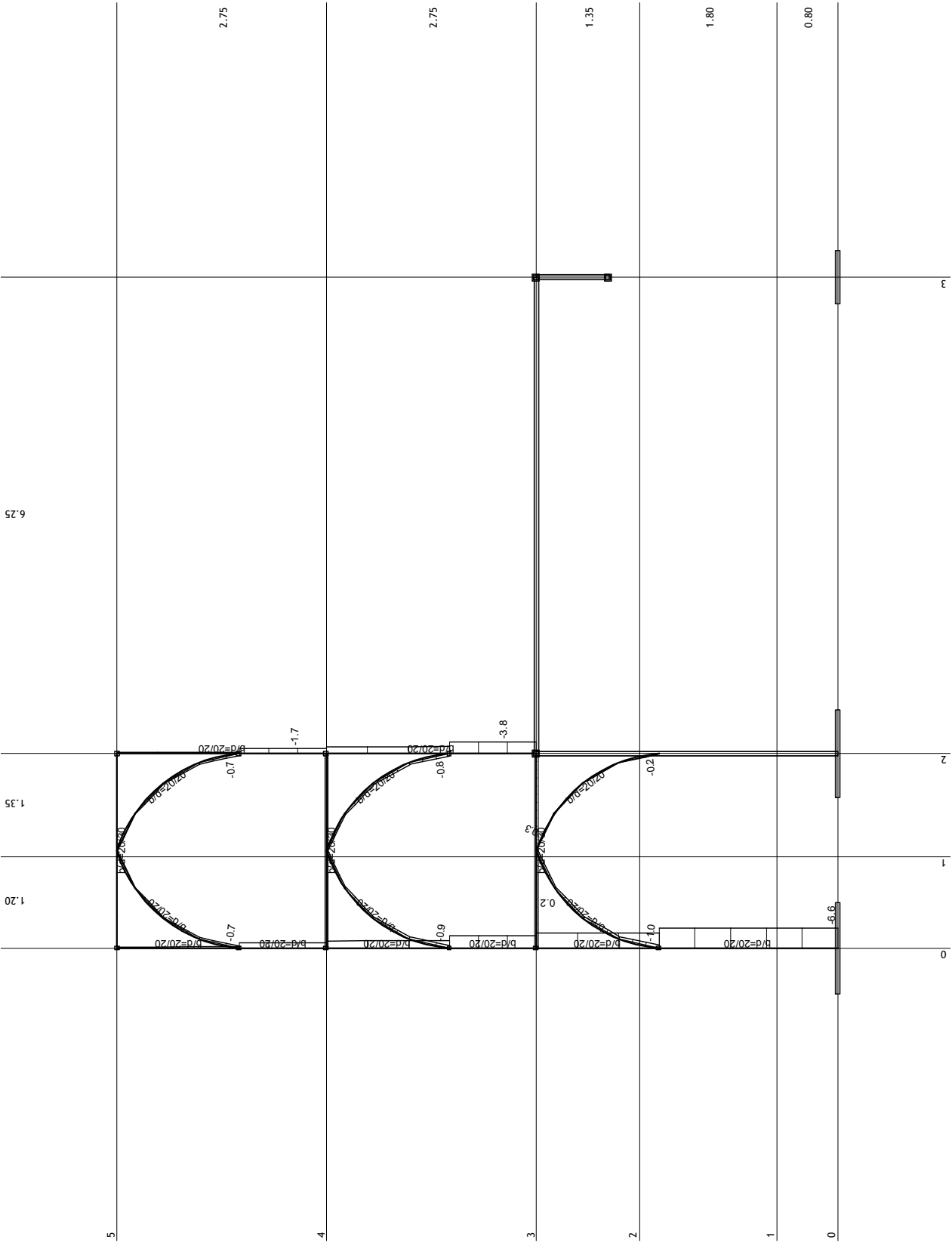
Nivo: Krov kuće [3.15 m]
Uticaji u gredi: max T2= 31.4 / min T2= -75.6 kN



Nivo: St greda [1.80 m]
Uticaji u gredi: max M3= 30.7 / min M3= -5.8 kNm

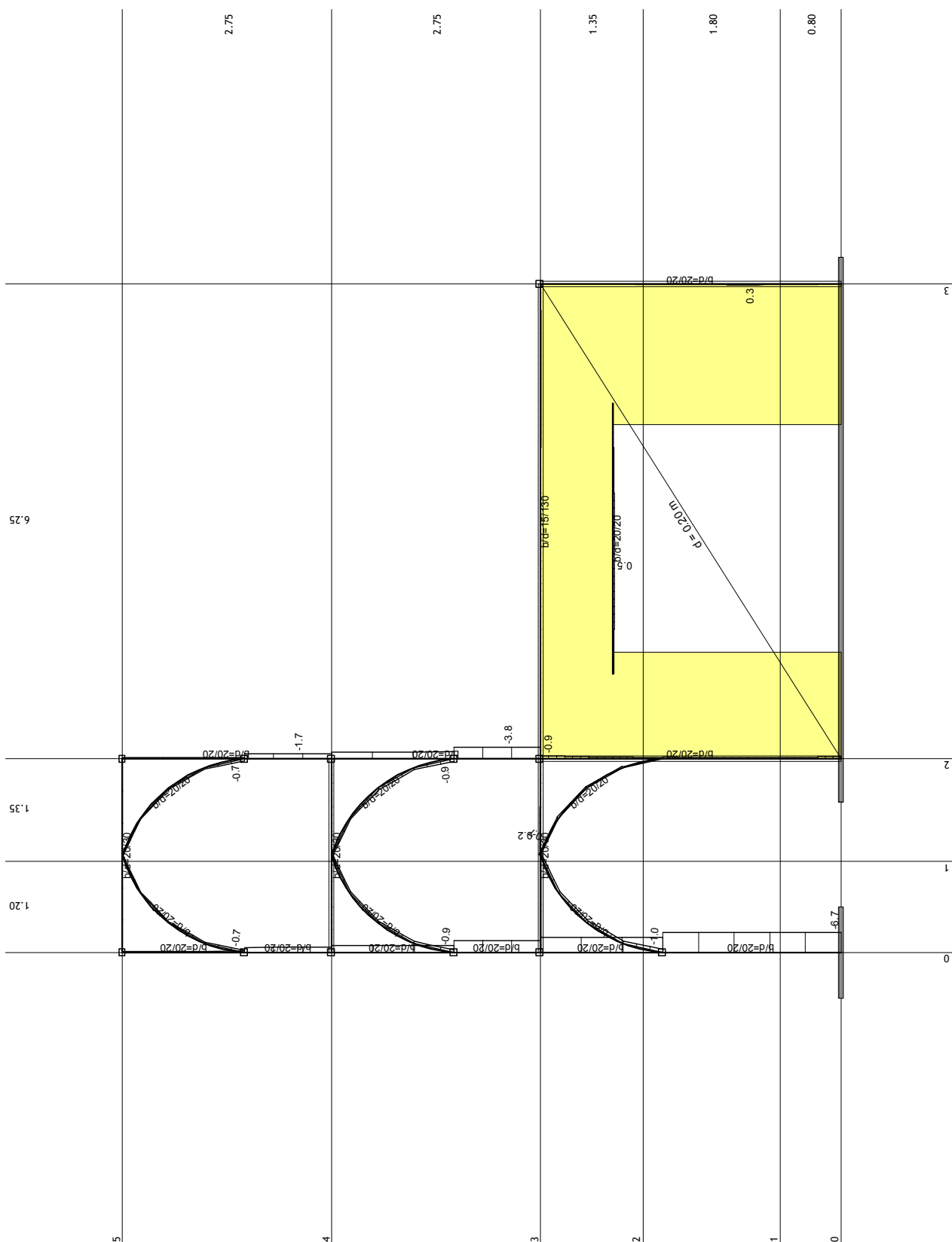


Nivo: St greda [1.80 m]
Uticaji u gredi: max T2= 72.1 / min T2= -66.9 kN



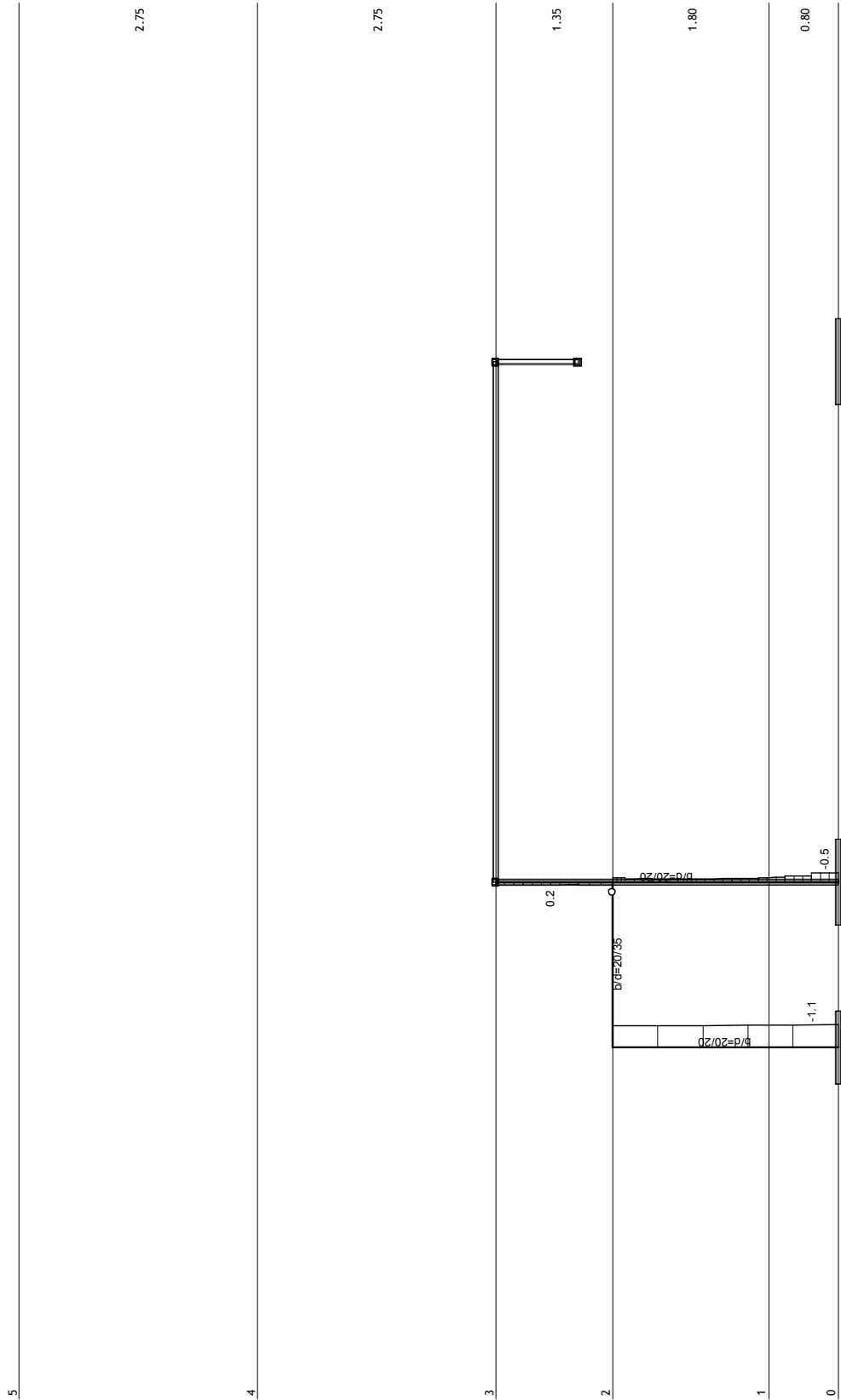
Ram: H_3
Uticaji u gredi: max σ ,0= 0.3 / min σ ,0= -6.6 MPa

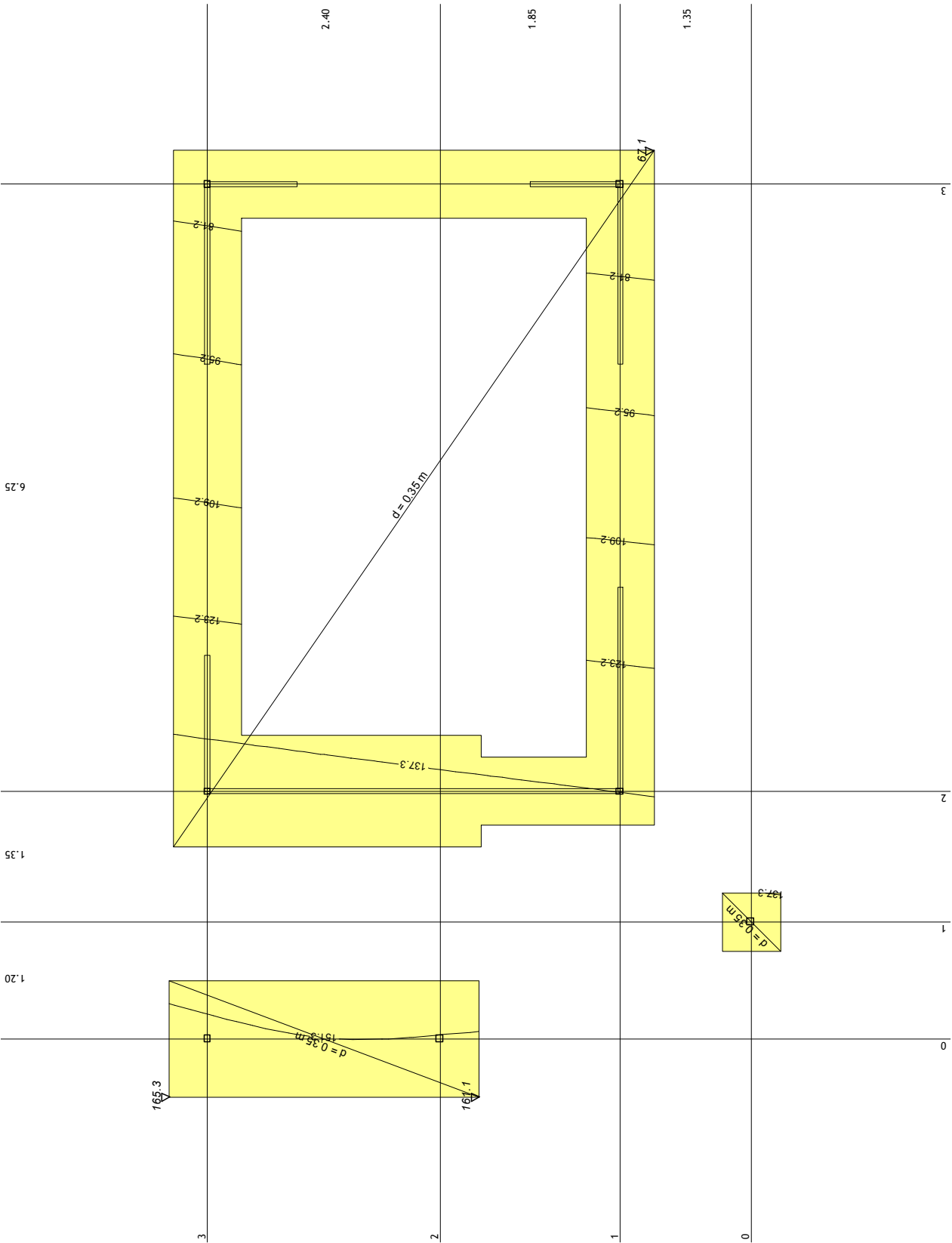
Opt. 6: I+II+III



Ram: H_2

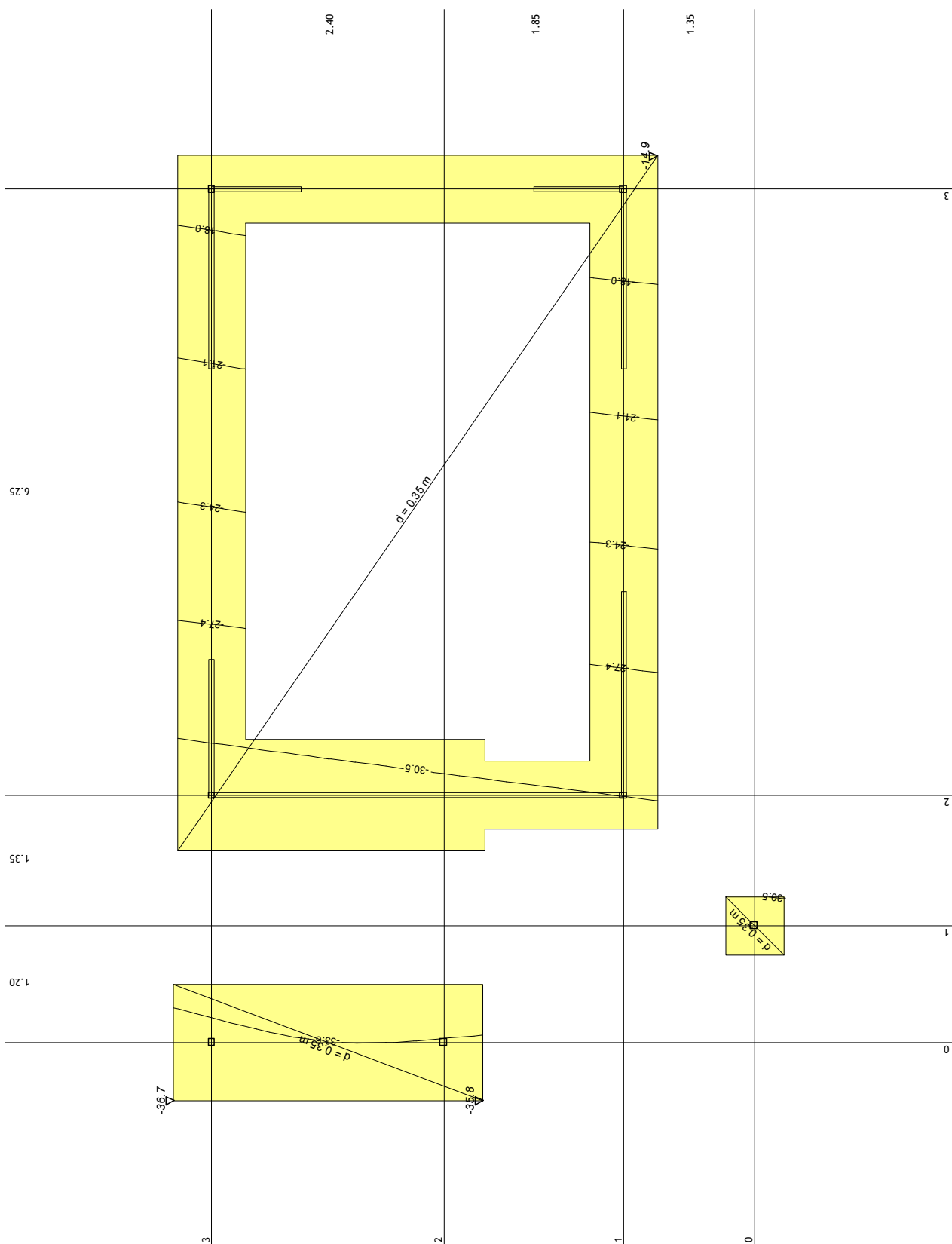
Uticaji u gredi: $\max \sigma_{,0} = 0.7$ / $\min \sigma_{,0} = -6.7$ MPa





Nivo: Temelji [-0.80 m]
Uticaji u pov. osloncu: max σ , tla= 165.3 / min σ , tla= 67.1 kN/m²

Opt. 6: I+II+III

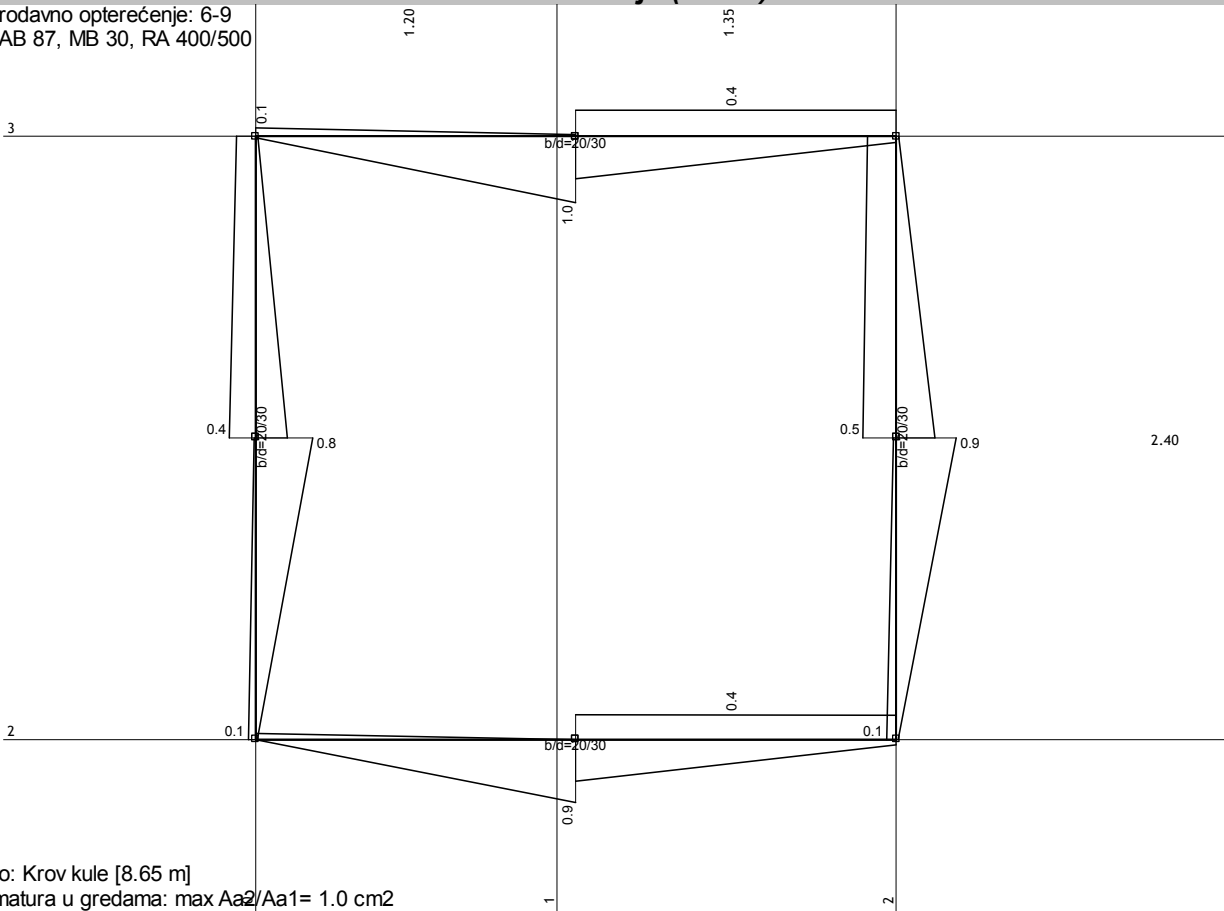


Nivo: Temelji [-0.80 m]

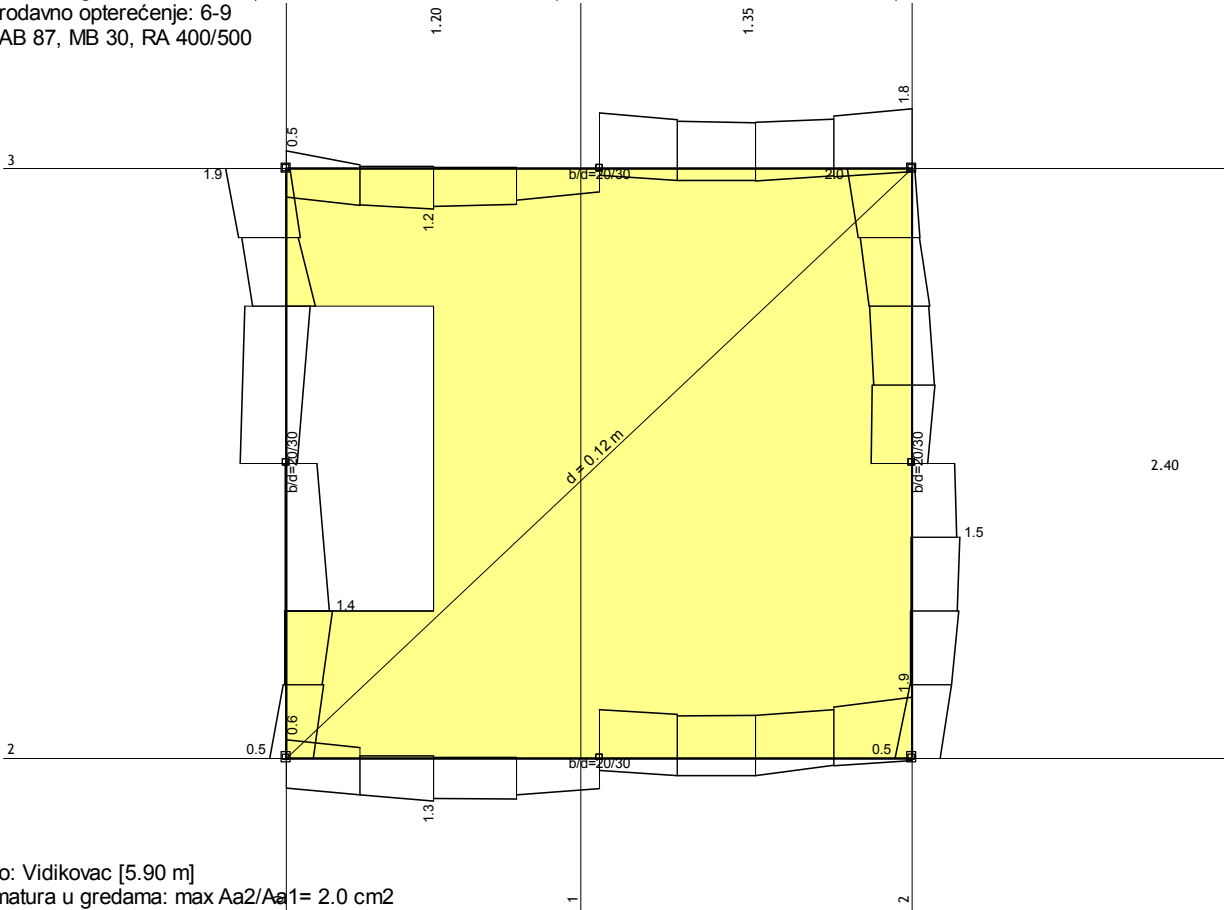
Utjecaji u pov. osloncu: max s,tla= -14.9 / min s,tla= -36.7 m / 1000

Dimenzionisanje (beton)

Merodavno opterećenje: 6-9
PBAB 87, MB 30, RA 400/500

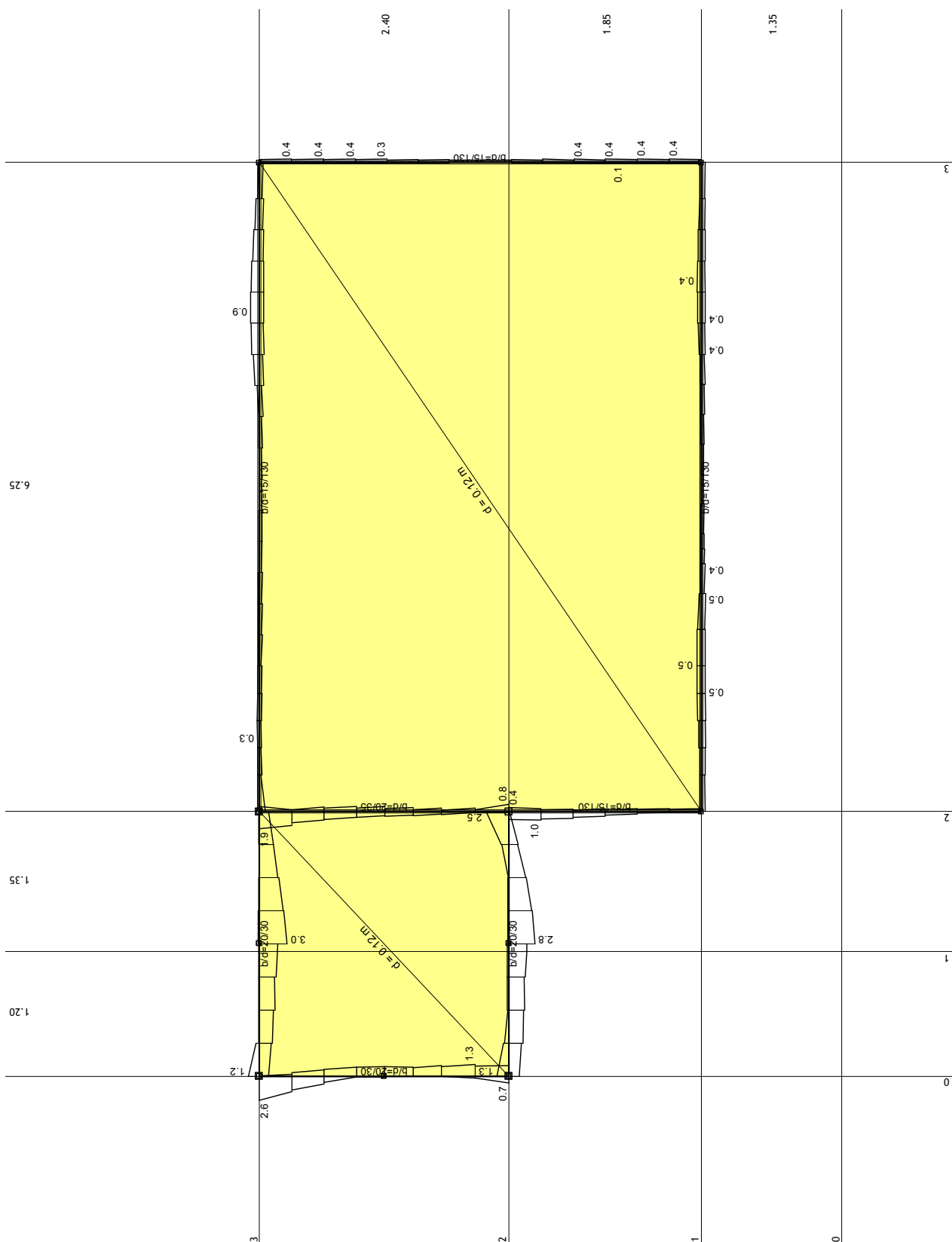


Nivo: Krov kule [8.65 m]
Armatura u gredama: max $A_{a2}/A_{a1} = 1.0 \text{ cm}^2$
Merodavno opterećenje: 6-9
PBAB 87, MB 30, RA 400/500



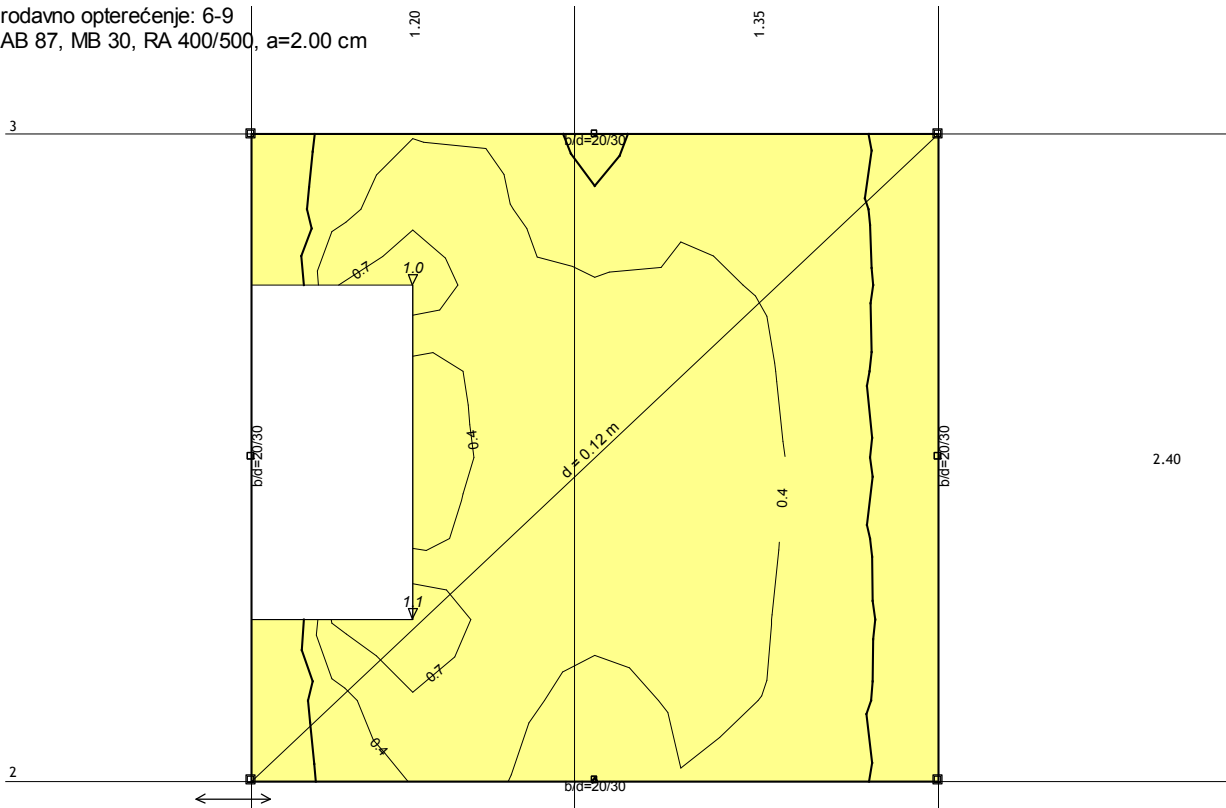
Nivo: Vidikovac [5.90 m]
Armatura u gredama: max $A_{a2}/A_{a1} = 2.0 \text{ cm}^2$

Merodavno opterećenje: 6-9
PBAB 87, MB 30, RA 400/500

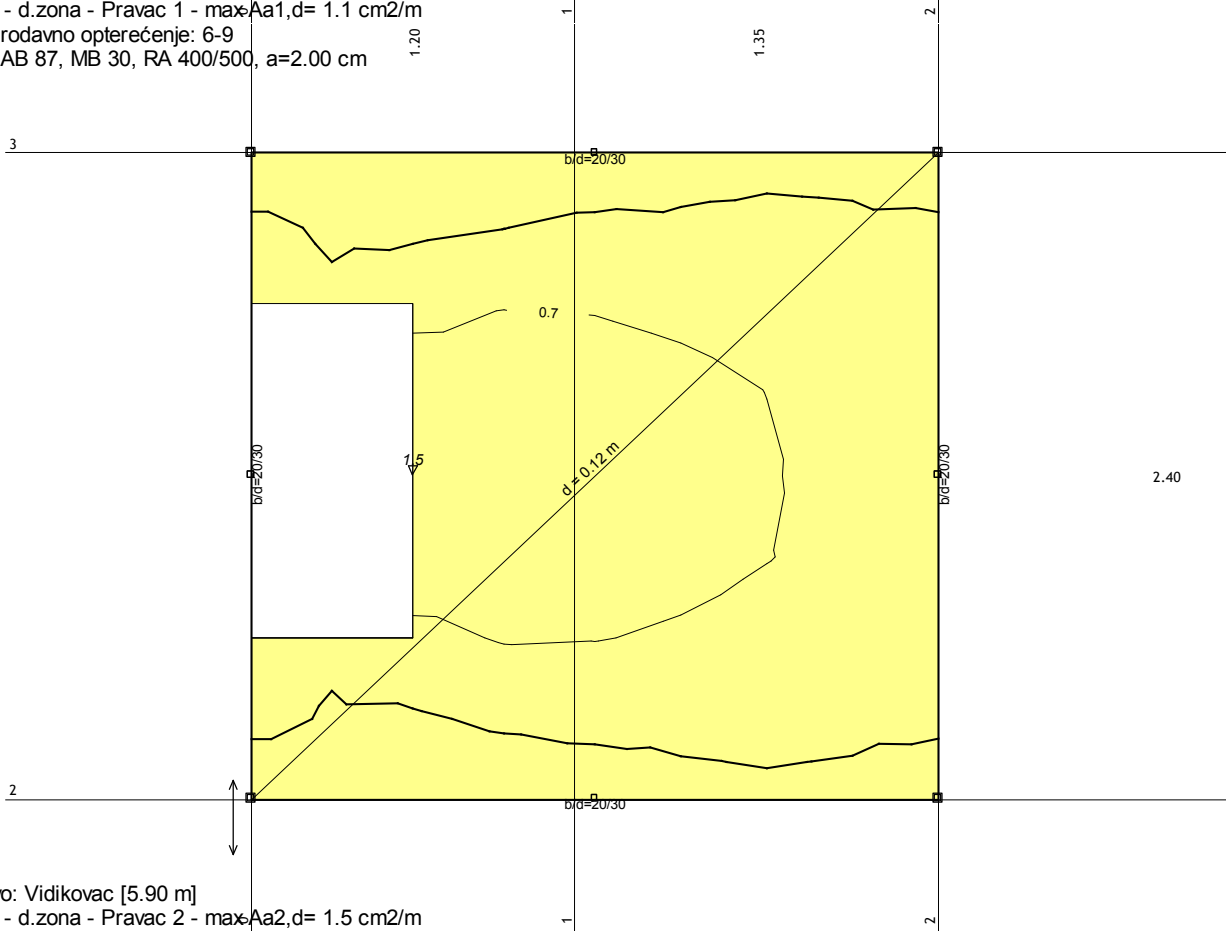


Nivo: Krov kuće [3.15 m]
Armatura u gredama: $\max A_{a2}/A_{a1} = 3.0 \text{ cm}^2$

Merodavno opterećenje: 6-9
PBAB 87, MB 30, RA 400/500, a=2.00 cm

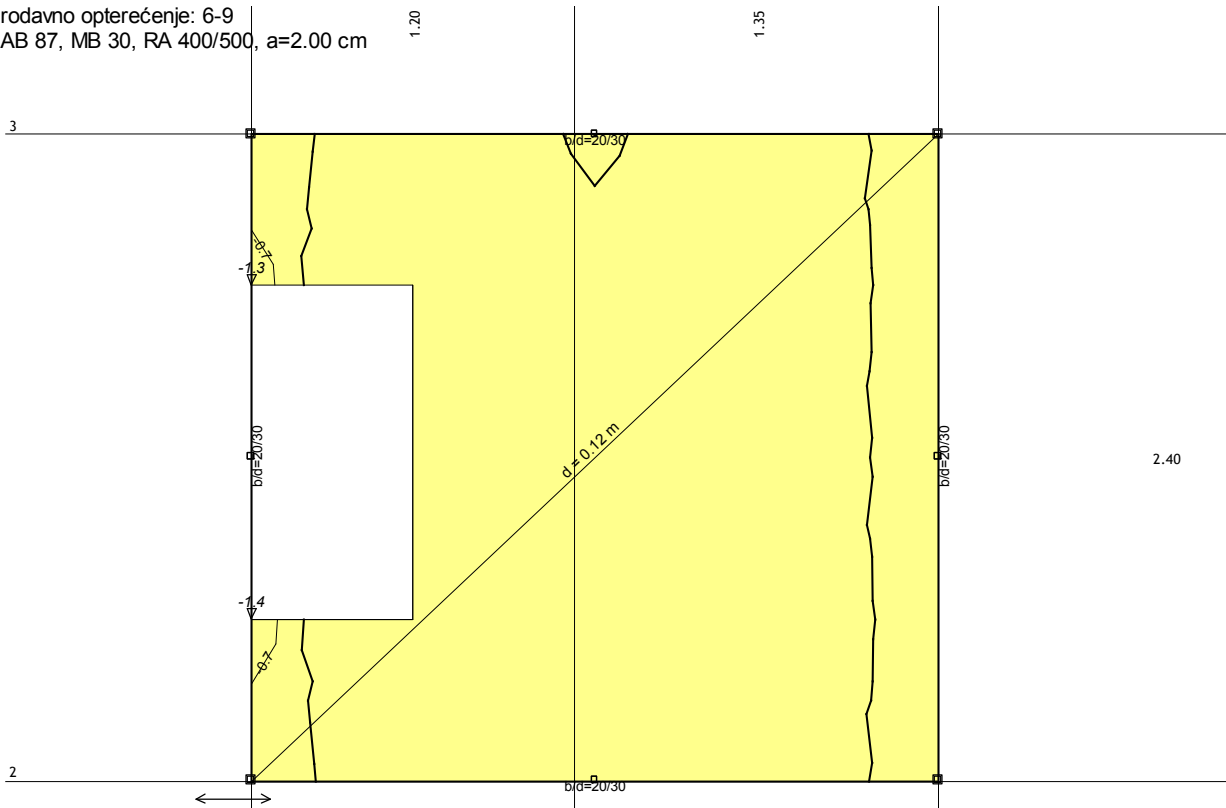


Nivo: Vidikovac [5.90 m]
Aa - d.zona - Pravic 1 - max Aa1, d= 1.1 cm²/m
Merodavno opterećenje: 6-9
PBAB 87, MB 30, RA 400/500, a=2.00 cm

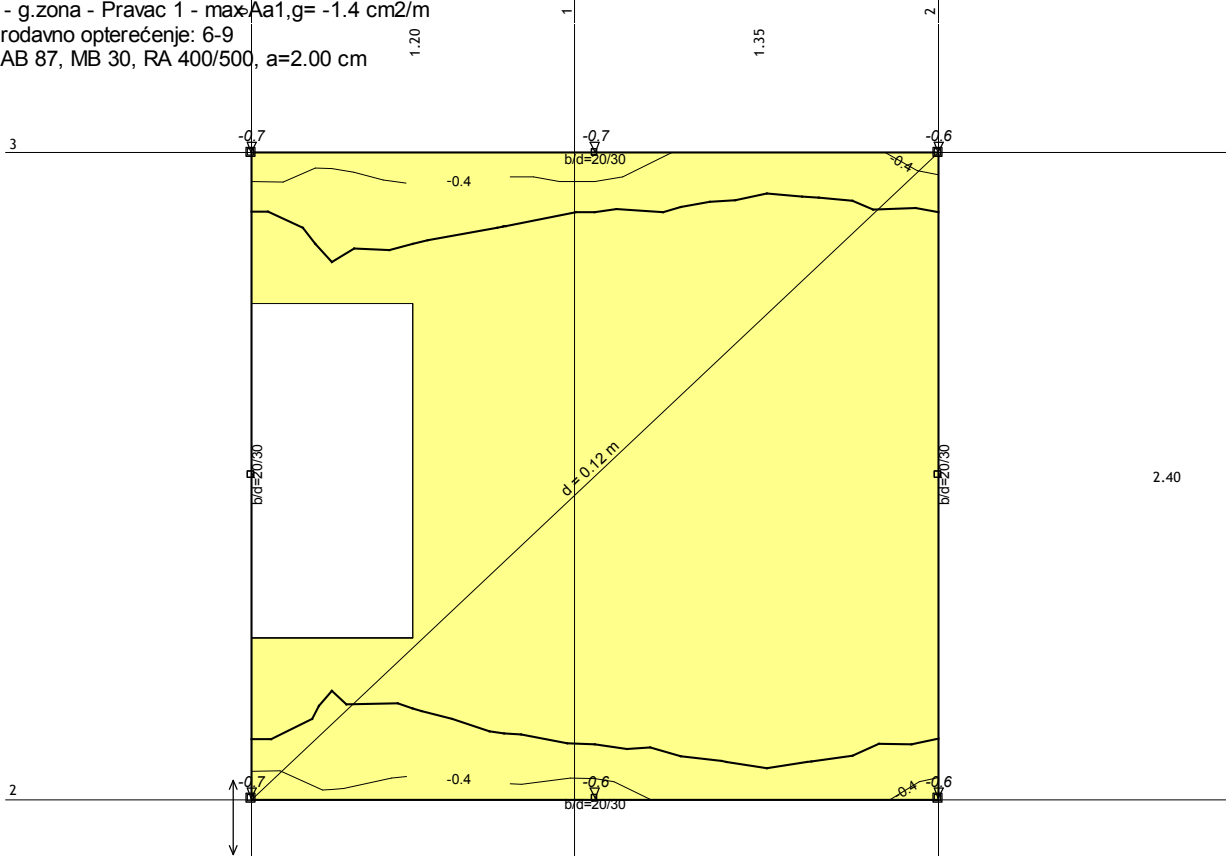


Nivo: Vidikovac [5.90 m]
Aa - d.zona - Pravic 2 - max Aa2, d= 1.5 cm²/m

Merodavno opterećenje: 6-9
PBAB 87, MB 30, RA 400/500, a=2.00 cm

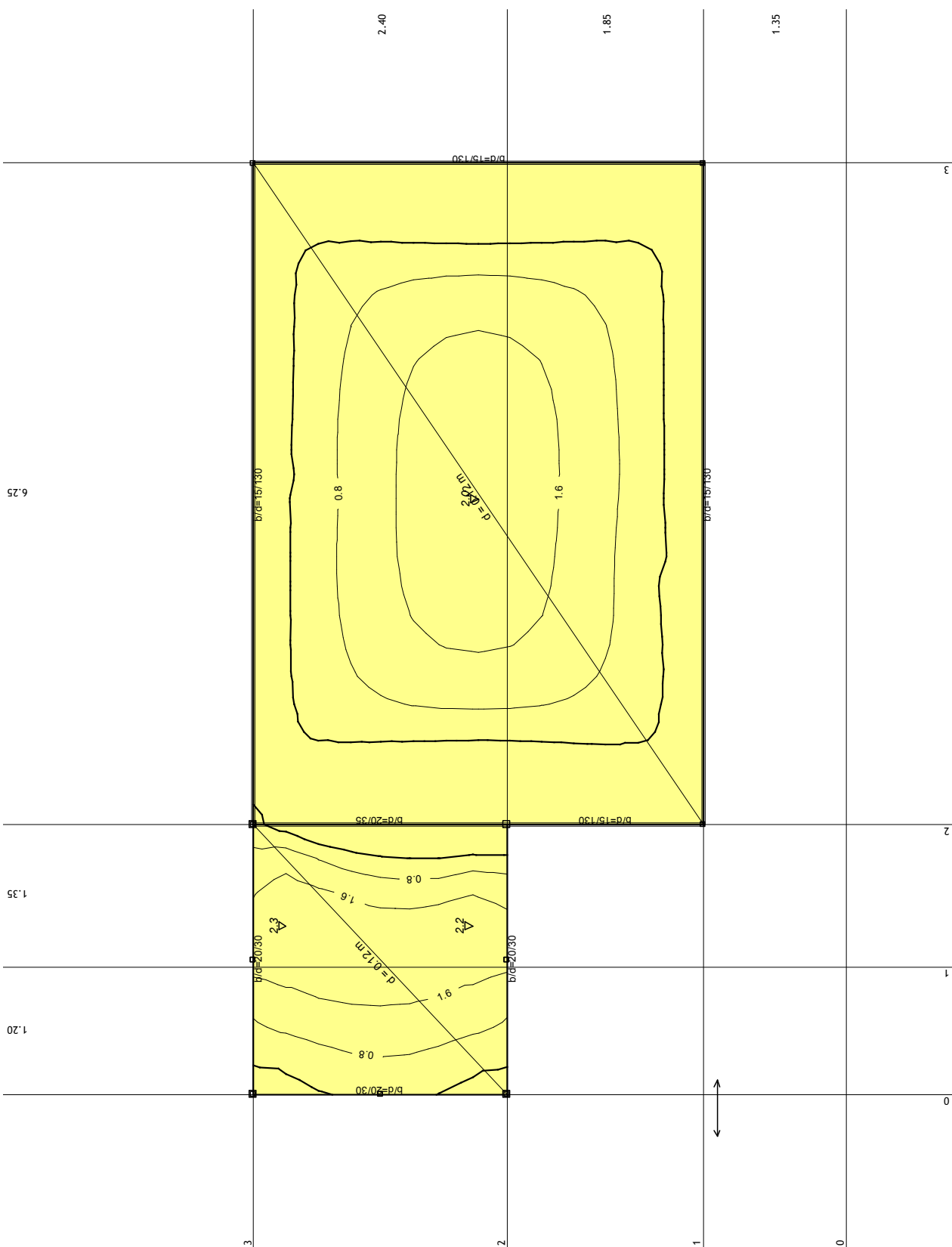


Nivo: Vidikovac [5.90 m]
Aa - g.zona - Pravac 1 - max Aa1,g= -1.4 cm²/m
Merodavno opterećenje: 6-9
PBAB 87, MB 30, RA 400/500, a=2.00 cm



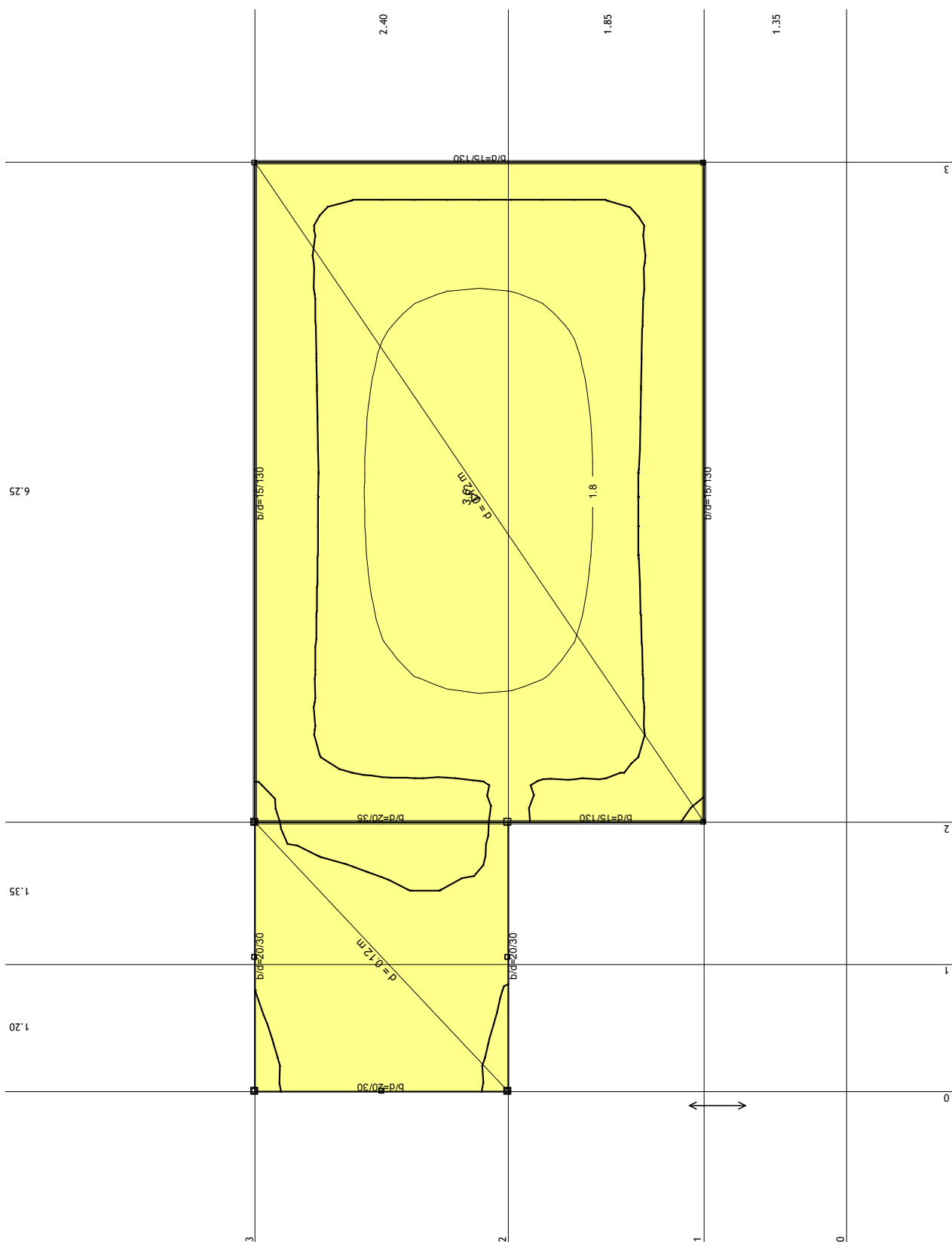
Nivo: Vidikovac [5.90 m]
Aa - g.zona - Pravac 2 - max Aa2,g= -0.7 cm²/m

Merodavno opterećenje: 6-9
PBAB 87, MB 30, RA 400/500, a=2.00 cm



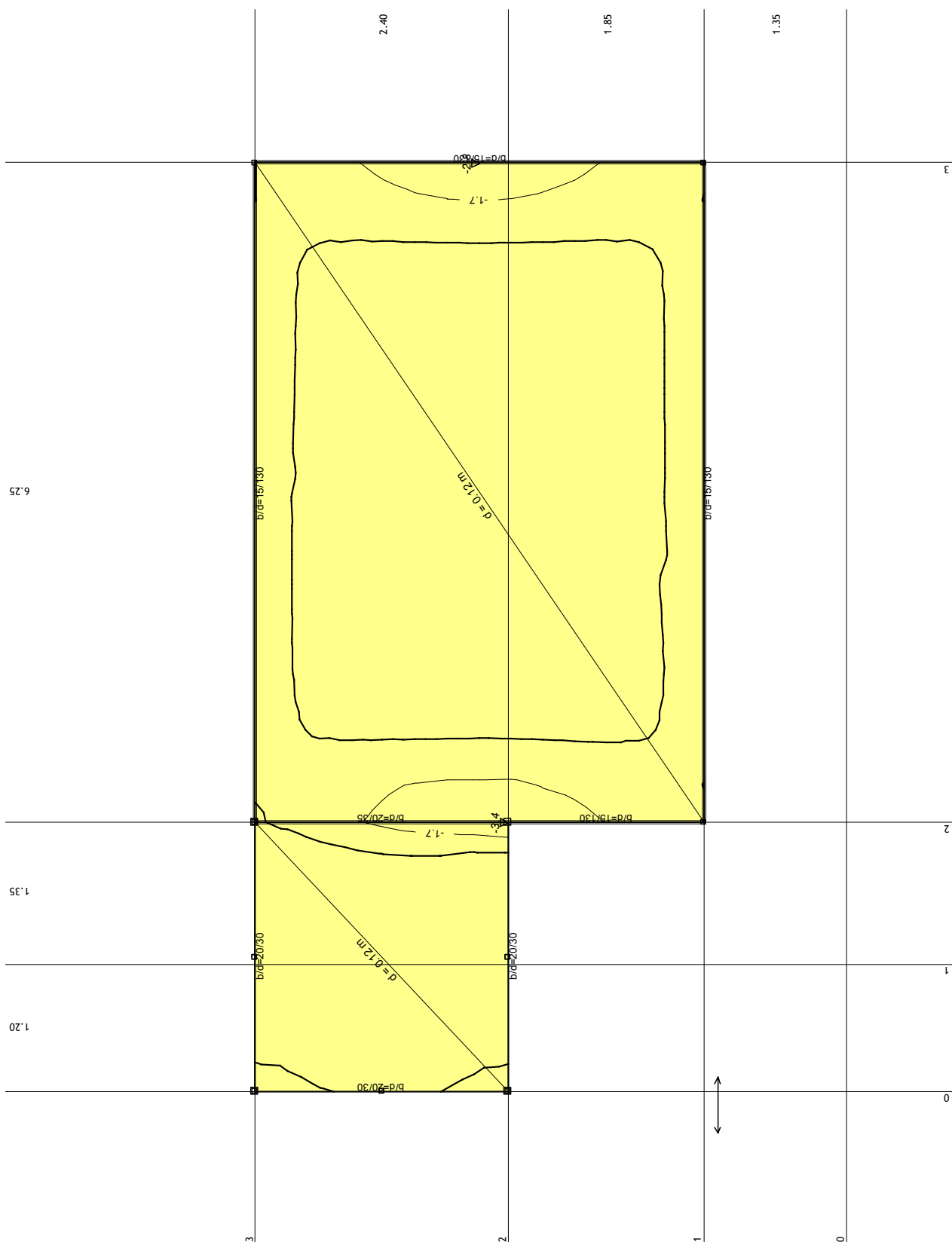
Nivo: Krov kuće [3.15 m]
Aa - d.zona - Pravac 1 - max Aa1,d= 2.3 cm²/m

Merodavno opterećenje: 6-9
PBAB 87, MB 30, RA 400/500, a=2.00 cm



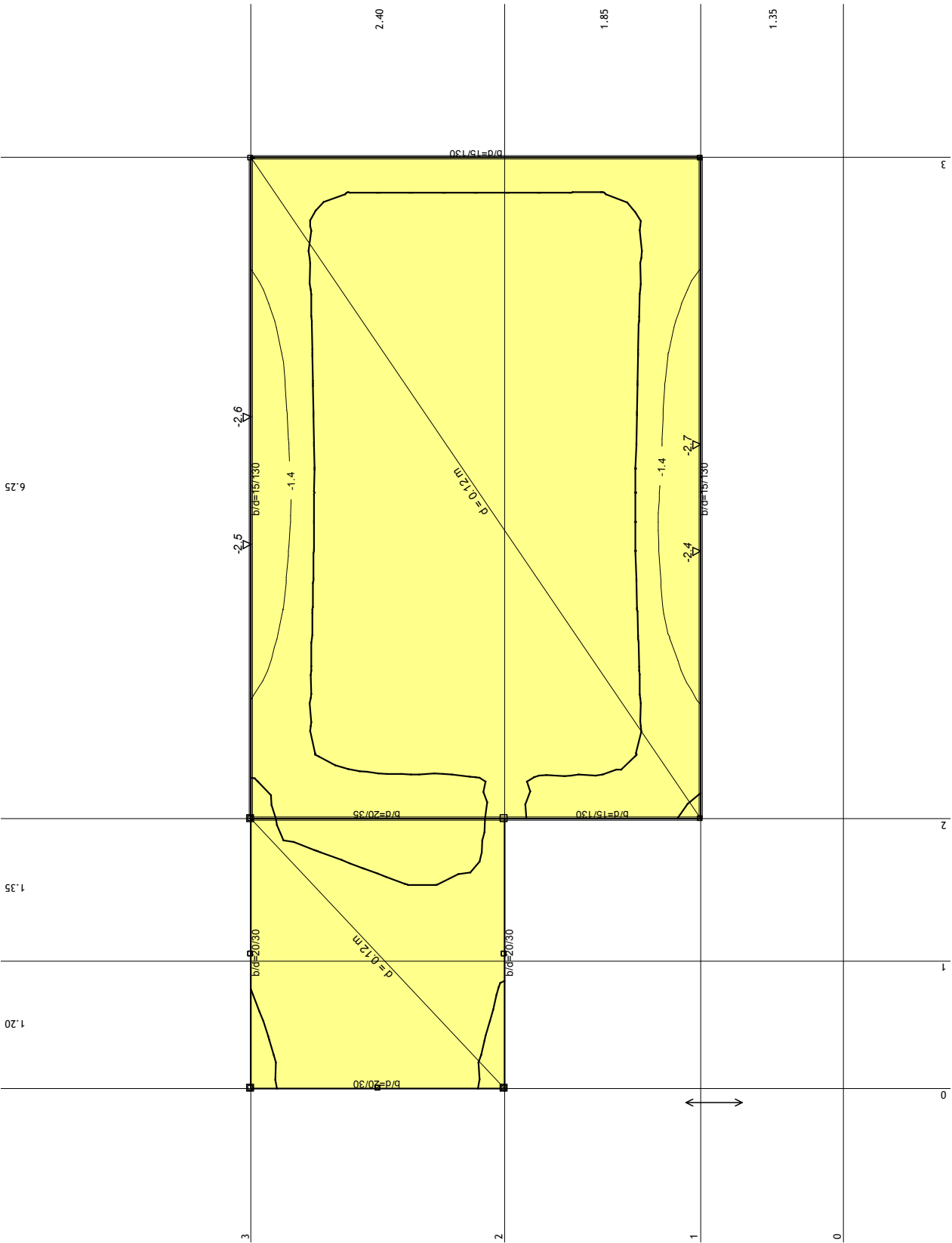
Nivo: Krov kuće [3.15 m]
Aa - d.zona - Pravac 2 - max Aa2,d= 3.6 cm2/m

Merodavno opterećenje: 6-9
PBAB 87, MB 30, RA 400/500, a=2.00 cm



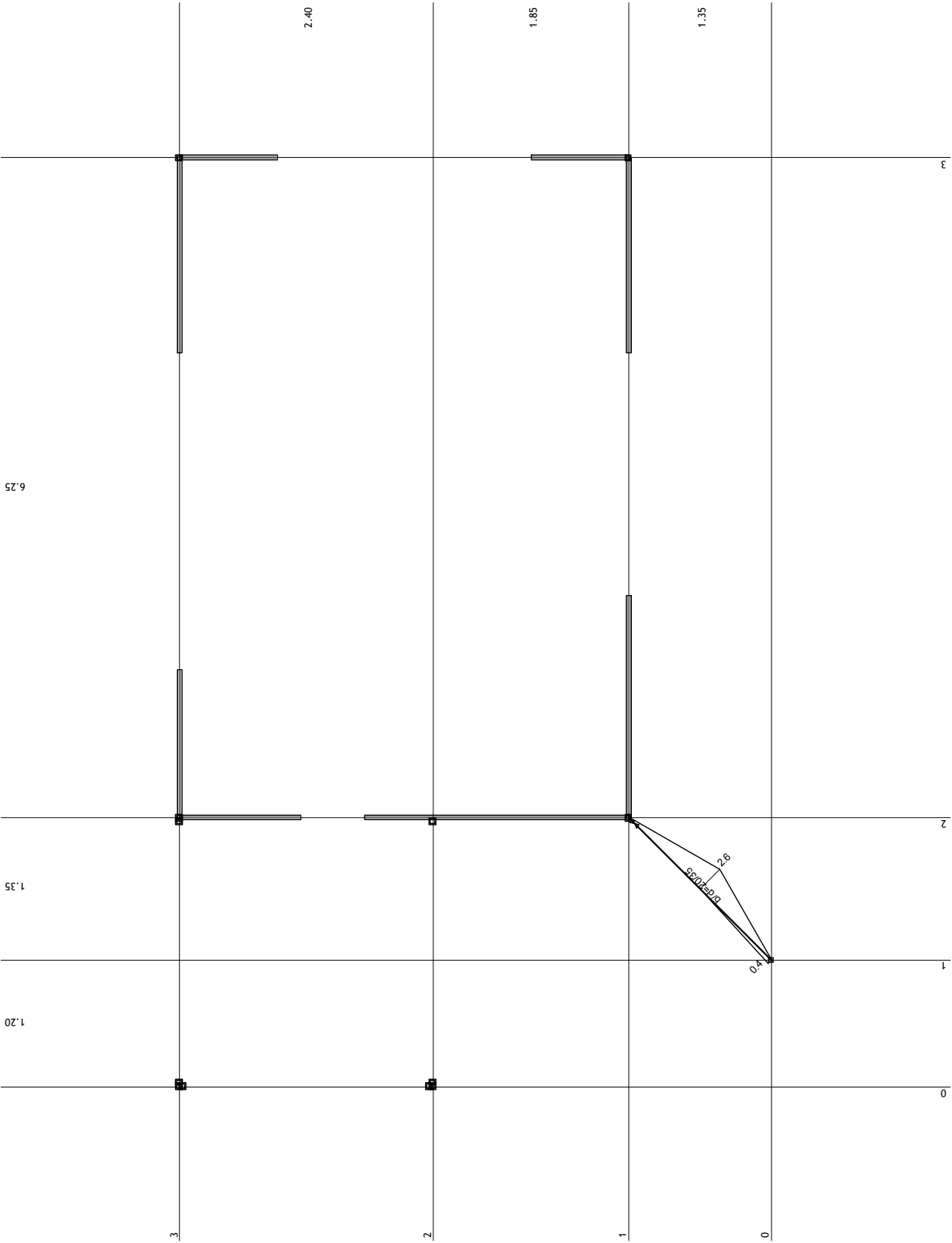
Nivo: Krov kuće [3.15 m]
Aa - g.zona - Pravac 1 - max Aa1,g= -3.4 cm²/m

Merodavno opterećenje: 6-9
PBAB 87, MB 30, RA 400/500, a=2.00 cm



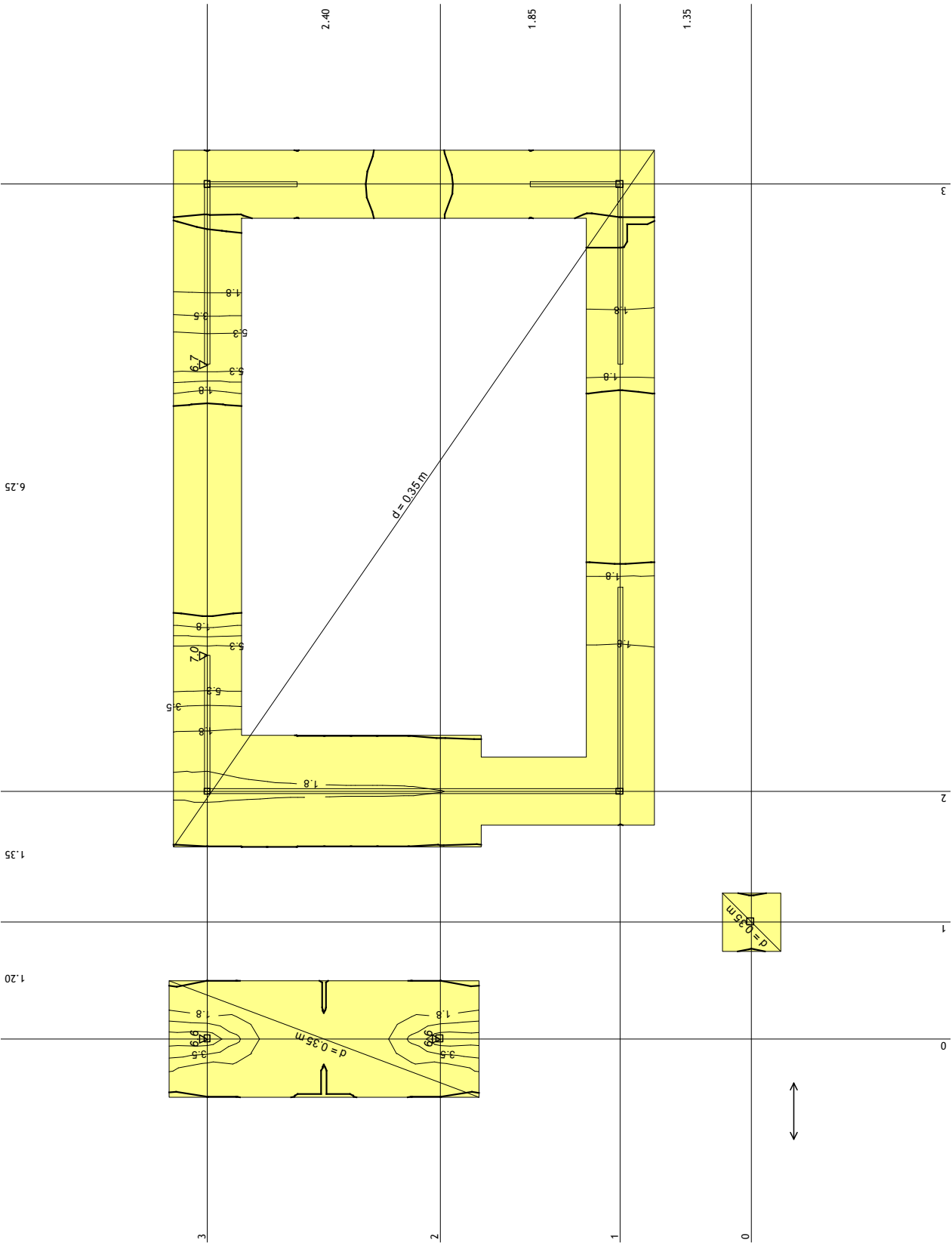
Nivo: Krov kuće [3.15 m]
Aa - g.zona - Pravic 2 - max Aa2,g= -2.7 cm²/m

Merodavno opterećenje: 6-9
PBAB 87, MB 30, RA 400/500



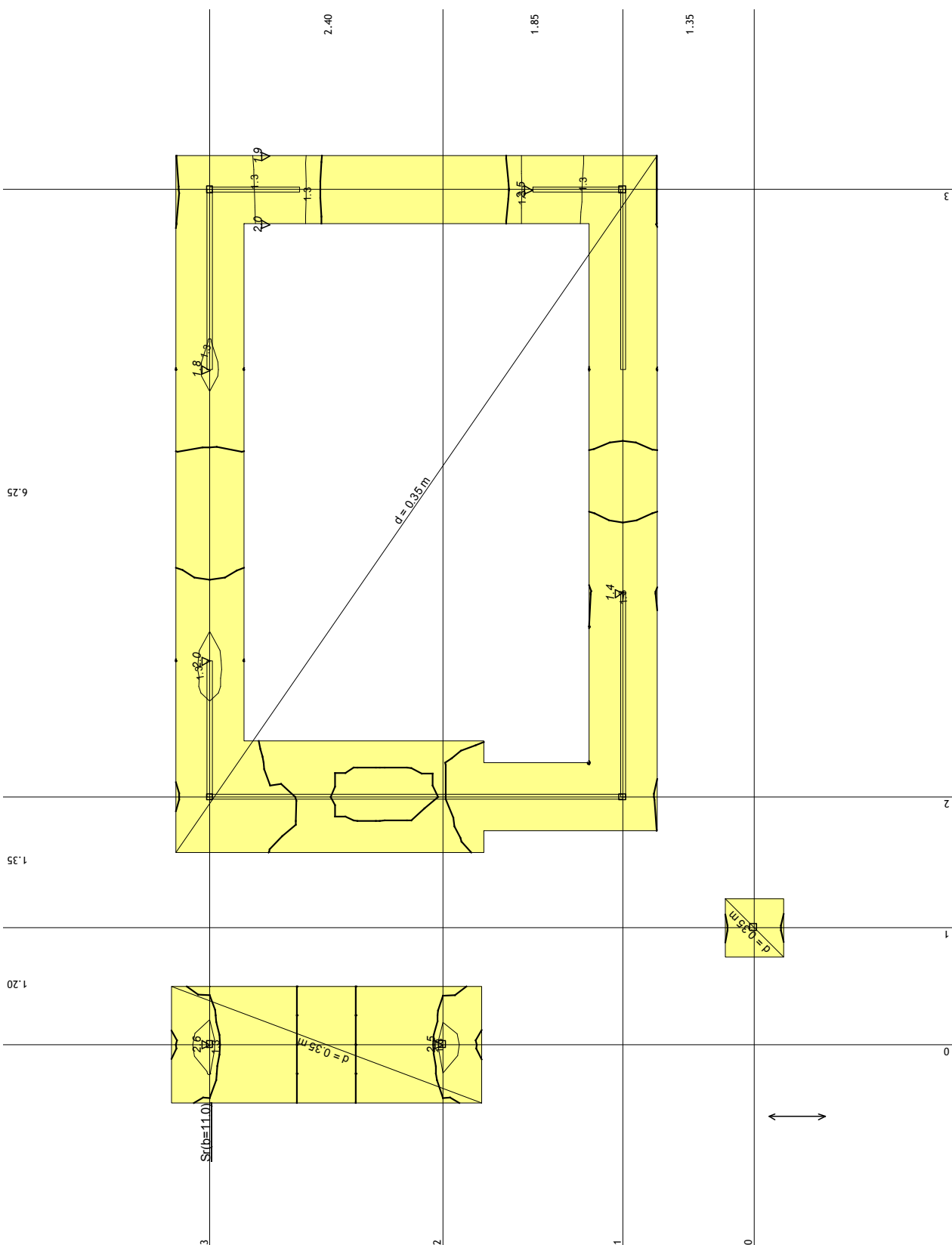
Nivo: St greda [1.80 m]
Armatura u gredama: max $A_{a2}/A_{a1} = 2.6 \text{ cm}^2$

Merodavno opterećenje: 6-9
PBAB 87, MB 30, RA 400/500, a=3.50 cm



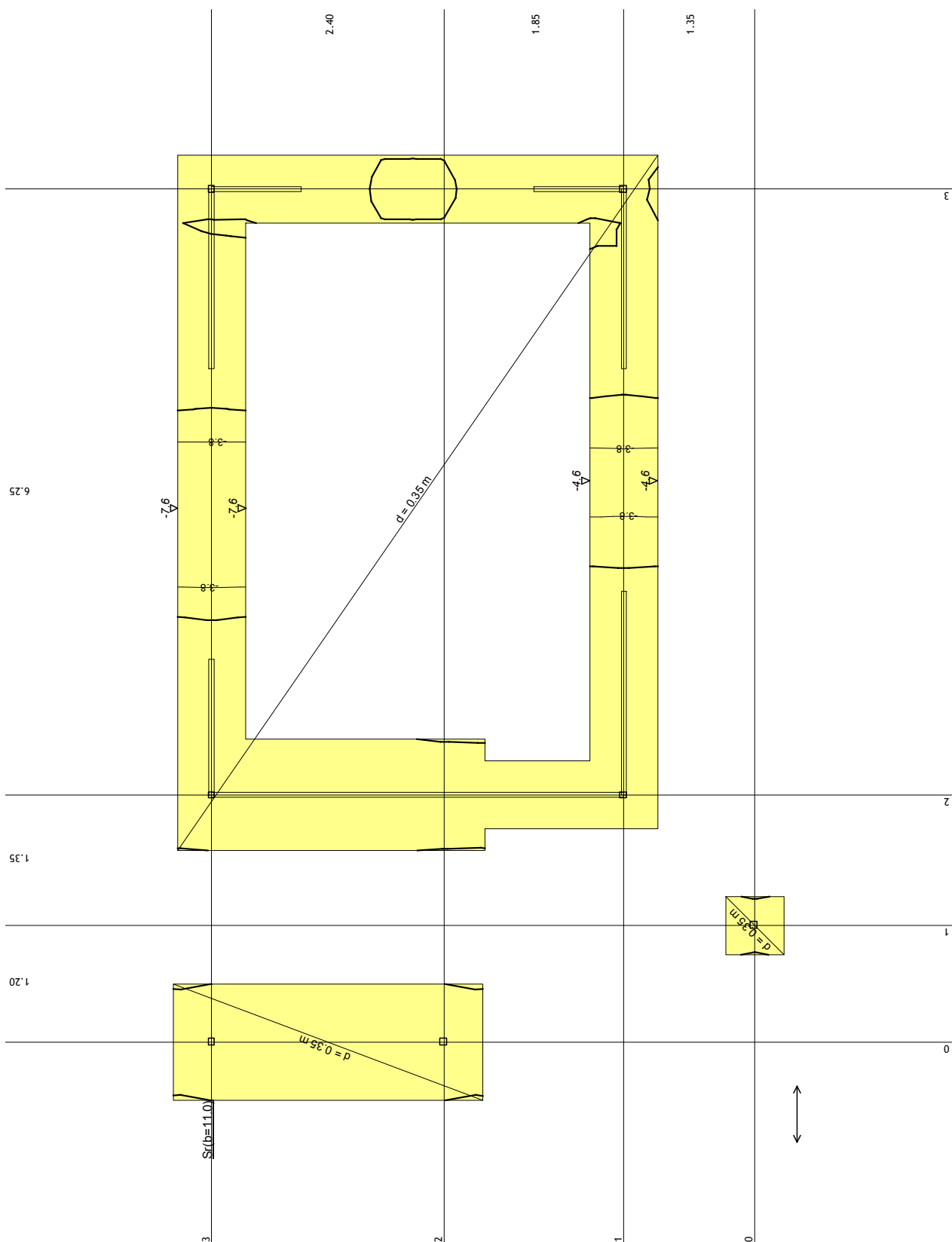
Nivo: Temelji [-0.80 m]
Aa - d.zona - Pravac 1 - max Aa1,d= 7.0 cm²/m

Merodavno opterećenje: 6-9
PBAB 87, MB 30, RA 400/500, a=3.50 cm



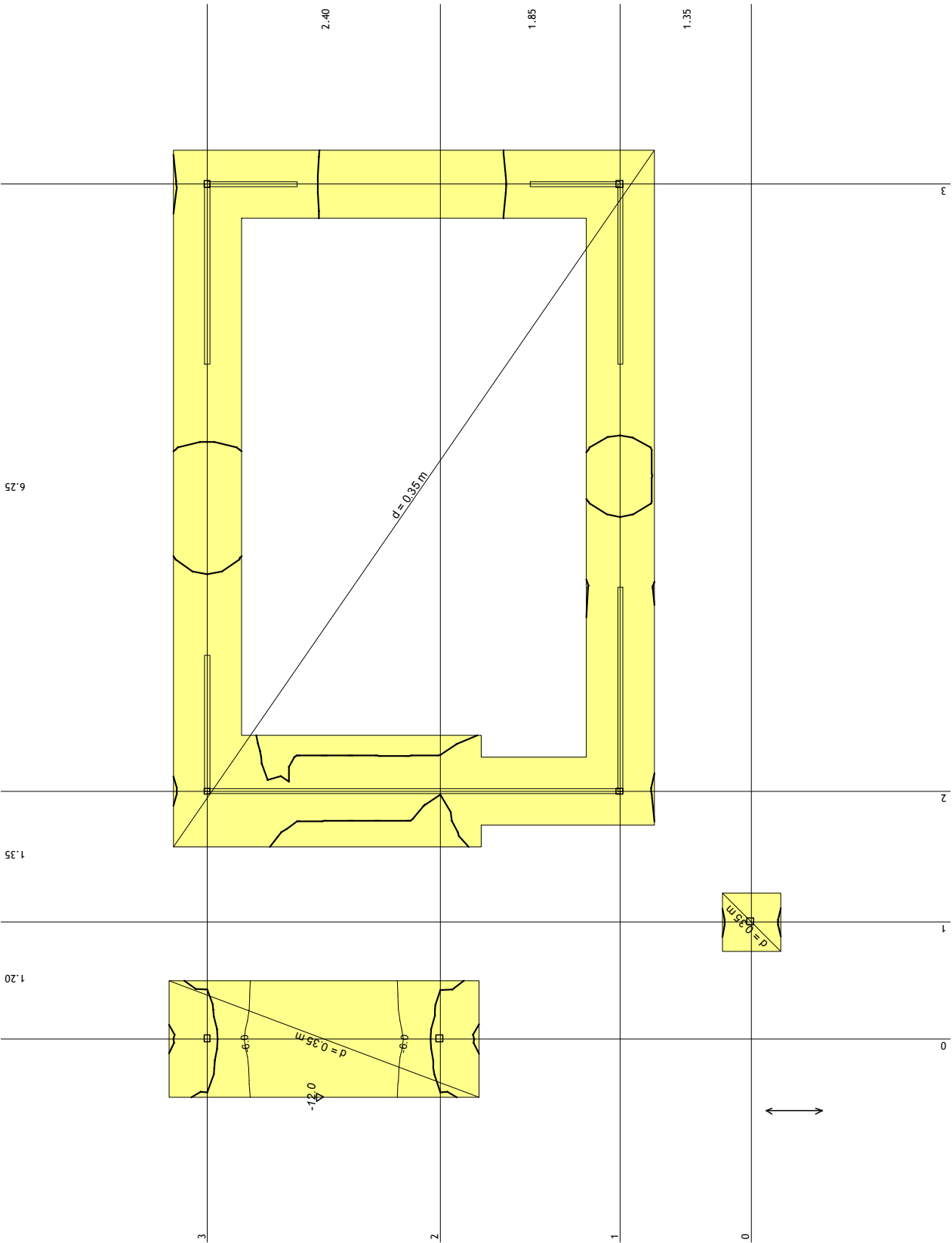
Nivo: Temelji [-0.80 m]
Aa - d.zona - Pravac 2 - max Aa2,d= 2.6 cm²/m

Merodavno opterećenje: 6-9
PBAB 87, MB 30, RA 400/500, a=3.50 cm



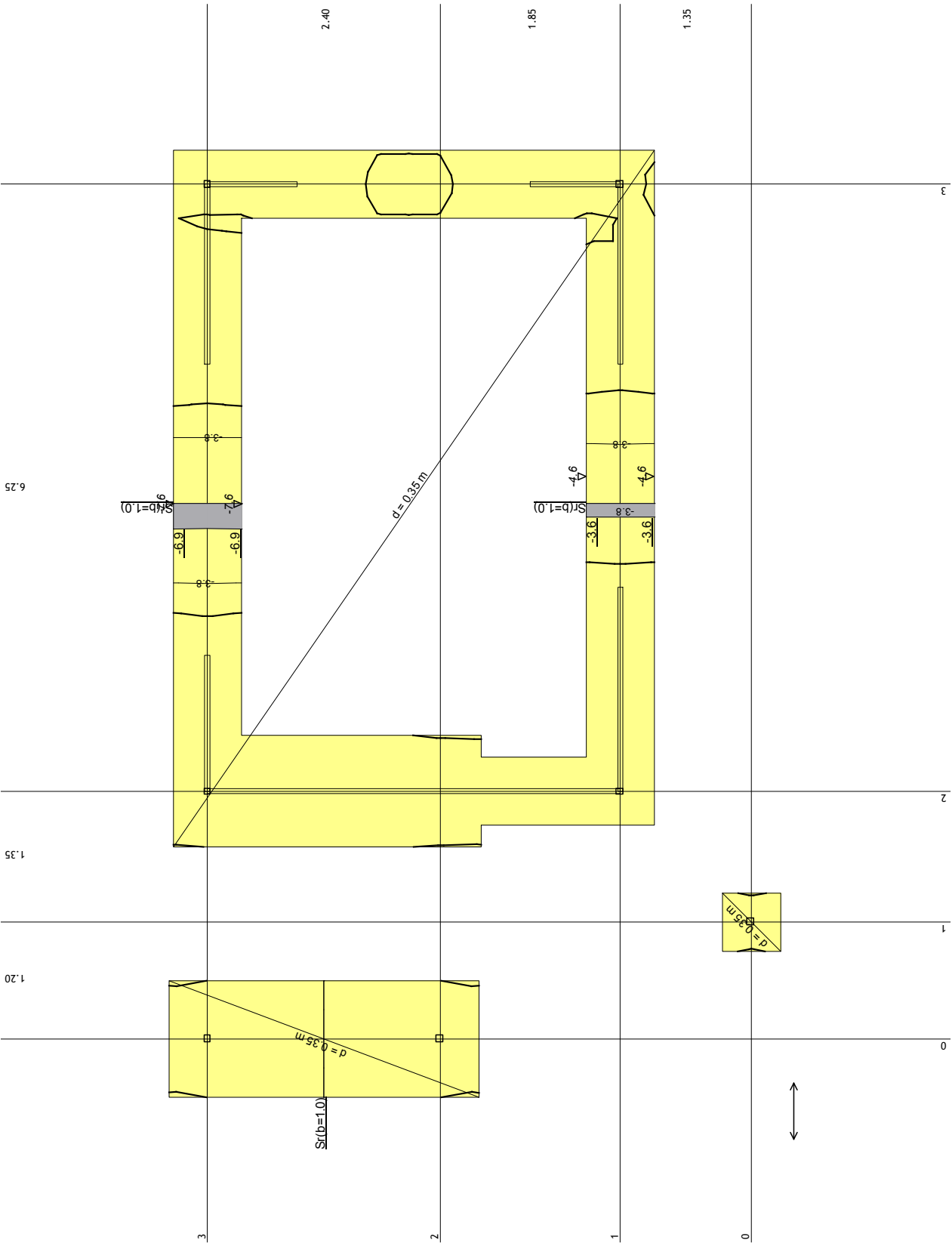
Nivo: Temelji [-0.80 m]
Aa - g.zona - Pravac 1 - max Aa1,g= -7.6 cm²/m

Merodavno opterećenje: 6-9
PBAB 87, MB 30, RA 400/500, a=3.50 cm



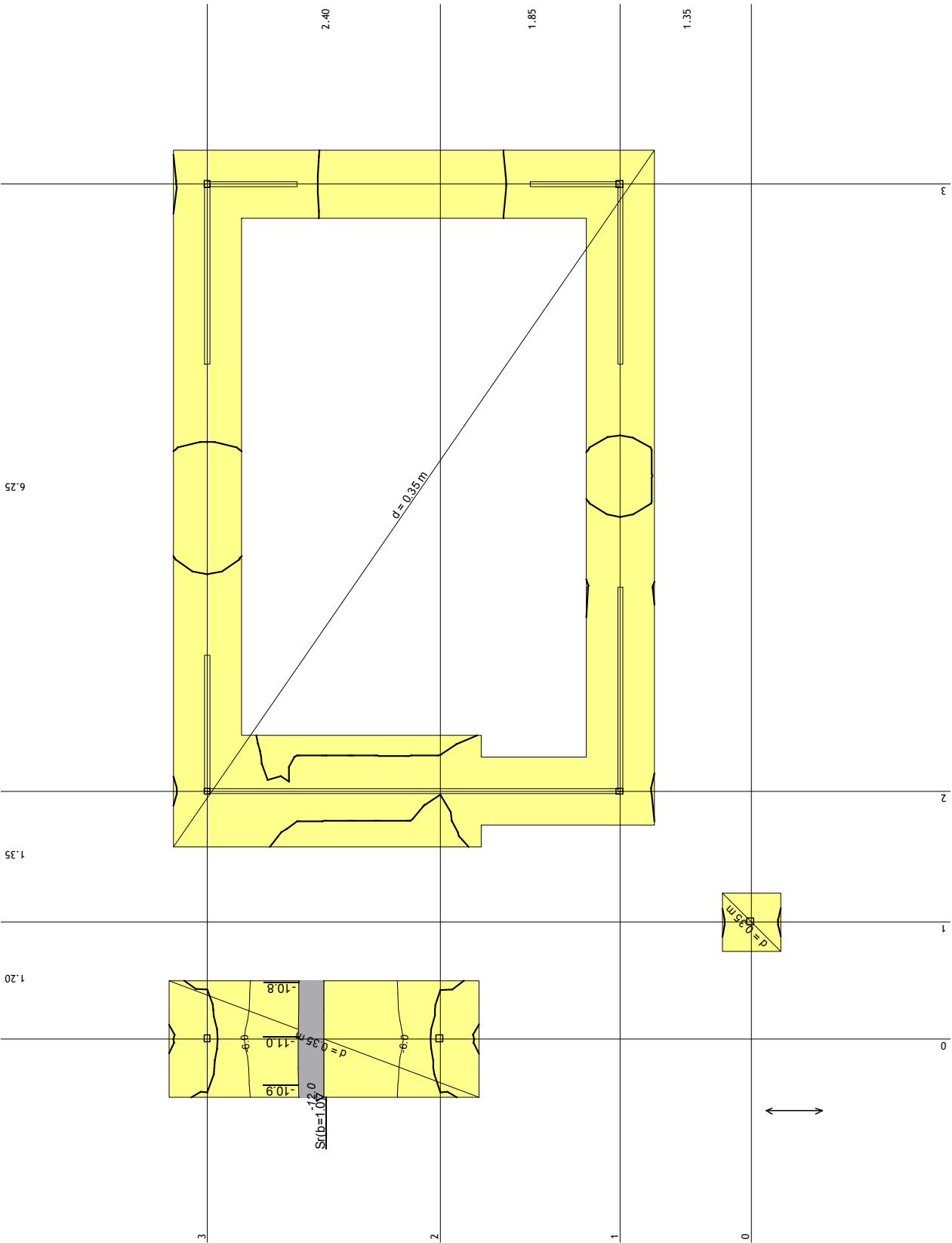
Nivo: Temelji [-0.80 m]
Aa - g.zona - Pravac 2 - max Aa2,g= -12.0 cm2/m

Merodavno opterećenje: 6-9
PBAB 87, MB 30, RA 400/500, a=3.50 cm



Nivo: Temelji [-0.80 m]
Aa - g.zona - Pravac 1 - max Aa1,g= -7.6 cm²/m

Merodavno opterećenje: 6-9
PBAB 87, MB 30, RA 400/500, a=3.50 cm



Nivo: Temelji [-0.80 m]
Aa - g.zona - Pravac 2 - max Aa2,g= -12.0 cm²/m

STEPENIŠTE

Osnovni podaci o modelu

Datoteka: step mala kula.twp
Datum proračuna: 13.12.2010

Način proračuna: 2D model (Xp, Zp, Yr)

- ☒ Teorija I-og reda ☐ Modalna analiza ☐ Stabilnost
☐ Teorija II-og reda ☐ Seizmički proračun ☐ Faze građenja
☐ Nelinearan proračun

Veličina modela

Broj čvorova: 2
Broj pločastih elemenata: 0
Broj grednih elemenata: 1
Broj graničnih elemenata: 5
Broj osnovnih slučajeva opterećenja: 2
Broj kombinacija opterećenja: 2

Jedinice mera

Dužina: m [cm,mm]
Sila: kN
Temperatura: Celsius

Ulazni podaci - Konstrukcija

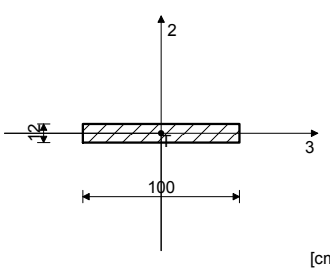
Tabela materijala

No	Naziv materijala	E[kN/m2]	μ	γ[kN/m3]	αt[1/C]	Em[kN/m2]	μm
1	Beton MB 30	3.150e+7	0.20	25.00	1.000e-5	3.150e+7	0.20

Setovi greda

Set: 1 Presek: b/d=100/12, Fiktivna ekscentričnost

Mat.	A1	A2	A3	I1	I2	I3
1 - Beton MB 30	1.200e-1	1.000e-1	1.000e-1	5.325e-4	1.000e-2	1.440e-4



Setovi tačkastih oslonaca

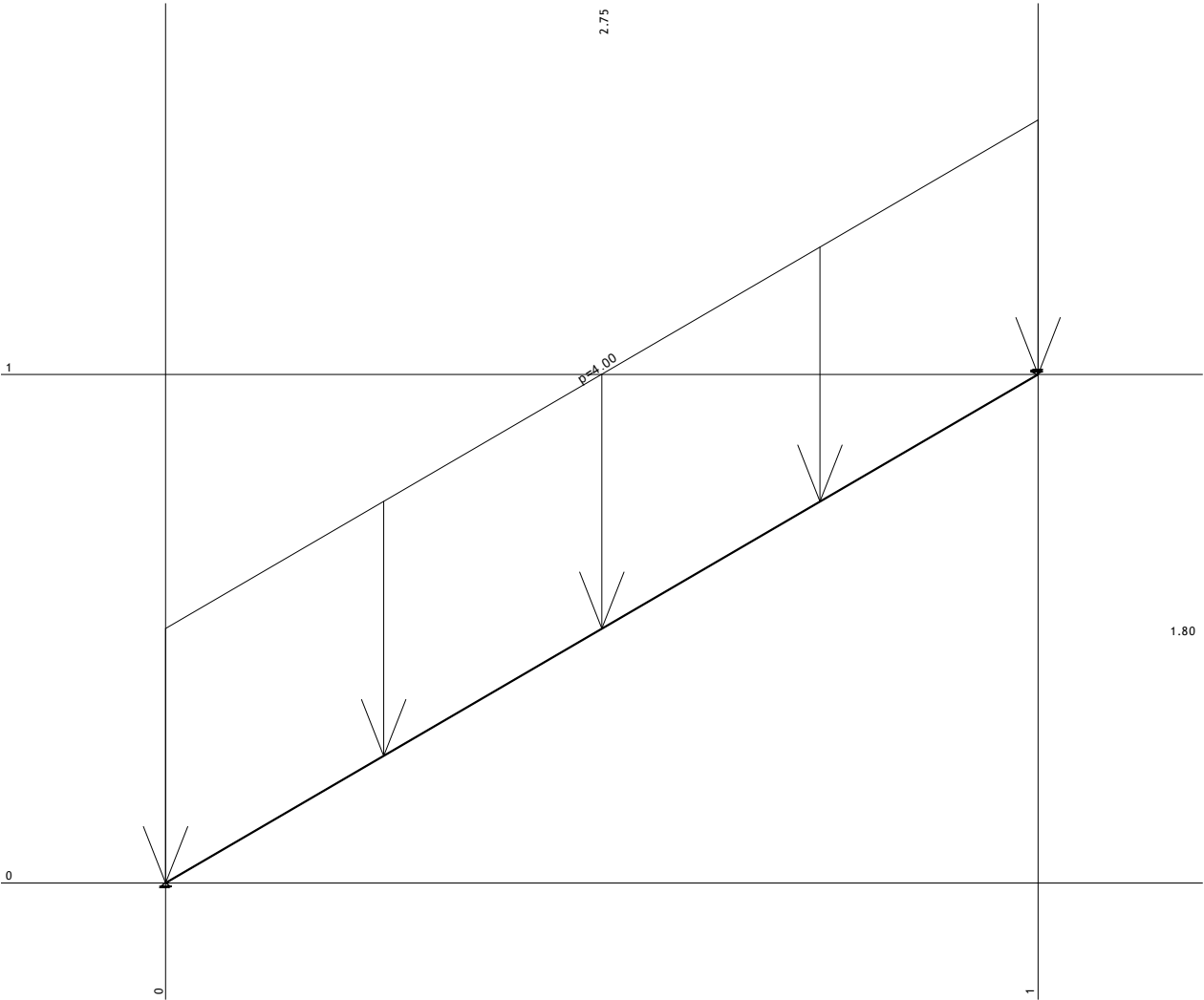
	K,R1	K,R2	K,R3	K,M1	K,M2	K,M3
1	1.000e+10	1.000e+10	1.000e+10			
2		1.000e+10	1.000e+10			

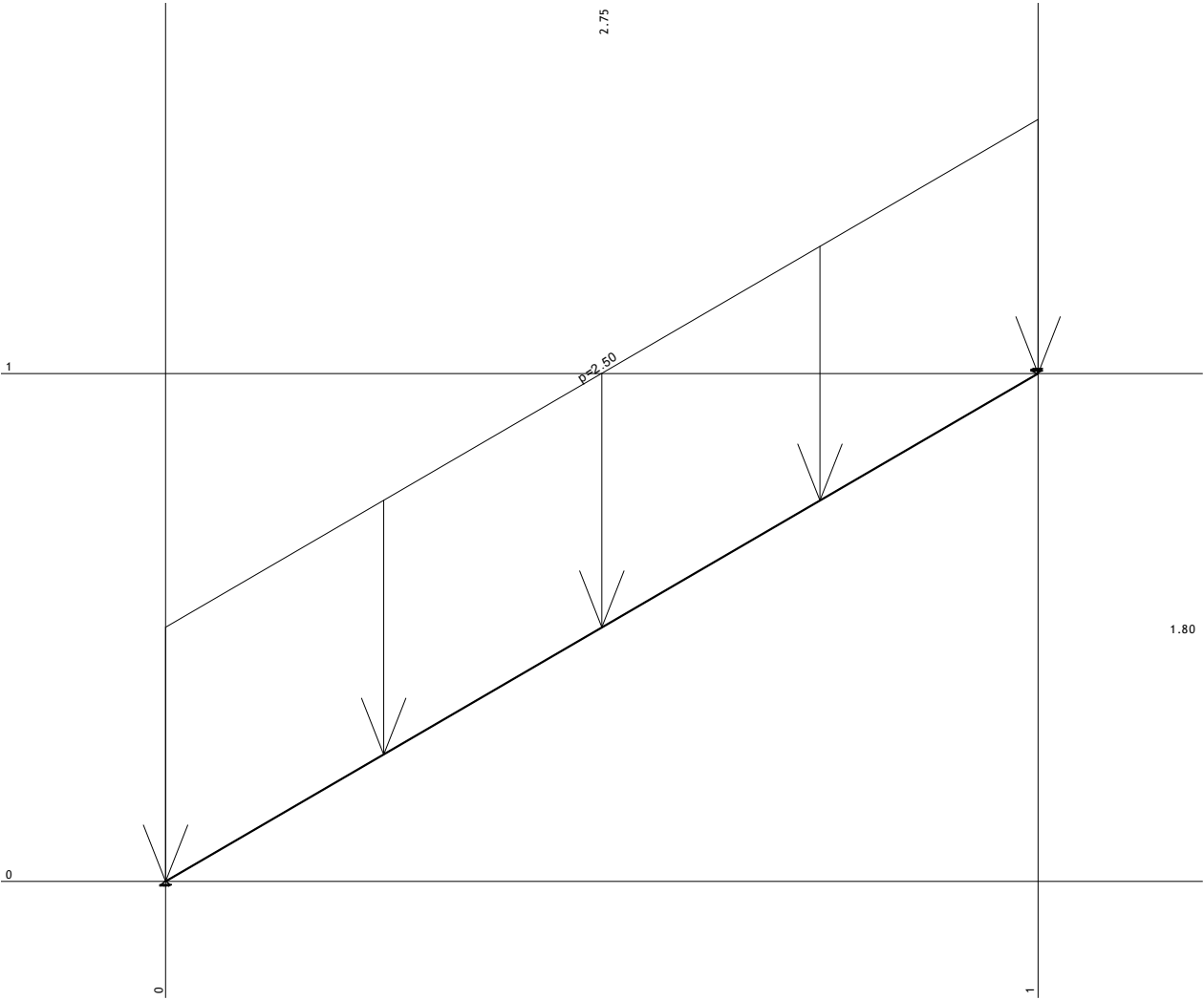
Ulazni podaci - Opterećenje

Lista slučajeva opterećenja

No	Naziv
1	stalno (g)
2	korisno
3	Komb.: I+II
4	Komb.: 1.6xI+1.8xII

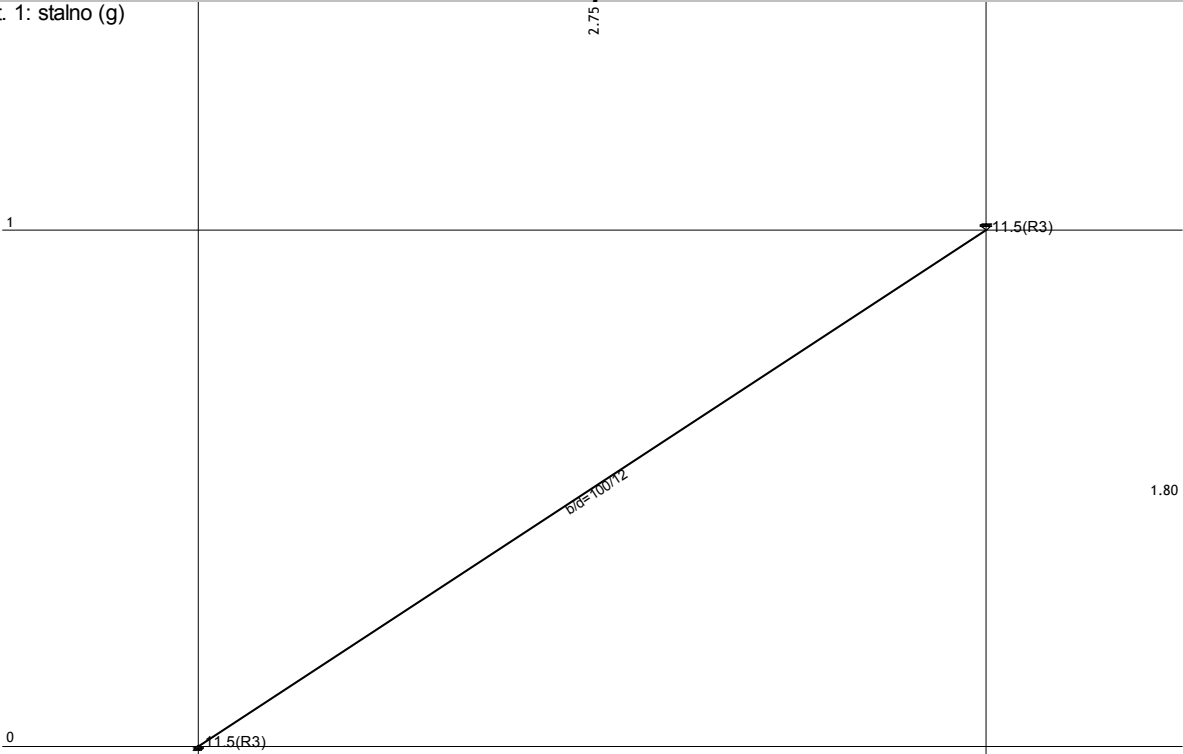
Opt. 1: stalno (g)



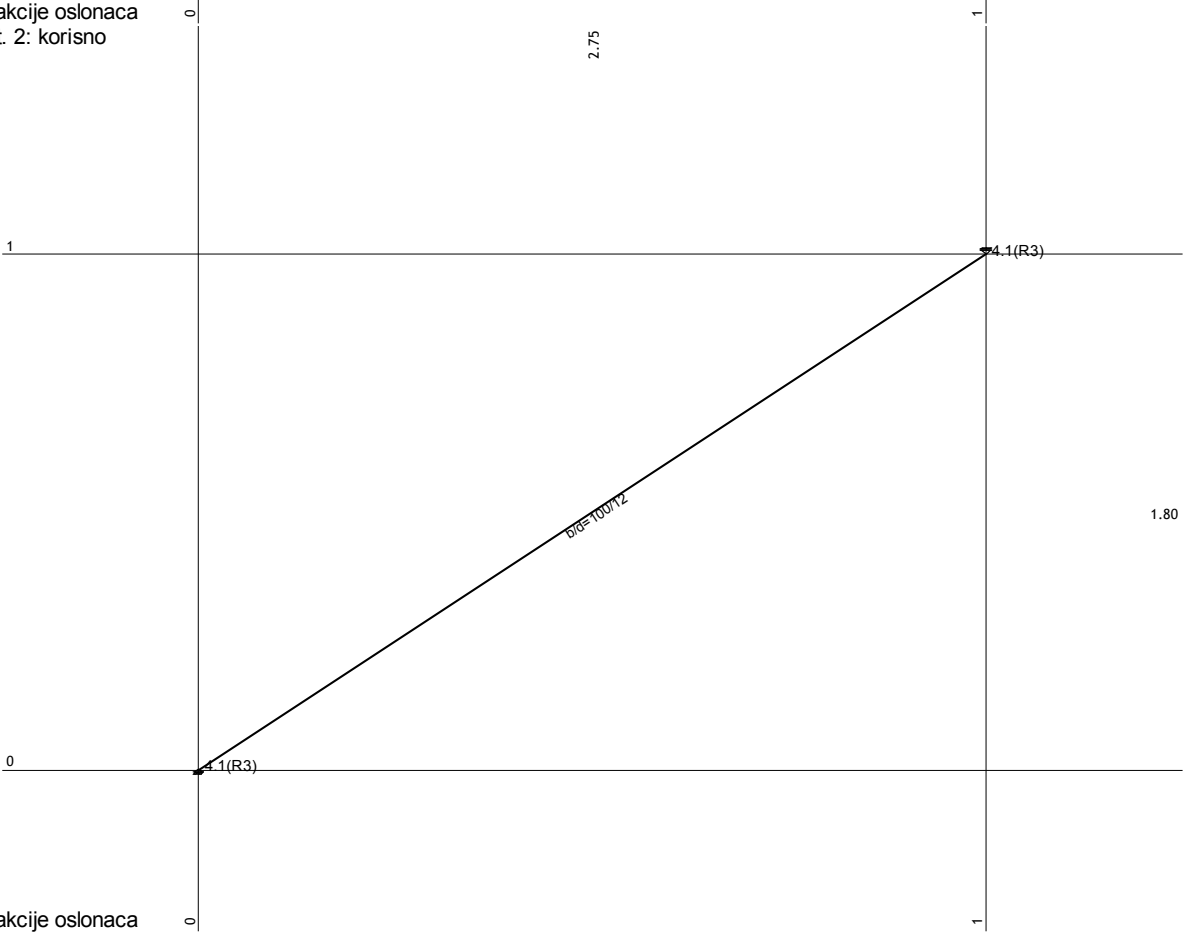


Statički proračun

Opt. 1: stalno (g)

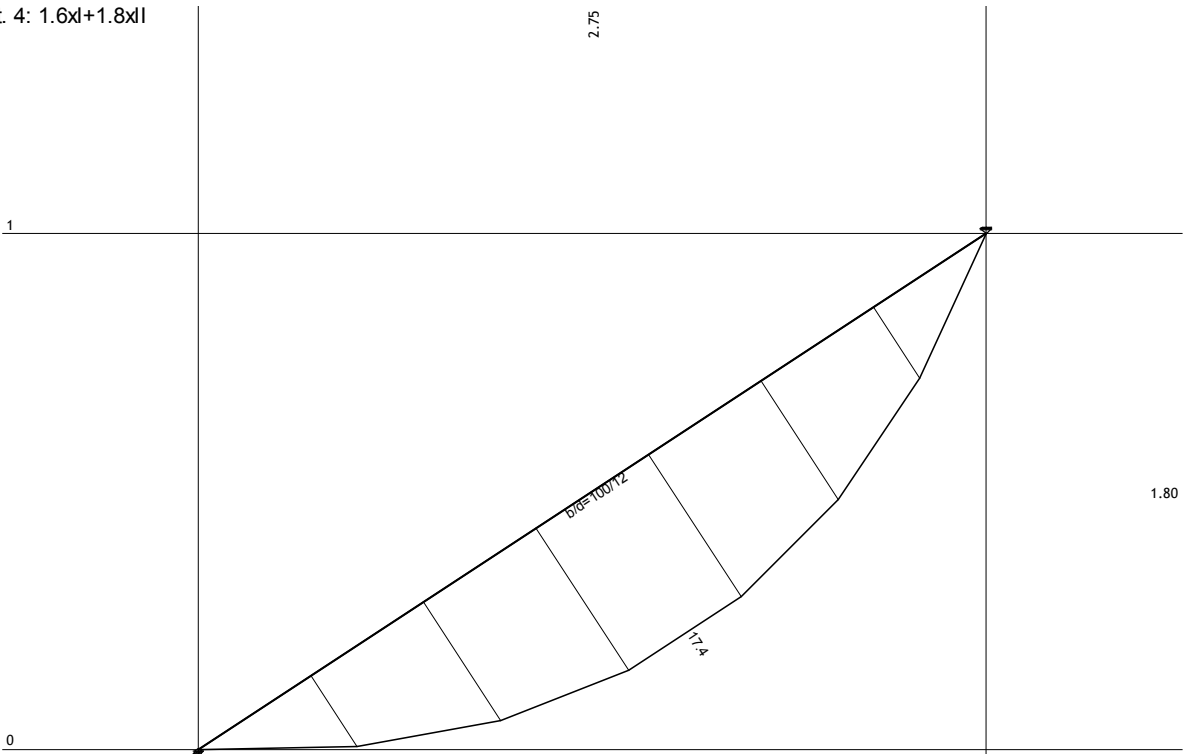


Reakcije oslonaca
Opt. 2: korisno

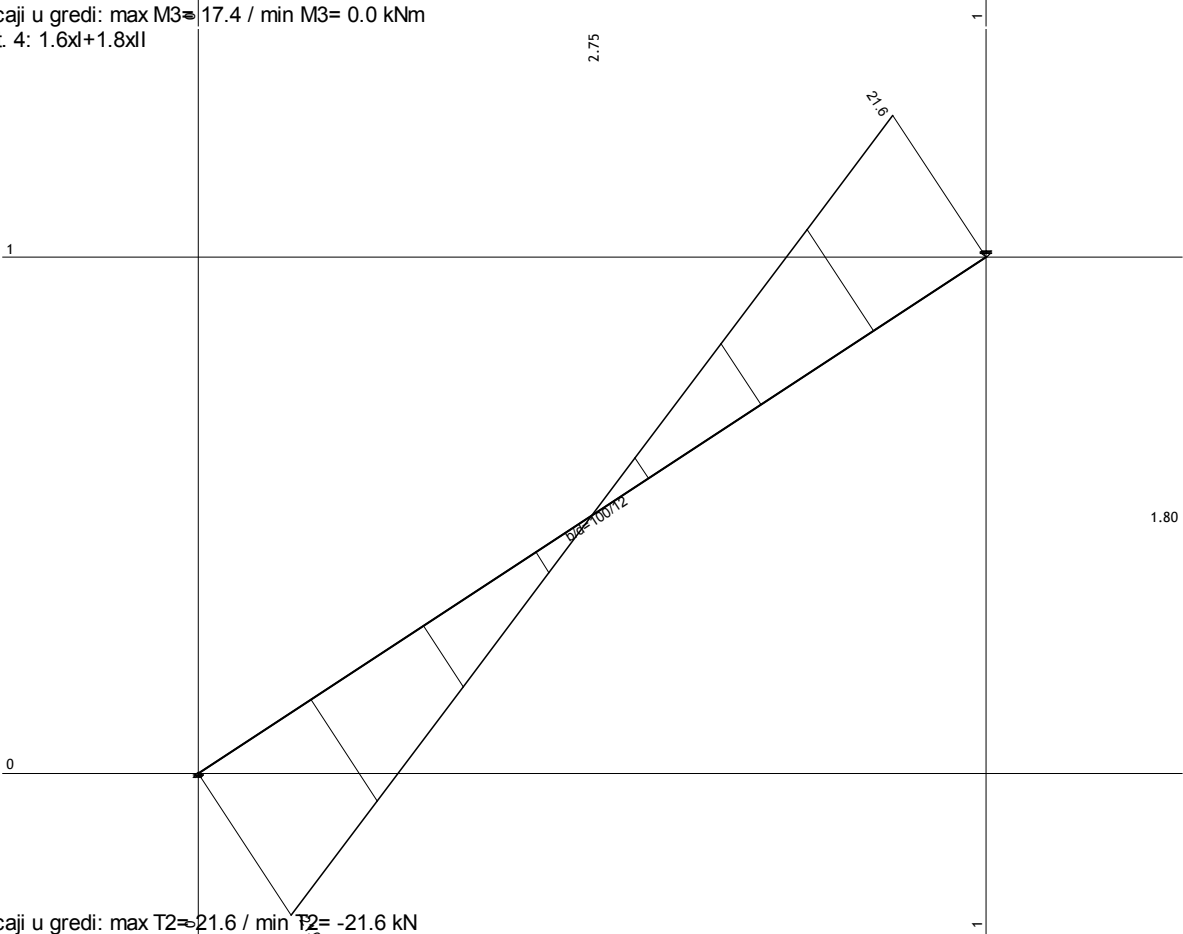


Reakcije oslonaca

Opt. 4: 1.6xl+1.8xll



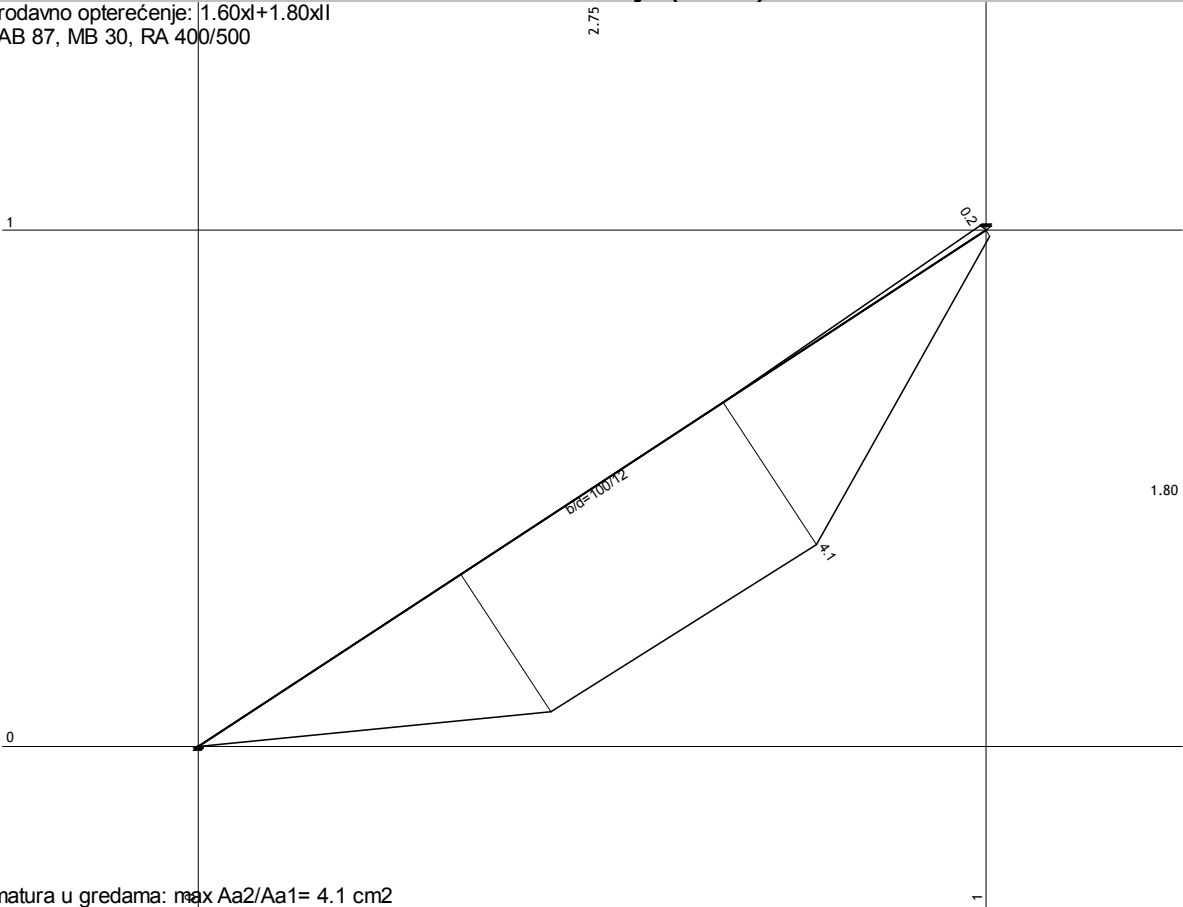
Uticaji u gredi: max M3= 17.4 / min M3= 0.0 kNm
Opt. 4: 1.6xl+1.8xll



Uticaji u gredi: max T2=21.6 / min T2= -21.6 kN

Dimenzionisanje (beton)

Merodavno opterećenje: 1.60xI+1.80xII
PBAB 87, MB 30, RA 400/500



Armatura u gredama: max Aa2/Aa1= 4.1 cm2

Ovlašćeni projektant