

Projekt: Theatergebäude [Fläche = 2.900m²]

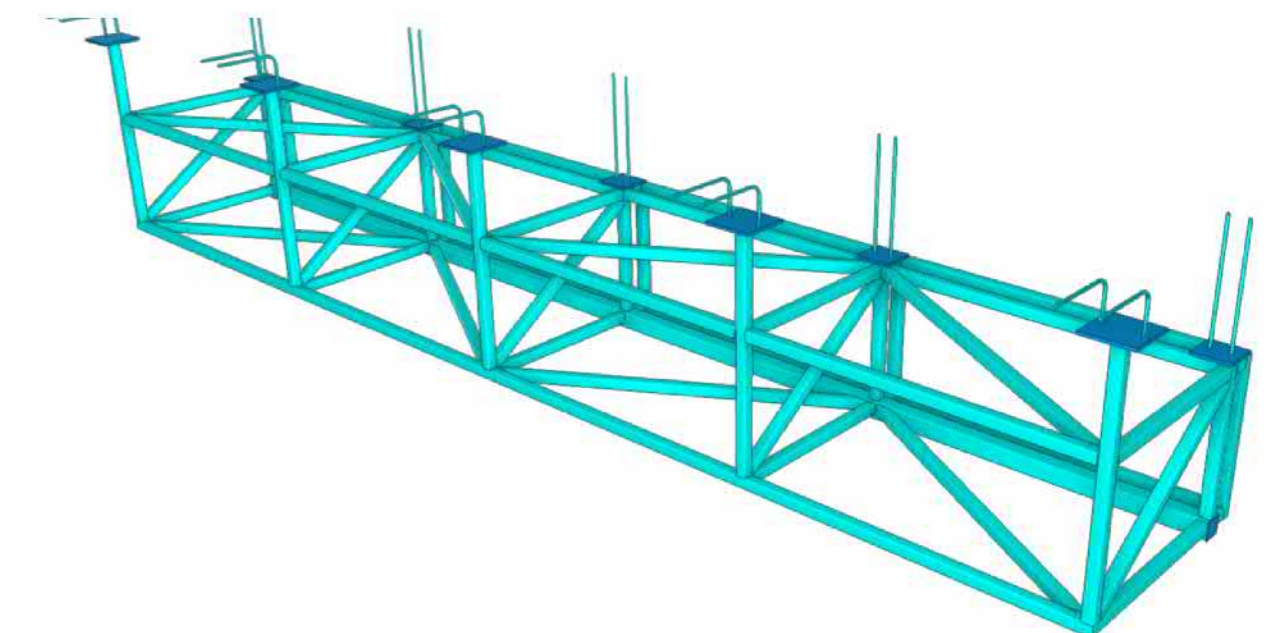
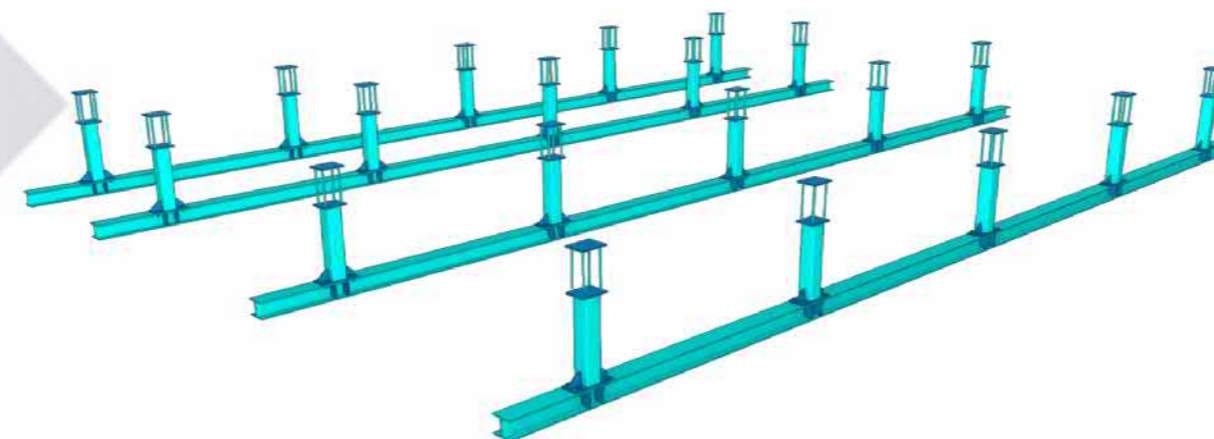
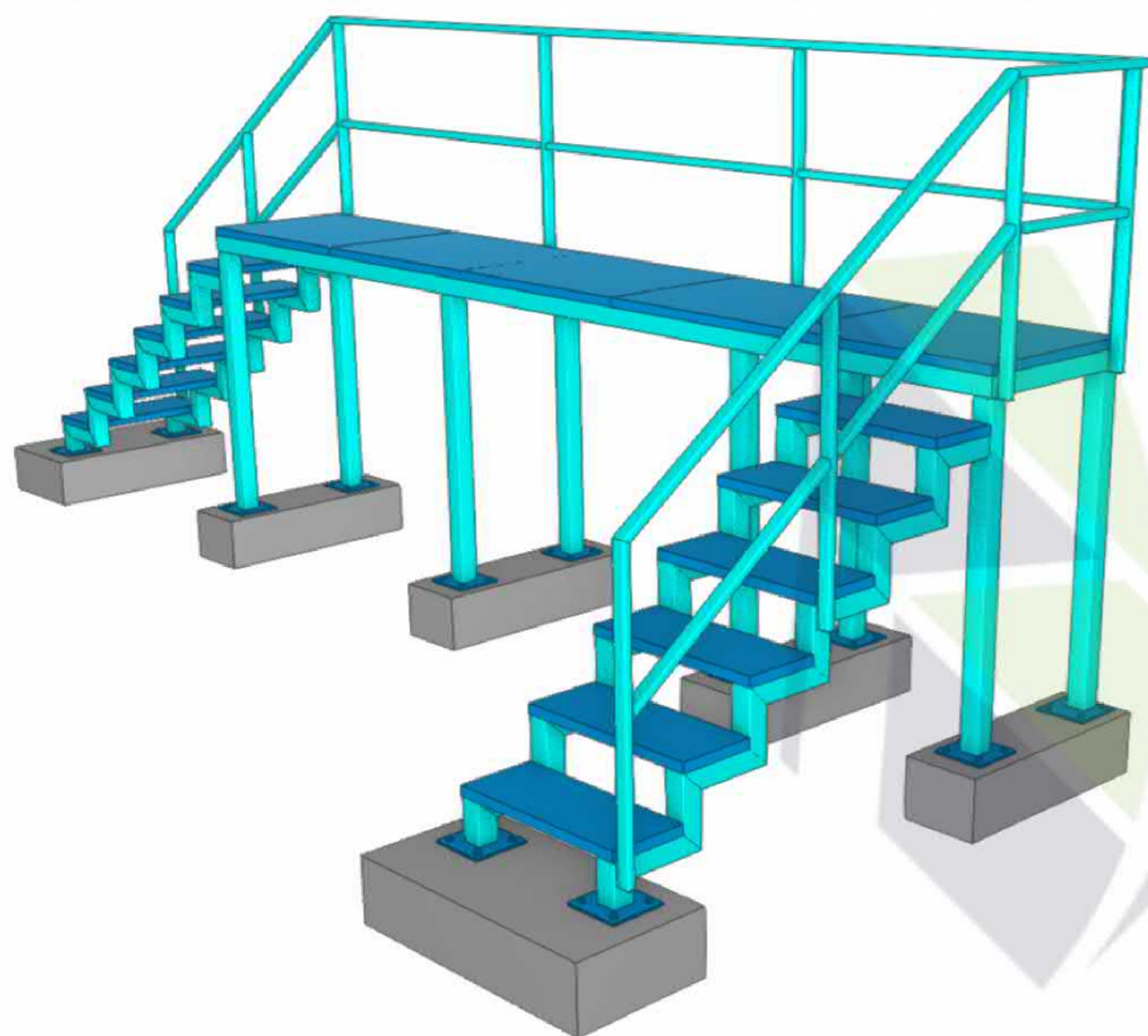
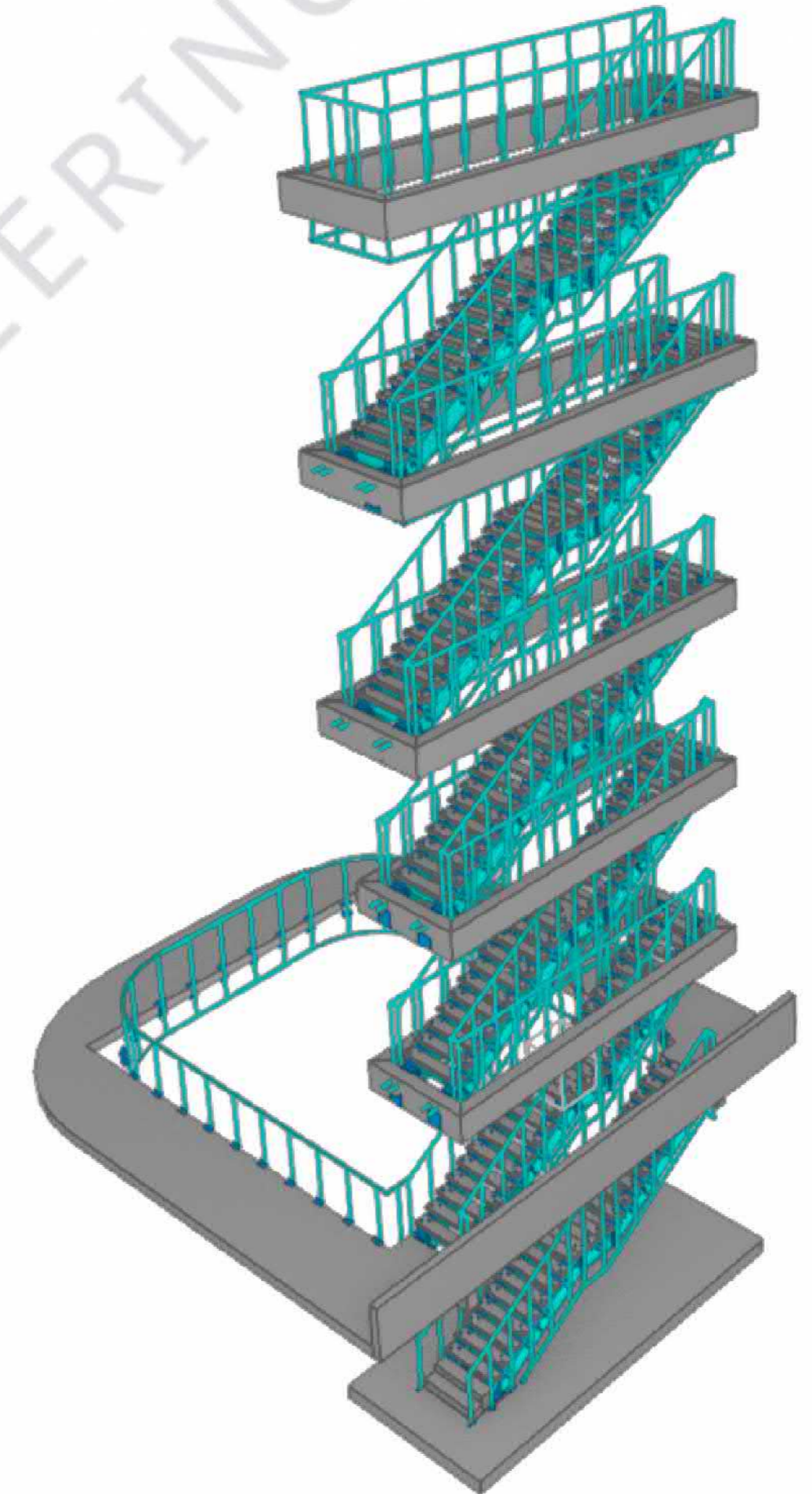
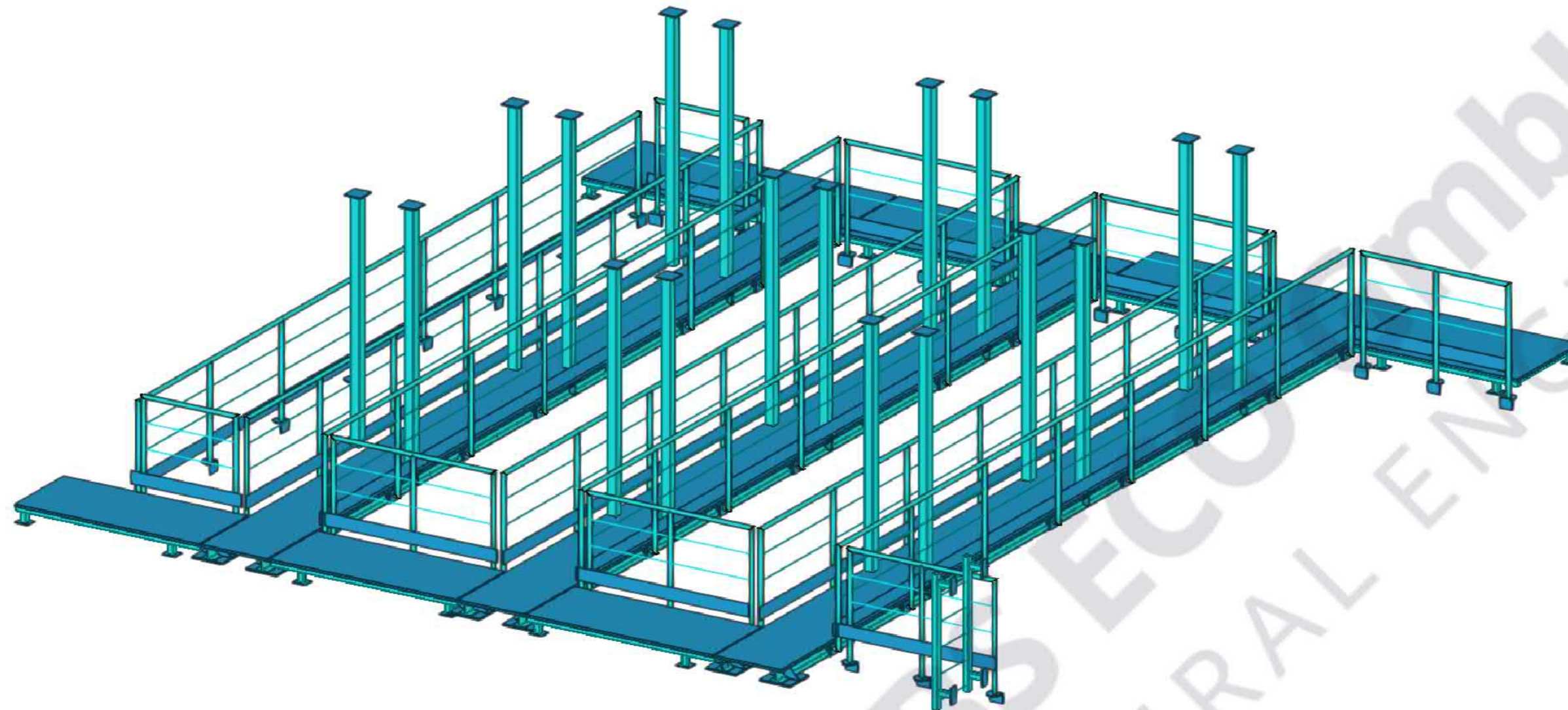
Land: Serbien

Leistungsumfang: Sekundärstahlkonstruktion:

- Koordination mit Architekten, HLK-Planung
- Projektoptimierung in Zusammenarbeit mit Stahlbauunternehmen
- Statische Berechnung
- Anschlussnachweise
- Tragwerkszeichnungen



HBS ECO GmbH
STRUCTURAL ENGINEERING



Statische Berechnung



HBS EDO GmbH
STRUCTURAL ENGINEERING

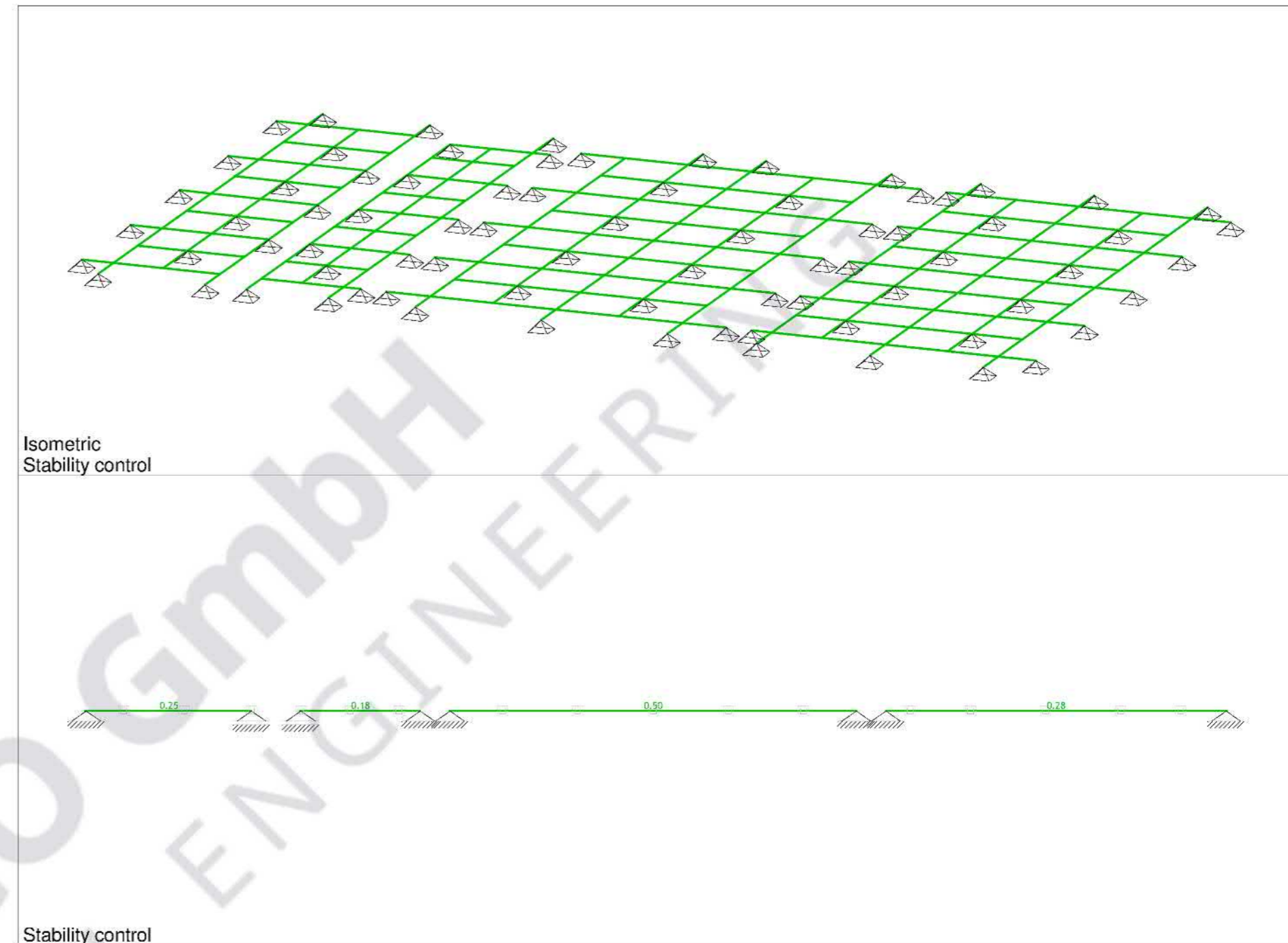
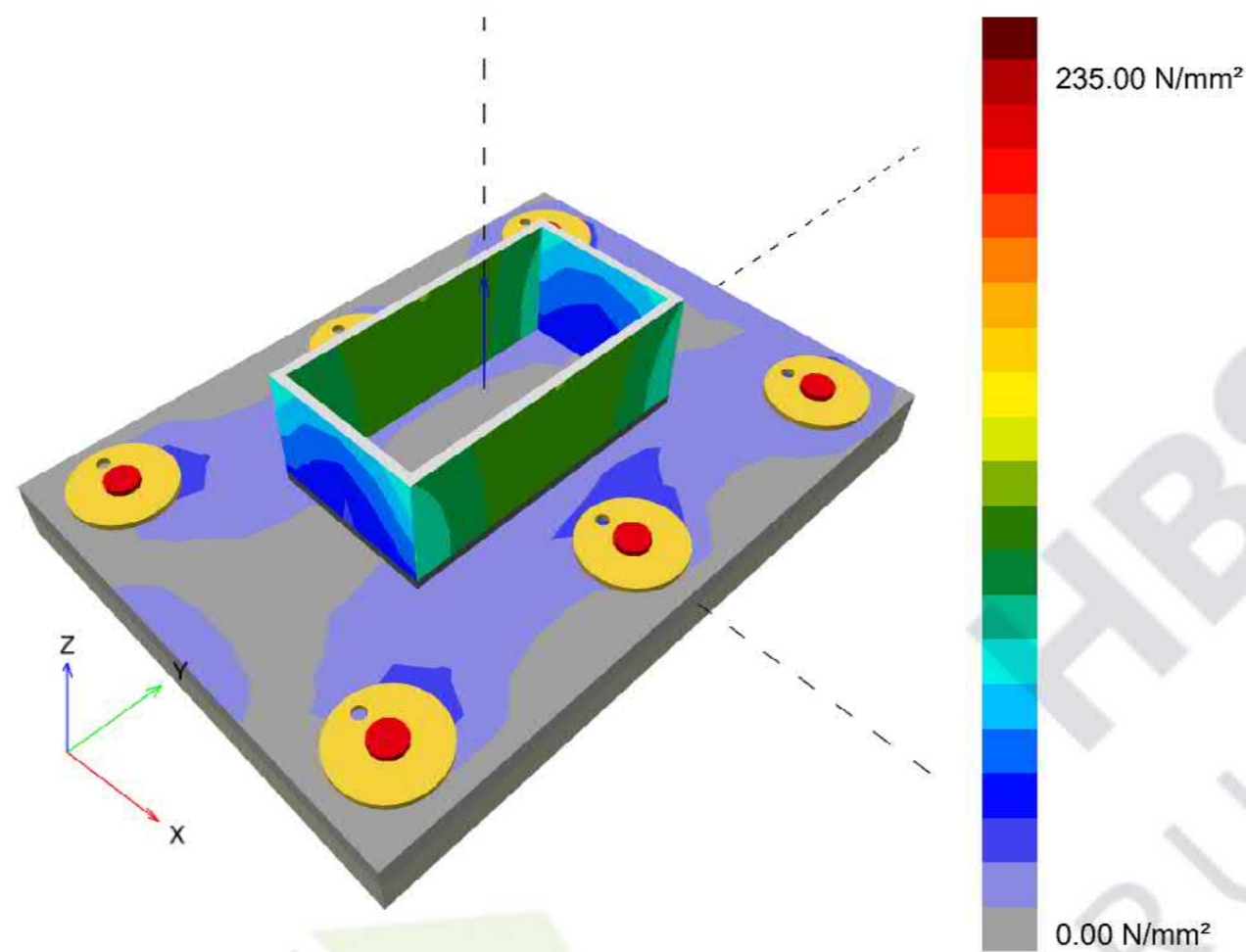
www.hilti.rs

Company: _____ Page: 13
 Address: _____ Specifier: _____
 Phone | Fax: _____ E-Mail: _____
 Design: 01. Čelični mostovi - 6 ankera Date: 5/21/2025
 Fastening Point: _____

Part	Load combination	Material	σ_{Ed} [N/mm ²]	ϵ_{Pl} [%]	f_y [N/mm ²]	γ_{M0}	f_y/γ_{M0} [N/mm ²]	ϵ_{lim} [%]	Status
Plate	Combination 1	S 235	65.40	0.00	235.00	1.00	235.00	5.00	OK
Profile	Combination 1	S 235	209.89	0.00	235.00	1.00	235.00	5.00	OK
Profile	Combination 1	S 235	211.51	0.00	235.00	1.00	235.00	5.00	OK
Profile	Combination 1	S 235	192.34	0.00	235.00	1.00	235.00	5.00	OK
Profile	Combination 1	S 235	192.33	0.00	235.00	1.00	235.00	5.00	OK

2.4.1.1 Equivalent stress

Results below are displayed for the decisive load combination: 1 - Combination 1



BEAM 468-177
 CROSS-SECTION: HOP [] 60x40x3 [S 355] [Set: 1]
 EUROCODE 3 (EN 1993-1-1:2005)

CROSS-SECTION PROPERTIES

Ax =	5.410 cm ²
Ay =	2.164 cm ²
Az =	3.246 cm ²
Ix =	29.121 cm ⁴
Iy =	24.170 cm ⁴
Iz =	12.730 cm ⁴
Wy =	8.057 cm ³
Wz =	6.365 cm ³
Wy,pl =	11.214 cm ³
Wz,pl =	8.394 cm ³
γ_{M0} =	1.000
γ_{M1} =	1.000
γ_{M2} =	1.250
Anet/A =	0.900

(fy = 35.5 kN/cm², fu = 51.0 kN/cm²)

UTILISATION FACTORS FOR ALL LOAD CASE COMBINATIONS
 3. $\gamma=0.50$ 4. $\gamma=0.33$

MEMBER SUBJECT TO BENDING
 (load 3, at 587.5 cm from the start of the member)

The shear force design value(z-z)	$V_{Ed,z}$ =	1.209 kN
The bending mom.design value(y-y)	$M_{Ed,y}$ =	1.473 kNm
System length	L =	675.00 cm

5.5 CLASSIFICATION OF CROSS-SECTIONS
 Class 1 cross-sections

6.2 RESISTANCE OF CROSS-SECTIONS
 6.2.5 Bending about the y-y axis

Plastic section modulus	$W_{y,pl}$ =	11.214 cm ³
The design moment resistance	$M_{c,Rd}$ =	3.981 kNm

Requirement 6.12: $M_{Ed,y} \leq M_{c,Rd,y}$ (1.47 <= 3.98)

6.2.6 Shear
 Design shear resistance $V_{pl,Rd,z}$ = 66.530 kN
 Design shear resistance $V_{c,Rd,z}$ = 66.530 kN
Requirement 6.17: $V_{Ed,z} \leq V_{c,Rd,z}$ (1.21 <= 66.53)

6.2.8 Bending and shear
 No reduction need be made in the resistance moment
 Requirement: $V_{Ed,z} \leq 50\%V_{pl,Rd,z}$

6.3 BUCKLING RESISTANCE OF MEMBERS
 6.3.2.1 Buckling resistance

Coefficient	C1 =	1.132
Coefficient	C2 =	0.459
Coefficient	C3 =	0.525
The eff.length fact.for later.restr.	k =	1.000
The eff.length fact.for tors.restr.	kw =	1.000
Coordinate	zg =	0.000 cm
Coordinate	zj =	0.000 cm
Length between lateral restr.points	L =	675.00 cm
The warping constant	Iw =	0.000 cm ⁶
The elast.crit.mom.(l-t buck.)	M_{cr} =	13.211 kNm
Appropriate section modulus	W_y =	11.214 cm ³
The imperfection factor	α_{LT} =	0.760
The non-dimensional slenderness	λ_{LT} =	0.549
The reduction factor (6.3.2.2.)	χ_{LT} =	0.745
The design buckling resistance	$M_{b,Rd}$ =	2.966 kNm

Requirement 6.54: $M_{Ed,y} \leq M_{b,Rd}$ (1.47 <= 2.97)

Check of the shear resistance
 (load 3, end of the member)

The shear force design value(z-z)	$V_{Ed,z}$ =	2.159 kN
System length	L =	675.00 cm

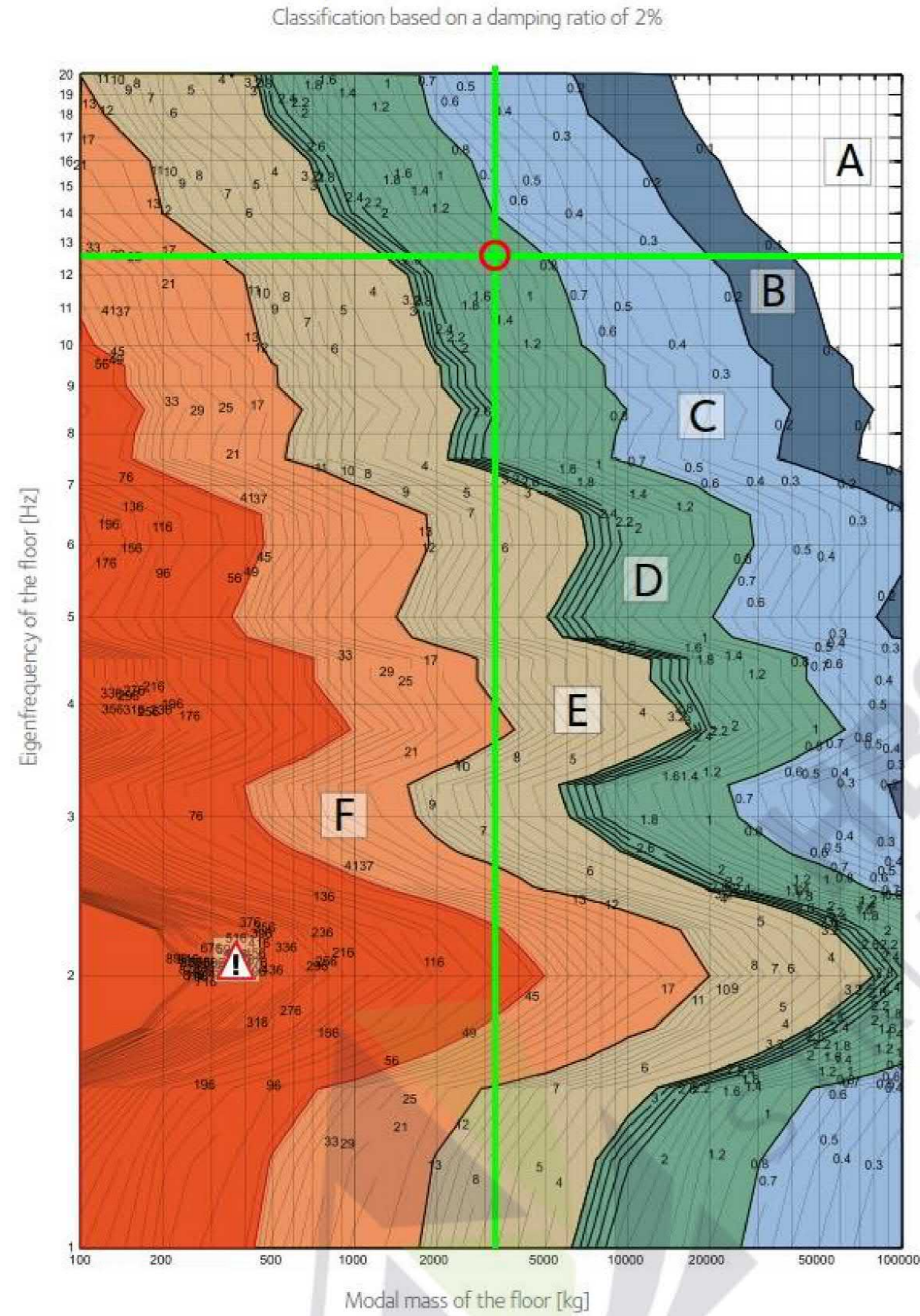
6.2 RESISTANCE OF CROSS-SECTIONS
 6.2.6 Shear

Design shear resistance	$V_{pl,Rd,z}$ =	66.530 kN
Design shear resistance	$V_{c,Rd,z}$ =	66.530 kN

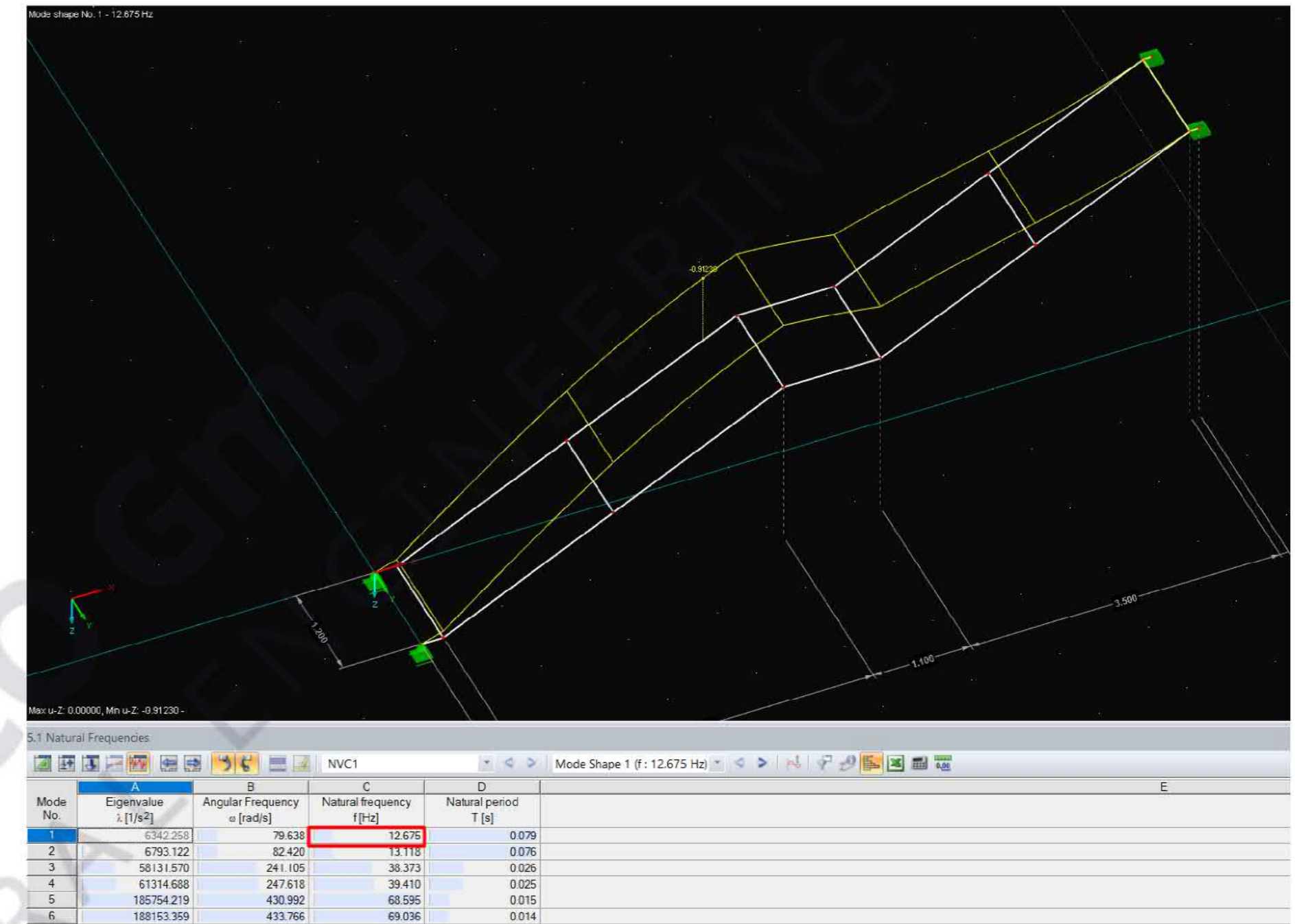
Requirement 6.17: $V_{Ed,z} \leq V_{c,Rd,z}$ (2.16 <= 66.53)

Determination of vibration class:

Figure 5 OS-RMS₉₀ for 2% Damping



Natural frequency: 12.6Hz



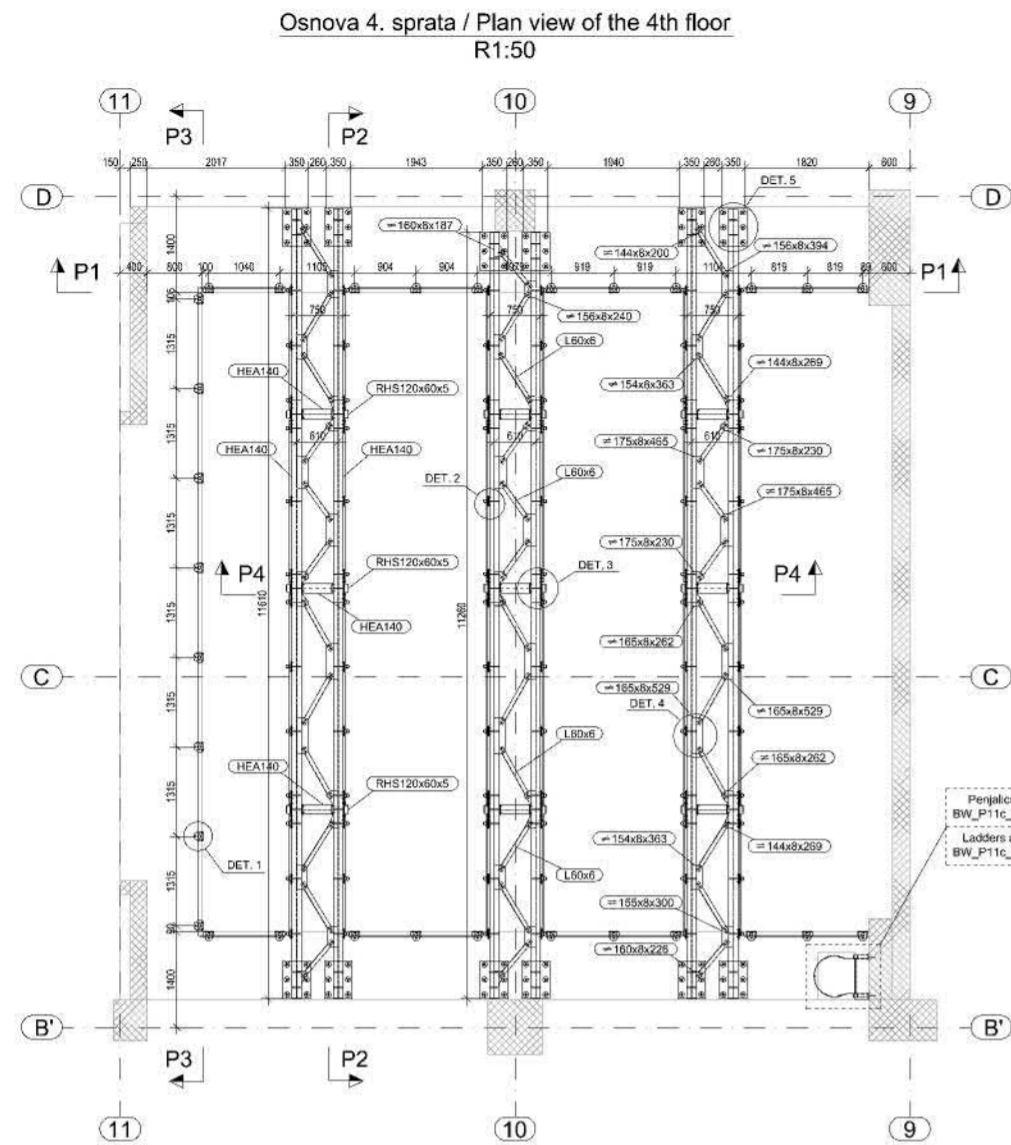
Modal mass:

Mode No.	Effective Modal Mass Factors									
	Modal Mass M_i [kg]	Effective Modal Mass			Effective Modal Mass Factor					
	M_i [kg]	m_{ex} [kg]	m_{ey} [kg]	m_{ez} [kg]	m_{ex} [kg.m ²]	m_{ey} [kg.m ²]	m_{ez} [kg.m ²]	f_{mex} [-]	f_{mey} [-]	f_{mez} [-]
1	3195.12	0.00	0.00	6152.70	0.00	1051.13	0.00	0.000	0.000	0.719
2	2396.61	0.00	0.00	0.00	2218.77	0.00	0.00	0.000	0.000	0.000
3	3446.34	0.00	0.00	82.52	0.00	23235.36	0.00	0.000	0.000	0.010
4	2412.60	0.00	0.00	0.00	27.58	0.00	0.00	0.000	0.000	0.000
5	2540.21	0.00	0.00	627.81	0.00	1032.18	0.00	0.000	0.000	0.073
6	2499.58	0.00	0.00	0.00	224.18	0.00	0.00	0.000	0.000	0.000
Sum	16491.45	0.00	0.00	6863.03	2470.53	25318.66	0.00	0.000	0.000	0.802

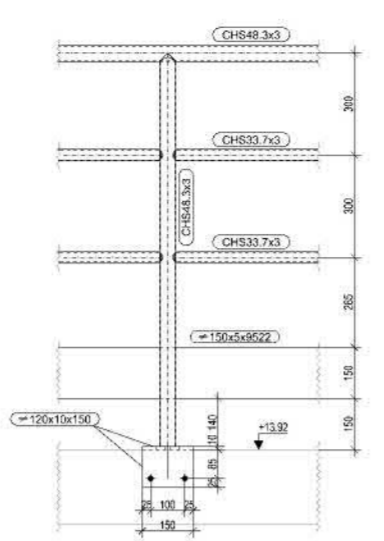
Tragwerkszeichnungen



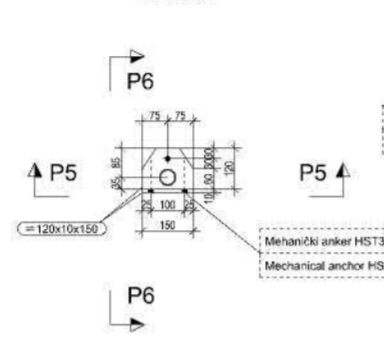
HBS ECO GmbH
STRUCTURAL ENGINEERING



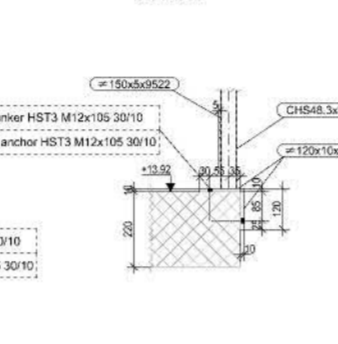
Presek P5-P5 / Section P5-P5
R1:10



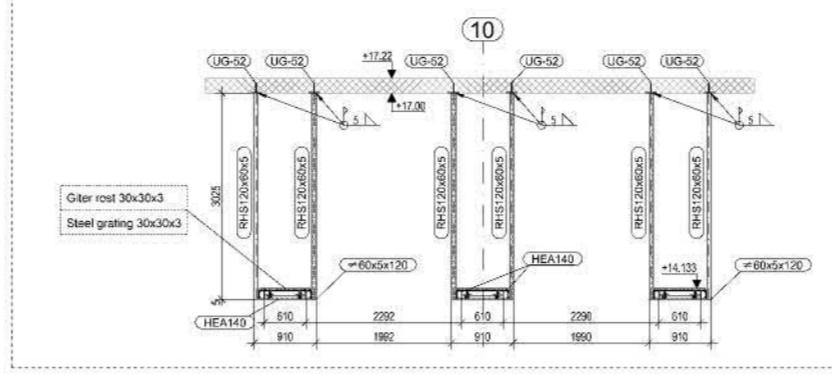
Detalj 1 / Detail 1
R 1:10



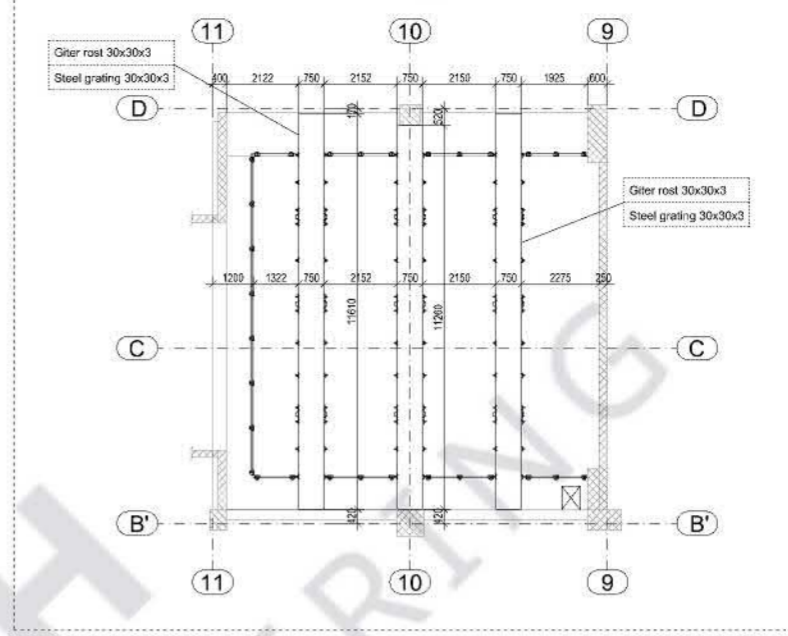
Presek P6-P6 / Section P6-P6
R1:10



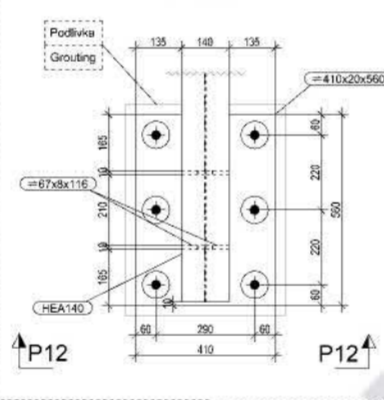
Presek P4-P4 / Section P4-P4
R1:50



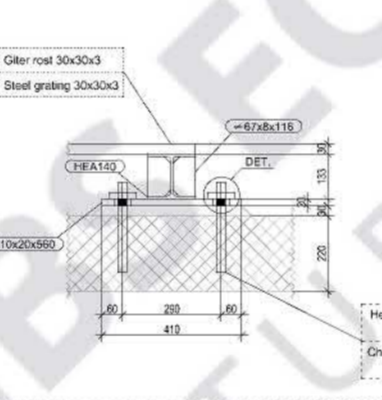
Giter rost 30x30x3 / Steel grating 30x30x3
R 1:100



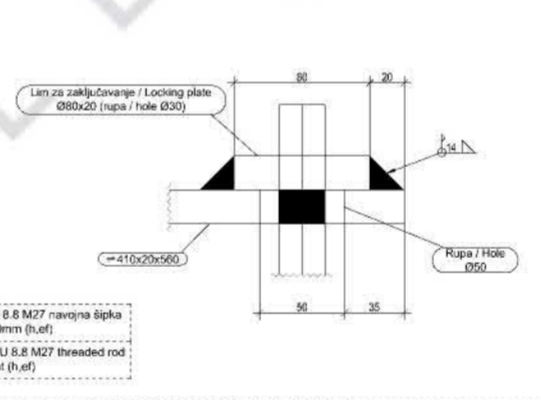
Detalj 5 / Detail 5
R 1:10



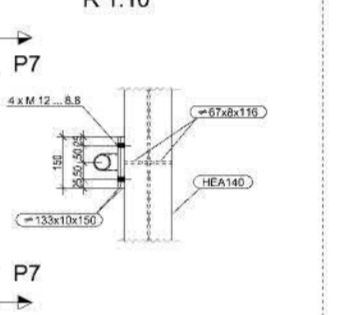
Presek P12-P12 / Section P12-P12
R1:10



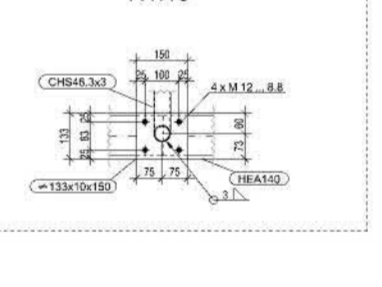
Detalj / Detail
R 1:2



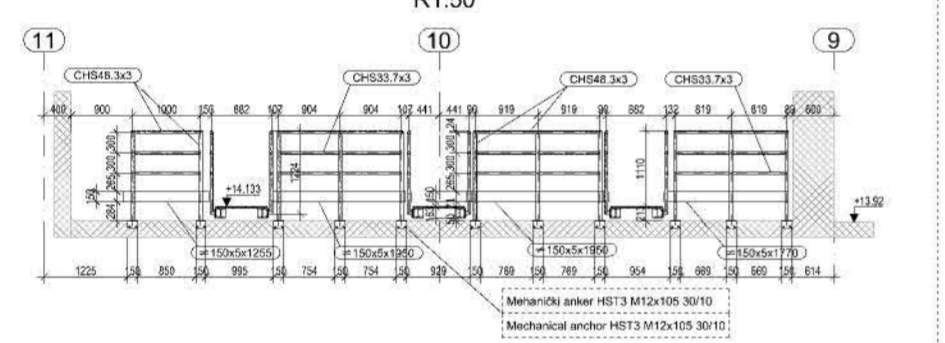
Detalj 2 / Detail 2
R 1:10



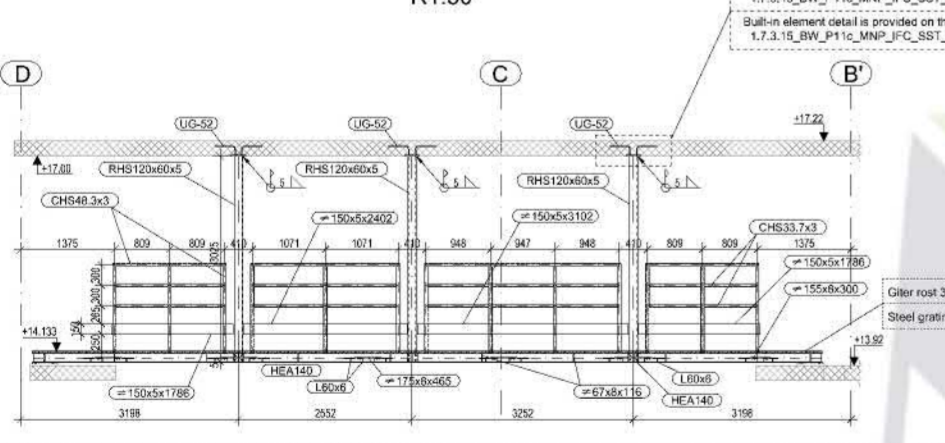
Presek P7-P7 / Section P7-P7
R1:10



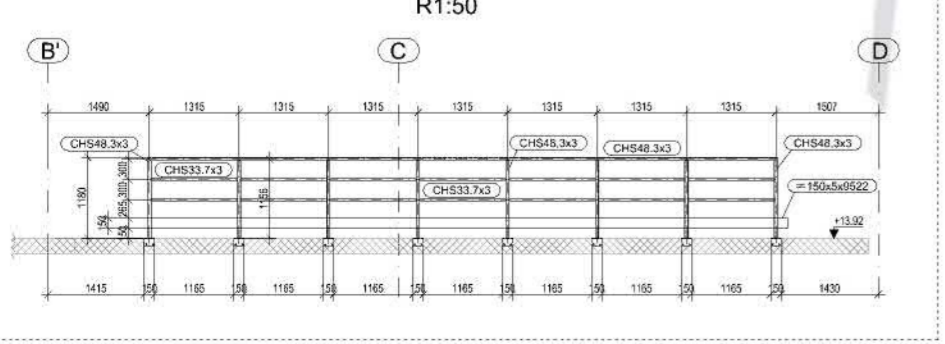
Presek P1-P1 / Section P1-P1
R1:50



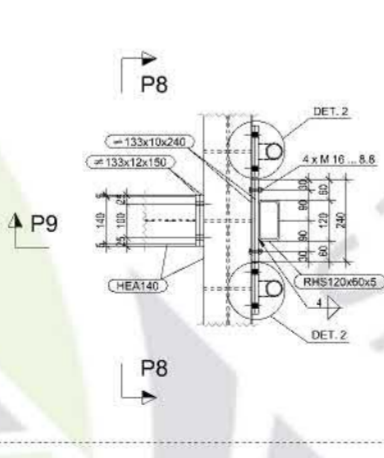
Presek P2-P2 / Section P2-P2
R1:50



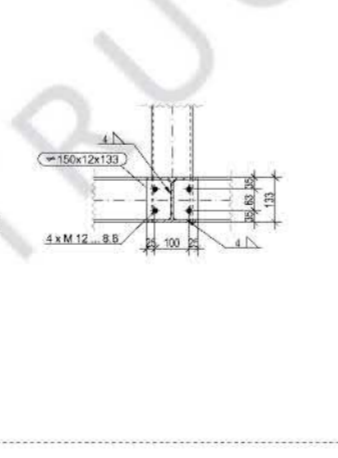
Presek P3-P3 / Section P3-P3
R1:50



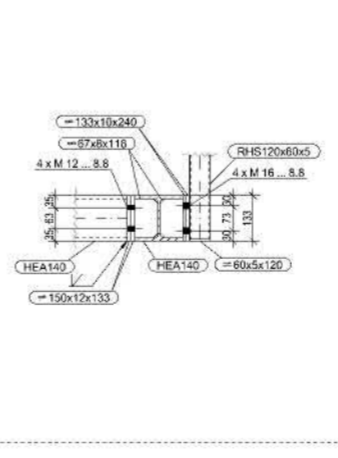
Detalj 3 / Detail 3
R 1:10



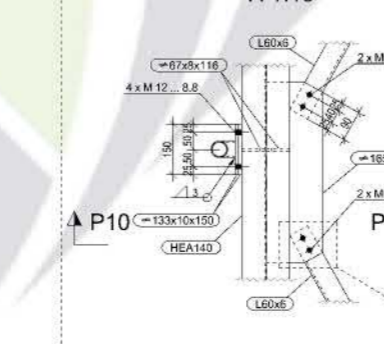
Presek P8-P8 / Section P8-P8
R1:10



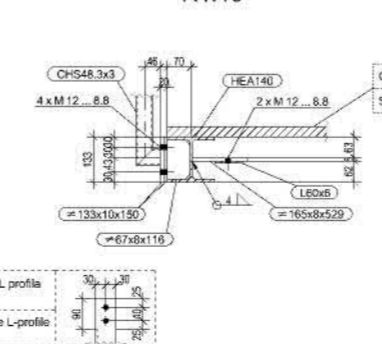
Presek P9-P9 / Section P9-P9
R1:10



Detalj 4 / Detail 4
R 1:10



Presek P10-P10 / Section P10-P10
R1:10

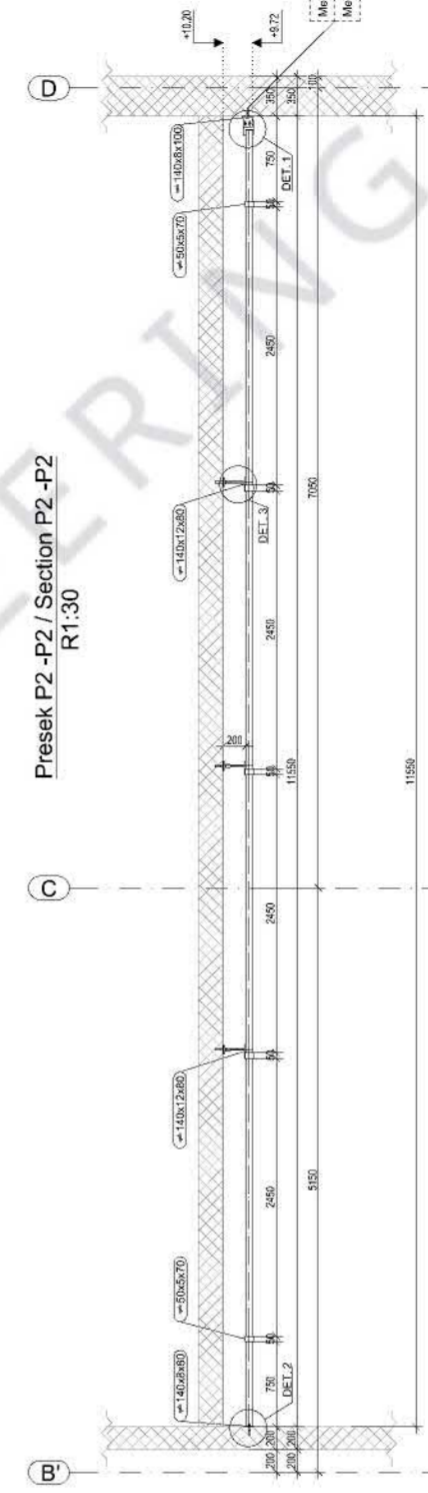
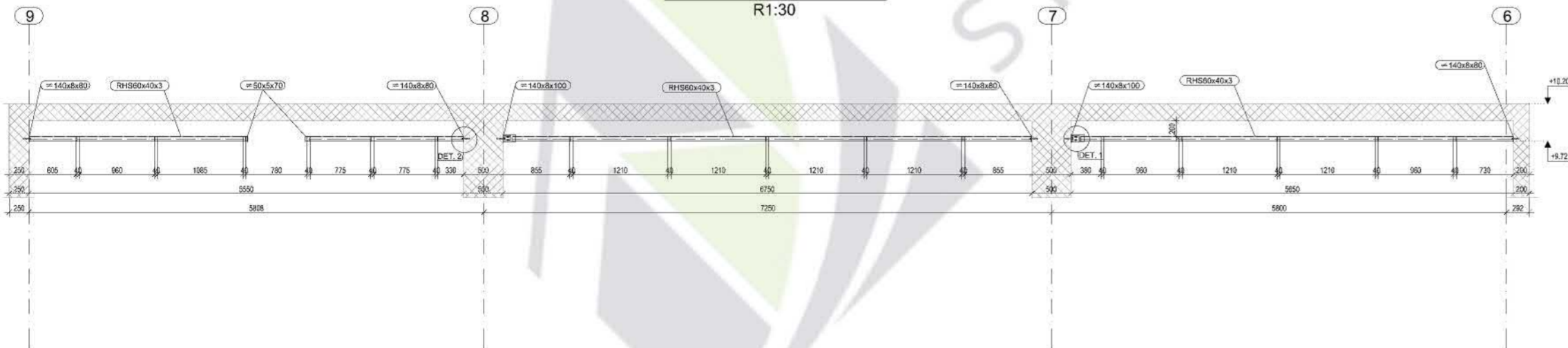
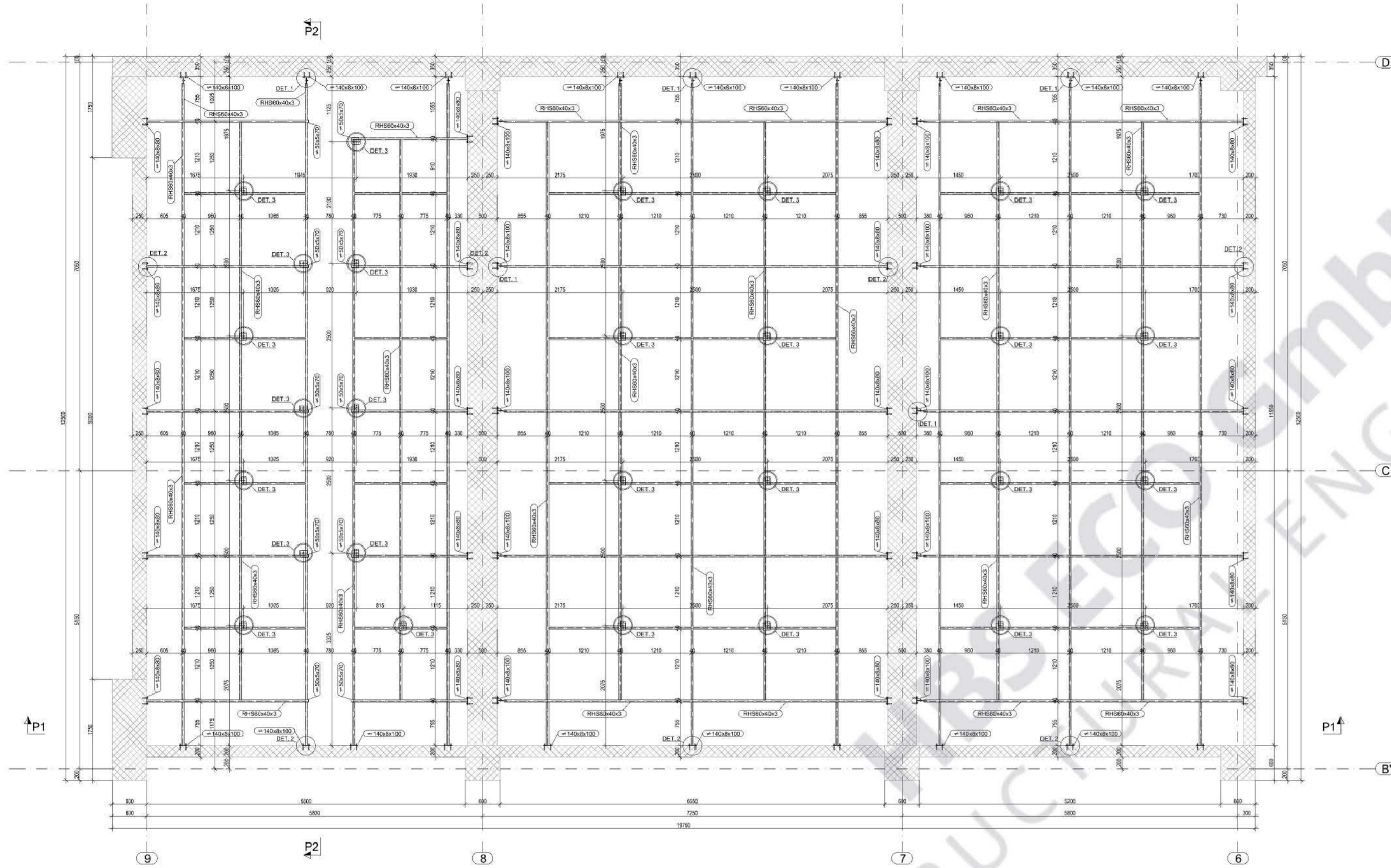


Material list / Specifikacija materijala					
Profil / Profile	Quantity / Kolicina	Material / Materijal	Length [mm] / Duzina [mm]	Total length [mm] / Ukupna duzina [mm]	Total weight [kg] / Ukupna tezina [kg]
Mostovi i ograde / Bridges and railings					
CHS33.7x3	/	S235JR	/	142183	322.76
CHS48.3x3	/	S235JR	/	205515	706.77
HEA140	/	S235JR	/	72638	1794.16
L60x6	/	S235JR	/	28671	155.4
RHS120x60x5	/	S235JR	/	54450	708.29
#60x5x120	18	S235JR	/	/	5.09
#67x8x116	192	S235JR	/	117.14	117.14
#120x10x150	50	S235JR	/	/	84.78
#133x10x150	156	S235JR	/	/	244.31
#133x10x240	36	S235JR	/	/	90.21
#133x12x150	36	S235JR	/	/	67.65
#144x8x200	2	S235JR	/	/	3.62
#144x8x209	6	S235JR	/	/	14.6
#150x5x1255	2	S235JR	/	/	14.78
#150x5x1770	2	S235JR	/	/	20.84
#150x5x1786	12	S235JR	/	/	126.18
#150x5x1950	4	S235JR	/	/	45.92
#150x5x2402	6	S235JR	/	/	84.85
#150x5x3102	6	S235JR	/	/	109.58
#150x5x3522	1	S235JR	/	/	56.06
#154x8x363	6	S235JR	/	/	21.06
#155x8x300	2	S235JR	/	/	8.76
#156x8x240	1	S235JR	/	/	2.35
#156x8x394	2	S235JR	/	/	7.72
#160x8x197	1	S235JR	/	/	1.88
#160x8x226	3	S235JR	/	/	6.91
#165x8x262	6	S235JR	/	/	16.29
#165x8x292	6	S235JR	/	/	32.89
#175x8x230	6	S235JR	/	/	15.17
#175x8x465	6	S235JR	/	/	30.66
#410x20x560	12	S235JR	/	/	432.57
Ø80x20	72	S235JR	/	/	48.96
Giter rost / Steel grating					
30x30x3 - 25.86 m ²	/	S235JR	/	/	1188.27
				Total / Ukupno:	6586.38
					5%
				Total / Ukupno:	6915.7

- NAPOMENE**
- Osnovni materijal za sve elemente željezne konstrukcije je S235JRQ2.
 - Sve zavrtanje je "C" kvaliteta.
 - Svi uglovi zavrtanje koji nisu označeni debljine su 0,7 mm, ali ne manje od 3 mm, osim kod veza kaptiranih profila kod kojih je debljina zavrtanja jednaka debljini zida.
 - Svi kontakti željeznih elemenata, osim veza sa zavrtanjem, zavrtanje su odgovarajućim ugnomiti ili suvozemnim šavovima.
 - Sve L-profile zavrtanje simetrično željeznom plohom.
 - Osnovni materijal za ankerne šipke je armatura B500B.
 - Osnovni materijal za zavrtanje je čelik klase 8.8.
 - Vidneške hole preoznače u projekciji arhitekture ili arhitektono-betonarne konstrukcije.
 - Neusklađenosti i odušumljanje u crtežima ili tekstualnim prilozima projekta obavezno razriješiti sa autorom i odgovornim projektantom.
 - Izmjene u delu projekta za vreme građenja vrši samo uz saglasnost autora i odgovornog projektanta.
 - Sve dimenzije proveriti na licu mesta!
- REMARKS**
- Basic material for all elements of the steel construction is S235JRQ2.
 - All welds are of "C" quality.
 - All fillet welds which are not marked are of thickness 0.7 mm, but are not smaller than 3mm, except for the hollow profiles where they are the same as the wall of the profile.
 - All contacts of steel elements, other than embosment with screws, are welded with appropriate fillet or butt welds.
 - All hollow profiles are to be closed with firm steel plate.
 - Basic material for all anchor rods is rebar B500B.
 - Basic material for all bolts is steel grade 8.8.
 - Elevation dimensions are taken from the architectural design or concrete structure design.
 - Inconsistencies in either drawings or textual appendices will have to be resolved with both the author and the design professional in responsible charge.
 - Design variations which may emerge during construction are only to be made with prior approval from both the author and the design professional in responsible charge.
 - All dimensions need to be checked on the spot!

EN 1090-2 - Klasa izvođenja / Execution class	EXC2
EN ISO 12944 - Antikoroziona zaštita / Corrosion protection	C2
Protežna zaštita / Fire protection	60 min (R6)

Roštilj ispod AB ploče / Grillage under the RC slab
R1:30



REMARKS

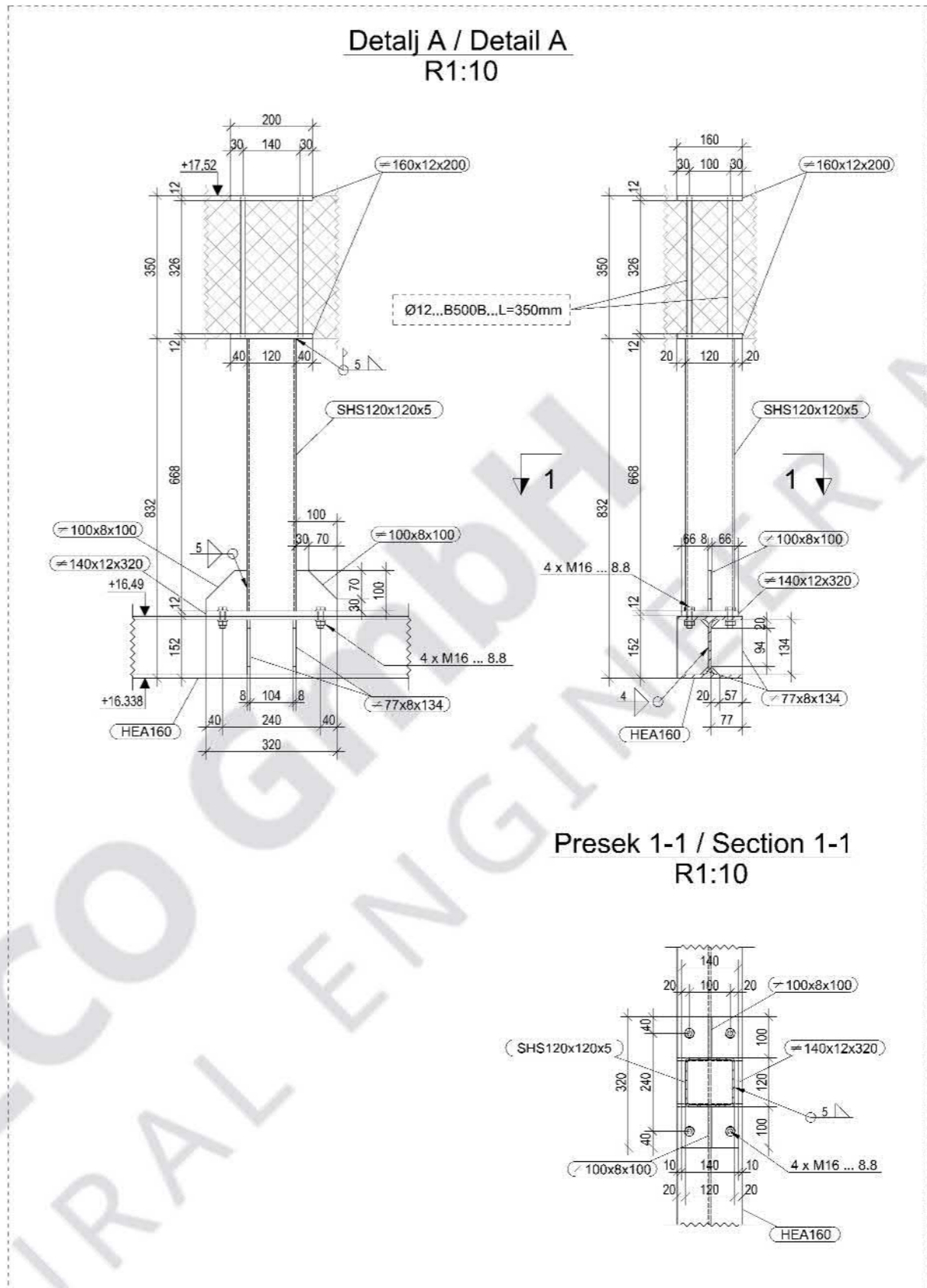
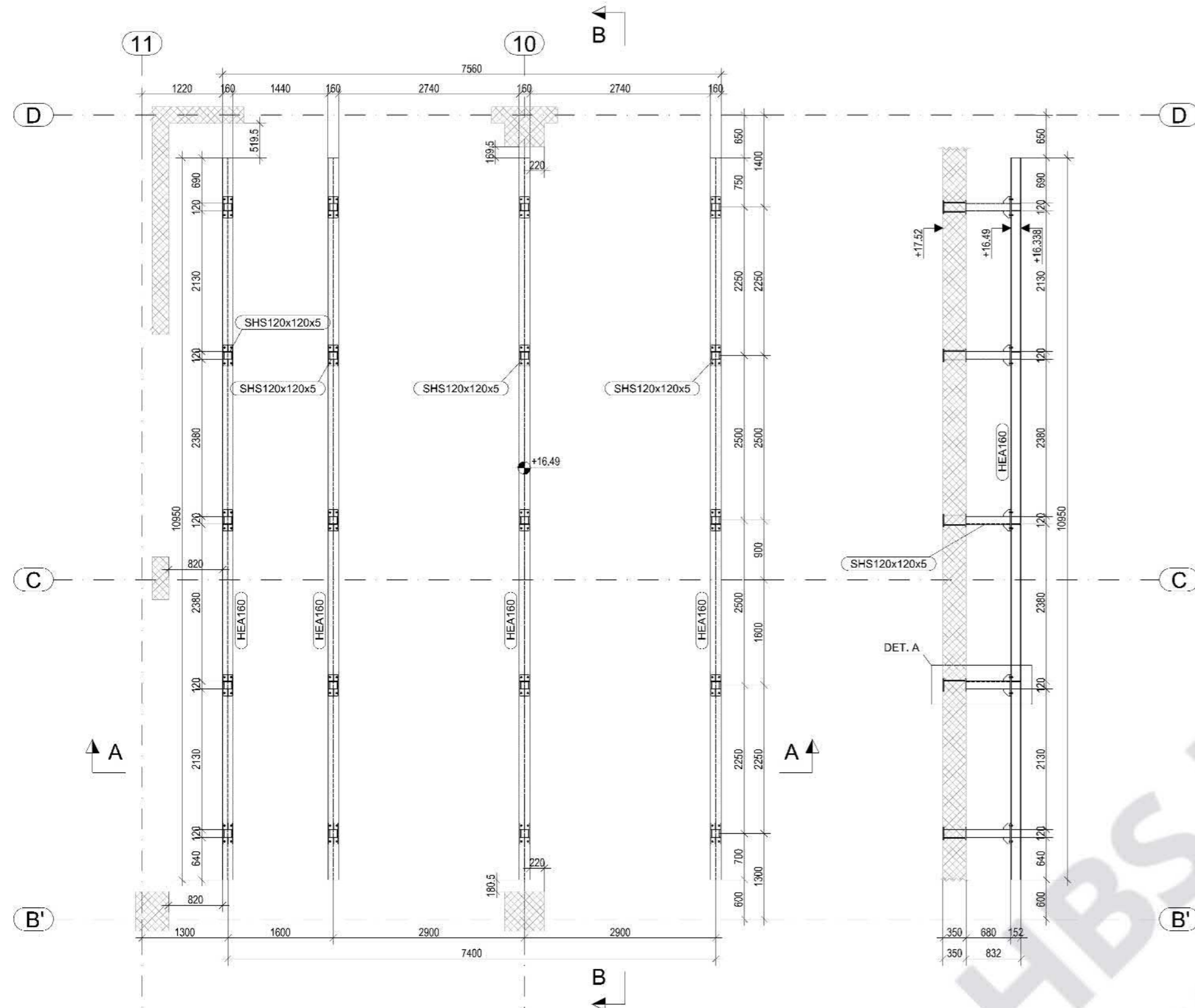
1. Basic material for all elements of the steel construction is S235JR02.
2. All welds are of 'C' quality.
3. All steel welds which are not marked are of thickness 0.7 mm, but are not smaller than 3mm, except for hollow profiles where they are the same as the wall of the profile.
4. All contacts of steel elements, other than embroidery with screws, are welded with appropriate fillet or full welds.
5. All hollow profiles are to be closed with firm steel plate.
6. Basic material for all anchor rods is rebars B500B.
7. Basic material for all bolts is steel grade 8.8.
8. Elevation dimensions are taken from the architectural design or concrete structure design.
9. Inconsistencies in other drawings and/or technical appendices will have to be resolved with both the author and the design professional in responsible charge.
10. Design variations which may emerge during construction are only to be made with prior approval from both the author and the design professional in responsible charge.
11. All dimensions need to be checked on the spot.

EN 1090-2 - Klasa izvođenja / Execution class:	EXC2
EN ISO 12944 - Antikoroziona zaštita / Corrosion protection:	C2
Protepcijama zaštite / Fire protection:	/

Osnova 4. sprata / Plan view of the 4th floor
R1:50

Presek B-B / Section B-B
R1:50

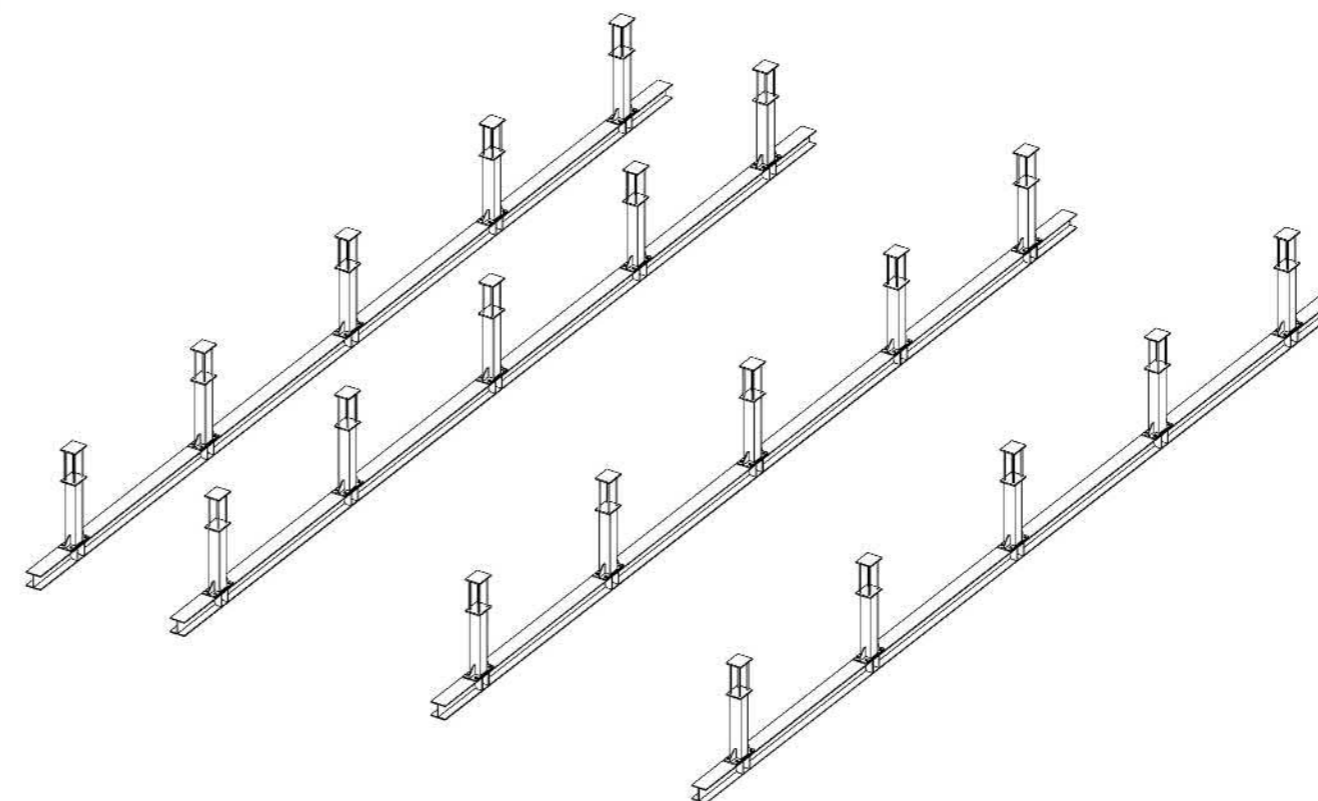
Detalj A / Detail A
R1:10



Presek A-A / Section A-A
R1:50

Detalj ugradbenog elementa prikazan je na crtežu
1.7.3.15_BW_P11c_MNP_IFC_SST_PDT_04
Built-in element detail is provided on the drawing
1.7.3.15_BW_P11c_MNP_IFC_SST_PDT_04

3D Prikaz / 3D View



Material list / Specifikacija materijala					
Profile Profil	Quantity Kolicina	Material Materijal	Length [mm] Duzina [mm]	Total length [mm] Ukupna duzina [mm]	Total weight [kg] Ukupna tezina [kg]
SHS120x120x5	20	S235JR	668	13360	236.71
HEA160	4	S235JR	10950	43800	1331.52
#77x8x134	80	S235JR	/	/	49.83
#100x8x100	40	S235JR	/	/	18.97
#140x12x320	20	S235JR	/	/	84.4
Total: / Ukupno:					1721.43
5%:					86.07
Total: / Ukupno:					1807.5

NAPOMENE

- Osnovni materijal za sve elemente čelične konstr. je S235JR/G2.
- Svi šavovi su "C" kvaliteta.
- Svi ugaoni šavovi koji nisu označeni debljine su 0,71 min. ali ne manje od 3 mm, osim kod veza šupljih profila kod kojih je debljina šavova jednaka debljini zida.
- Svi kontakti čeličnih elemenata, osim veza sa zavrtnjima, zavareni su odgovarajućim ugaonim ili sučeonim šavovima.
- Sve šuplje profile zatvoriti 5mm čeličnom pločom.
- Osnovni materijal za ankerne šipke je armatura B500B.
- Osnovni materijal za zavrtnjeve je čelik klase 8.8.
- Visinske kote preuzete iz projekta arhitekture ili armirano-betonske konstrukcije.
- Neusaglasnosti i odstupanja u crtežima i/ili tekstualnim prilogima projekta obavezno razrešiti sa autorom i odgovornim projektantom.
- Izmene u delu projekta za vreme građenja vršiti samo uz saglasnost autora i odgovornog projektanta.
- Sve dimenzije proveriti na licu mesta!

REMARKS

- Basic material for all elements of the steel construction is S235JR/G2.
- All welds are of "C" quality.
- All fillet welds which are not marked are of thickness 0,71 min, but are not smaller than 3mm, except for the hollow profiles where they are the same as the wall of the profile.
- All contacts of steel elements, other than embroidery with screws, are welded with appropriate fillet or butt welds!
- All hollow profiles are to be closed with 5mm steel plate.
- Basic material for all anchor rods is rebar B500B.
- Basic material for all bolts is steel grade 8.8.
- Elevation dimensions are taken from the architectural design or concrete structure design.
- Inconsistencies in either drawings and/or textual appendices will have to be resolved with both the author and the design professional in responsible charge.
- Design variations which may emerge during construction are only to be made with prior approval from both the author and the design professional in responsible charge.
- All dimensions need to be checked on the spot!

EN 1090-2 - Klasa izvođenja: / Execution class:	EXC2
EN ISO 12944 - Antikoroziona zaštita: / Corrosion protection:	C2
Protivpožarna zaštita: / Fire protection:	/

