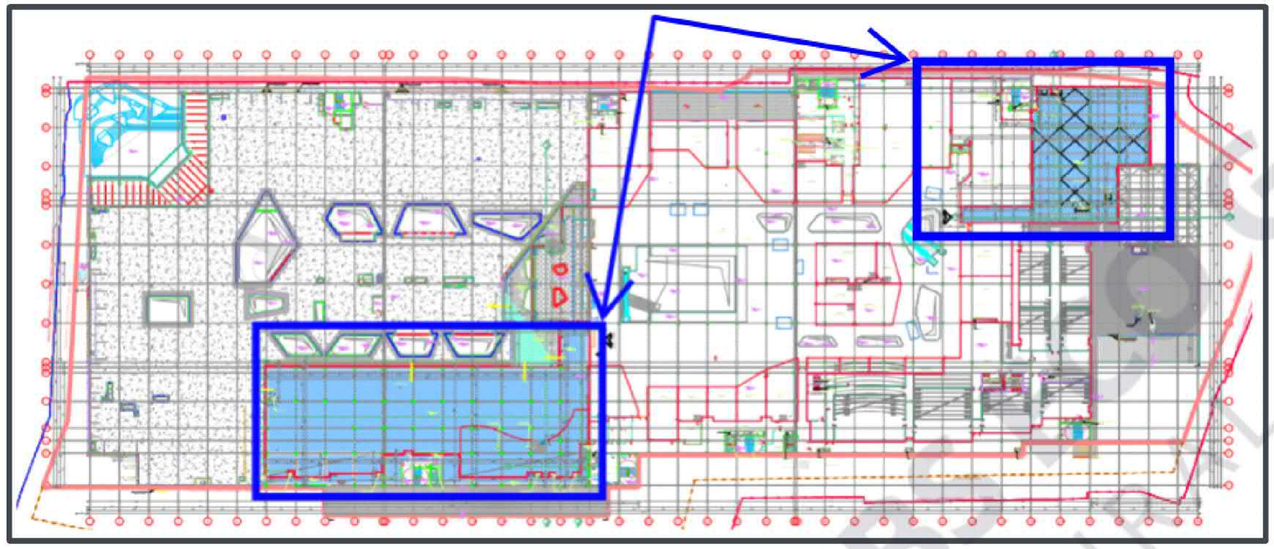
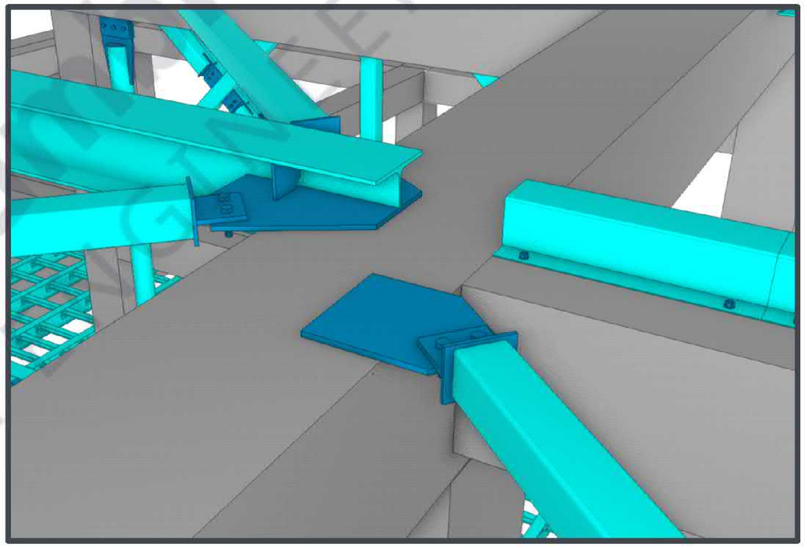
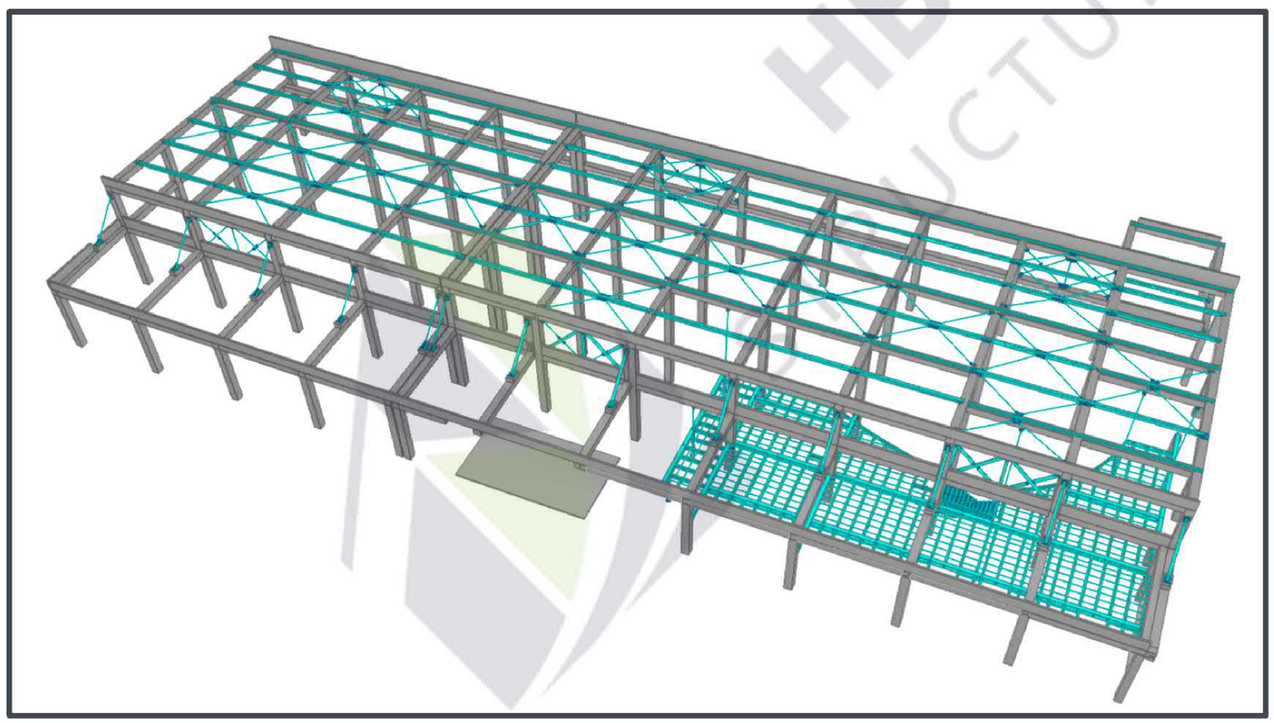
Projekt: Einkaufszentrum - Aufstockung [Fläche = 2.900m2]
Land: Serbien
Leistungsumfang: Primär- und Sekundärstahlkonstruktion:

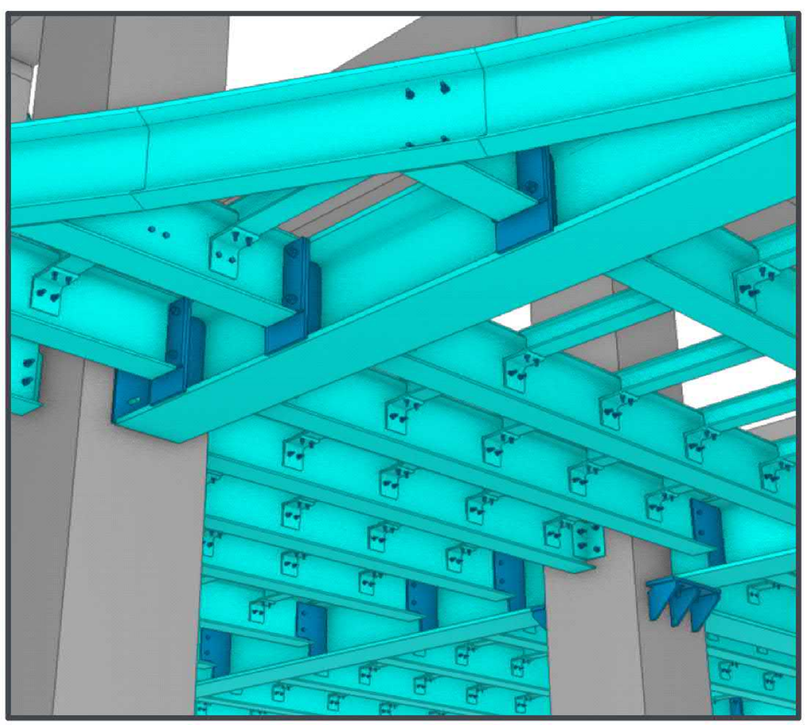
- Koordination mit Architekten, HLK-Planung
- Projektoptimierung in Zusammenarbeit mit Stahlbauunternehmen
- Statische Berechnung mit Schwingungsuntersuchung einer Stahl-Zwischendecke
- Anschlussnachweise
- Tragwerkszeichnungen

HBS ECO GmbH
STRUCTURAL ENGINEERING

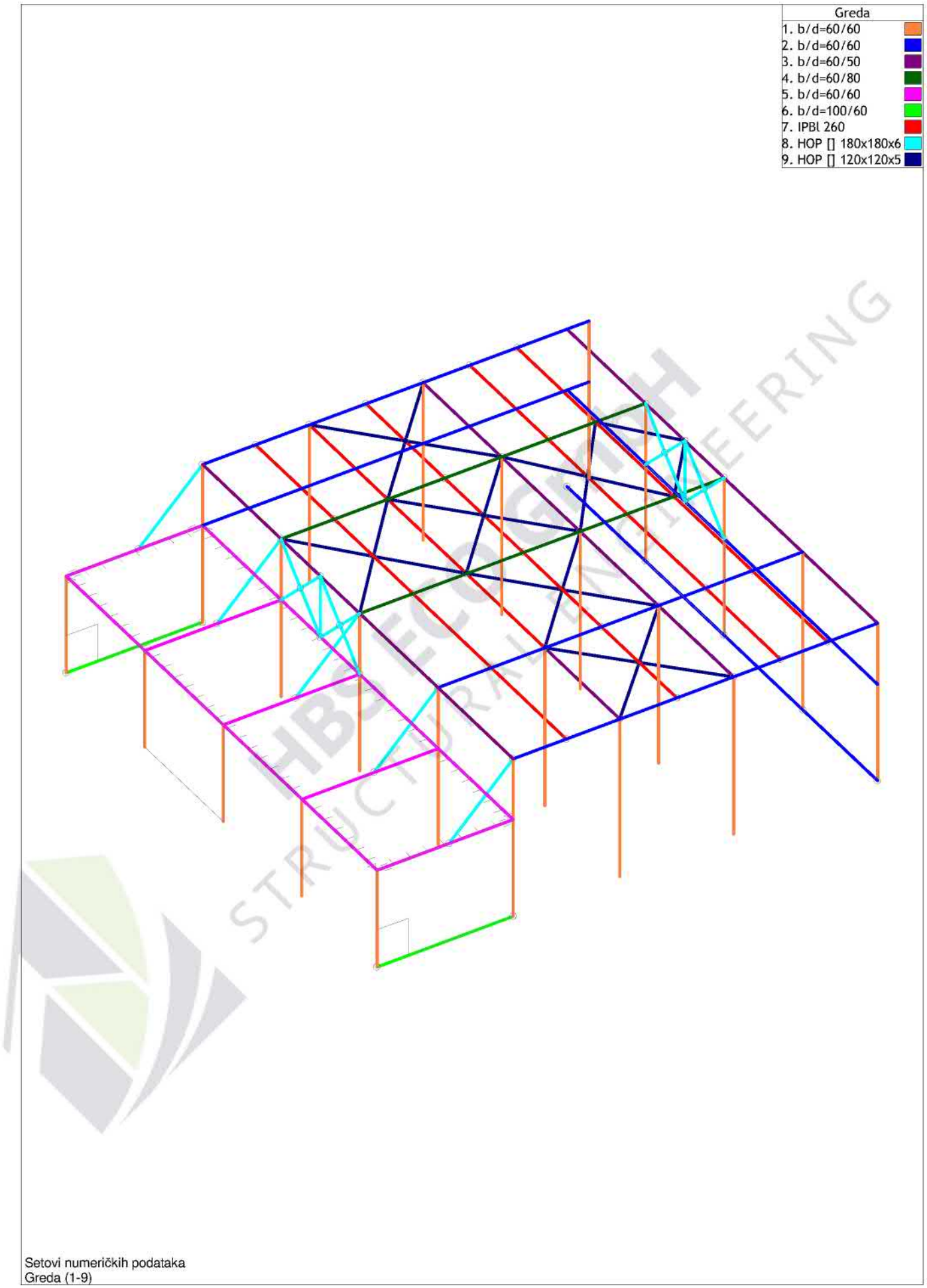






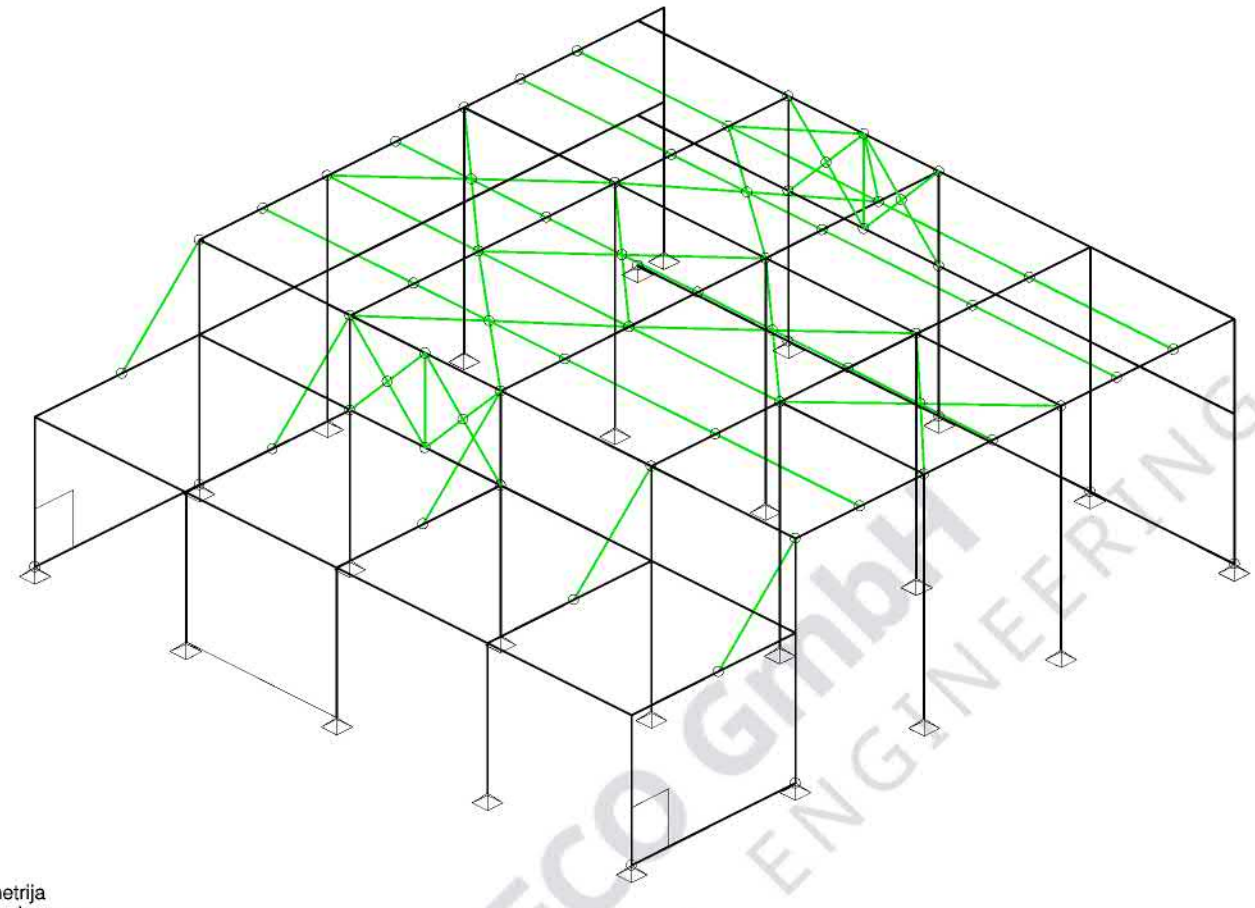


Statische Berechnung



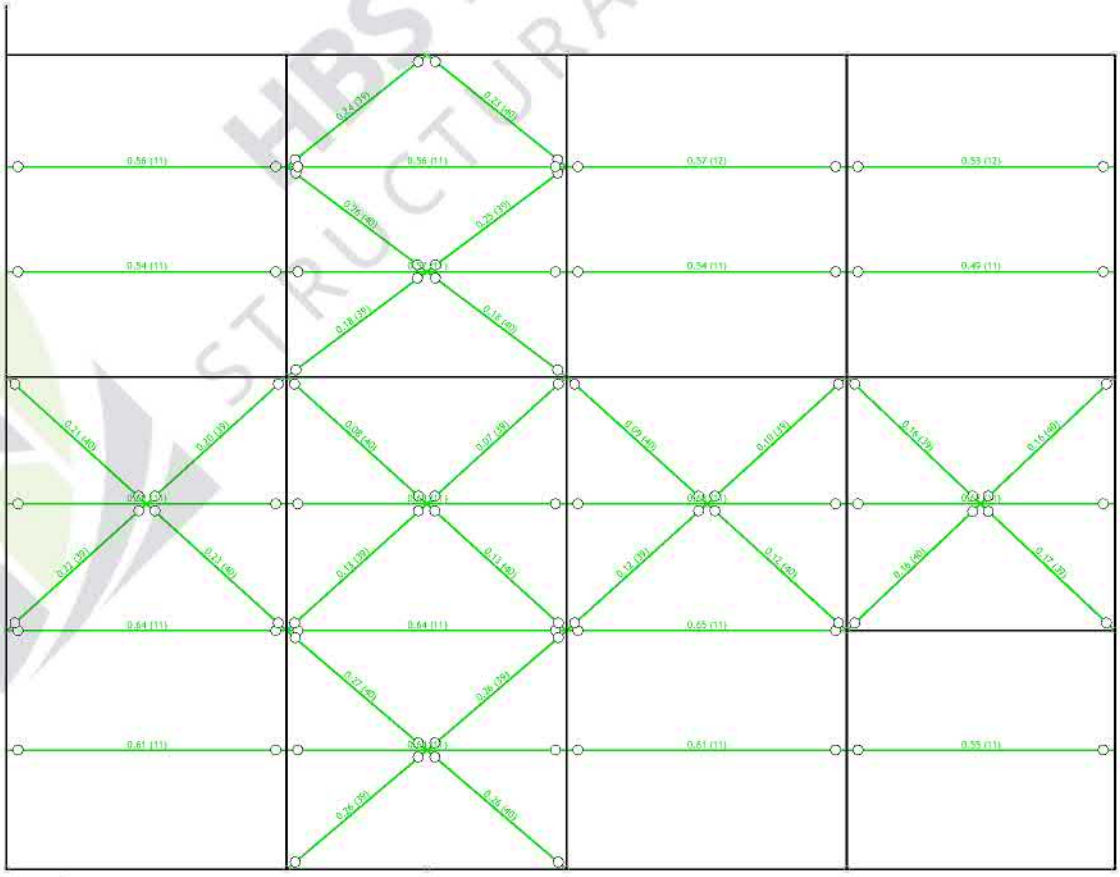
Setovi numeričkih podataka
Greda (1-9)

Kontrola napona



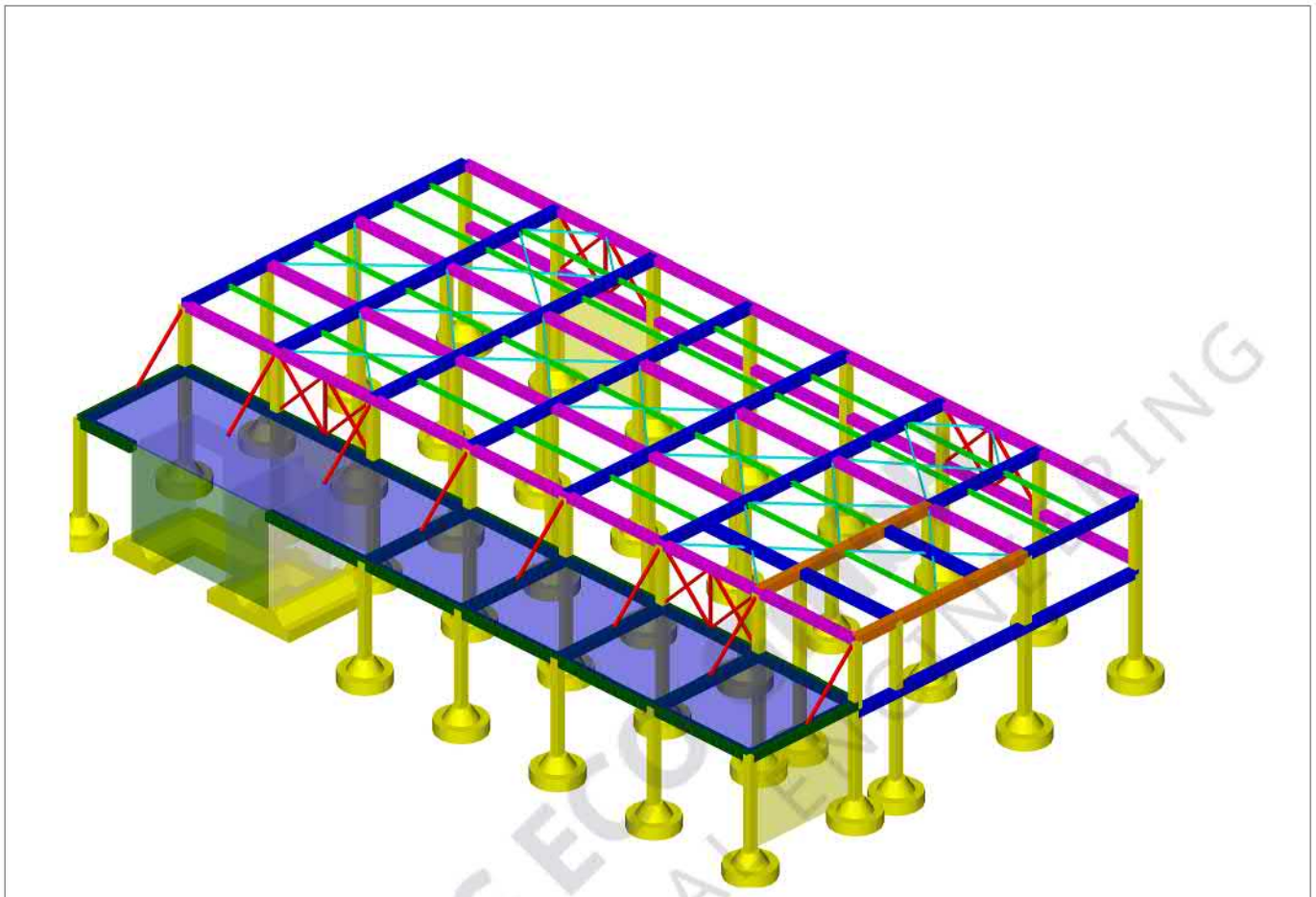
Izometrija
Kontrola napona

Kontrola napona



Nivo: Krov [10.60 m]
Kontrola napona

Konstrukcija-ulazni podaci



Izometrija

Šema nivoa

Naziv	z [m]	h [m]
Krov	10.60	4.10
Nizi krov	6.50	3.50

Naziv	z [m]	h [m]
galerija	3.00	3.00
2.sprat	0.00	

Tabela materijala

No	Naziv materijala	E[kN/m2]	μ	γ[kN/m3]	αt[1/C]	Em[kN/m2]	μm
1	Concrete C30/37	3.300e+7	0.20	25.00	1.000e-5	3.300e+7	0.20
2	Celik	2.100e+8	0.30	78.50	1.000e-5	2.100e+8	0.30

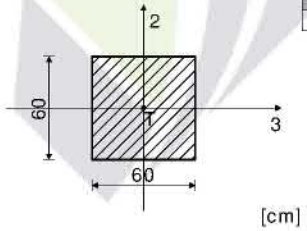
Setovi ploča

No	d[m]	e[m]	Materijal	Tip proračuna	Ortotropija	E2[kN/m2]	G[kN/m2]	α
<1>	0.150	0.075	1	Tanka ploča	Izotropna			
<2>	0.200	0.100	1	Tanka ploča	Izotropna			
<3>	0.250	0.125	1	Tanka ploča	Izotropna			
<4>	0.300	0.150	1	Tanka ploča	Izotropna			

Setovi greda

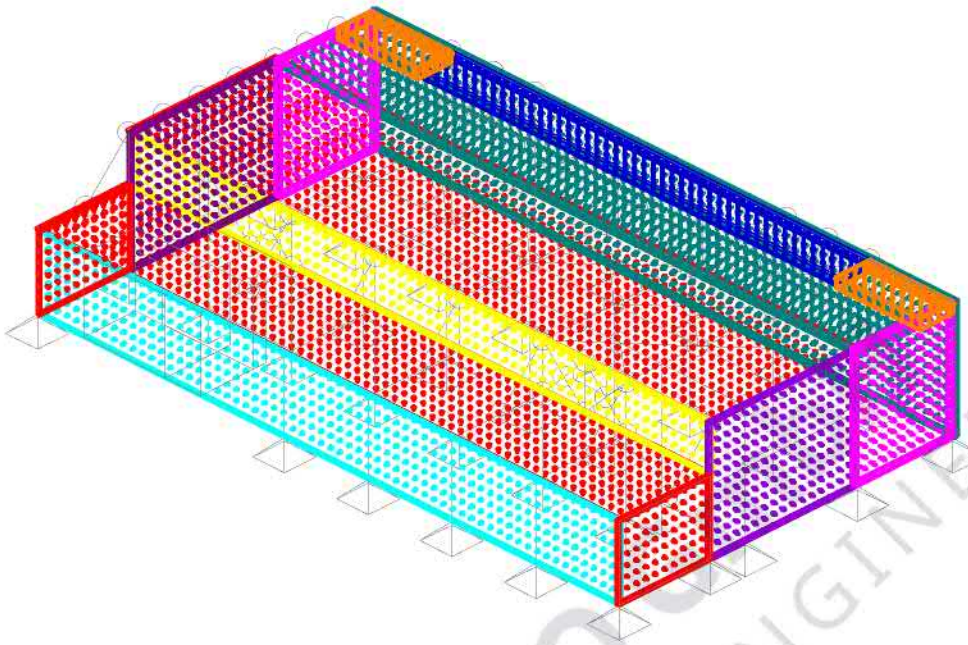
Set: 1 Presek: b/d=60/60, Fiktivna ekscentričnost

Mat.	A1	A2	A3	I1	I2	I3
1 - Concrete C30/37	3.600e-1	3.000e-1	3.000e-1	1.825e-2	1.080e-2	1.080e-2



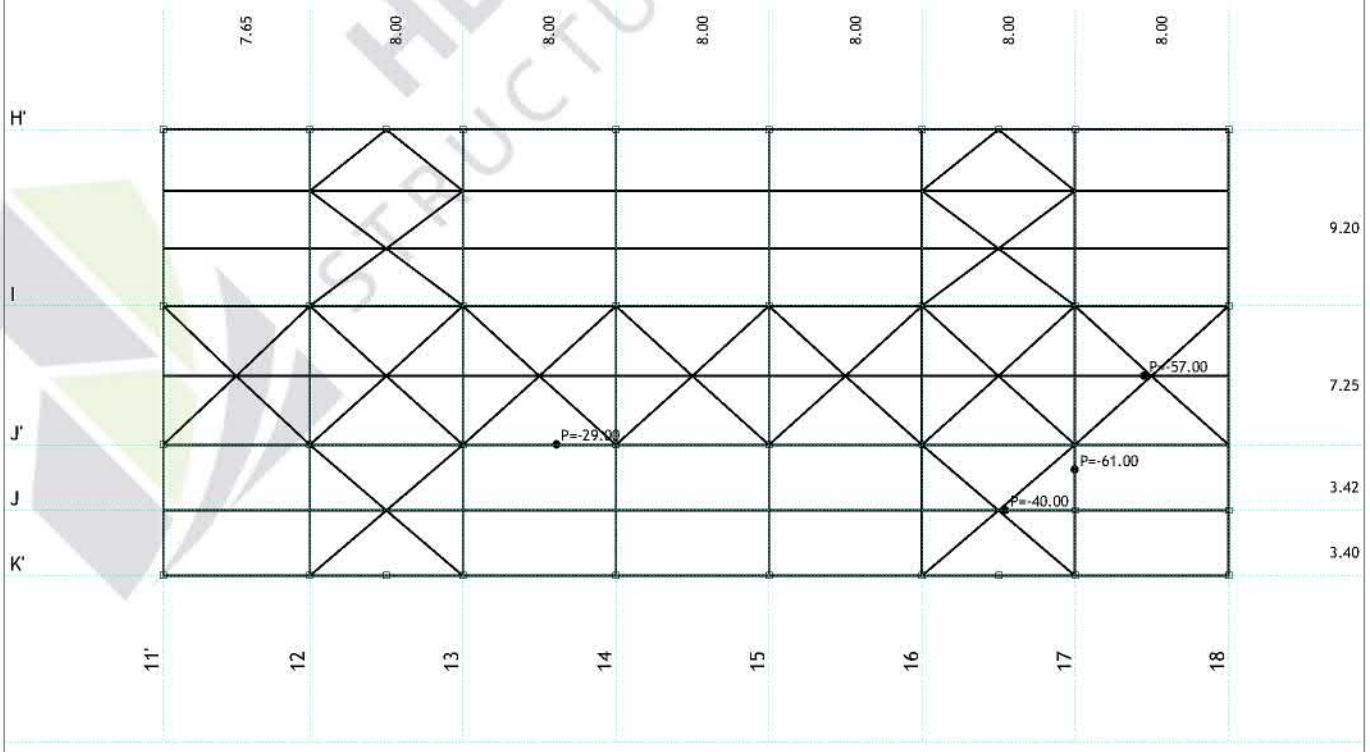
[cm]

Opt. 7: Wy



Setovi numeričkih podataka
Površinsko opterećenje (1,2,4,7,8,11,15-20)

Opt. 5: z



Nivo: Krov [10.60 m]

Računska normalna sila	N_{Ed} =	-32.034 kN
Transverzalna sila u z pravcu	$V_{Ed,z}$ =	0.511 kN
Momenat savijanja oko y ose	$M_{Ed,y}$ =	-0.225 kNm
Sistemska dužina štapa	L =	572.80 cm

6.2 NOSIVOST POPREČNIH PRESEKA

6.2.6 Smicanje

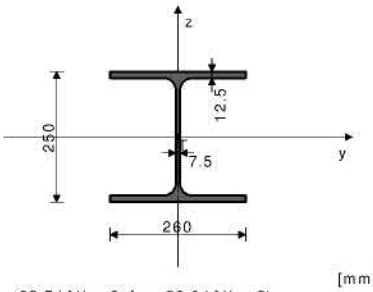
Proračunska nosivost na smicanje	$V_{pl,Rd,z}$ =	251.80 kN
Proračunska nosivost na smicanje	$V_{c,Rd,z}$ =	251.80 kN

Uslov 6.17: $V_{Ed,z} <= V_{c,Rd,z}$ (0.51 <= 251.80)

ŠTAP 2503-2119

POPREČNI PRESEK : IPBI 260 [S 235] [Set: 6]
EUROCODE 3 (EN 1993-1-1:2005)

GEOMETRIJSKE KARAKTERISTIKE PRESEKA



[mm]

Ax =	86.800 cm2
Ay =	58.063 cm2
Az =	28.738 cm2
Ix =	52.600 cm4
Iy =	10450 cm4
Iz =	3670.0 cm4
Wy =	836.00 cm3
Wz =	282.31 cm3
Wy,pl =	904.09 cm3
Wz,pl =	422.50 cm3
γM0 =	1.100
γM1 =	1.100
γM2 =	1.250
Anet/A =	0.900

(fy = 23.5 kN/cm2, fu = 36.0 kN/cm2)

FAKTORI ISKORIŠĆENJA PO KOMBINACIJAMA OPTEREĆENJA

13. γ=0.84	52. γ=0.84	54. γ=0.84
141. γ=0.84	76. γ=0.82	78. γ=0.82
21. γ=0.82	167. γ=0.82	132. γ=0.78
43. γ=0.78	131. γ=0.78	205. γ=0.78
154. γ=0.76	62. γ=0.76	153. γ=0.76
210. γ=0.76	14. γ=0.75	55. γ=0.75
142. γ=0.75	53. γ=0.75	23. γ=0.74
173. γ=0.74	84. γ=0.74	86. γ=0.74
58. γ=0.73	143. γ=0.73	15. γ=0.73
56. γ=0.73	22. γ=0.73	77. γ=0.73
168. γ=0.73	79. γ=0.73	37. γ=0.72
195. γ=0.72	115. γ=0.72	117. γ=0.72
175. γ=0.71	25. γ=0.71	88. γ=0.71
90. γ=0.71	19. γ=0.69	17. γ=0.69
68. γ=0.69	70. γ=0.69	161. γ=0.68
63. γ=0.68	162. γ=0.68	215. γ=0.68
105. γ=0.67	29. γ=0.67	33. γ=0.67
103. γ=0.67	189. γ=0.66	190. γ=0.66
102. γ=0.66	222. γ=0.66	24. γ=0.65
87. γ=0.65	85. γ=0.65	174. γ=0.65
179. γ=0.63	93. γ=0.63	95. γ=0.63
27. γ=0.63	116. γ=0.63	38. γ=0.63
118. γ=0.63	196. γ=0.63	145. γ=0.63
146. γ=0.63	60. γ=0.63	61. γ=0.63
39. γ=0.61	119. γ=0.61	121. γ=0.61
197. γ=0.61	177. γ=0.60	178. γ=0.60
98. γ=0.60	92. γ=0.60	71. γ=0.60
18. γ=0.60	69. γ=0.60	20. γ=0.60
107. γ=0.59	109. γ=0.59	35. γ=0.59
31. γ=0.59	144. γ=0.59	59. γ=0.59
57. γ=0.59	16. γ=0.59	125. γ=0.58
127. γ=0.58	41. γ=0.58	201. γ=0.58
104. γ=0.58	30. γ=0.58	34. γ=0.58
106. γ=0.58	46. γ=0.57	44. γ=0.57
133. γ=0.57	135. γ=0.57	89. γ=0.56
26. γ=0.56	176. γ=0.56	91. γ=0.56
206. γ=0.56	149. γ=0.56	64. γ=0.56
147. γ=0.56	229. γ=0.55	50. γ=0.54
137. γ=0.54	139. γ=0.54	48. γ=0.54
97. γ=0.53	99. γ=0.53	181. γ=0.53
182. γ=0.53	165. γ=0.51	74. γ=0.51
72. γ=0.51	163. γ=0.51	200. γ=0.50
123. γ=0.50	124. γ=0.50	199. γ=0.50
110. γ=0.50	36. γ=0.50	108. γ=0.50
32. γ=0.50	94. γ=0.49	28. γ=0.49
96. γ=0.49	180. γ=0.49	211. γ=0.48
66. γ=0.48	155. γ=0.48	157. γ=0.48
134. γ=0.48	45. γ=0.48	136. γ=0.48
47. γ=0.48	204. γ=0.47	129. γ=0.47
130. γ=0.47	225. γ=0.47	203. γ=0.47
120. γ=0.47	40. γ=0.47	198. γ=0.47
122. γ=0.47	218. γ=0.46	183. γ=0.46
185. γ=0.46	100. γ=0.46	209. γ=0.45
152. γ=0.45	151. γ=0.45	226. γ=0.45
208. γ=0.45	140. γ=0.45	49. γ=0.45
138. γ=0.45	51. γ=0.45	171. γ=0.44
80. γ=0.44	82. γ=0.44	169. γ=0.44
126. γ=0.44	202. γ=0.44	42. γ=0.44
128. γ=0.44	164. γ=0.43	73. γ=0.43
75. γ=0.42	166. γ=0.42	191. γ=0.41
193. γ=0.41	111. γ=0.41	113. γ=0.41
65. γ=0.41	207. γ=0.41	150. γ=0.41
148. γ=0.41	223. γ=0.40	216. γ=0.40
213. γ=0.38	160. γ=0.38	159. γ=0.38
227. γ=0.38	214. γ=0.38	217. γ=0.36
224. γ=0.36	221. γ=0.35	188. γ=0.35
187. γ=0.35	228. γ=0.35	220. γ=0.35
172. γ=0.35	81. γ=0.35	170. γ=0.35
83. γ=0.35	67. γ=0.34	158. γ=0.34
156. γ=0.34	212. γ=0.34	114. γ=0.33
194. γ=0.33	112. γ=0.33	192. γ=0.33
101. γ=0.32	219. γ=0.32	186. γ=0.32
184. γ=0.32		

ŠTAP IZLOŽEN ZATEZANJU I SAVIJANJU
(slučaj opterećenja 13, na 400.0 cm od početka štapa)

Računska normalna sila	N_{Ed} =	0.164 kN
Transverzalna sila u z pravcu	$V_{Ed,z}$ =	-1.246 kN
Momenat savijanja oko y ose	$M_{Ed,y}$ =	113.41 kNm
Sistemska dužina štapa	L =	800.00 cm

5.5 KLASIFIKACIJA POPREČNIH PRESEKA
Klasa preseka 1

6.2 NOSIVOST POPREČNIH PRESEKA
6.2.3 Zatezanje

Plast.rač.otpornost bruto preseka	$N_{pl,Rd}$ =	1854.4 kN
Granična rač.otpornost neto preseka	$N_{u,Rd}$ =	2024.9 kN
Računska otp. na zatezanje	$N_{t,Rd}$ =	1854.4 kN

Uslov 6.5: $N_{Ed} <= N_{t,Rd}$ (0.16 <= 1854.36)

6.2.5 Savijanje y-y

Plastični otporni moment	Wy,pl =	904.09 cm3
Računska otpornost na savijanje	$M_{c,Rd}$ =	193.15 kNm

Uslov 6.12: $M_{Ed,y} <= M_{c,Rd,y}$ (113.41 <= 193.15)

6.2.6 Smicanje

Proračunska nosivost na smicanje	$V_{pl,Rd,z}$ =	354.46 kN
Proračunska nosivost na smicanje	$V_{c,Rd,z}$ =	354.46 kN

Uslov 6.17: $V_{Ed,z} <= V_{c,Rd,z}$ (1.25 <= 354.46)

6.2.10 Savijanje smicanje i aksijalna sila
Nije potrebna redukcija momenata otpornosti
Uslov: $V_{Ed,z}$ <= 50%$V_{pl,Rd,z}$

6.2.9 Savijanje i aksijalna sila

Odnos N_{Ed} / $N_{pl,Rd}$		0.000
Reduk.moment plast.otp.na savijanje	$M_{N,y,Rd}$ =	193.15 kNm
Koeficijent	α =	1.000
Odnos $(M_{y,Ed} / M_{N,y,Rd})^{\alpha}$		0.587

Uslov 6.41: (0.59 <= 1)

6.3 NOSIVOST ELEMENATA NA IZVIJANJE
6.3.2.1 Nosivost na bočno-torziono izvijanje

Koeficijent	C1 =	1.132
Koeficijent	C2 =	0.459
Koeficijent	C3 =	0.525
Koef.efekt.dužine bočnog izvijanja	k =	1.000
Koef.efekt.dužine torzionog uvrtanja	kw =	1.000
Koordinata	zg =	12.500 cm
Koordinata	zj =	0.000 cm
Razmak bočno pridržanih tačaka	L =	800.00 cm
Sektorski momenat inercije	Iw =	5.16e+5 cm6
Krit.mom.za bočno tor.izvijanje	Mcr =	232.86 kNm
Odgovarajući otporni momenat	W_y =	904.09 cm3
Koeficijent imperf.	αLT =	0.210
Bezdimenziona vitkost	λLT_ =	0.955
Koeficijent redukcije (6.3.2.2.)	χLT =	0.697
Računska otpornost na izvijanje	$M_{b,Rd}$ =	134.57 kNm

Uslov 6.54: $M_{Ed,y} <= M_{b,Rd}$ (113.41 <= 134.57)

PROVERA OTPORNOSTI NA SMICANJE
(slučaj opterećenja 13, početak štapa)

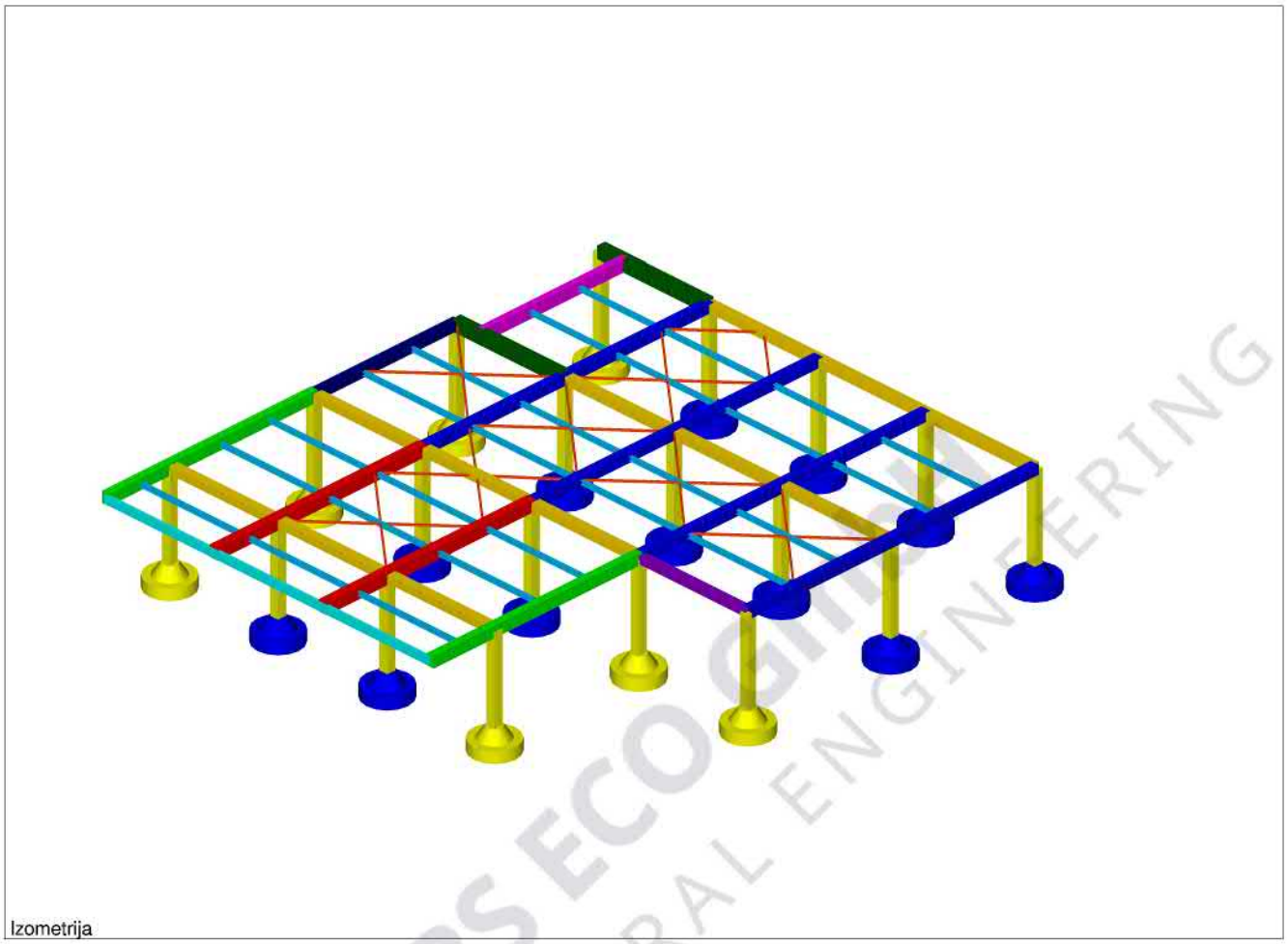
Računska normalna sila	N_{Ed} =	0.164 kN
Transverzalna sila u z pravcu	$V_{Ed,z}$ =	-55.461 kN
Sistemska dužina štapa	L =	800.00 cm

6.2 NOSIVOST POPREČNIH PRESEKA
6.2.6 Smicanje

Proračunska nosivost na smicanje	$V_{pl,Rd,z}$ =	354.46 kN
Proračunska nosivost na smicanje	$V_{c,Rd,z}$ =	354.46 kN

Uslov 6.17: $V_{Ed,z} <= V_{c,Rd,z}$ (55.46 <= 354.46)

Konstrukcija-ulazni podaci



Izometrija

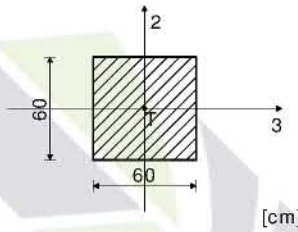
Tabela materijala

No	Naziv materijala	E[kN/m2]	μ	γ[kN/m3]	αt[1/C]	Em[kN/m2]	μm
1	Concrete C30/37	3.300e+7	0.20	25.00	1.000e-5	3.300e+7	0.20
2	Celik	2.100e+8	0.30	78.50	1.000e-5	2.100e+8	0.30

Setovi greda

Set: 1 Presek: b/d=60/60, Fiktivna ekscentričnost

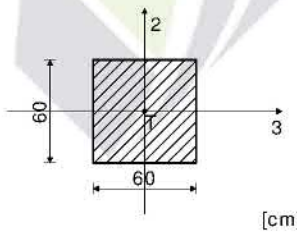
Mat.	A1	A2	A3	I1	I2	I3
1 - Concrete C30/37	3.600e-1	3.000e-1	3.000e-1	1.825e-2	1.080e-2	1.080e-2



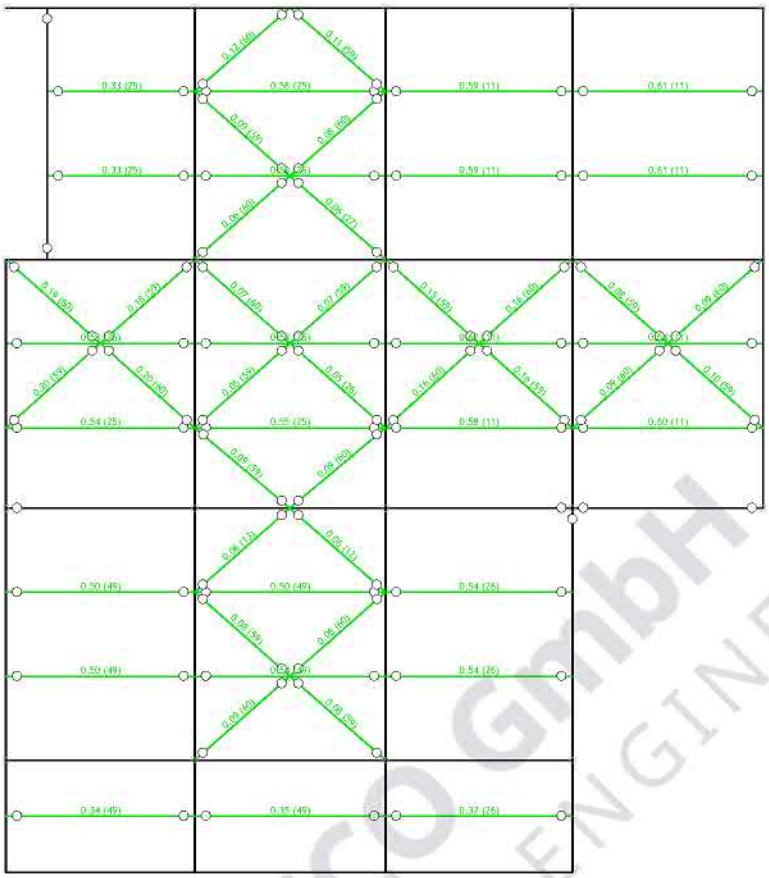
[cm]

Set: 2 Presek: b/d=60/60, Fiktivna ekscentričnost

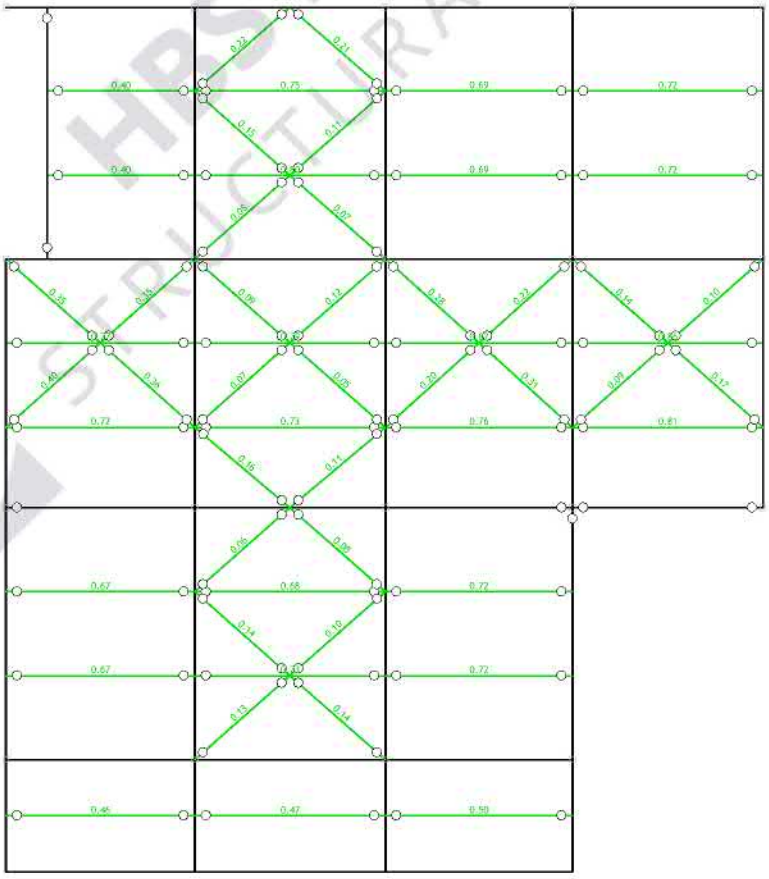
Mat.	A1	A2	A3	I1	I2	I3
1 - Concrete C30/37	3.600e-1	3.000e-1	3.000e-1	1.825e-2	1.080e-2	1.080e-2



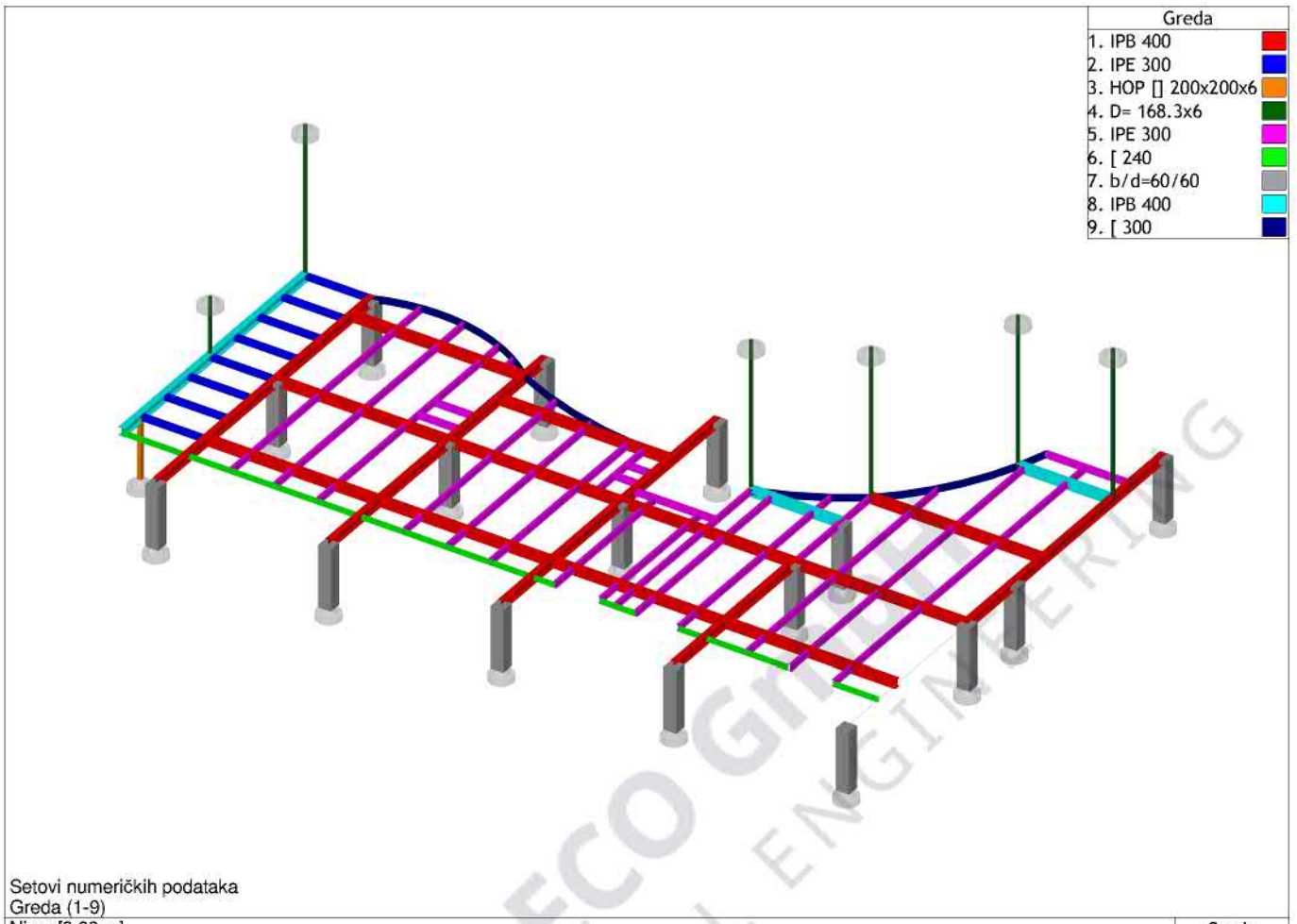
[cm]



Nivo: Krov [5.75 m]
Kontrola napona



Nivo: Krov [5.75 m]
Kontrola stabilnosti



Setovi numeričkih podataka
Greda (1-9)

Nivo: [0.00 m]

Setovi numeričkih podataka
Greda (1,2,5,6,8,9)

Sopstvena frekvencija i modalna masa:

Tower:

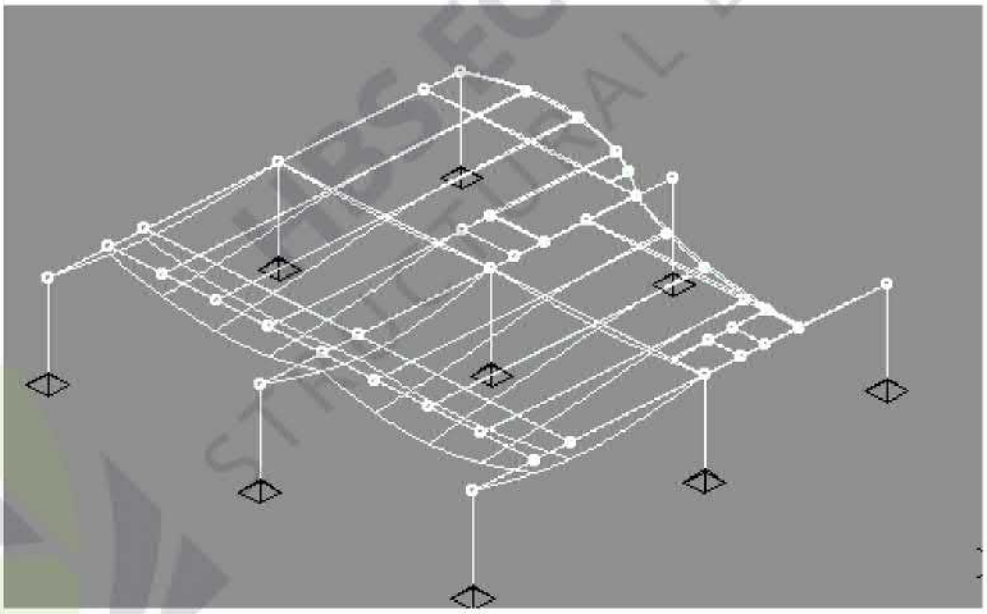
Modalna analiza

Napredne opcije seizmičkog proračuna
Sprečeno oscilovanje u X pravcu
Sprečeno oscilovanje u Y pravcu

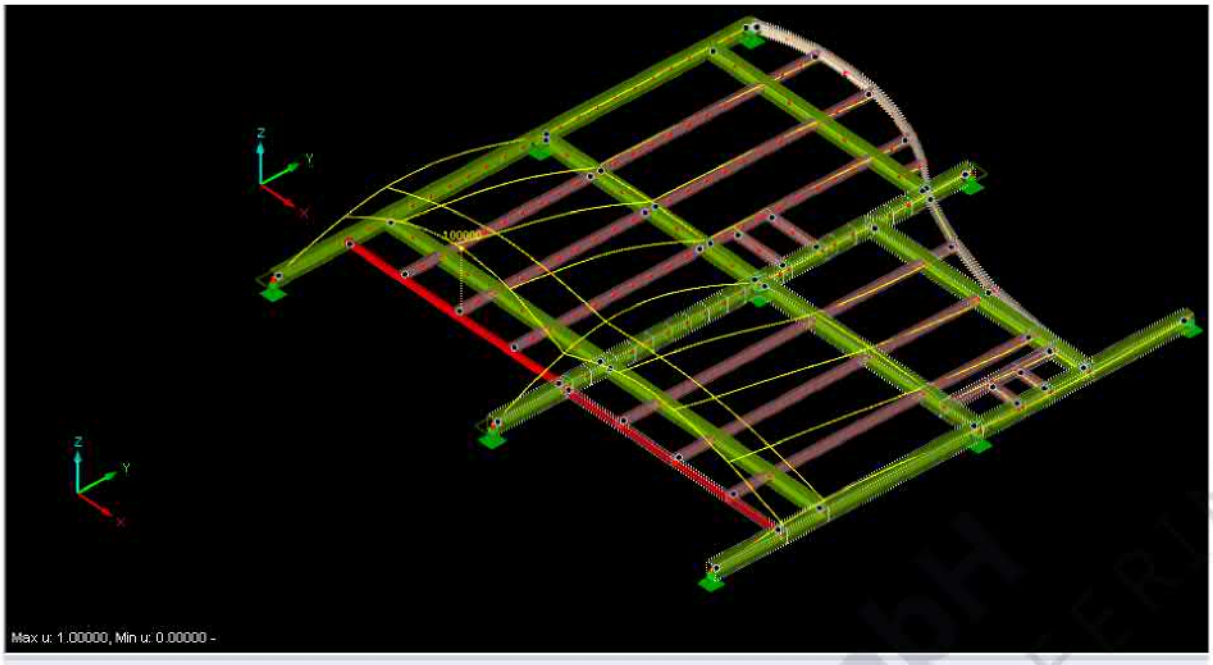
Faktori opterećenja za proračun masa		
No	Naziv	Koeficijent
1	g (g)	1.00
2	p	0.10

Raspored masa po visini objekta					
Nivo	Z [m]	X [m]	Y [m]	Masa [T]	T/m²
	0.00	10.94	5.86	88.02	
Ukupno:	0.00	10.94	5.86	88.02	

Periodi oscilovanja konstrukcije			
No	T [s]	f [Hz]	m' [T]
1	0.1924	5.1981	8.6650
2	0.1640	6.0979	10.4973
3	0.1452	6.8880	7.6446
4	0.1327	7.5337	1.3225
5	0.1274	7.8516	4.4210
6	0.1233	8.1122	6.6813
7	0.1095	9.1356	1.1589
8	0.0970	10.3111	1.2992



Dlubal:



5.1 Natural Frequencies

NVC1 | Mode Shape 1 (f : 5.017 Hz)

Mode No.	A Eigenvalue λ [1/s²]	B Angular Frequency ω [rad/s]	C Natural frequency f [Hz]	D Natural period T [s]
1	993.849	31.525	5.017	0.199
2	1465.315	38.279	6.092	0.164
3	1713.127	41.390	6.587	0.152
4	1990.923	44.620	7.101	0.141

5.7 Effective Modal Mass Factors

NVC1 | Mode Shape 1 (f : 5.017 Hz)

Mode No.	A Modal Mass M_i [kg]	B m_{eX} [kg]	C m_{eY} [kg]	D m_{eZ} [kg]	E $m_{\varphi X}$ [kg.m²]	F $m_{\varphi Y}$ [kg.m²]	G $m_{\varphi Z}$ [kg.m²]	H f_{meX} [-]	I f_{meY} [-]	J f_{meZ} [-]
		Effective Modal Mass						Effective Modal Mass Factor		
1	7961.85	0.00	0.00	27053.08	383786.92	20754.96	0.00	0.000	0.000	0.390
2	10044.66	0.00	0.00	180.77	45523.83	782654.29	0.00	0.000	0.000	0.003
3	4025.28	0.00	0.00	18258.74	374231.28	24922.18	0.00	0.000	0.000	0.263
4	2749.24	0.00	0.00	22.63	3241.02	181.38	0.00	0.000	0.000	0.000
Sum	24781.03	0.00	0.00	45515.21	806783.05	828512.82	0.00	0.000	0.000	0.656

Određivanje prigušenja:
Usvojeno je prigušenje od 3%.

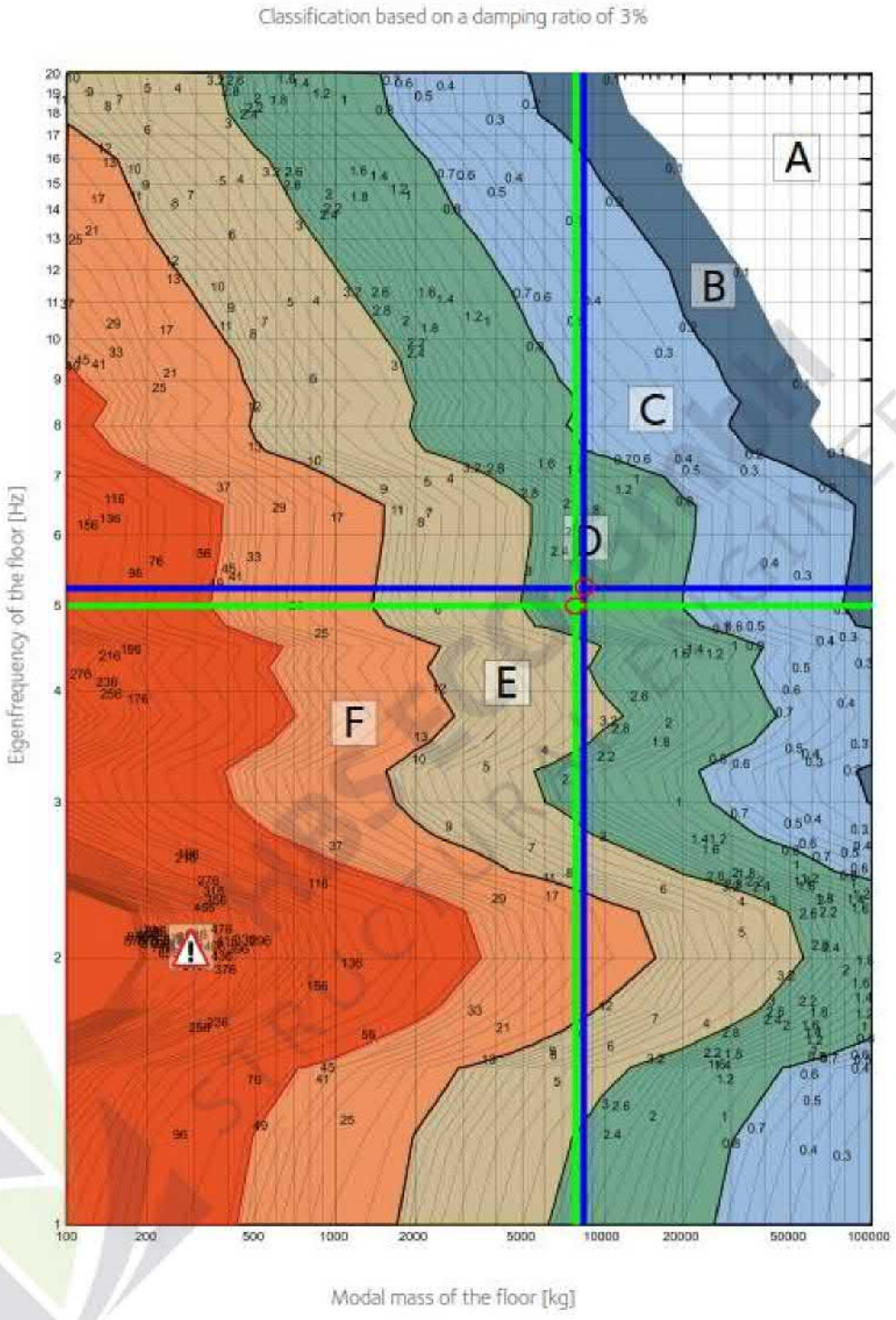
Table 1 Determination of damping

Type	Damping (% of critical damping)
Structural Damping D_1	
Wood	6%
Concrete	2%
Steel	1%
Composite (steel-concrete)	1%
Damping due to furniture D_2	
Traditional office for 1 to 3 persons with separation walls	2%
Paperless office	0%
Open plan office	1%
Library	1%
Houses	1%
Schools	0%
Gymnastic	0%
Damping due to finishes D_3	
Ceiling under the floor	1%
Free floating floor	0%
Swimming screed	1%
Total Damping $D = D_1 + D_2 + D_3$	

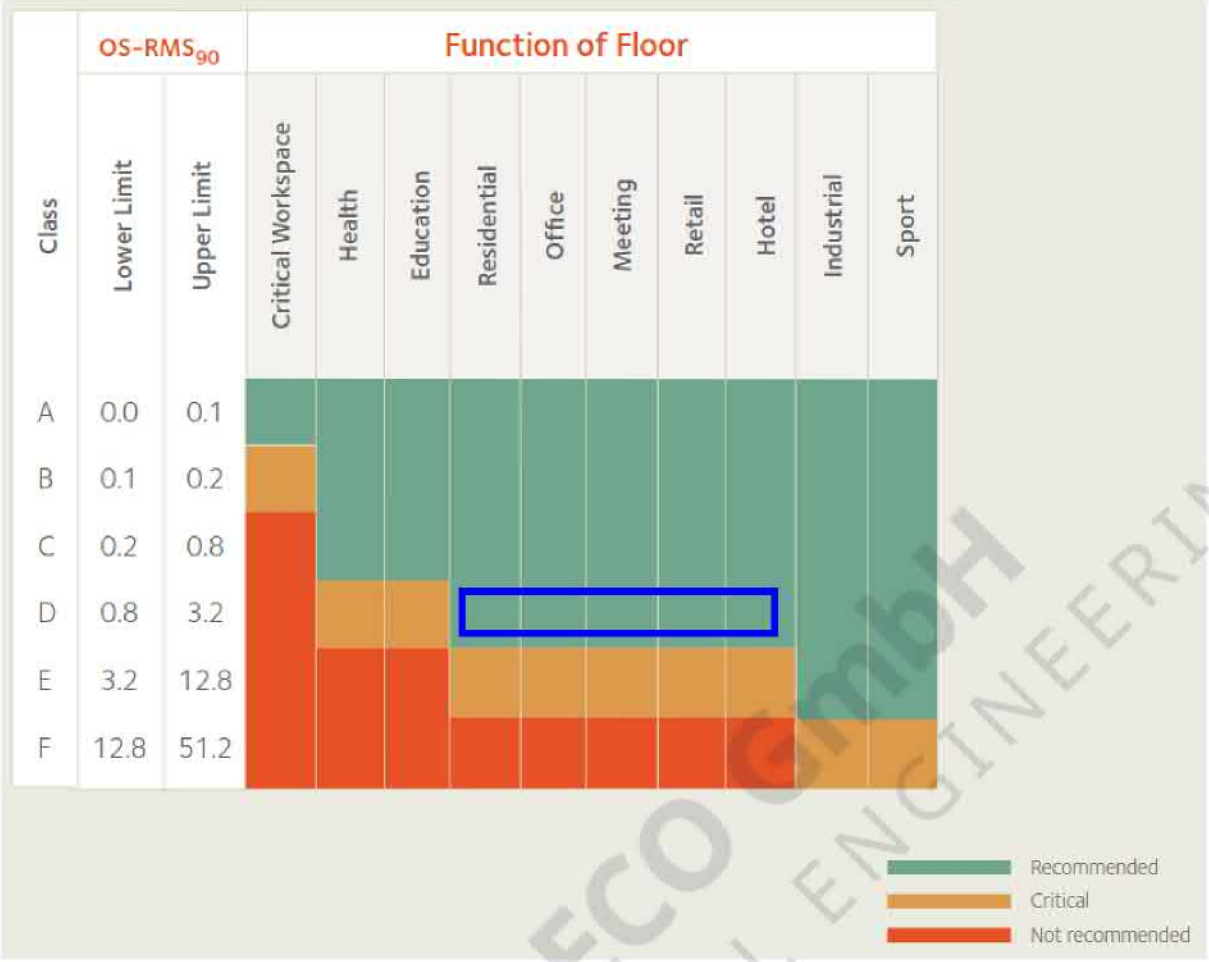
Određivanje klase vibracije:

OS-RMS$_{90}$ for 3% Damping

Rezultati iz Tower programa
Rezultati iz Dlubal programa



Proračunom vibracija, zaključenao je da galerija spada u prihvatljivu kategoriju – D.



Anschlussnachweise

Project item CON1

Design

Name	CON1
Description	
Analysis	Stress, strain/ simplified loading

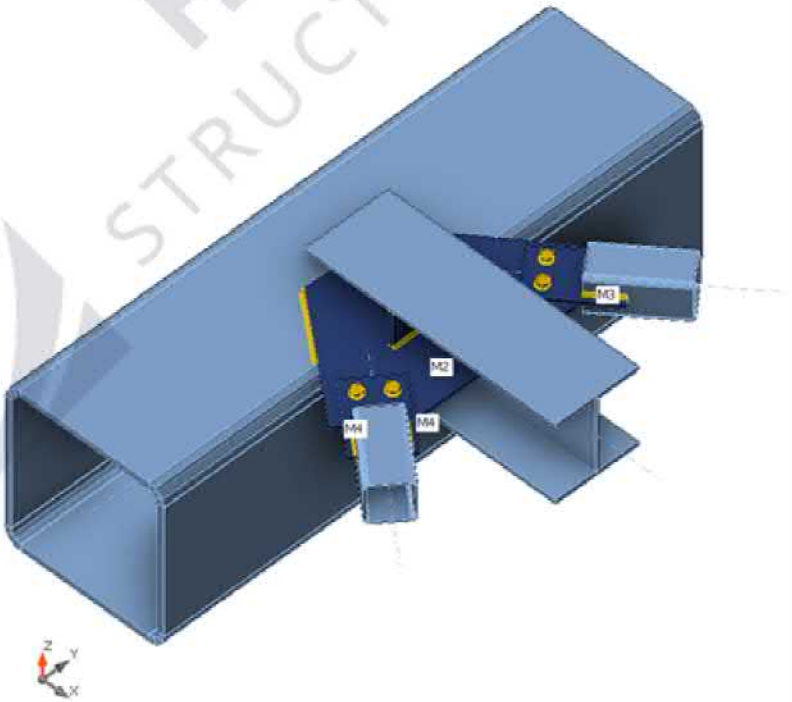
Members

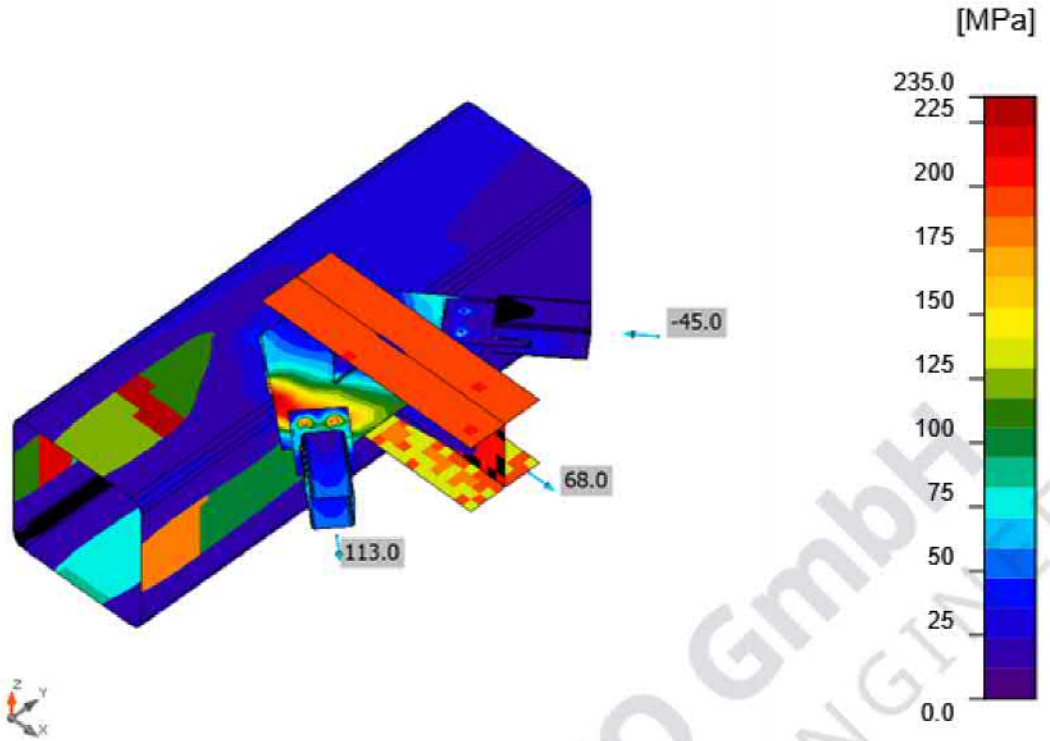
Geometry

Name	Cross-section	β – Direction [°]	γ - Pitch [°]	α - Rotation [°]	Offset ex [mm]	Offset ey [mm]	Offset ez [mm]
M1	1 - SHS500/500/19.0	90.0	0.0	0.0	-300	0	0
M2	2 - HEA260	0.0	0.0	0.0	25	500	265
M3	3 - SHS120/120/5.0	39.0	0.0	0.0	625	360	260
M4	3 - SHS120/120/5.0	-39.0	0.0	0.0	-5	420	260

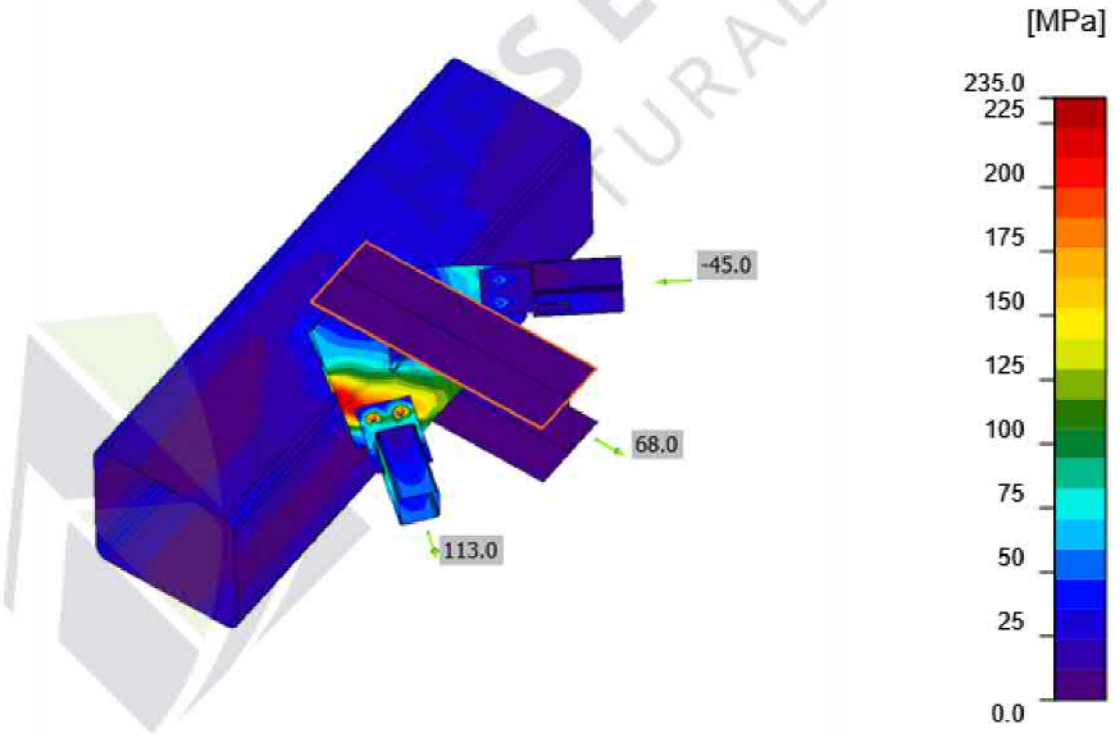
Supports and forces

Name	Support	Forces in	X [mm]
M1 / end	N-Vy-Vz-Mx-My-Mz	Node	0
M2 / end		Bolts	0
M3 / end		Bolts	0
M4 / end		Bolts	0

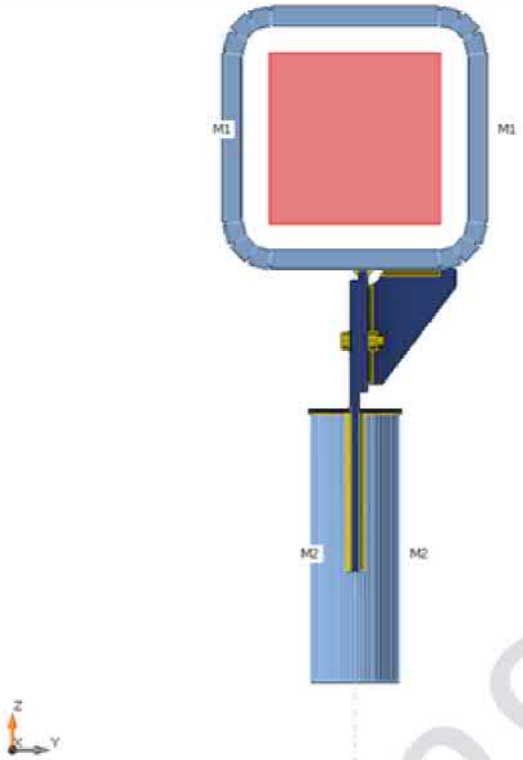




Equivalent stress, 1dil - 2



Equivalent stress, For extreme



Cross-sections

Name	Material
1 - SHS500/500/36.0	S 235
2 - CHS168.3/6.3	S 235

Bolts

Name	Diameter [mm]	f_y [MPa]	f_u [MPa]	Gross area [mm^2]
M20 8.8	20	640.0	800.0	314

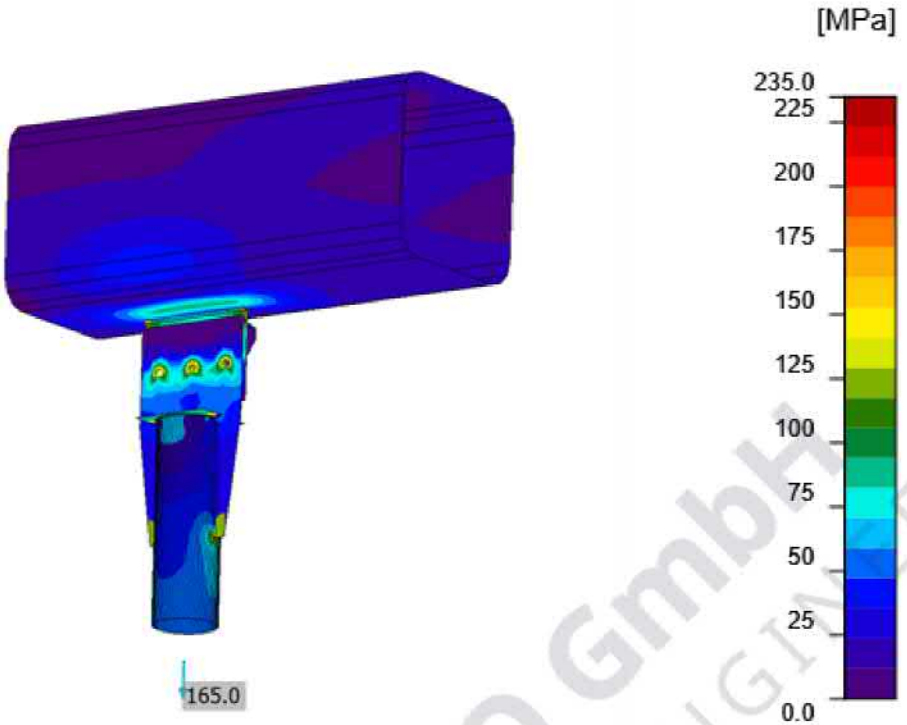
Load effects (Equilibrium not required)

Name	Member	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
LE1	M2 / End	165.0	0.0	0.0	0.0	0.0	0.0

Check

Summary

Name	Value	Check status
Analysis	100.0%	OK
Plates	0.0 < 5.0%	OK
Bolts	64.5 < 100%	OK
Welds	51.8 < 100%	OK
Buckling	114.63	
GMNA	Calculated	



Equivalent stress, LE1

Equivalent stress, LE1

Project item CON1

Design

Name	CON1
Description	
Analysis	Stress, strain/ simplified loading

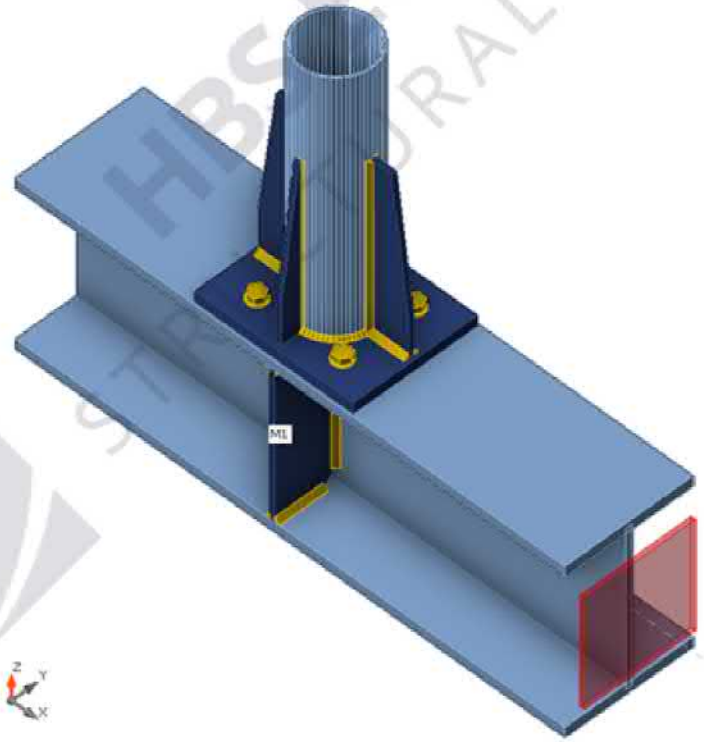
Members

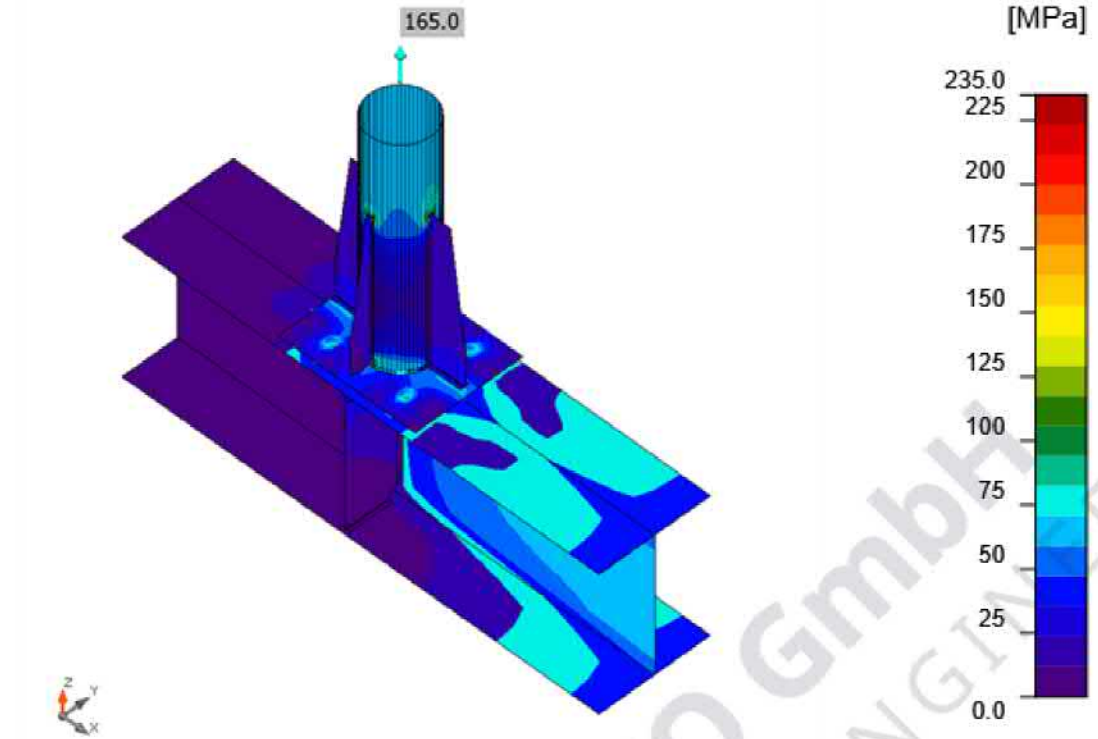
Geometry

Name	Cross-section	β – Direction [°]	γ - Pitch [°]	α - Rotation [°]	Offset ex [mm]	Offset ey [mm]	Offset ez [mm]
M1	1 - HEB400	0.0	0.0	0.0	0	0	0
M2	2 - CHS168.3/5.0	0.0	90.0	0.0	0	0	-600

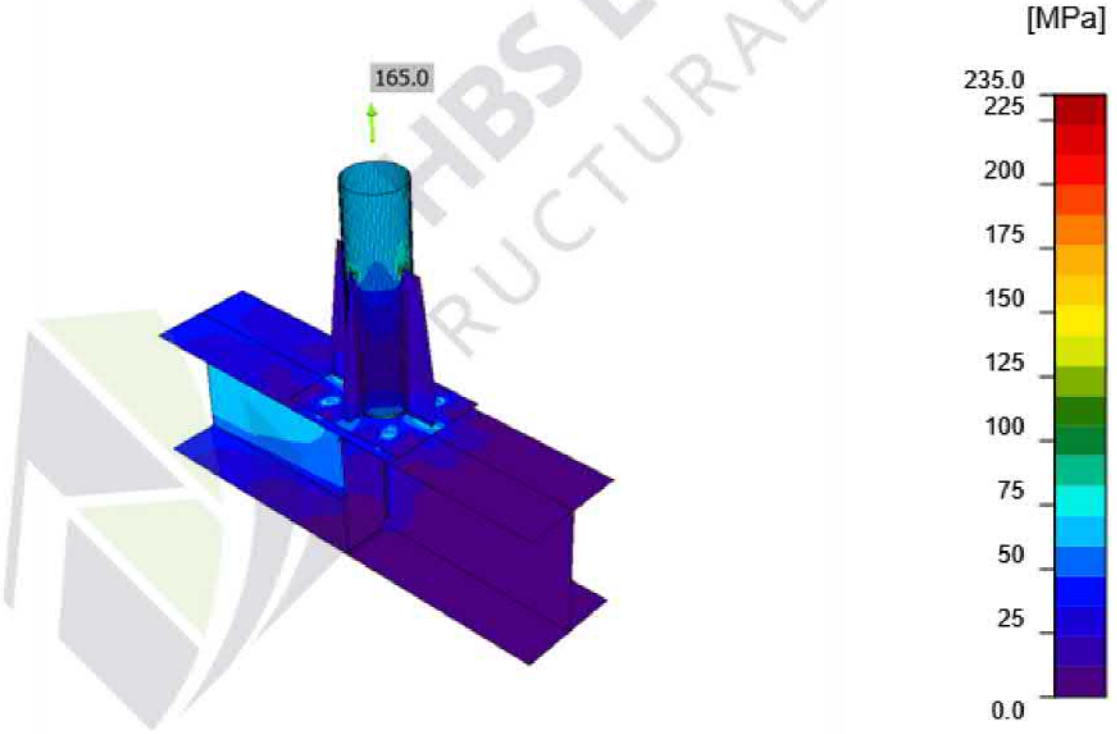
Supports and forces

Name	Support	Forces in	X [mm]
M1 / end	N-Vy-Vz-Mx-My-Mz	Node	0
M2 / end		Node	0





Equivalent stress, LE1

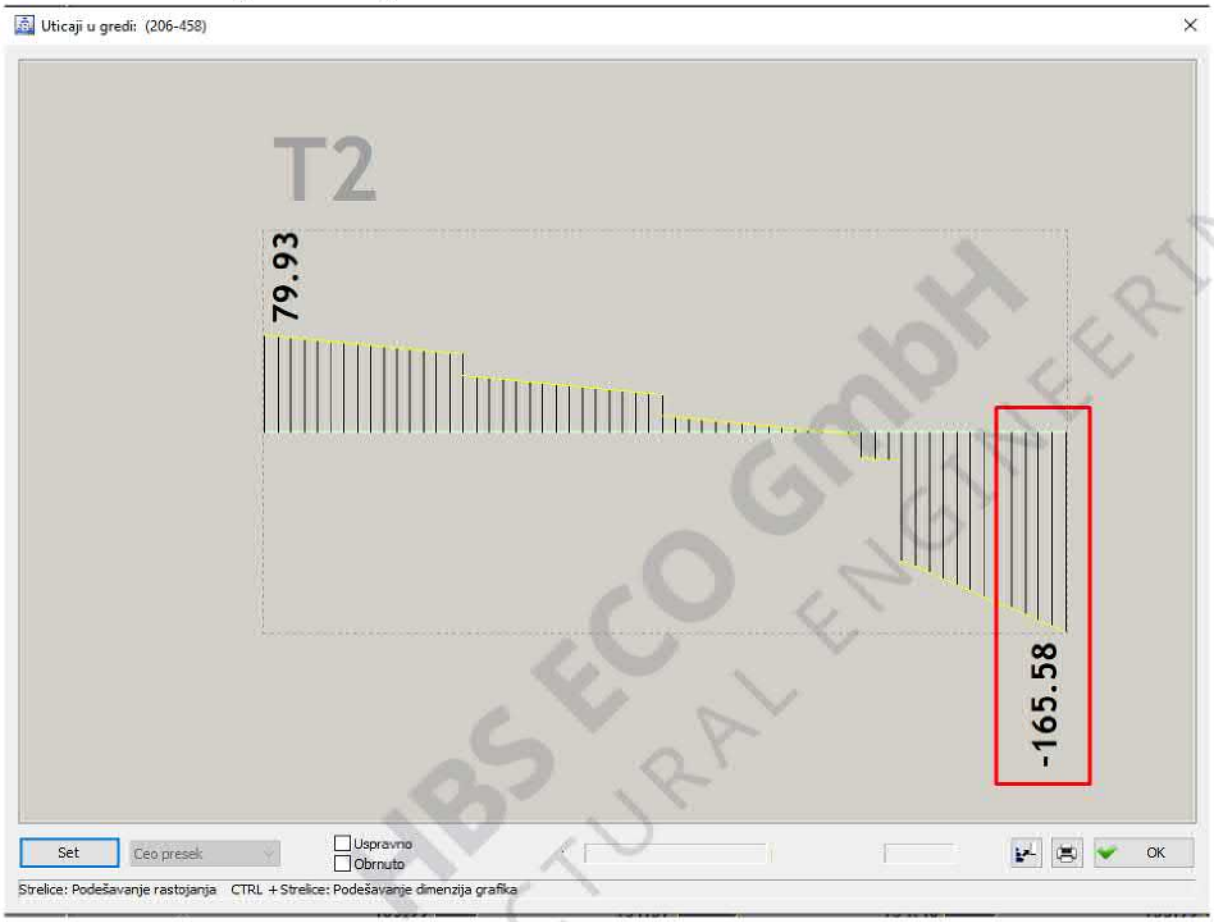


Equivalent stress, LE1

1.6.2.3.5 Veza stolice za AB stub – UG11A

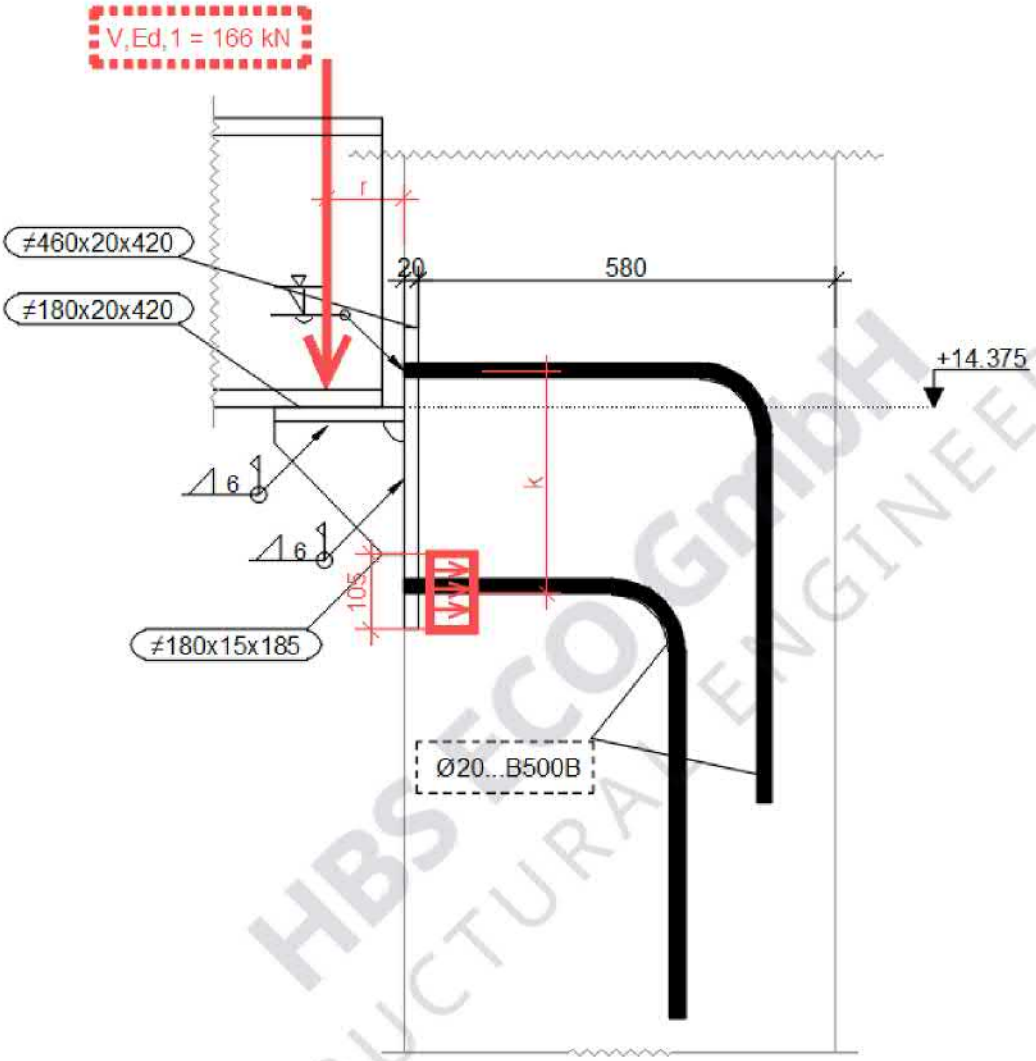
A. Određivanje merodavnih uticaja

Prikaz ULS uticaja – Galerija:



Kod merodavnih slučajeva razmatrani su svi čvorovi u kojima su nosači HEB 400 oslonjeni na AB stub skladno detalju UG-11A i određen je merodavan slučaj. Analizom sila koje deluju u čvor, dobijene su sledeće vrednosti uticaja za proračun veze (ULS): **V,Ed = 166 kN.**

B. Prikaz usvojenog detalja



Usvojeno: 6 x Φ20 B500B

Moment savijanja usled ekscentriciteta transverzalne sile:

M,ed = V,Ed × r = 166 kN × 0.105 m = 18 kNm

Sila zatezanja u ankerima usled momenta savijanja:

M,Ed = Z,ed × k = Z,ed × 0.30 m

Z,Ed = M,Ed ÷ 0.30 m = 18 kNm ÷ 0.30 m = 60 kN

C. Dokaz ankera u betonu – na ZATEZANJE:

C.1 Sila koja deluje na jedan anker

Rezultujuća sila zatezanja: Z,Ed = 60 kN
N,Ed = 60 kN / 3 kom = 20 kN

Površina armature: As = 3.14cm2
Proračunska vrednost granice razvlačenja armature: fyd = 43.5 kN/cm2
Proračunska nosivost armature: Rd = 3.14cm2 x 43.5kN/cm2 x 0.75(1**) = 102,40 kN

C.2 Iskorišćenost:

N,Ed = 20 kN
Rd,uk = 102,40 kN > N,Ed = 20 kN (20% iskorišćenost)

S obzirom na to da se zatezanje nastalo usled lokalnog momenta, prenosi preko ankera na ankernu ploču sa druge strane stuba i odupire se celom svojom površinom, smatra se da je otporna sila dovoljno velika i da nije potreban poseban dokaz.

D. Dokaz ankera u betonu – na SMICANJE:

Nosivost na SMICANJE - 1 anker:

Površina koja učestvuje u prenosu sile:
A = d * 5d = 2cm x 5 x 2cm = 20cm2
5d - razmatrana dužina armature koja prenosi silu (lokalni prit.betona)
d - prečnik armature

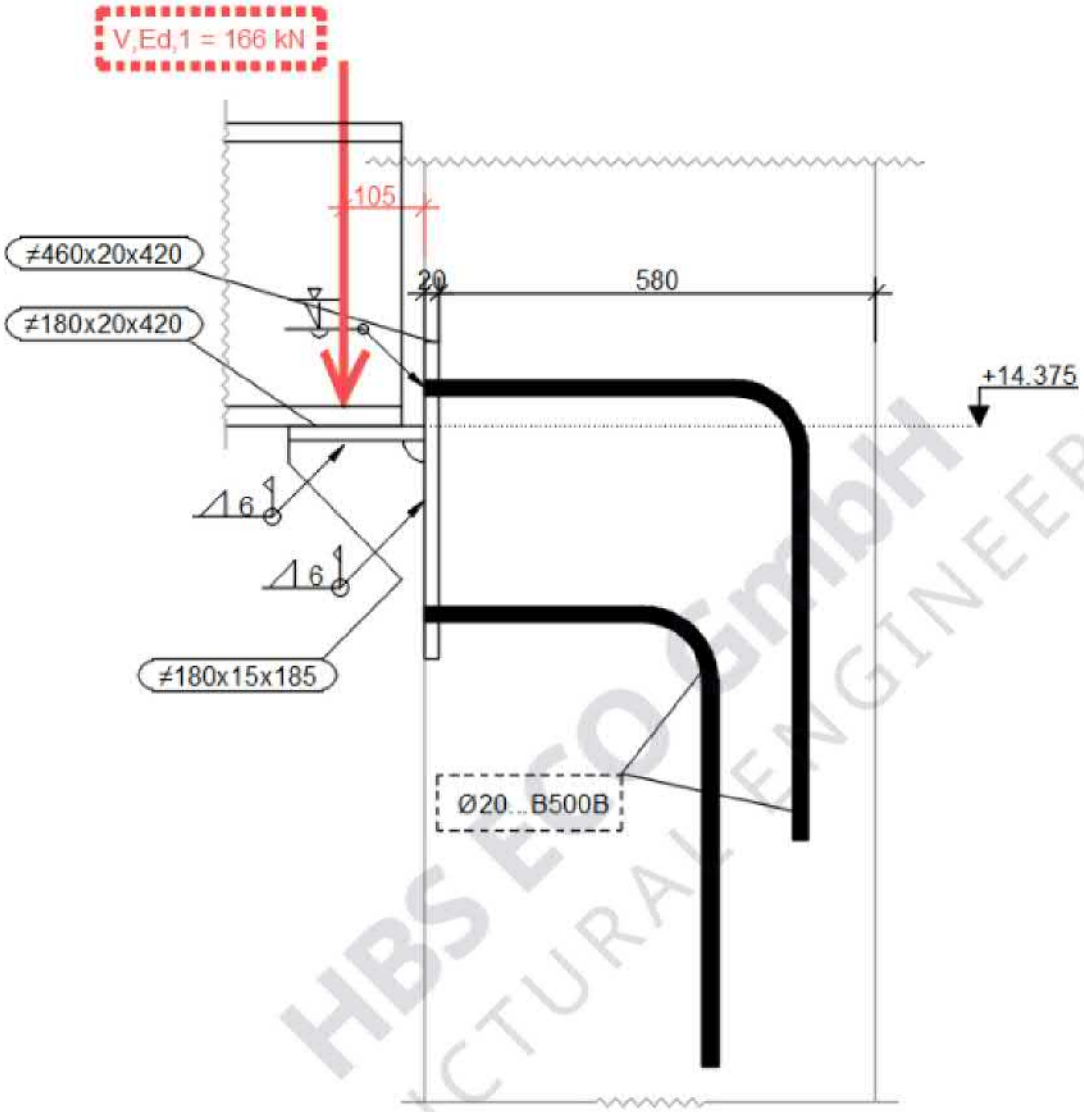
Nosivost na smicanje jednog ankera:
fcd= 0.85*fck/1.5=0.85*30/1.5=17 MPa , za beton C30/37.
Rd = A x fcd = 20cm2 x 1.7 kN/cm2 = 34 kN

Sila koja deluje na 1 anker:

N,Ed = 60 kN / 6 kom = 10 kN
Rd,uk = 34kN > N,Ed = 10 kN (30% iskorišćenost)

Usvojeno: 6 x M20 B500B

E. Dokaz varova:



Ukupna sila smicanja: V,Ed = 166 kN

Ukupan moment savijanja: M,Ed = 166 kN × 10.50 cm = 1750 kNcm

Dužina vara: l = 155 mm

Uticaji koji deluju na dvostrani ugaoni var dužine l = 155 mm:

V,Ed = 166 kN / 3 kom = 56 kN

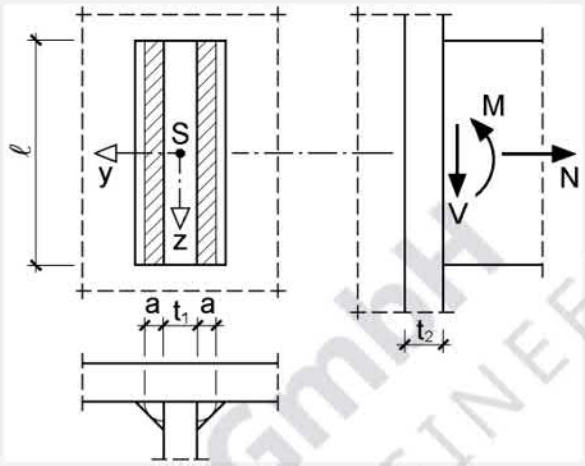
M,Ed = 1750 kNcm / 3 kom = 584 kNcm

U proračunu veze, razmatran je samo vertikalni var na dužini od 155 mm. Var je proračunat pomoću nemačkog RUBSTAHL programa razvijenog na univerzitetu u Bohumu.

RUBSTAHL-Lehr- und Lernprogramme für Studium und Weiterbildung
Programm Kehlnahtanschlüsse erstellt von A. Wöllhardt, L. Gödde
Ruhr-Universität Bochum • Lehrstuhl für Stahl-, Leicht- und Verbundbau
Prof. Dr. M. Knobloch • www.ruhr-uni-bochum.de/stahlbau

Nachweis von Doppelkehlnähten nach DIN EN 1993-1-8 (EC3) (10/2014)

Kommentar:



System und Belastung

Material: Stahlsorte wählen

Stahlsorte:	S 235	
Bruchspannung f_u =	36.0	kN/cm²
Teilsicherheitsb. γ_{M2} =	1.25	[-]
Schweißbeiwert β_w =	0.80	[-]

Geometrie:

Schweißnahtlänge l =	155	mm
Schweißnahtdicke a =	6.0	mm

Kehlnaht über gesamte Länge voll ausgeführt (einschließlich Nahtenden) ☐

Schweißnahtlänge l_{eff} =	143.0	mm
Blechdicke t_1 =	12.0	mm
Blechdicke t_2 =	15.0	mm

Belastung:

Querkraft V =	60	kN
Normalkraft N =	0	kN
Moment M =	600	kNcm

Kontrolle der Schweißnahtdicke:

a_{min} = 3.37 mm
$a_{min} \le a$ eingehalten

Schweißnahtspannungen:

$\tau_{\parallel}$ =	3.50	kN/cm²
$\tau_{\perp}$ =	10.37	kN/cm²
$\sigma_{\perp}$ =	10.37	kN/cm²

Nachweis mit dem vereinfachten Verfahren

- bezogene Kräfte

F_w	≤	$F_{w,Rd}$		
18.10	≤	24.94	[kN/cm]	Nachweis erfüllt

Nachweis mit dem richtungsbezogenen Verfahren

Bedingung 1

21.61	≤	36.00	[kN/cm2]	eingehalten

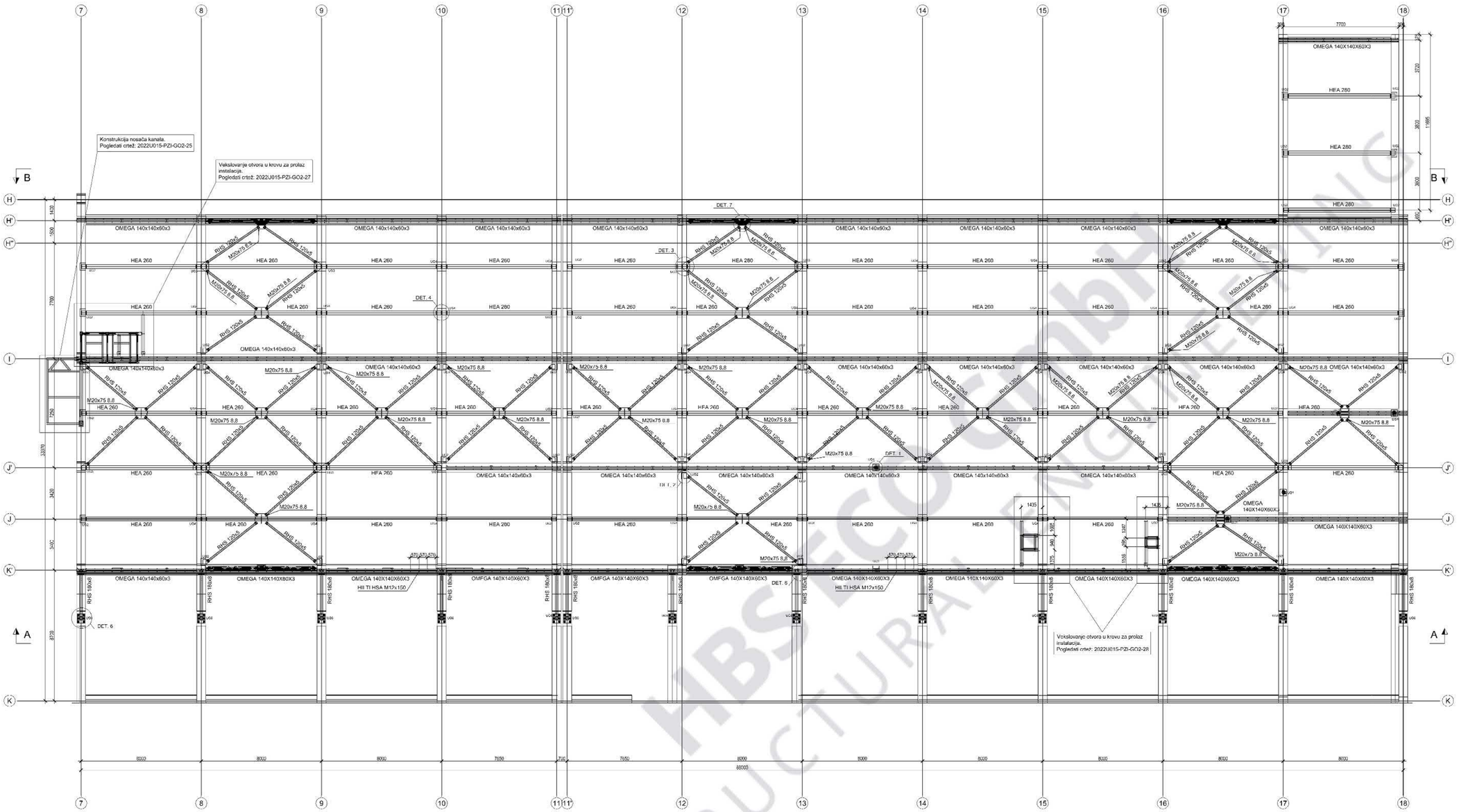
Bedingung 2

10.37	≤	25.92	[kN/cm2]	eingehalten

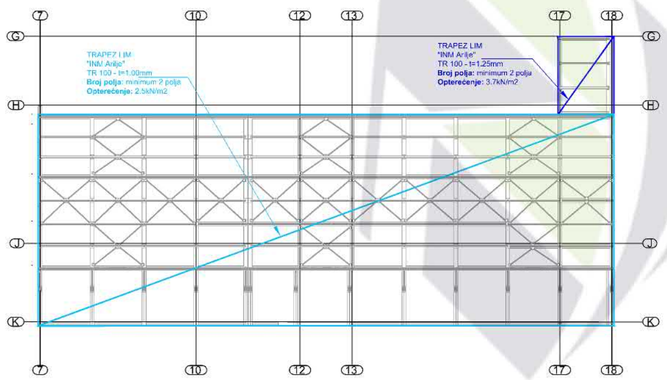
Nachweis erfüllt

Tragwerkszeichnungen

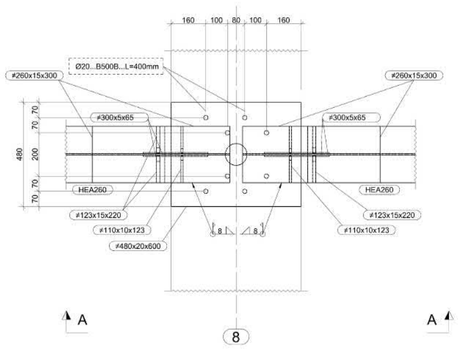
ČELIČNA KONSTRUKCIJA KROVA ose K-G/7-18 - DISPOZICIJA



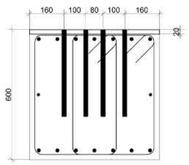
USVOJENI TRAPEZ LIMOVI



Detalj 4

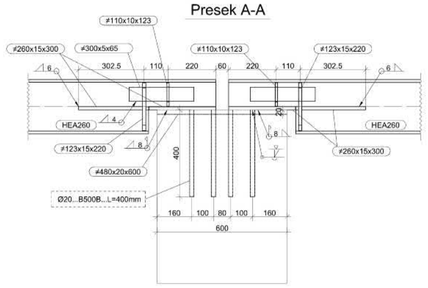


Prikaz armature

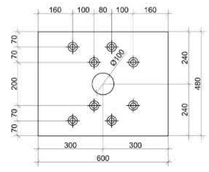


Pos.	Materijal	Kom.	Presek	Dužina 1 kom.	Dužina Ukupno	Masa kg/m	Masa ukupno
Ugradbeni element UG4 (40 kom.)							
1	B500B	8	Ø 20	400	3.20	2.47	7.9
2	S235JRG2	1	480 # 20	600	0.60	76.80	46.1
za 1 kom. kg							54.0
Ukupno za 40 kom. kg							2158.4

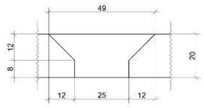
Presek A-A



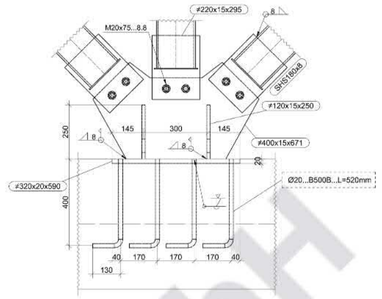
POS 2 ≠480x20x600



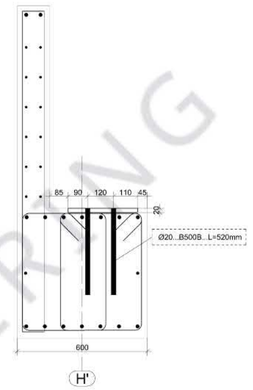
Detalj rupe R1:1



Detalj 5

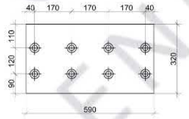


Prikaz armature

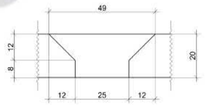


Pos.	Materijal	Kom.	Presek	Dužina 1 kom.	Dužina Ukupno	Masa kg/m	Masa ukupno
Ugradbeni element UG5 (9 kom.)							
1	B500B	8	Ø 20	520	4.16	2.47	10.3
2	S235JRG2	1	320 # 20	590	0.59	51.20	30.2
za 1 kom. kg							40.5
Ukupno za 9 kom. kg							364.3

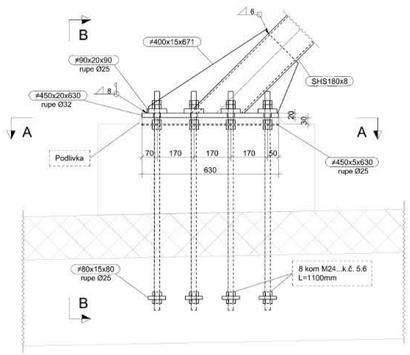
POS 2 ≠320x20x590



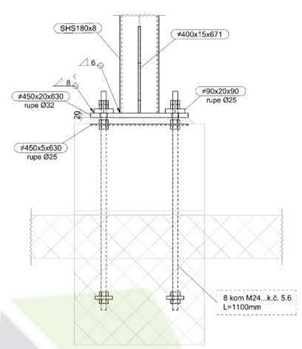
Detalj rupe R1:1



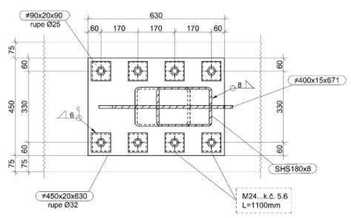
Detalj 6



Presek B-B

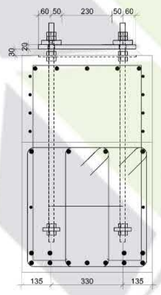


Presek A-A

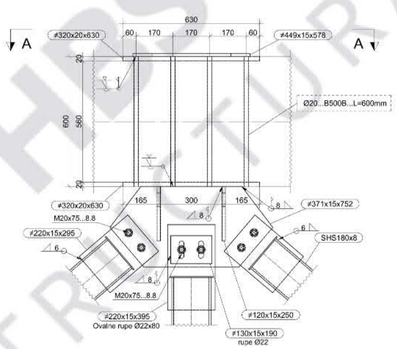


Pos.	Materijal	Kom.	Presek	Dužina 1 kom.	Dužina Ukupno	Masa kg/m	Masa ukupno
Ugradbeni element UG6 (13 kom.)							
1	k.č. 5.6	8	M24	1100	8.80	3.55	31.2
2	S235JRG2	1	450 # 5	630	0.63	18.00	11.3
za 1 kom. kg							42.5
Ukupno za 13 kom. kg							553.5

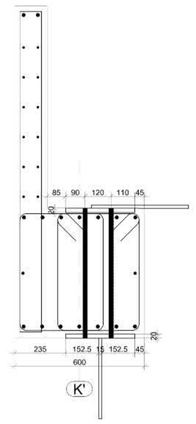
Prikaz armature



Detalj 7

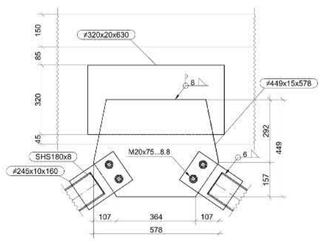


Prikaz armature

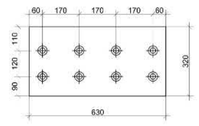


Pos.	Materijal	Kom.	Presek	Dužina 1 kom.	Dužina Ukupno	Masa kg/m	Masa ukupno
Ugradbeni element UG7 (3 kom.)							
1	B500B	6	Ø 20	600	4.00	2.47	11.9
2	S235JRG2	2	320 # 20	600	1.28	51.20	64.5
za 1 kom. kg							76.4
Ukupno za 3 kom. kg							229.1

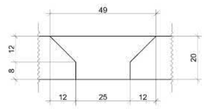
Presek A-A



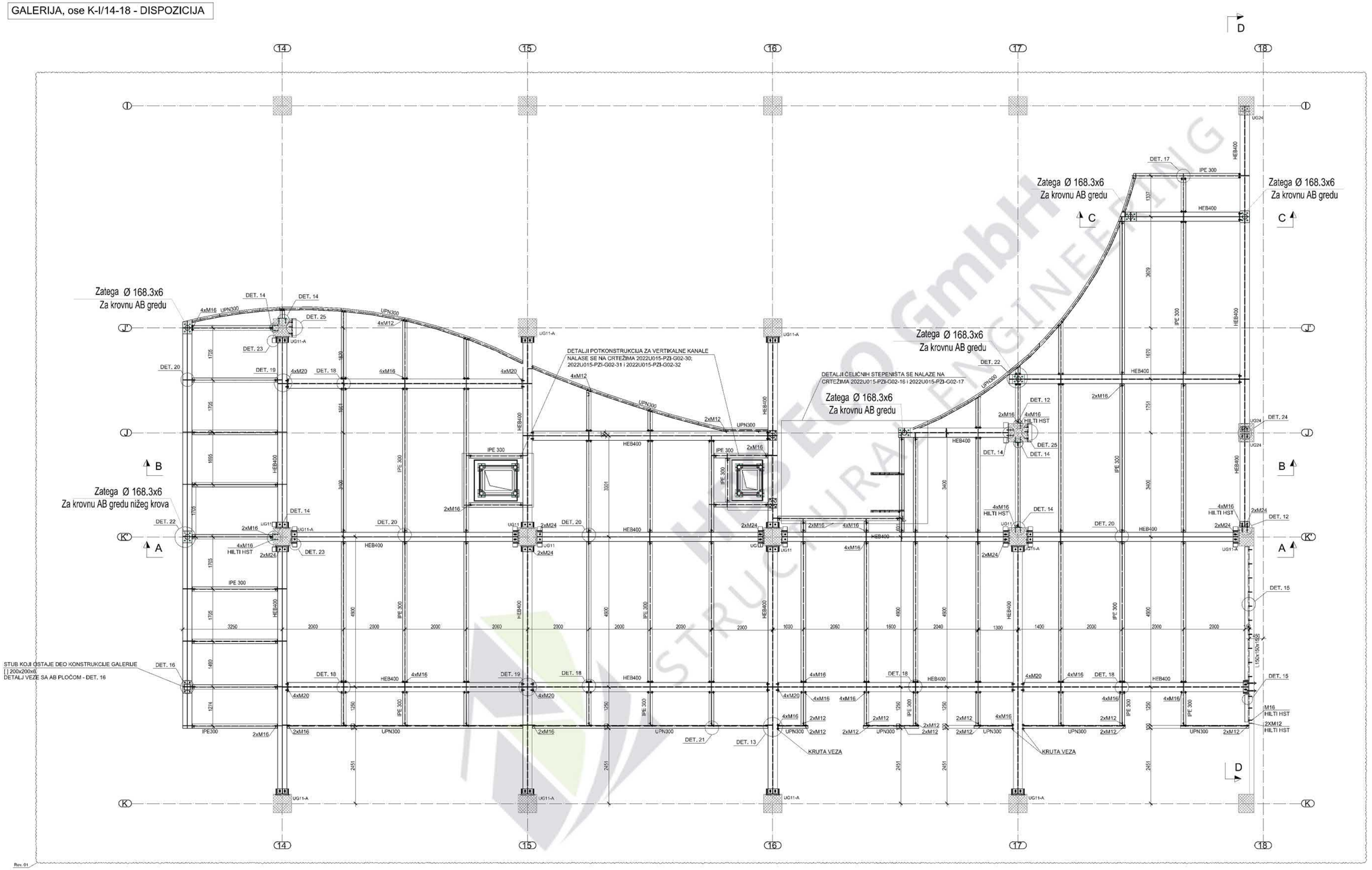
POS 2 ≠320x20x630



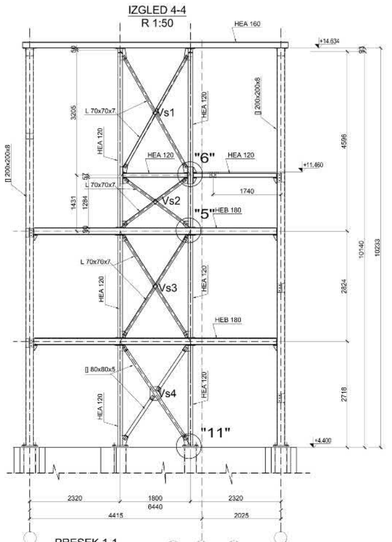
Detalj rupe R1:1

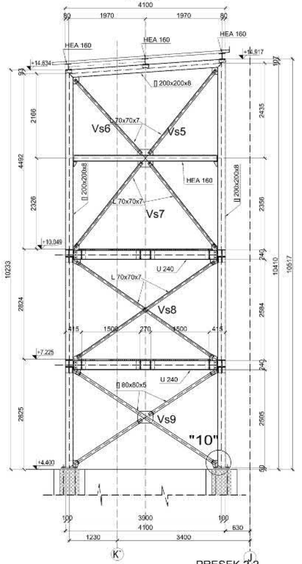


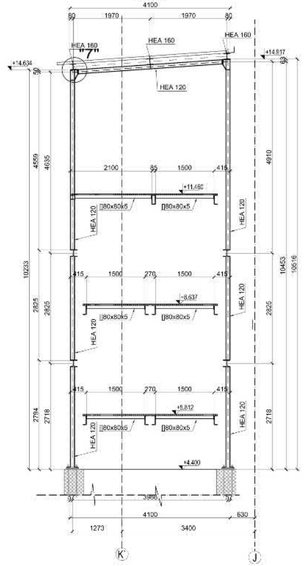
GALERIJA, ose K-I/14-18 - DISPOZICIJA

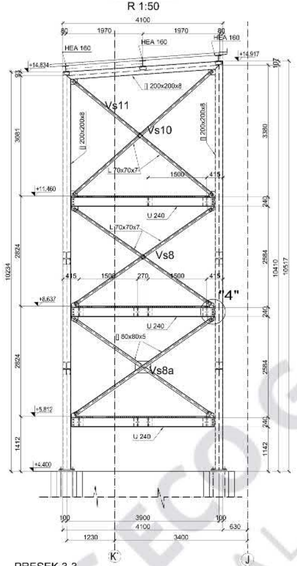


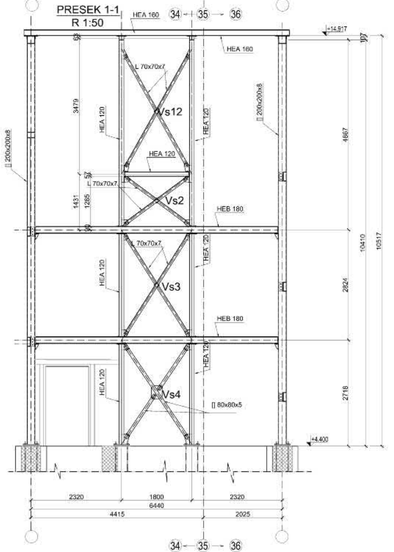
EVAKUACIONO STEPENIŠTE - DISPOZICIJA

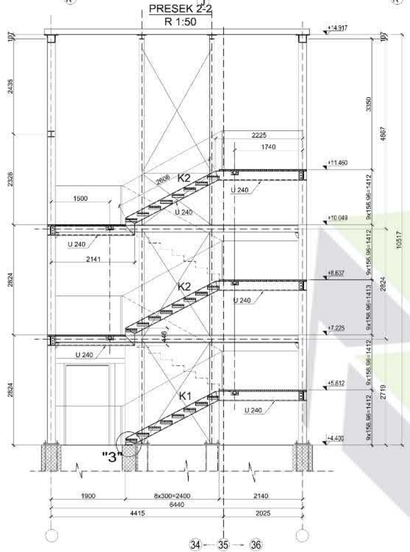


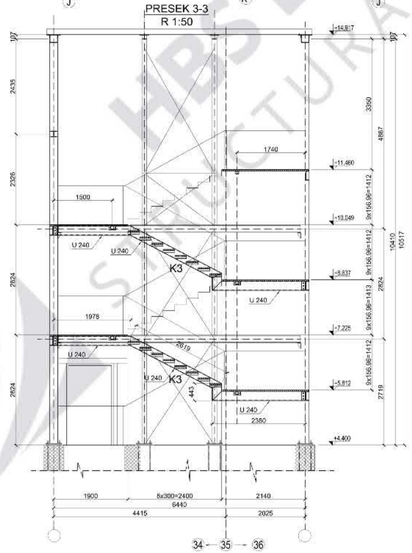


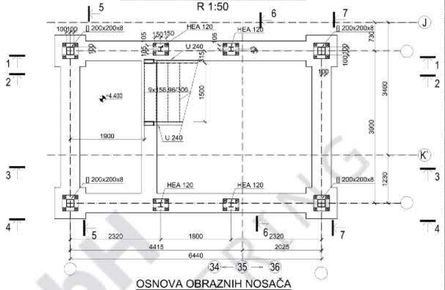


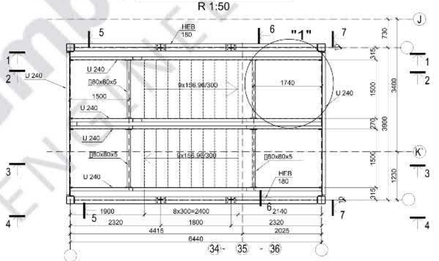


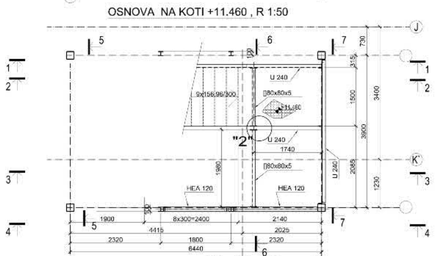


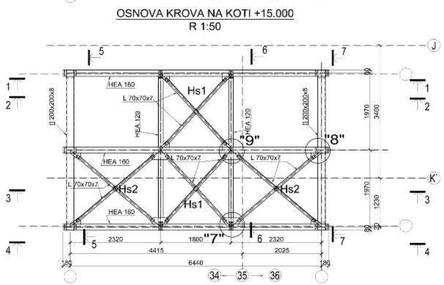






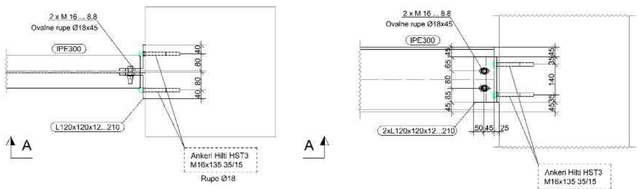






Poz.	Čelik	Kom	PRESEK		Dužina za 1 kom.		ukupno	Masa jedinična	ukupno	Primedba
					cm		m	kg/m	kg	
rani	S235	2	[]	200x200x	x	8	10517	21.03	45.50	978.08
	S235	2	[]	200x200x	x	8	10234	20.47	46.50	951.70
	S235	2	[]	200x200x	x	8	4116	8.22	46.50	382.23
horizontale	S235	1		HEA 160			3900	3.90	30.40	118.56
horizontale	S235	4		HEB 180			6440	25.76	51.20	1318.91
nosač	S235	3		HEA 160			6900	20.40	30.40	620.16
stub	S235	2		HEA 120			10517	21.03	19.90	418.58
stub	S235	2		HEA 120			10234	20.47	19.90	407.31
kosovi nosač	S235	2		HEA 120			3880	7.76	19.90	154.42
horizontale	S235	2		HEA 120			1800	3.60	19.90	71.64
horizontale	S235	1		HEA 120			2320	2.32	19.90	46.17
horizontale	S235	5	1		240		3900	19.50	33.20	647.40
K1	S235	2	1		240		2608	5.22	33.20	173.17
	S235	2	1		240		2226	4.45	33.20	147.81
	S235	2	1		240		177	0.35	33.20	11.75
K2	S235	4	1		240		2141	8.56	33.20	284.32
	S235	4	1		240		2608	10.43	33.20	346.34
	S235	4	1		240		2225	8.90	33.20	295.48
	S235	4	1		240		446	1.78	33.20	59.23
K3	S235	4	1		240		1978	7.91	33.20	262.68
	S235	4	1		240		2819	10.48	33.20	347.80
	S235	4	1		240		2380	9.52	33.20	316.06
	S235	4	1		240		443	1.77	33.20	58.83
	S235	9	[]	80x80	x	5	1500	13.50	11.27	152.15
		1	[]	80x80	x	5	1980	1.98	11.27	22.31
Vs1	S235	2	L	70x70	x	7	3295	6.59	7.38	48.63
Vs2	S235	4	L	70x70	x	7	1975	7.90	7.38	58.30
Vs3	S235	4	L	70x70	x	7	3005	12.02	7.38	88.71
Vs4	S235	4	L	70x70	x	7	2920	11.68	7.38	86.20
Vs5	S235	1	L	70x70	x	7	2750	2.75	7.38	20.30
Vs6	S235	1	L	70x70	x	7	2550	2.55	7.38	18.82
Vs7	S235	2	L	70x70	x	7	2760	5.52	7.38	40.74
Vs8	S235	4	L	70x70	x	7	4300	17.20	7.38	126.94
Vs8a	S235	2	L	80x80	x	8	4300	8.60	9.66	83.08
Vs9	S235	2	L	80x80	x	8	4340	8.68	9.66	83.85
Vs10	S235	1	L	70x70	x	7	4790	4.79	7.38	35.35
Vs11	S235	1	L	70x70	x	7	4640	4.64	7.38	34.24
Vs12	S235	2	L	70x70	x	7	3495	6.99	7.38	51.59
Hs1	S235	4	L	70x70	x	7	2310	9.24	7.38	68.19
Hs2	S235	4	L	70x70	x	7	2620	10.48	7.38	77.34
G	Gazište rešetka h=30mm, oko 30x30 P=84m2 Težina ~56m2 x 48kg/m2=								2688.00	
	S235	80	L	50x50	x	5	300	24.00	3.77	90.48
								Σ =	12,293.92	kg
								10% =	1,229.39	kg
								Σ =	13,523.31	kg

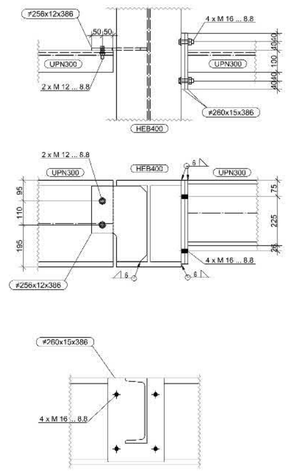
Detalj 12
IPE300 / HEB400 preko „L" profila



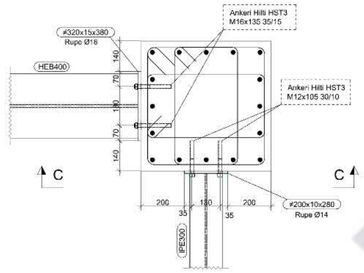
Presek A-A

Napomena: Isti detalj primenitti i na veri HFB400 profila sa AB elemontom preko Hilti ankera

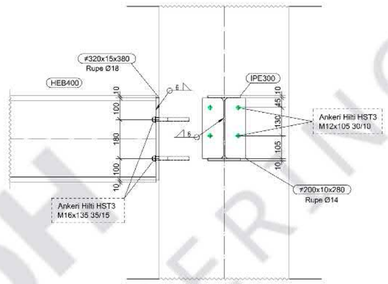
Detalj 13



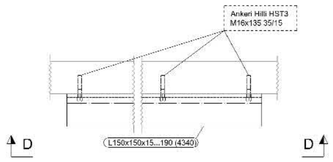
Detalj 14
IPE300 / HEB400 preko ploča



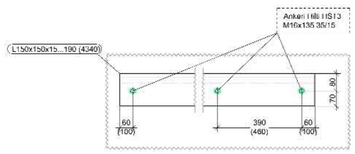
Presek C-C



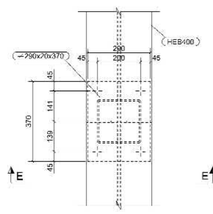
Detalj 15
„L" profili



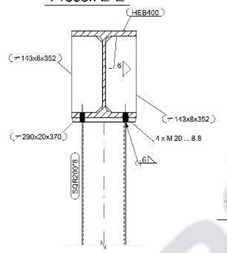
Presek D-D



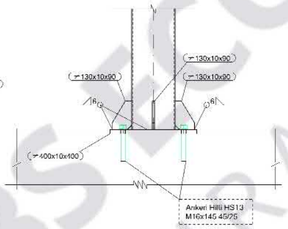
Detalj 16



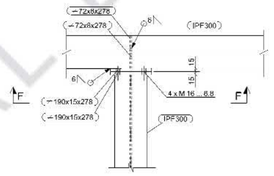
Presek E-E



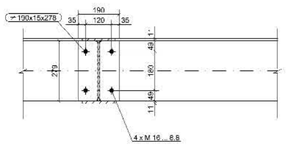
Detalj veze stuba i AB ploče



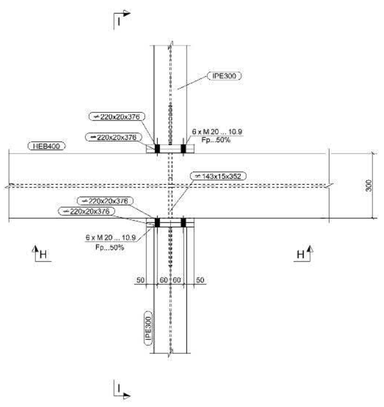
Detalj 17



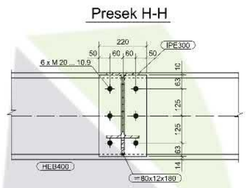
Presek F-F



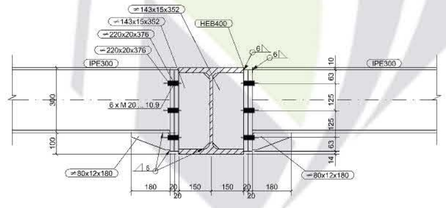
Detalj 18



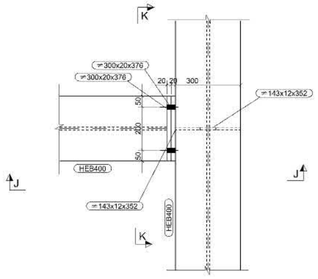
Presek H-H



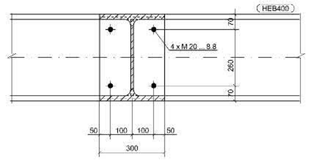
Presek I-I



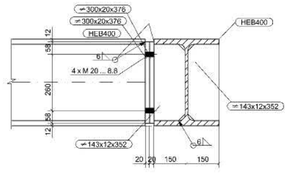
Detalj 19



Presek K-K

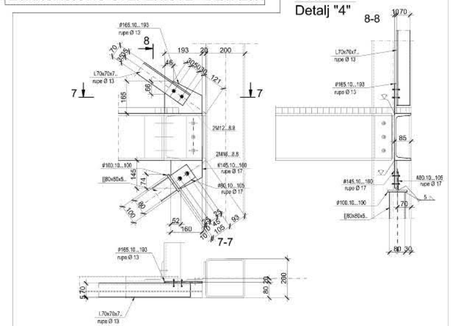


Presek J-J

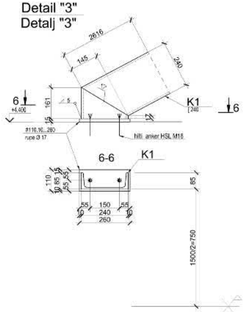


EVAKUACIONO STEPENIŠTE - DETALJI

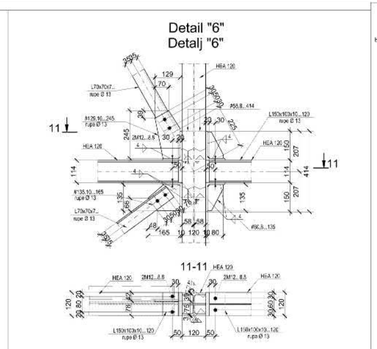
Detail "4"
Detalj "4"



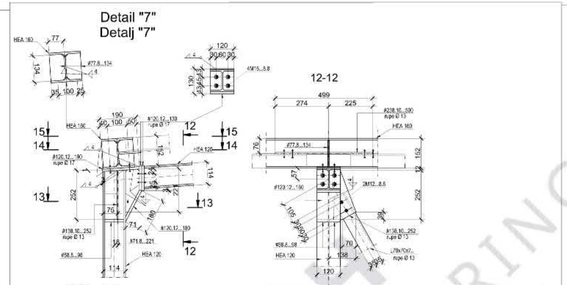
Detail "3"
Detalj "3"



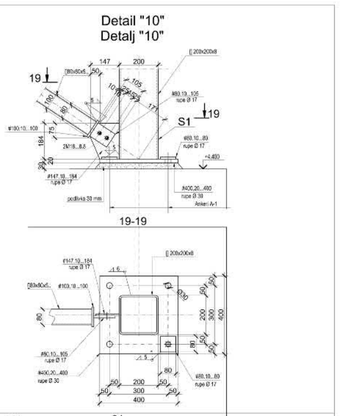
Detail "6"
Detalj "6"



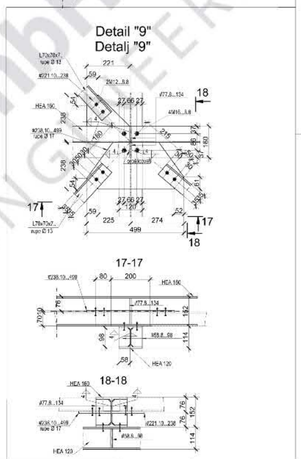
Detail "7"
Detalj "7"

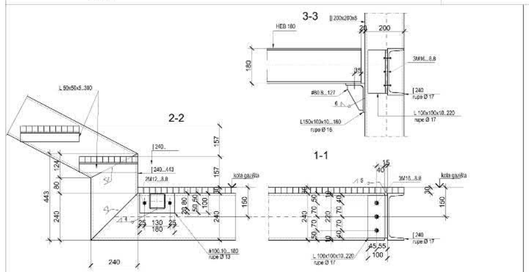


Detail "10"
Detalj "10"

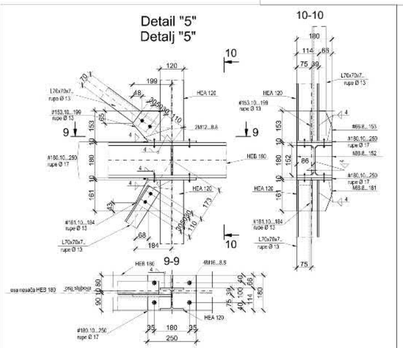


Detail "9"
Detalj "9"

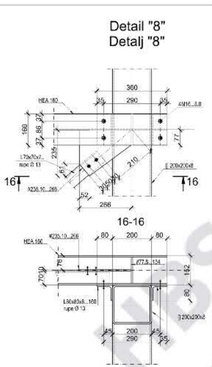


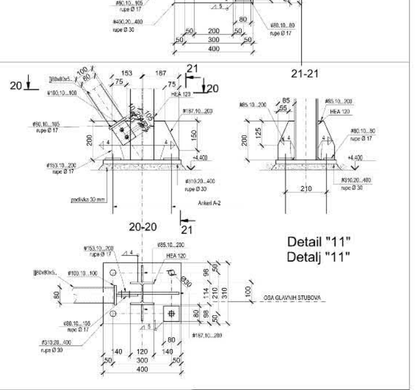


Detail "5"
Detalj "5"

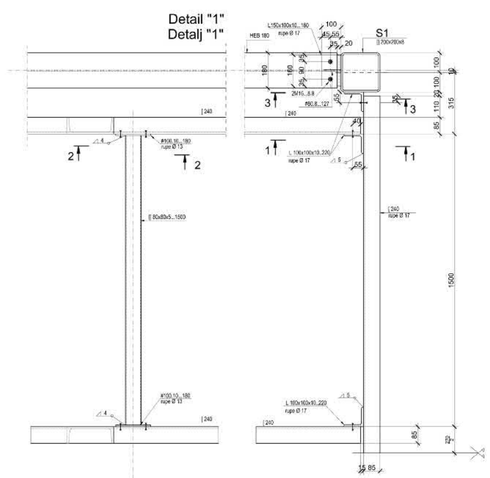


Detail "8"
Detalj "8"

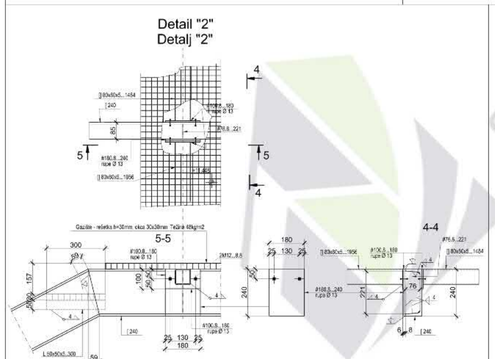


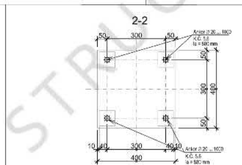


Detail "1"
Detalj "1"

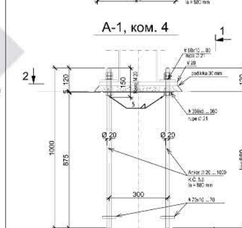


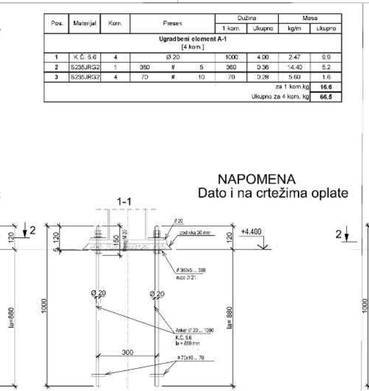
Detail "2"
Detalj "2"





Pos.	Materijal	Kom.	Presek	Dužina		Masa	
				1 kom.	Ukupno	kg/m	ukupno
Ugradbeni element A-1 [4 kom.]							
1	K.Č. 5.6	4	Ø 20		1000	4.00	2.47	9.9
2	S235JRG2	1	360	#	5	360	0.36	14.40	5.2
3	S235JRG2	4	70	#	10	70	0.28	5.60	1.6
						za 1 kom. kg			**16.6**
						Ukupno za 4 kom. kg			**66.5**





Pos.	Materijal	Kom.	Presek	Dužina		Masa	
				1 kom.	Ukupno	kg/m	ukupno
Ugradbeni element A-2 [4 kom.]							
1	K.Č. 5.6	4	Ø 20		1000	4.00	2.47	9.9
2	S235JRG2	1	270	#	5	360	0.30	10.80	3.9
3	S235JRG2	4	70	#	10	70	0.28	5.60	1.6
						za 1 kom. kg			**16.3**
						Ukupno za 4 kom. kg			**65.3**