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<p><b>ŠT. POROČILA:</b></p> <p><b>IZVOD:</b></p> <p><b>KRAJ IN DATUM:</b></p>	<p>24/24</p> <p style="text-align: right;">/3</p> <p>Vipava, 12.5.2024</p>

## STATIČNA PRESOJA NAMESTITVE RDC - STREHA FRI

<b>1. SPLOŠNO .....</b>	<b>3</b>
<b>2. OPIS OBSTOJEČE KONSTRUKCIJE .....</b>	<b>3</b>
<b>3. OPIS SKLADNOSTI POSEGA S PROSTORSKIMI AKTI IN PREDPISI O UREJANJU PROSTORA .....</b>	<b>4</b>
3.4 OPIS SKLADNOSTI .....	4
3.4.1 Prostorska zaznavnost .....	<i>Napaka! Zaznamek ni definiran.</i>
3.4.2 Hrup .....	<i>Napaka! Zaznamek ni definiran.</i>
<b>4. PODLOGE IN PRIDOBLJENA DOKUMENTACIJA .....</b>	<b>5</b>
<b>5. UPORABLJENI STANDARDI .....</b>	<b>5</b>
<b>6. STATIČNA PRESOJA .....</b>	<b>5</b>
6.1 PREDVIDENA OBREMENITEV ZARADI POSTAVITVE RDC IN KLIMATA .....	6
6.2 VPLIV DODATNE MASE NA GLOBALNO OBNAŠANJE KONSTRUKCIJE .....	6
6.3 KONTROLA VPLIVA NA AB STREŠNO PLOŠČO .....	7
6.4 KONTROLA VPLIVA NA AB STEBRE .....	7
<b>7. DIMENZIONIRANJE JEKLENEGA PODESTA .....</b>	<b>9</b>
7.1 UPORABLJENI MATERIALI .....	9
7.2 OBTEŽBE .....	9
7.3 OMEJITEV POVESOV .....	11
7.4 KONTROLA MSN .....	11
7.5 DIMENZIONIRANJE SPOJEV .....	11
<b>8. IZVEDBA .....</b>	<b>11</b>
8.1 FAZNOST IZVEDBE .....	11
8.2 TEHNIČNI POGOJI IZVEDBE IN MONTAŽE JEKLENE PODKONSTRUKCIJE .....	12
<b>9. ZAKLJUČKI .....</b>	<b>12</b>

## 1. SPLOŠNO

Predmet naloge je ocena statične nosilnosti obstoječe konstrukcije za namen postavitve dveh kontejnerjev RDC in zunanjih enot klimatov na streho objekta Fakultete za računalništvo in informatiko (FRI).

Pri statičnem izračunu so bili uporabljeni pripomočki izdelovalca v MS Excelu, programska oprema Tower 3D 8 za statičen izračun jeklene konstrukcije, IDEA StatiCa za dimenzioniranje konstrukcije in detajlov in Hilti PROFIS Engineering za izračun sidranja konstrukcije v obstoječo konstrukcijo.

## 2. OPIS OBSTOJEČE KONSTRUKCIJE

Obstoječ objekt FRI se nahaja na parceli št. 1820/3, k.o. 2682 Brdo. Objekt je pravokotne podolgovate oblike s prizidkom, zunanjih tlorskih dimenzij 110,15 m x 24,70 m + 47,10 m x 13,19 m. Zasnovan je kot armirano betonska stenasta konstrukcija etažnosti K+P+3. Celotni objekt je dilatiran na dva med seboj ločena konstrukcijska sklopa. Vse medetažne konstrukcije so zasnovane kot monolitne armirano betonske plošče, ki so podprte z armirano betonskimi stenami in slopi. Vertikalna obtežba stavbe se prenaša preko nosilnih armirano betonskih sten in slopov na temeljno ploščo, ki je podprta z uvrtnami benoto piloti.

Obstoječa konstrukcija je bila predana v uporabo leta 2014.



**Slika 1:** Situacija – streha obravnavanega objekta FRI.

### 3. OPIS SKLADNOSTI POSEGA S PROSTORSKIMI AKTI IN PREDPISI O UREJANJU PROSTORA

#### 3.1 Predvideni posegi v prostor

Predviden poseg predstavlja postavitve tehnične naprave za obratovanje objekta. Skladno z Uredbo o razvrščanju objektov (Uradni list RS, št. 96/2022 z dne 15.7.2022) in Tehnično smernico TSG – V – 006: 2022, poseg klasificiramo kot vzdrževanje objekta. Poseg uvrstimo pod točko 4 priloge 3 Uredbe o razvrščanju objektov: Namestitve novih inštalacij in tehnoloških naprav, potrebnih za delovanje objekta.

**Vzdrževanje objekta** so dela, namenjena ohranjanju uporabnosti in vrednosti objekta, izboljšave, ki upoštevajo napredek tehnike, in manjši inštalacijski preboji (GZ-1).

#### 3.2 Lokacija, namenska raba

Postavitve naprave je predvidena na strehi obstoječega objekta FRI, ki se nahaja na parceli št. 1820/3, k.o. 2682 Brdo.

Postavitve naprave je predvidena v enoti urejanja prostora RD-359.

Postavitve naprave je predvidena v območju z s podrobnejšo namensko rabo prostora: CDi – Območja centralnih dejavnosti za izobraževanje

#### 3.3 Veljavni prostorski akti

Veljavni prostorski akti:

- I. Odlok o zazidalnem načrtu za območje urejanja VI3/3 Biotehniška fakulteta (Uradni list RS, št. 123/04, 78/10, 63/12, 59/22 in 74/23)
- II. Odlok o občinskem prostorskem načrtu Mestne občine Ljubljana – strateški del (Uradni list RS, št. 78/10, 10/11 - DPN, 72/13 - DPN, 92/14 - DPN, 17/15 - DPN, 50/15 - DPN, 88/15 - DPN, 12/18 - DPN in 42/18)
- III. Odlok o občinskem prostorskem načrtu Mestne občine Ljubljana – izvedbeni del (Uradni list RS, št. 78/10, 10/11 – DPN, 22/11 – popr., 43/11 – ZKZ-C, 53/12 – obv. razl., 9/13, 23/13 – popr., 72/13 – DPN, 71/14 – popr., 92/14 – DPN, 17/15 – DPN, 50/15 – DPN, 88/15 – DPN, 95/15, 38/16 – avtentična razlaga, 63/16, 12/17 – popr., 12/18 – DPN, 42/18, 78/19 – DPN in 59/22)

Postavitve naprave je v skladu z navedenimi akti.

#### 3.4 Opis skladnosti

V nadaljevanju je opisana skladnost le za zahteve na katere vpliva postavitve naprave. Vseh ostalih zahtev, ki so navedene v prostorskih aktih, in za katere je bilo izpolnjevanje dokazano že v vodilni mapi PGD projektne dokumentacije (Nova gradnja objektov s pripadajočo zunanjo, prometno in komunalno ureditvijo, št. projekta 14/2007, projektant Inženiring 4M d.o.o.), ne navajamo eksplicitno.

V 5. členu zazidalnega načrta je navedeno:

– *h* – je najvišja dopustna višina objekta, merjena od kote pritličja (KP) do zgornjega roba zaključnega venca objekta. **Nad njo je dopustno postaviti tehnične naprave za obratovanje objekta, inštalacijske jaške, jaške dvigal, dostope na streho, transparentno zaščitno ograjo z višino največ 1,10 m, svetlobnike in podobno;**



Objekta FRI in FKKT spadata znotraj zazidalnega načrta v funkcionalno enoto F12, za katero je v 10. členu podano:

*FUNKCIONALNA ENOTA F12 Kota terena: 297.20 m.n.v. Kota pritličja (KP): 298.50 m n.v. Maksimalna višina objektov: 16 m do zgornjega roba zaključnega venca objekta.*

#### 4. PODLOGE IN PRIDOBLEJENA DOKUMENTACIJA

Za namene statične presoje so bili pridobljeni naslednji dokumenti:

- [1] Fakulteta za računalništvo in informatiko, načrt gradbenih konstrukcij PGD in PZI  
Projektant: Elea iC.  
Odgovorni projektant: Andrej Pogačnik, univ. dipl. inž. gradb. IZS G-0187  
Št. projekta: 14/2007  
Št. načrta: 715100  
Datum: februar 2010
  
- [2] FKKT in FRI – območje urejanja VI 3/3 Biotehniška fakulteta, načrt arhitekture PGD in PZI  
Projektant: INŽENIRING 4M d.o.o.  
Odgovorni vodja projekta: Mojca Švigelj Černigoj, u.d.i.a. ZAPS 0488 A  
Št. projekta: 14/2007  
Št. načrta: 14/2007A2  
Datum: februar 2010
  
- [3] Presoja požarne varnosti za malo fotovoltaično elektrarno  
Projektant: DATACOM d.o.o.  
Pooblaščen inženir: Biba Muhič Gomezelj u.d.i.a. IZS PI PV0751  
Št. presoje: 02/2024 MFE  
Datum: februar 2024

#### 5. UPORABLJENI STANDARDI

Pri izdelavi projekte dokumentacije smo upoštevali spodaj navedene standarde, vse povezane standarde, dopolnila in nacionalne dodatke.

EUROCODE 0 (SIST EN 1990) – Osnove projektiranja konstrukcij  
EUROCODE 1 (SIST EN 1991) – Vplivi na konstrukcije  
EUROCODE 2 (SIST EN 1992) – Projektiranje betonskih konstrukcij  
EUROCODE 3 (SIST EN 1993) – Projektiranje jeklenih konstrukcij  
EUROCODE 8 (SIST EN 1998) – Projektiranje potresnoodpornih konstrukcij

#### 6. STATIČNA PRESOJA

Kontrole vplivov na obstoječ objekt in dimenzioniranje predvidenega podesta izvedemo po trenutno veljavnih predpisih Evrokod (glej poglavje 4). Mehansko odpornosti in stabilnost objekta po namestitvi RDC-ja in klimatov dokazujemo s kontrolo kritičnih konstrukcijskih elementov. Kritični konstrukcijskih elementi obstoječega objekta, ki jih kontroliramo, so strešna plošča, AB stebri in AB slopi. Kontrole

temeljijo na podatkih dokumentiranih v projektu gradbenih konstrukcij PGD in PZI in projektu arhitekture PZI (glej poglavje 3) in na izmerah pridobljenih na objektu.

Dne 13.3.2024 je bil opravljen ogled objekta, kjer smo preverili skladnost dejanskega stanja z načrti gradbenih konstrukcij in arhitekture. Geometrija konstrukcije se ujema s stanjem na načrtih. Pravilnost in točnost detajlov in kvalitete vgrajenih materialov iz načrtov gradbenih konstrukcij in načrta arhitekture ni predmet te statične presoje. Tekom ogleda smo preverili sestavo konstrukcijskih slopov na strehi do filca pod plastjo pranelega prodca. Ocenjujemo, da je sestava konstrukcijskih slopov na predvidenem mestu postavitve RDC izvedena v skladu s projektom arhitekture.

Presoja vplivov je izvedena za več možnih lokacij postavitve RDC-ja. Preko kontrol obstoječe konstrukcije in ob upoštevanju zunanjih omejitev, smo določili 5 možnih lokacij postavitve RDC-ja, ki so prikazane na risbi.

### 6.1 Predvidena obremenitev zaradi postavitve RDC in klimata

V tem poročilu je privzeto, da je posamezen kontejner okvirnih gabaritov 1400x400x400 cm in skupne teže z IT opremo 40 ton. Podatek o teži in dimenzijah je bil pridobljen s strani naročnika. Maksimalna širina kontejnerja, ki še omogoča varen dostop iz vseh strani znaša 475 cm.

Dodatno je predvidena postavitve večjega klimata okvirnih gabaritov 400x115x225 cm. Podatek o masi je razbran iz dokumenta, ki nam ga je posredoval naročnik. Predvidena je namestitve modela TSAF 1521 2PUMPS s skupno maso 2 ton.

Na strehi konstrukcije je predvidena postavitve dveh sistemov RDC s potrebno podkonstrukcijo in vsemi potrebnimi podpornimi instalacijami.

Preglednica 1: Teža celotnega sistema dveh RDC-jev.

teža konstrukcije podesta	65	kN	(6,5 T)
največja predvidena teža kontejnerja z opremo	400	kN	(40 T)
teža klimata	21	kN	(2,1 T)
skupna teža enega sistema	486	kN	(48,6 T)
<b>skupna teža dveh sistemov</b>	<b>972</b>	<b>kN</b>	<b>(97,2 T)</b>

V statičnem izračunu so bili poleg zgoraj navedenega, obravnavani še dodatni primeri:

- Primer postavitve enega sistema, pri čemer je masa kontejnerja z IT opremo enaka 55 ton.
- Primer podesta s previsom 1,5 m v vzdolžni smeri, kjer sta poleg kontejnerja postavljena dva klimata.

Vse v nadaljevanju prikazane kontrole so izpolnjene tudi za ta dva primera.

### 6.2 Vpliv dodatne mase na globalno obnašanje konstrukcije

Vpliv postavitve RDC-ja in klimata na globalno obnašanje konstrukcije v primeru potresne obtežbe ocenimo s primerjavo mas.

V PZI načrtu gradbenih konstrukcij – stran 205 statičnega izračuna, so podane mase, ki so bile upoštevane pri modalni analizi konstrukcije.

Preglednica 2: Razporeditev mas po višini objekta – povzeto po načrtu gradbenih konstrukcij PZI [1], stran 205.

Razporeditev mas po višini objekta			
Nivo	Z [m]	Masa [T]	T/m <sup>2</sup>
<b>plošča nad 3. nad. POZ 100</b>	<b>17,05</b>	<b>3848,9</b>	<b>1,73</b>
plošča nad 2. nad. POZ 200	13,45	3797,8	1,7
plošča nad 1. nad. POZ 300	9,85	4867,2	1,79
plošča nad priti POZ 400	5,95	4814,3	1,77
plošča nad klet POZ 500	2,8	3366,7	1,81
temelji POZ 600	0	6729,2	2,07
Skupno		27424,1	

**(masa dveh sistemov) / (masa plošče nad 3. nad.) = 2,5 %**

Skupna predvidena dodana masa torej predstavlja ca 2,5% celotne mase, ki je bila upoštevana v analizi za ploščo nad 3. nadstropjem. Tako povečanje mase je v okviru dopustnih toleranc in predvidoma ne bo imelo vpliva na globalno obnašanje konstrukcije.

Da se izognemo neugodnemu vplivu na obnašanje obstoječe konstrukcije, ocenjujemo, da postavitve RDC-ja na zunanje vogale objekta ni primerna, saj bi s tem povečali ekscentričnost mase. Lokacije, ki so prikazane na risbi 2 so sprejemljive

### 6.3 Kontrola vpliva na AB strešno ploščo

Iz statičnega računa in armaturnih načrtov izhaja, da je plošča nad 3. nadstropjem dimenzionirana tako, da ne omogoča postavitve večjih obremenitev. V primeru postavitve RDC-ja neposredno na AB ploščo, tvegamo prekoračitev napetosti v plošči in pojav razpok.

Postavitev RDC-ja na AB strešno ploščo ni sprejemljiva. Vplivu na strešno ploščo se izognemo na način, da predvidimo postavitve RDC-ja na jeklen podstavek, ki je podprt na mestih nad AB stebri in AB stenami. S tem zagotovimo, da je vpliv na strešno ploščo minimalen, obtežba pa se prenaša neposredno na vertikalne nosilne elemente.

### 6.4 Kontrola vpliva na AB stebre

Predvidena postavitve jeklenega podesta bo povzročila, da bo v stebrih prišlo do povečanja osne sile, ostale notranje statične količine se predvidoma ne bodo spreminjale.

V nadaljevanju preverimo vpliv postavitve sistema RDC na vse posamezne stebre in stene. Kontroliramo povečanje normirane osne sile.

Iz preglednic 3 in 4 izhaja, da dodatna obremenitev stebra S6B ni sprejemljiva. Vsi ostali stebri in stene tudi v primeru dodatne obremenitve izpolnjujejo pogoje, ki jih za konstrukcije DCM določa standard EC8.

Kritični steber kontroliramo tudi s pomočjo interakcijskih diagramov N – M. Ob dodatni obremenitvi nikjer ne pride do prekoračitve nosilnosti prereza.

Preglednica 3: Vpliv dodatne obtežbe na normirano osno silo v stebrih

$N_{\text{dodatno, max}}$  190 kN

Sile vzete iz PGD statika pdf stran 151										DCM kontrola		
	a/b [cm]	$A_c$ [cm <sup>2</sup> ]	$N_d$ [kN]	$f_{ck}$ [kN/cm <sup>2</sup> ]	$f_{cd}$ [kN/cm <sup>2</sup> ]	$v_d = N_d / (A_c \cdot f_{cd})$	$N_d + N_{\text{dodatno}}$	$V_d + V_{\text{dodatno}}$				
S0A	40/90	3600	826	3	2	0,11	1016	0,14	<	0,65	OK	
S0B	40/90	3600	1606	3	2	0,22	1796	0,25	<	0,65	OK	
S0C	40/90	3600	1637	3	2	0,23	1827	0,25	<	0,65	OK	
S0D	40/90	3600	850	3	2	0,12	1040	0,14	<	0,65	OK	
S1A	40/90	3600	1742	3	2	0,24	1932	0,27	<	0,65	OK	
S1B	40/90	3600	4260	3	2	0,59	4450	0,62	<	0,65	OK	
S1C	40/90	3600	3486	3	2	0,48	3676	0,51	<	0,65	OK	
S1D	40/90	3600	1800	3	2	0,25	1990	0,28	<	0,65	OK	
S2C	40/90	3600	3670	3	2	0,51	3860	0,54	<	0,65	OK	
S3B	40/90	3600	4222	3	2	0,59	4412	0,61	<	0,65	OK	
S3C	40/90	3600	2263	3	2	0,31	2453	0,34	<	0,65	OK	
S4C	40/90	3600	3391	3	2	0,47	3581	0,50	<	0,65	OK	
S5A	40/90	3600	998	3	2	0,14	1188	0,17	<	0,65	OK	
S5B	40/90	3600	1922	3	2	0,27	2112	0,29	<	0,65	OK	
S5C	40/90	3600	2719	3	2	0,38	2909	0,40	<	0,65	OK	
S5D	40/90	3600	1746	3	2	0,24	1936	0,27	<	0,65	OK	
S6A	40/90	3600	443	3	2	0,06	633	0,09	<	0,65	OK	
S6B	40/90	3600	4711	3	2	0,65	4901	0,68	<	0,65	NI OK	
S6C	40/90	3600	3136	3	2	0,44	3326	0,46	<	0,65	OK	
S6D	40/90	3600	1818	3	2	0,25	2008	0,28	<	0,65	OK	
S7aC	30/90	2700	1114	3	2	0,21	1304	0,24	<	0,65	OK	
S7bC	30/90	2700	1188	3	2	0,22	1378	0,26	<	0,65	OK	
S8A	40/90	3600	1537	3	2	0,21	1727	0,24	<	0,65	OK	
S8A'	40/90	3600	1548	3	2	0,22	1738	0,24	<	0,65	OK	
S8B	40/90	3600	4167	3	2	0,58	4357	0,61	<	0,65	OK	
S8C	40/90	3600	3412	3	2	0,47	3602	0,50	<	0,65	OK	
S8D	40/90	3600	1541	3	2	0,21	1731	0,24	<	0,65	OK	
S9A	40/90	3600	1727	3	2	0,24	1917	0,27	<	0,65	OK	
S9B	40/90	3600	4114	3	2	0,57	4304	0,60	<	0,65	OK	
S9C	40/90	3600	2911	3	2	0,40	3101	0,43	<	0,65	OK	
S9D	40/90	3600	1742	3	2	0,24	1932	0,27	<	0,65	OK	
S10C	40/90	3600	2703	3	2	0,38	2893	0,40	<	0,65	OK	
S11B	40/90	3600	4193	3	2	0,58	4383	0,61	<	0,65	OK	
S11C	40/90	3600	2416	3	2	0,34	2606	0,36	<	0,65	OK	
S12C	40/90	3600	3394	3	2	0,47	3584	0,50	<	0,65	OK	
S13A	40/90	3600	1749	3	2	0,24	1939	0,27	<	0,65	OK	
S13B	40/90	3600	4237	3	2	0,59	4427	0,61	<	0,65	OK	
S13C	40/90	3600	3434	3	2	0,48	3624	0,50	<	0,65	OK	
S13D	40/90	3600	1802	3	2	0,25	1992	0,28	<	0,65	OK	
S14A	40/90	3600	902	3	2	0,13	1092	0,15	<	0,65	OK	

S14B	40/90	3600	527	3	2	0,07	717	0,10	<	0,65	OK
S14C	40/90	3600	530	3	2	0,07	720	0,10	<	0,65	OK
S14D	40/90	3600	911	3	2	0,13	1101	0,15	<	0,65	OK

Preglednica 4: Vpliv dodatne obtežbe na normirano osno silo v stenah

$N_{\text{dodatno,max}}$  190 kN

Sile vzete iz PGD statika pdf stran 152											
	a/b [cm]	$A_c$ [cm <sup>2</sup> ]	$N_d$ [kN]	$f_{ck}$ [kN/cm <sup>2</sup> ]	$f_{cd}$ [kN/cm <sup>2</sup> ]	$v_d = N_d / (A_c \cdot f_{cd})$	$N_d + N_{\text{dodatno}}$	$v_d + v_{\text{dodatno}}$	DCM kontrola		
ST A2-4	1560/40	62400	12331	2,5	1,67	0,12	12523	0,12	<	0,4	OK
ST D2-4	1560/40	62400	15927	2,5	1,67	0,15	16119	0,15	<	0,4	OK
ST A10-12	1560/40	62400	10168	2,5	1,67	0,10	10360	0,10	<	0,4	OK
ST D10-12	1560/40	62400	15216	2,5	1,67	0,15	15408	0,15	<	0,4	OK
ST C2	340/40	13600	1100	2,5	1,67	0,05	1292	0,06	<	0,4	OK
ST C12	340/40	13600	877	2,5	1,67	0,04	1069	0,05	<	0,4	OK
ST 2A-B	820/40	32800	15498	2,5	1,67	0,28	15690	0,29	<	0,4	OK
ST 4A-B	820/40	32800	10637	2,5	1,67	0,19	10829	0,20	<	0,4	OK
ST 2C-D	630/40	25200	11069	2,5	1,67	0,26	11261	0,27	<	0,4	OK
ST 4C-D	630/40	25200	5639	2,5	1,67	0,13	5831	0,14	<	0,4	OK
ST 5A-B	820/40	32800	9399	2,5	1,67	0,17	9591	0,18	<	0,4	OK
ST 7aA-B	820/30	24600	6801	2,5	1,67	0,17	6993	0,17	<	0,4	OK
ST 7aC-D	630/30	18900	3007	2,5	1,67	0,10	3199	0,10	<	0,4	OK
ST 7bA-B	820/30	24600	5551	2,5	1,67	0,14	5743	0,14	<	0,4	OK
ST 7bC-D	630/30	18900	3072	2,5	1,67	0,10	3264	0,10	<	0,4	OK
ST 8C-D	750/30	22500	2492	2,5	1,67	0,07	2684	0,07	<	0,4	OK
ST 10A-B	820/40	32800	11494	2,5	1,67	0,21	11686	0,21	<	0,4	OK
ST 10C-D	630/40	25200	6279	2,5	1,67	0,15	6471	0,15	<	0,4	OK
ST 12A-B	820/40	32800	13731	2,5	1,67	0,25	13923	0,25	<	0,4	OK
ST12C-D	630/40	25200	10336	2,5	1,67	0,25	10528	0,25	<	0,4	OK

## 7. DIMENZIONIRANJE JEKLENEGA PODESTA

Jeklen podest je dimenzioniran s programom Tower 8 in Idea StatiCa Member. Spoji so dimenzionirani s programom IDEA StatiCa Detail. Zasnovan je na način, da so vplivi na obstoječo konstrukcijo minimalni.

### 7.1 Uporabljeni materiali

Kot material kovinske konstrukcije je predvideno jeklo S355 J2, ki zagotavlja ustrezno žilavost do -55°C (nacionalni dodatek k SIST EN 1993-1-10; priročnik 3-10).

### 7.2 Obtežbe



Jeklen podest je dimenzioniran na obtežbo RDC in klimata, ki so podane v preglednici Preglednica 1. Dodatno je na podestu upoštevana obtežba vetra, ki je povzeta iz spletne strani ARSO – atlas okolja, projektna hitrost vetra: [http://gis.arso.gov.si/atlasokolja/profile.aspx?id=Atlas\\_Okolja\\_AXL@Arso](http://gis.arso.gov.si/atlasokolja/profile.aspx?id=Atlas_Okolja_AXL@Arso)

Parcela je uvrščena v 1. cono vetra (I).

#### OBTEŽBE VETRA po SIST EN 1991-1-4

zgornja kota stene h(m):	20,00	spodnja kota stene h <sub>0</sub> (m):	16,00
dolžina stene a(m):	14,00		
višina stene (m):	4,00		
faktor zapolnjenosti φ:	1,00		
vetrovna cona:	I	20 m/s	q <sub>b</sub> = 0,250 kN/m <sup>2</sup>
kategorija terena:	III	Področje z običajnim rastlinjem in stavbami ali s posameznimi ovirami (drevesi, stavbami) na razdalji največ 20 višin ovir (vasi, podeželje, stalni gozd)	
faktor hrapavosti terena		z <sub>0</sub> 0,3	z <sub>min</sub> 5 z <sub>0n</sub> 0,05
k <sub>r</sub> =	0,215		
c <sub>r</sub> (z)=	0,905		
koeficient hribovitosti terena			
c <sub>0</sub> (z)	1		
faktor turbulence k <sub>1</sub>	1		

#### določitev sil vetra na stene

intenziteta turbulence I <sub>v</sub> (z)	0,238
faktor izpostavljenosti c <sub>e</sub> (z)	2,182
največji tlak pri sunkih vetra q <sub>p</sub> :	<b>0,546 kN/m<sup>2</sup></b>
l/h	3,5
površina stene [m <sup>2</sup> ]	56
Podatki za steno	
	A B C D
koeficient neto tlaka c <sub>p,net</sub>	2,450 1,500 1,250 1,200
površina cone A-D [m <sup>2</sup> ]	4,8 27,2 24 0
neto pritisk vetra w <sub>net</sub> [kN/m <sup>2</sup> ]	1,337 0,818 0,682 0,655

**povprečen pritisk na steno 0,804 kN/m<sup>2</sup>**

celotna sila zaradi vetra	45,0 kN
linijska obtežba na podporo	1,61 kN/m

### 7.3 Omejitev povesov

Na tabeli so prikazani izračunani povesi podesta. Vsi pomiki so znotraj dovoljenih vrednosti.

prečno - HEB340			
Prostoležeči nosilec			
Razpon:	7800	mm	
Izračunani pomiki		Kombinacija	
$w_{max}$ =	27,2	mm	MSU
Omejitev			
$w_{max}$	≤	$l/250$	31,2 mm

vzdolžno - HEA240			
Prostoležeči nosilec			
Razpon:	7800	mm	
Izračunani pomiki		Kombinacija	
$w_{max}$ =	16,7	mm	MSU
Omejitev			
$w_{max}$	≤	$l/250$	31,2 mm

### 7.4 Kontrola MSN

Obtežne kombinacije za kontrolo mejnega stanja nosilnosti so prikazane v poročilu računa statike. Pri dimenzioniranju jeklene konstrukcije v programu Tower smo notranje statične količine izračunali z upoštevanjem teorije drugega reda (TDR). Pri dimenzioniranju konstrukcije v programu IDEA StatiCa Member, smo notranje statične količine izračunali z GMNIA metodo (geometrijsko in materialno nelinearna metoda z upoštevanjem imperfekcij konstrukcije).

V obeh modelih je dokazana ustrezna nosilnost konstrukcije.

### 7.5 Dimenzioniranje spojev

Vsi spoji jeklene konstrukcije so dimenzionirani na vplive dobljene iz modela za račun po teoriji drugega reda in na vplive dobljene iz modela za račun potresnih obremenitev. Dimenzioniranje je bilo izvedeno v programu IDEA StatiCa po metodi CBFEM. Detajli sidranja v obstoječo konstrukcijo so bili še dodatno dimenzionirani v programu HILTI Profis Engineering, kjer smo določili potrebno globino sidranja, tip sider in kemično maso, ki se jo uporabi.

## 8. IZVEDBA

### 8.1 Faznost izvedbe

#### 1. FAZA: Pripravljalna dela

Pripravljalna dela obsegajo dodatne detajlne izmere na točno izbrani lokaciji postavitve jeklenega podesta.

#### 2. FAZA: Rušitvena dela

Rušitvena dela obsegajo odstranitev ovoja stavbe na mestih kjer je predvidena izvedba točkovnega sidranja podesta. Odvisno od končne lokacije podesta, je lahko potrebna tudi odstranitev betonskih pranih plošč ali dela prodca.

#### 3. FAZA: Postavitev jeklenega podesta

Jekleni podest je potrebno izdelati v skladu z načrtom in navodili podanimi v poglavju 8.2.

#### 4. FAZA: Zapiranje ovoja stavbe

V tej fazi naj izvajalec sanira vsa mesta, kjer je bil ovoj stavbe med montažo jeklene konstrukcije odstranjen. To obsega izvedbo ustrezne hidroizolacije, toplotne izolacije, dobetoniranje parapetnega zidu, izvedba ustrezne odkapne pločevine ipd. Izvajalec je dolžan zagotoviti izvedbo detajlov, ki preprečujejo zamakanje in degradiranje konstrukcije.

#### 5. FAZA: Namestitve kontejnerja RDC in klimata

Po končanih vseh ostalih delih se na jekleni podest namesti kontejner RDC in klimat.

### 8.2 Tehnični pogoji izvedbe in montaže jeklene podkonstrukcije

Jeklena podkonstrukcija se izdelava po delavniških načrtih. Delavniške načrte je izvajalec dolžan predati v kontrolo pooblaščenemu inženirju, ki je izdelal ta elaborat. Konstrukcija podesta mora biti v celoti ustrezno antikorozijsko zaščitena – vroče cinkana. Za vse elemente, ki so vroče cinkani je potrebno upoštevati zahteve standarda SIST EN ISO 14713-(deli 1 do 3) in SIST EN ISO 1461:2009.

Za izdelavo jeklene konstrukcije predvidimo izvedbeni razred EXC1 (CC1, PC1, SC1). Vsi deli konstrukcije podesta so izdelani v delavnici in nato sestavljeni na končni lokaciji.

Opozarjam, da je izvajalec dolžan organizirati in opravljati kontrolo izdelave jeklene konstrukcije in izdelati dokumentacijo, ki sestoji iz:

- kontrole dobavljenega materiala (certifikati o ustreznosti materiala),
- kontrola varjenja z dokazom kvalitete zvarov,
- kontrola izdelave z detajlnim načrtom tehnološkega procesa izdelave z upoštevanjem sodobnih postopkov za preprečevanje deformacij pri varjenju, čistost površin pred varjenjem, pogojev varjenja (temperatura, veter,...), kontrolo lokalnih zarez pri nateznih elementih,
- kontrola montaže s predhodno zapisniškim prevzemom konstrukcije v delavnici,
- kontrola ležišč oz. temeljev na katera se montira konstrukcija, kontrola transporta z namenom, da se prepreči deformacija konstrukcije pri transportu, kontrola antikorozijske zaščite

Detajli D1-D7 (označeni na prerezi) se izvedejo v skladu z risbami prikazanimi v izračunih programa IDEA StatiCa.

Lokacija točkovnih podpor podesta mora biti izvedena v skladu z načrtom, v težišču stebrov oziroma v osi stene. Točen razpored lukenj za sidra v sidrni pločevini se lahko delno prilagodi glede na ugotovljeno pozicijo armaturnih palic v zgornjem sloju plošče. Pričakovana armatura so palice  $\Phi 22/15$  cm. Globina sidranja v ploščo znaša minimalno 15 cm.

## 9. ZAKLJUČKI

Na podlagi ogleda, prejete dokumentacije, razgovora s predstavniki naročnika ter statične presoje sledi, da je postavitve RDC sprejemljiva le na način, da ni vplivov na strešno ploščo, ampak se obtežbo preko jeklenega podesta prenašajo direktno v stebre in stene. Sprejemljive lokacije postavite RDC-ja so označene na risbi 2. Postavitve podesta na druge lokacije ni sprejemljiva z vidika zagotavljanja ustrezne mehanske odpornosti in stabilnosti konstrukcije.

Mehansko odpornost in stabilnost objekta po namestitvi RDC smo dokazovali s kontrolo nosilnosti posameznih kritičnih elementov nosilne konstrukcije v skladu z zahtevami Evrokod ter z oceno vpliva dodatne mase na globalno obnašanje objekta pri potresni obtežbi.

Presoja je bila pripravljena na podlagi podatkov, posredovanih s strani lastnika/upravljalca objekta. Pripravljena je bila v veri, da so vsi posredovani podatki resnični in da je avtor tega poročila bil obveščen o vseh bistvenih spremembah, ki so bile in bodo na objektu izvedene.

DELOVNA VERZIJA




	<b>GLOBALNE IN LOKALNE ANALIZE KONSTRUKCIJE</b>
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1	<b>GLOBALNE ANALIZE</b>	
1.1	Statična analiza podesta po TDR	Tower 8.5
1.2	Statična analiza podesta po GMNIA	IDEA StatiCa Member 24.0
2	<b>LOKALNE ANALIZE</b>	
2.1	Dimenzioniranje detajlov D1 – D7	IDEA StatiCa Detail 24.0
2.2	Dimenzioniranje sidranja v obstoječo konstrukcijo	Hilti PROFIS Engineering 3.0.9

DELOVNA VERZIJA



	Statična presoja namestitve RDC - streha FRI	list 1 / 13
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### Osnovni podatki o modelu

Datoteka: RDC podstavek.twp  
Datum preračuna: 17.5.2024

Način preračuna: 3D model

- ☐ Teorija I-ga reda   
 ☐ Modalna analiza   
 ☐ Stabilnost  
☒ Teorija II-ga reda   
 ☐ Seizmični preračun   
 ☐ Faze gradnje  
☐ Nelinearen preračun

#### Velikost modela

Število vozlišč: 224  
 Število ploskovnih elementov: 0  
 Število grednih elementov: 221  
 Število robnih elementov: 36  
 Število osnovnih obtežnih primerov: 4  
 Število kombinacij obtežb: 4

#### Enote mer

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

DELOVNA VERZIJA

## Vhodni podatki - Konstrukcija

### Schema nivojev

	Naziv	z [m]	h [m]
Podest		1.00	0.10
Podest 0		0.90	0.90

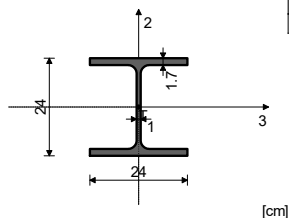
	Naziv	z [m]	h [m]
Streha		0.00	

### Tabele materialov

No	Naziv materiala	E[kN/m <sup>2</sup> ]	$\mu$	$\gamma$ [kN/m <sup>3</sup> ]	$\alpha_t$ [1/C]	Em[kN/m <sup>2</sup> ]	$\mu_m$
1	Jeklo (S355 J2)	2.100e+8	0.30	78.00	1.000e-5	2.100e+8	0.30

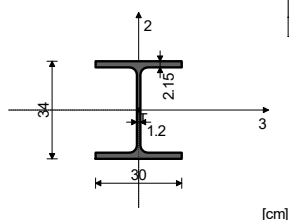
### Seti gred

#### Set: 1 Prerez: HEB 240, Fiktivna ekscentričnost



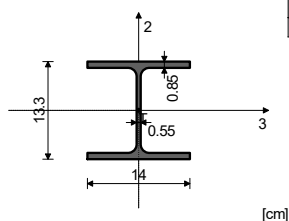
Mat.	A1	A2	A3	I1	I2	I3
1 - Jeklo (S355 J2)	1.060e-2	3.324e-3	7.276e-3	1.030e-6	3.920e-5	1.126e-4

#### Set: 2 Prerez: HEB 340, Fiktivna ekscentričnost



Mat.	A1	A2	A3	I1	I2	I3
1 - Jeklo (S355 J2)	1.710e-2	5.619e-3	1.148e-2	2.580e-6	9.690e-5	3.666e-4

#### Set: 3 Prerez: HEA 140, Fiktivna ekscentričnost



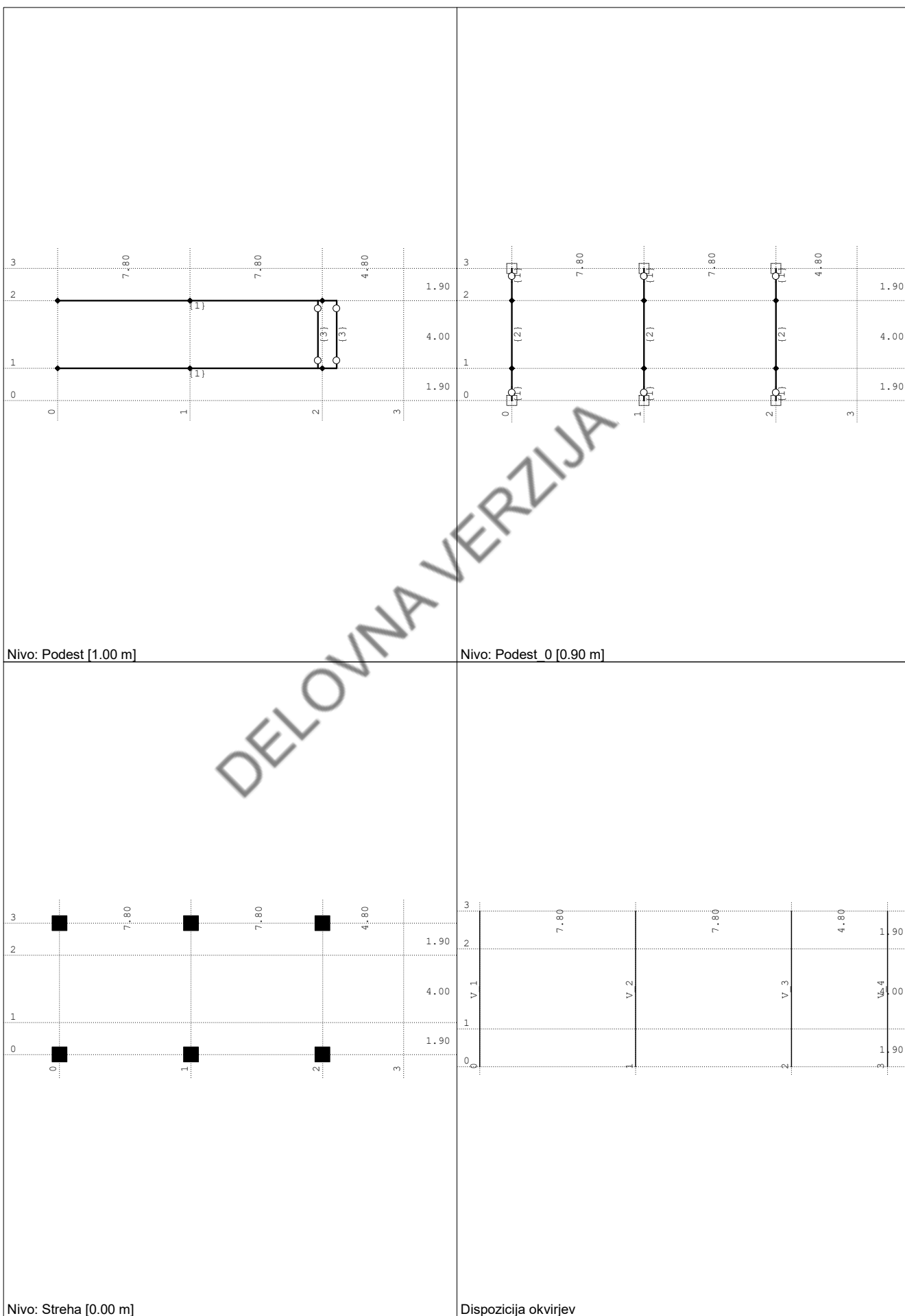
Mat.	A1	A2	A3	I1	I2	I3
1 - Jeklo (S355 J2)	3.140e-3	1.011e-3	2.129e-3	8.160e-8	3.890e-6	1.030e-5

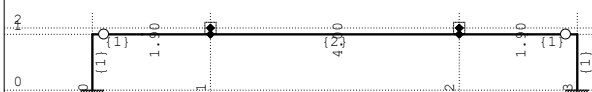
### Seti točkovnih podpor

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

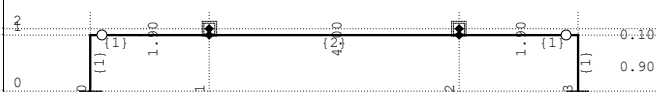
### Seti zvez

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

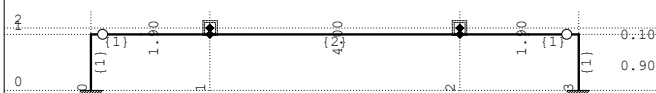




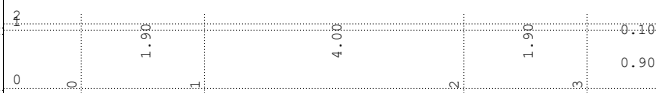
Okvir: V 1



Okvir: V 2



Okvir: V 3



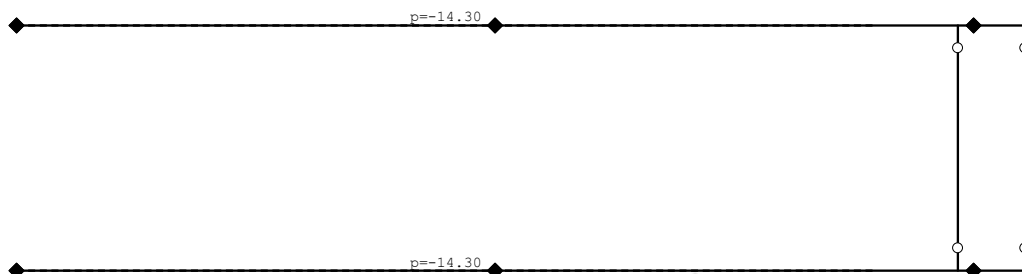
Okvir: V 4

**Vhodni podatki - Obtežba**
**Lista obtežnih primerov**

LC	Naziv
1	Lastna (g)
2	RDC
3	klimat
4	veter

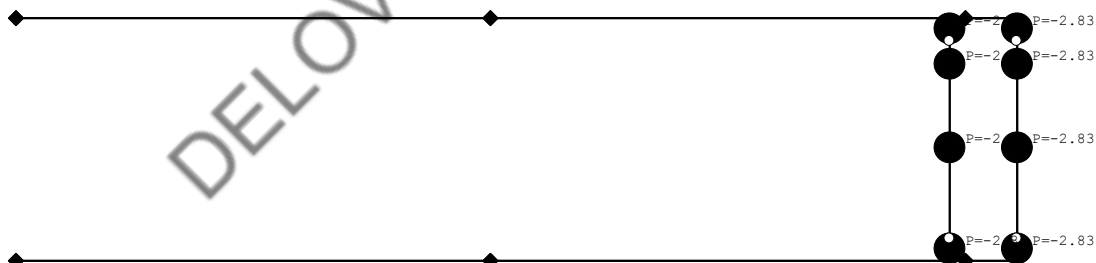
LC	Naziv
5	Komb.: 1.35xl+II+III
6	Komb.: 1.35xl+II+III+1.5xIV
7	Komb.: I+II+III
8	Komb.: I+II+III+IV

Obt. 2: RDC



Nivo: Podest [1.00 m]

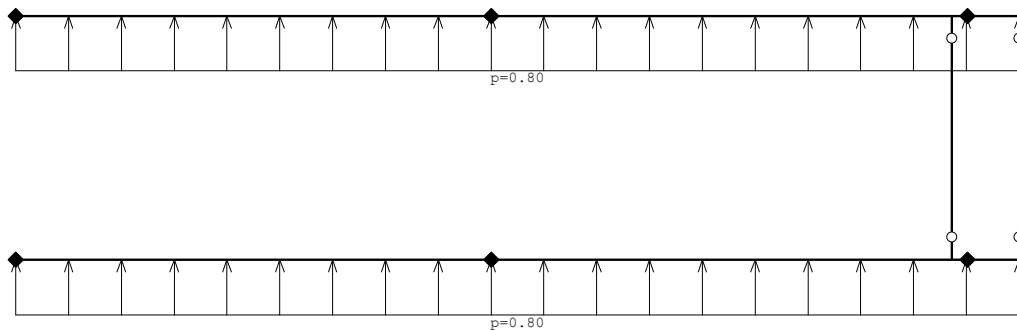
Obt. 3: klimat



Nivo: Podest [1.00 m]



Obt. 4: veter

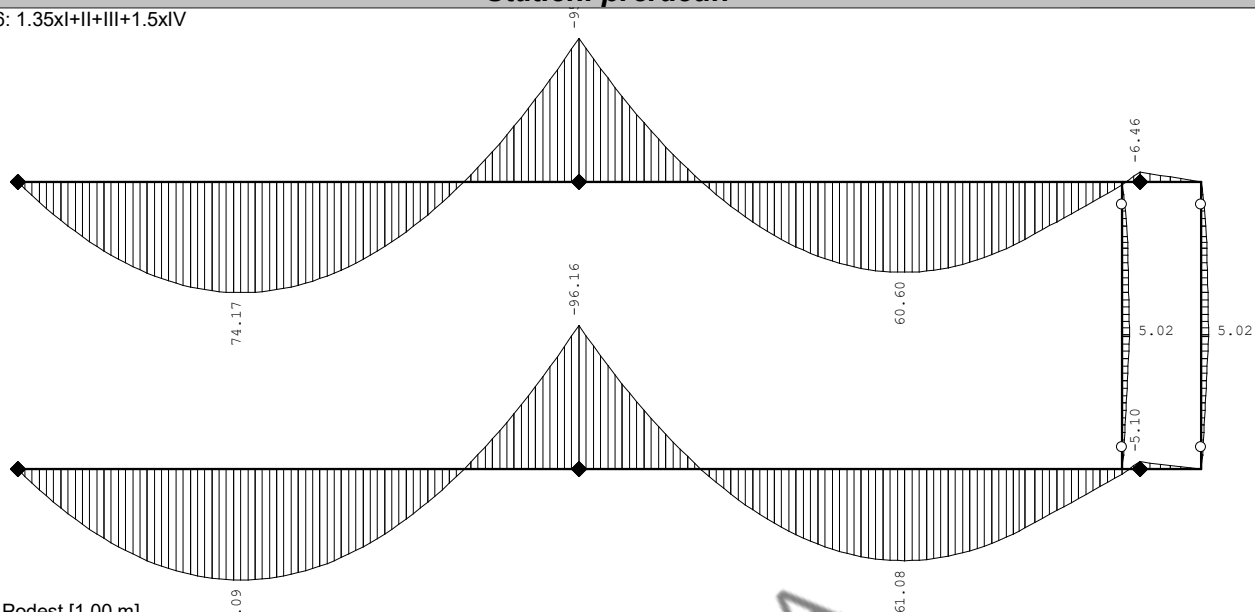


Nivo: Podest [1.00 m]

DELOVNA VERZIJA

**Statični preračun**

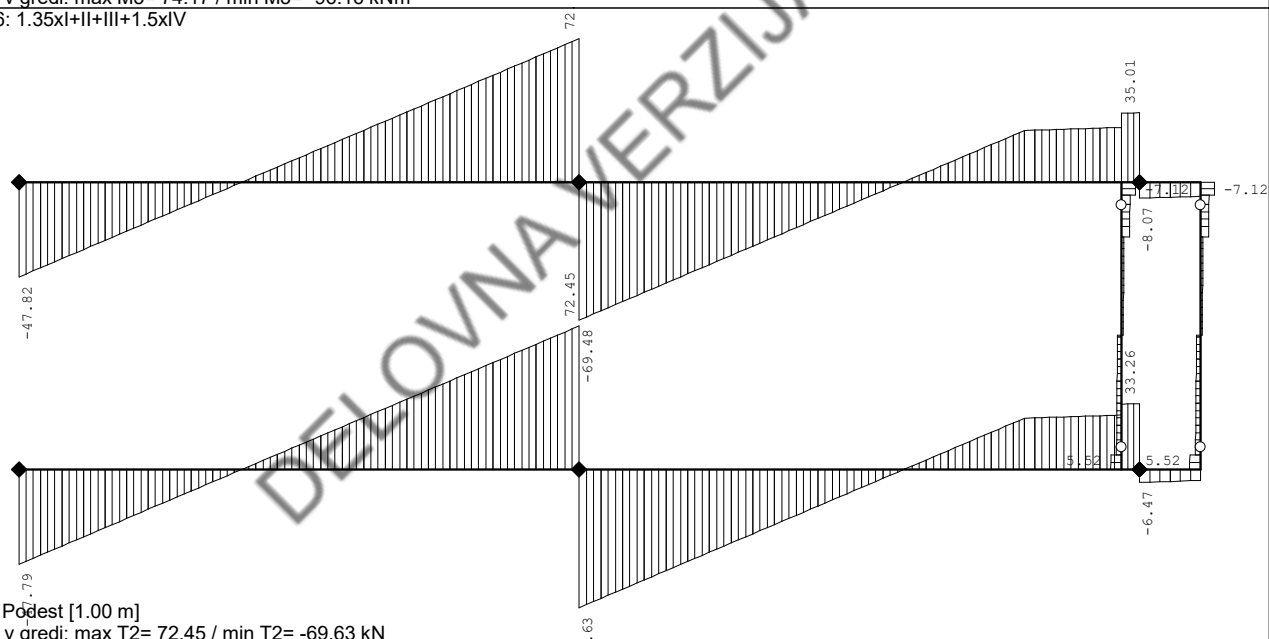
Obt. 6: 1.35xI+II+III+1.5xIV



Nivo: Podest [1.00 m]

Vplivi v gredi: max M3= 74.17 / min M3= -96.16 kNm

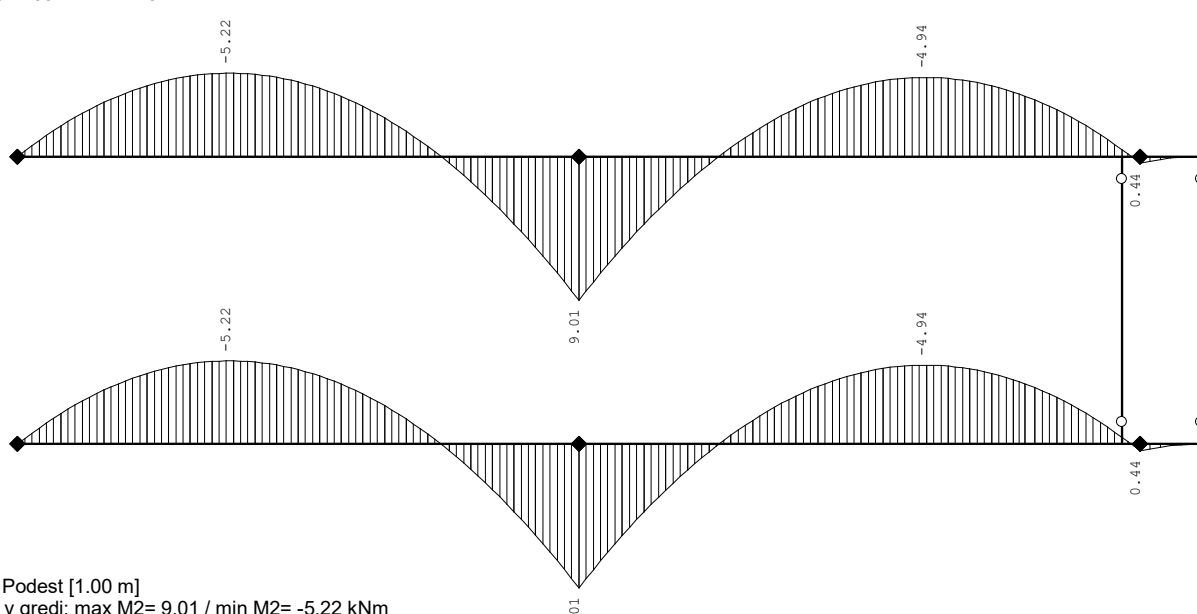
Obt. 6: 1.35xI+II+III+1.5xIV



Nivo: Podest [1.00 m]

Vplivi v gredi: max T2= 72.45 / min T2= -69.63 kN

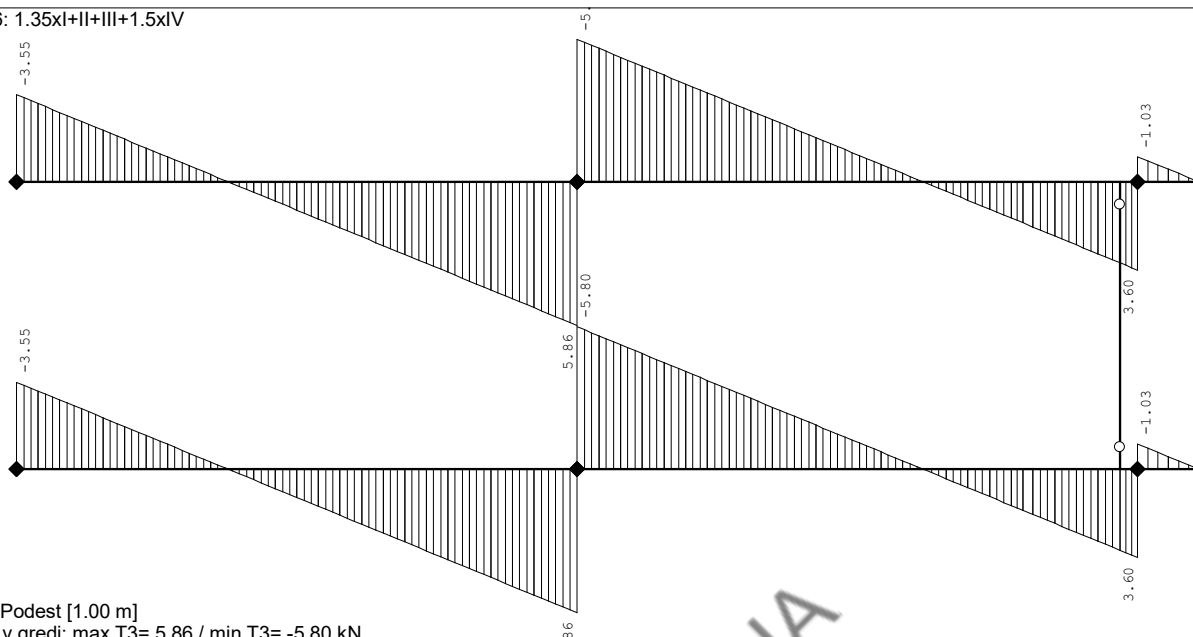
Obt. 6: 1.35xI+II+III+1.5xIV



Nivo: Podest [1.00 m]

Vplivi v gredi: max M2= 9.01 / min M2= -5.22 kNm

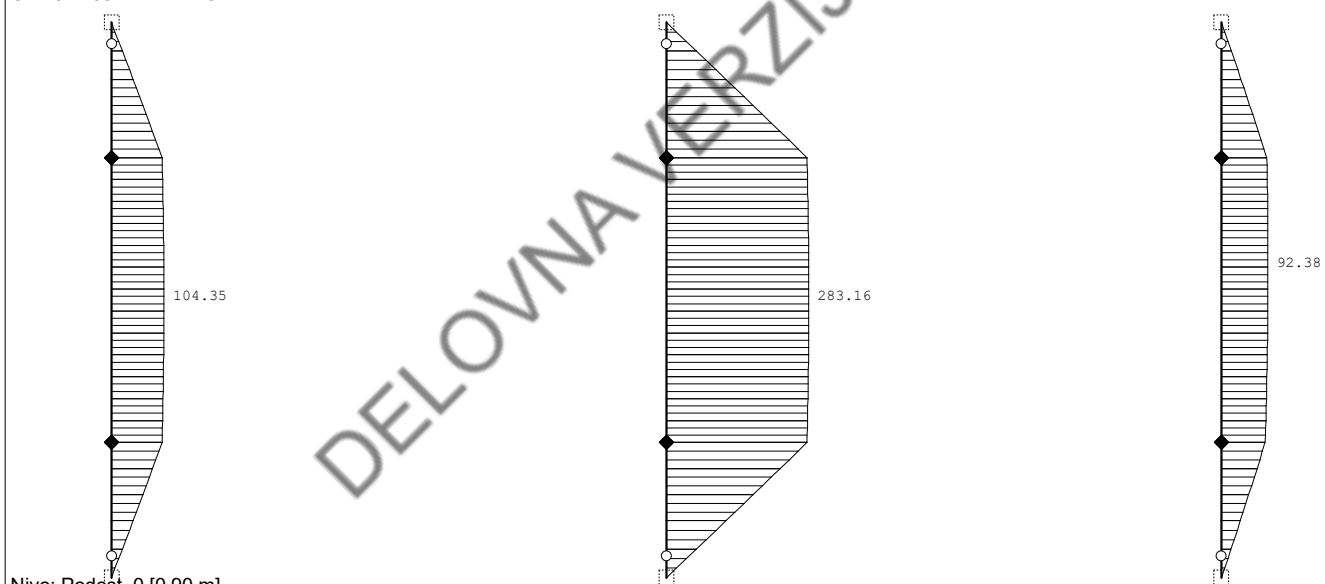
Obt. 6: 1.35xI+II+III+1.5xIV



Nivo: Podest [1.00 m]

Vplivi v gredi: max T3= 5.86 / min T3= -5.80 kN

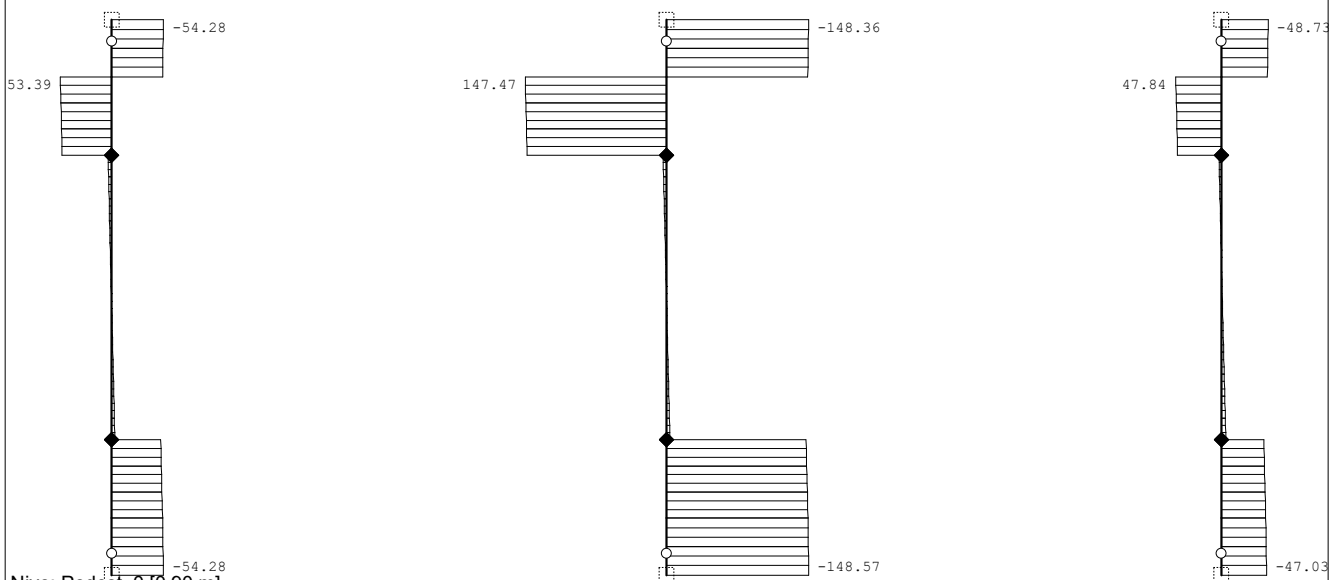
Obt. 6: 1.35xI+II+III+1.5xIV



Nivo: Podest\_0 [0.90 m]

Vplivi v gredi: max M3= 283.16 / min M3= 0.00 kNm

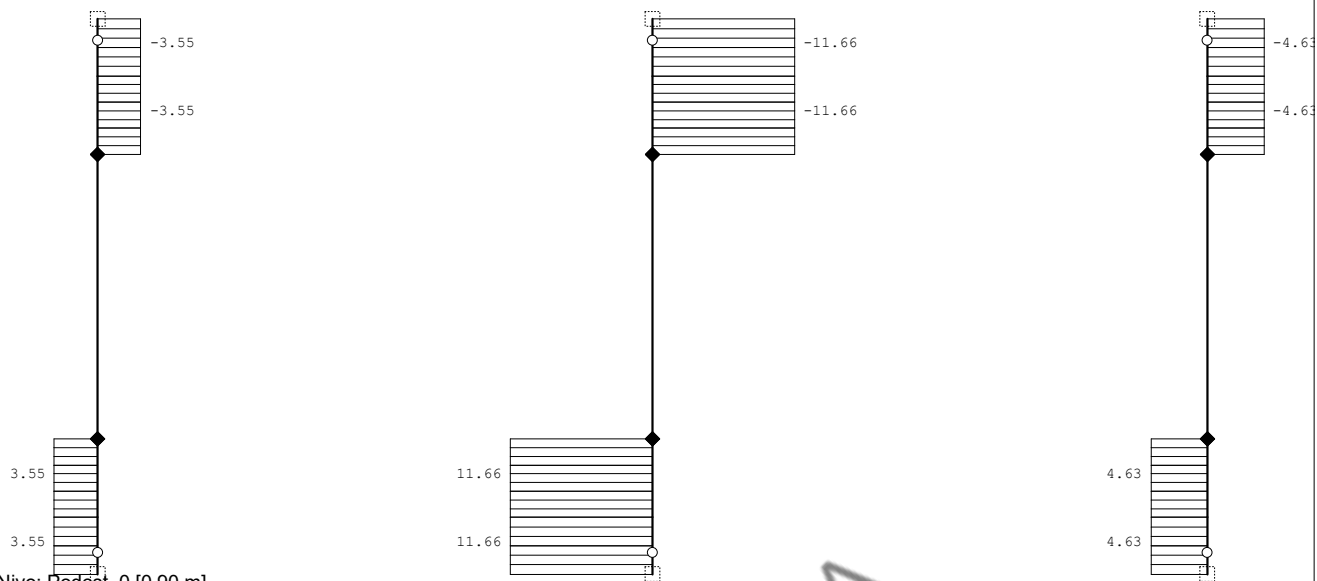
Obt. 6: 1.35xI+II+III+1.5xIV



Nivo: Podest\_0 [0.90 m]

Vplivi v gredi: max T2= 147.47 / min T2= -148.57 kN

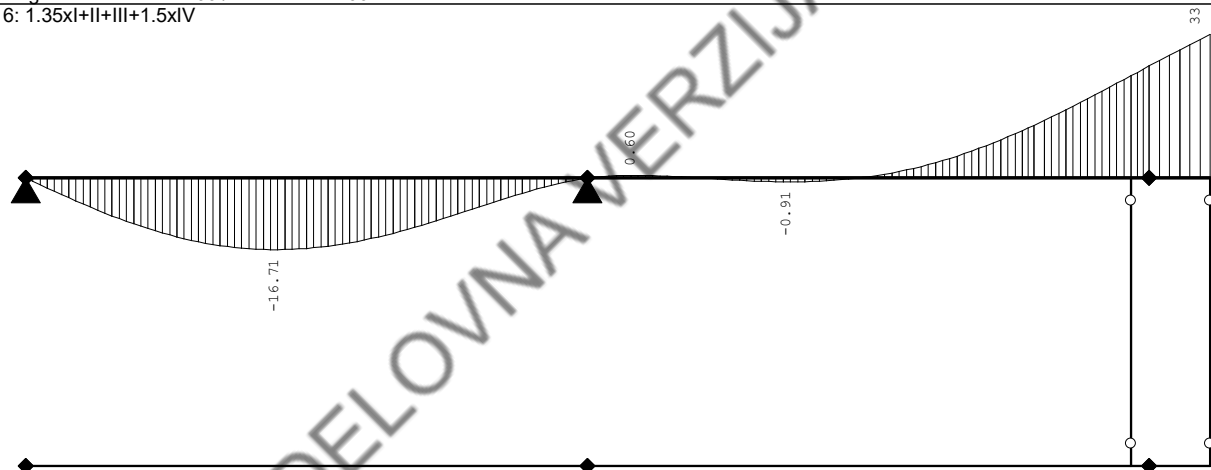
Obt. 6: 1.35xI+II+III+1.5xIV



Nivo: Podest\_0 [0.90 m]

Vplivi v gredi: max N1= 11.66 / min N1= -11.66 kN

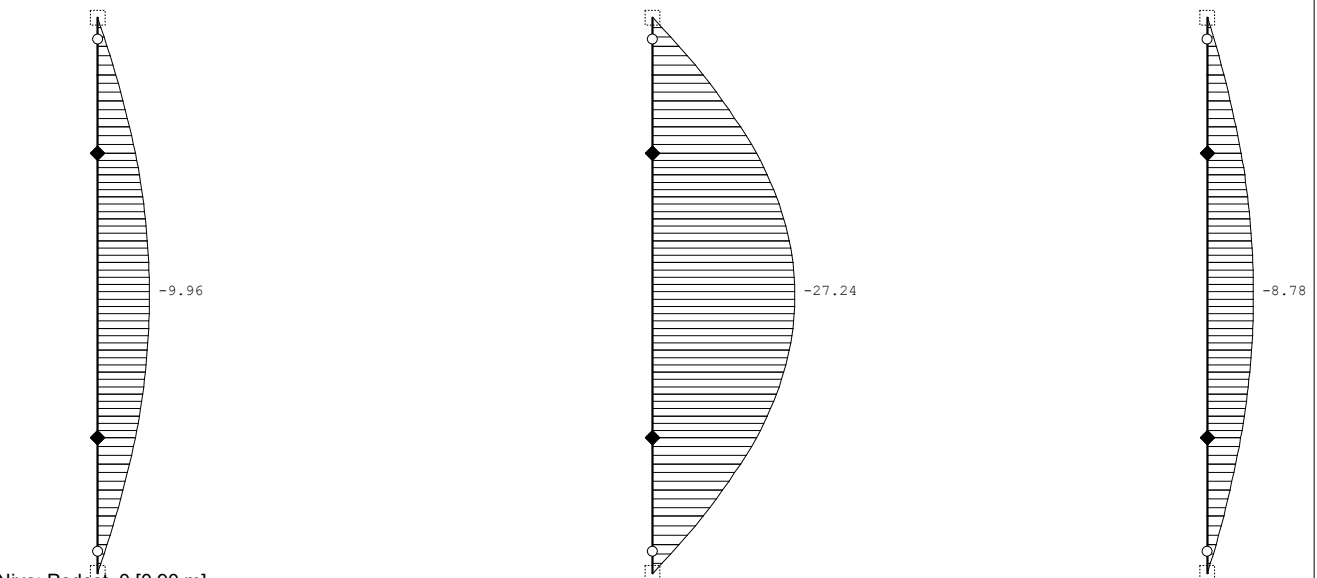
Obt. 6: 1.35xI+II+III+1.5xIV



Nivo: Podest [1.00 m]

Vplivi v gredi: max u,rel.(Z)= 33.55 / min u,rel.(Z)= -16.71 m / 1000

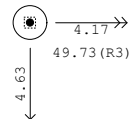
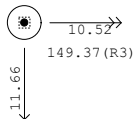
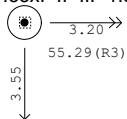
Obt. 6: 1.35xI+II+III+1.5xIV



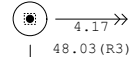
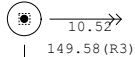
Nivo: Podest\_0 [0.90 m]

Vplivi v gredi: max Zp= -0.02 / min Zp= -27.24 m / 1000

Obt. 6: 1.35xI+II+III+1.5xIV



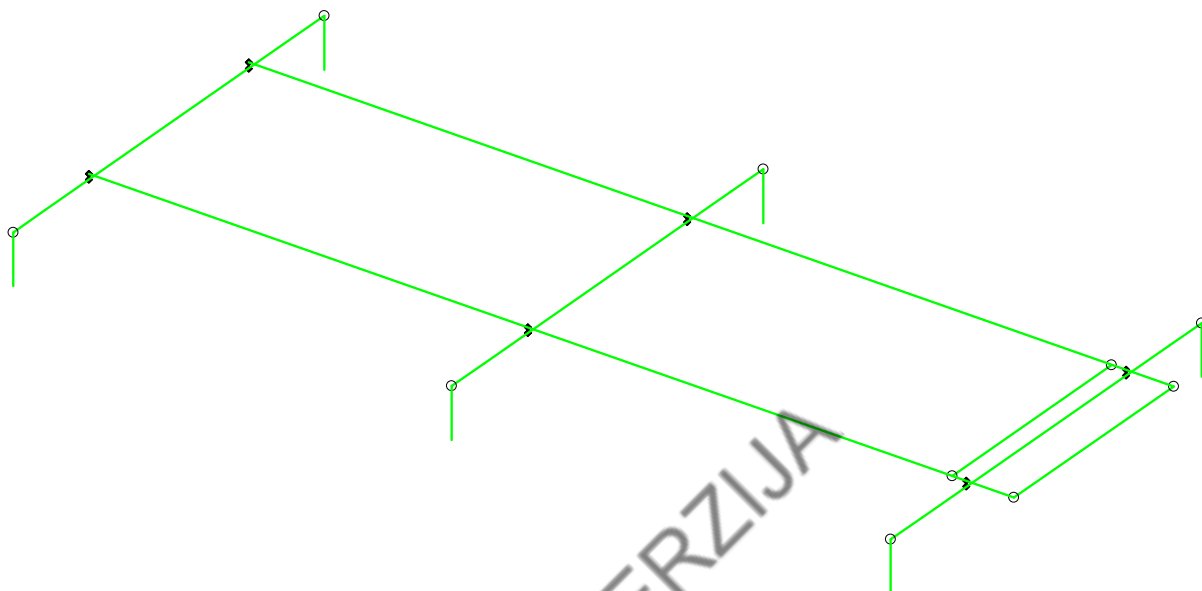
Nivo: Streha [0.00 m]  
Reakcije podpor. 29 (R3)



DELOVNA VERZIJA



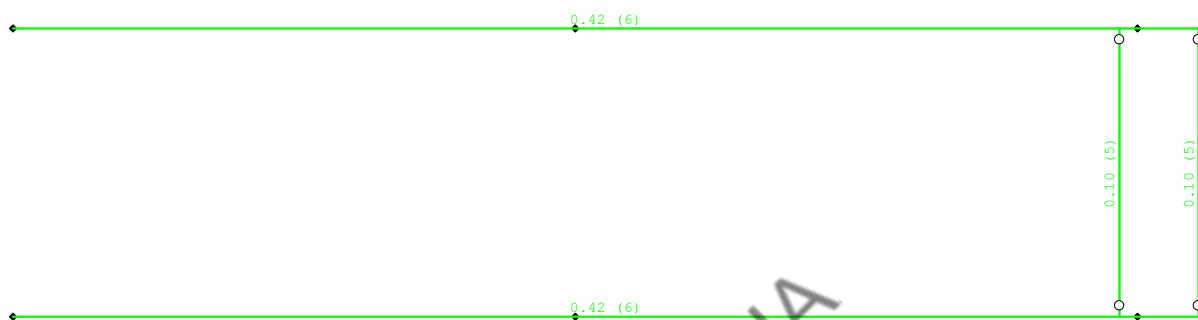
**Dimenzioniranje (jeklo)**



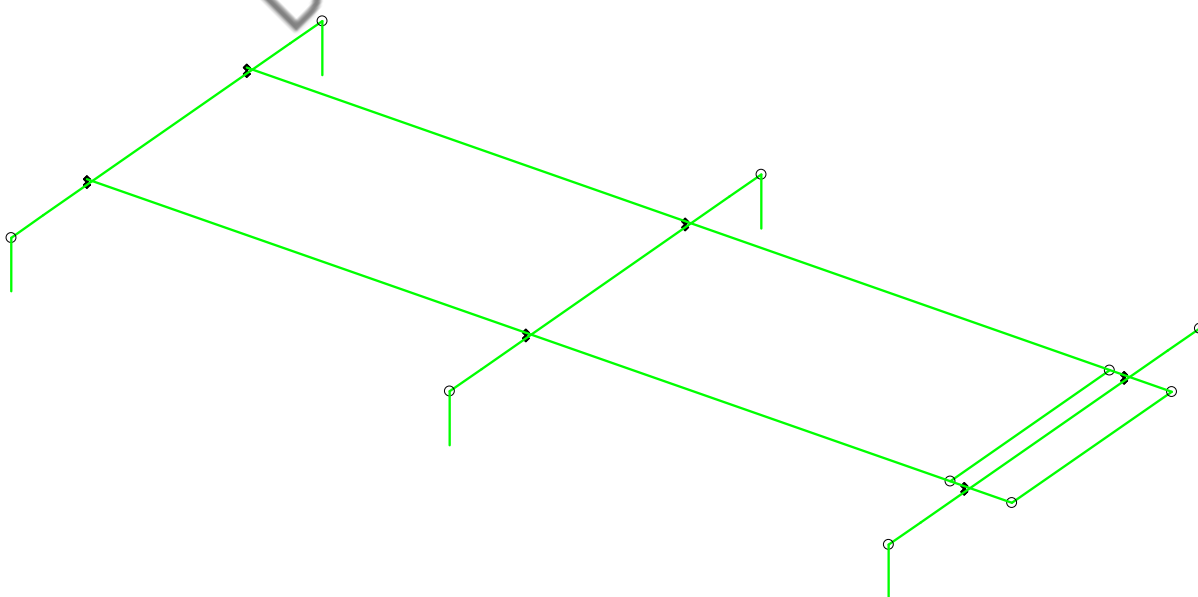
Izometrija  
Kontrola napetosti



Nivo: Podest\_0 [0.90 m]  
Kontrola napetosti



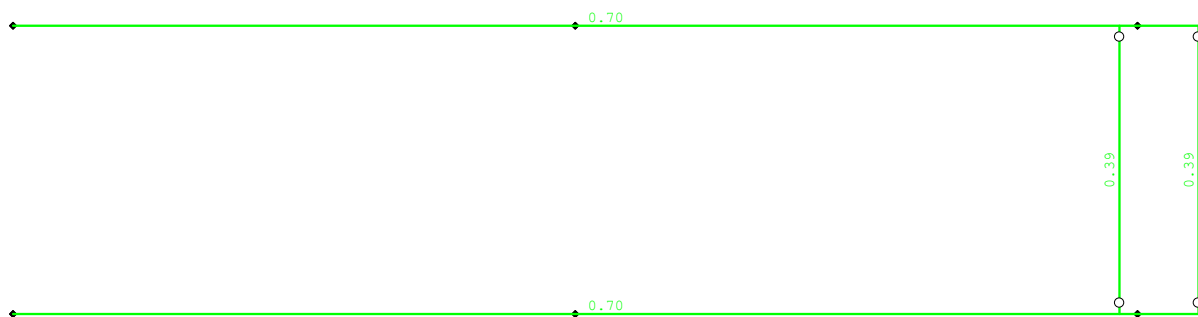
Nivo: Podest [1.00 m]  
Kontrola napetosti



Izometrija  
Kontrola stabilnosti



Nivo: Podest\_0 [0.90 m]  
Kontrola stabilnosti



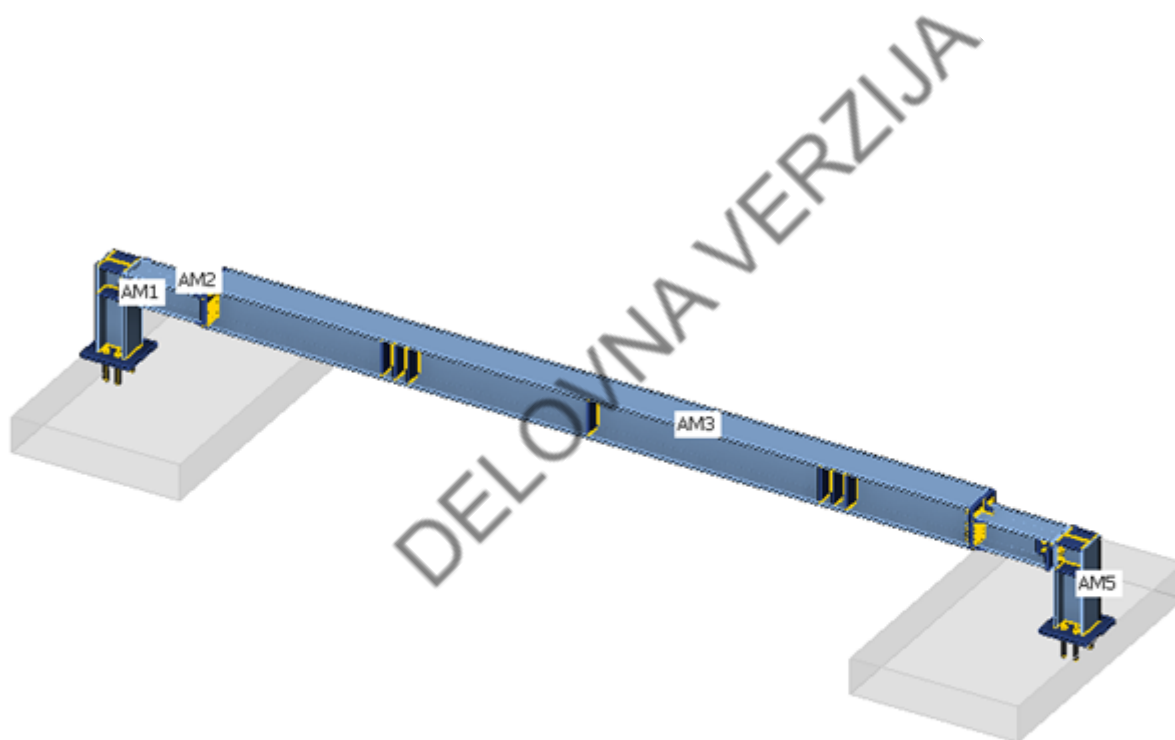
Nivo: Podest [1.00 m]  
Kontrola stabilnosti

Project: RDC - STREHA FRI  
Project no: 24/24  
Author: Detajl infrastruktura

## Project data

Project name	RDC - STREHA FRI
Project number	24/24
Author	Detajl infrastruktura
Description	
Date	13. 05. 2024
Design code	EN

## Geometry



## Analyzed members

### AM1

Property	Value
Name	AM1
Members	M1
Cross-section	HEB240
Length	0,60 m
ey	0 mm
ez	0 mm
Begin	(0,00; 0,00; 0,00) m
End	(0,00; 0,00; 0,60) m

### AM2

Property	Value
Name	AM2
Members	M2
Cross-section	HEB240
Length	0,80 m
ey	0 mm
ez	0 mm
Begin	(0,00; 0,00; 0,60) m
End	(0,80; 0,00; 0,60) m

### AM3

Property	Value
Name	AM3
Members	M3
Cross-section	HEB340
Length	6,40 m
ey	0 mm
ez	50 mm
Begin	(0,80; 0,00; 0,60) m
End	(7,20; 0,00; 0,60) m

Project: RDC - STREHA FRI  
 Project no: 24/24  
 Author: Detajl infrastruktura

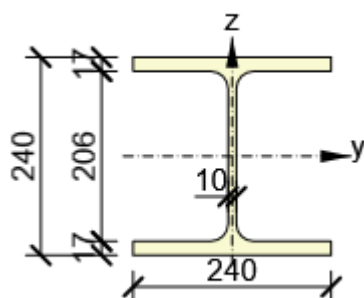
#### AM4

Property	Value
Name	AM4
Members	M4
Cross-section	HEB240
Length	0,80 m
ey	0 mm
ez	0 mm
Begin	(7,20; 0,00; 0,60) m
End	(8,00; 0,00; 0,60) m

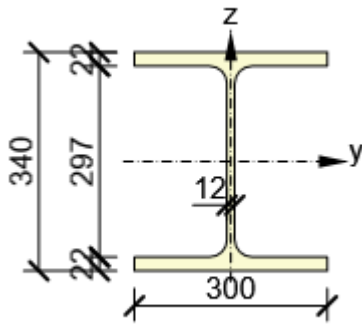
#### AM5

Property	Value
Name	AM5
Members	M5
Cross-section	HEB240
Length	0,60 m
ey	0 mm
ez	0 mm
Begin	(8,00; 0,00; 0,60) m
End	(8,00; 0,00; 0,00) m

#### Cross-section



HEB240, Material: S 355



HEB340, Material: S 355

## Loading

### LE1 – Type ULS

#### Line load

Member	Begin [m]	End [m]	X [kN/m]	Y [kN/m]	Z [kN/m]	Location	Width [mm]	Ey [mm]
AM1	0,00	0,60	0,0	0,0	0,0	Top	100	0
AM2	0,00	0,80	0,0	0,0	0,0	Top	100	0
AM3	0,00	6,40	0,0	0,0	0,0	Top	100	0
AM4	0,00	0,80	0,0	0,0	0,0	Top	100	0
AM5	0,00	0,60	0,0	0,0	0,0	Top	100	0

#### Point load

Member	N [kN]	Vy [kN]	Vz [kN]	Mx [kN]	My [kN]	Mz [kN]
AM3 / 0,25	12,0	0,0	-136,0	0,0	0,0	0,0
AM3 / 0,82	12,0	0,0	-136,0	0,0	0,0	0,0

## Fire design

### Material Degradation

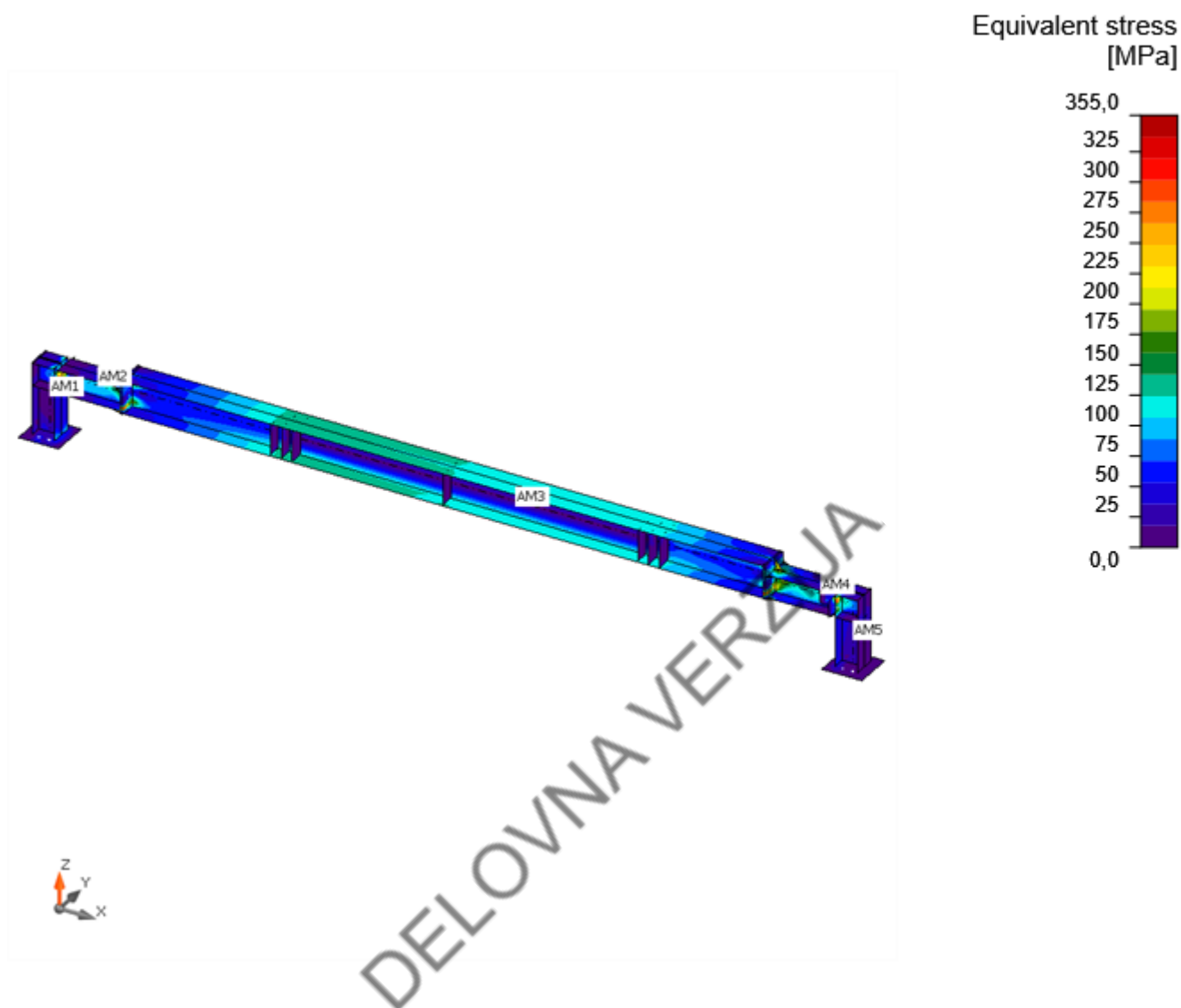
Material degradation - Steel plates	EN 1993-1-2
Material degradation - Welds	EN 1993-1-2
Material degradation - Bolts	EN 1993-1-2

## Results

### Materially non-linear analysis (MNA)

#### Summary

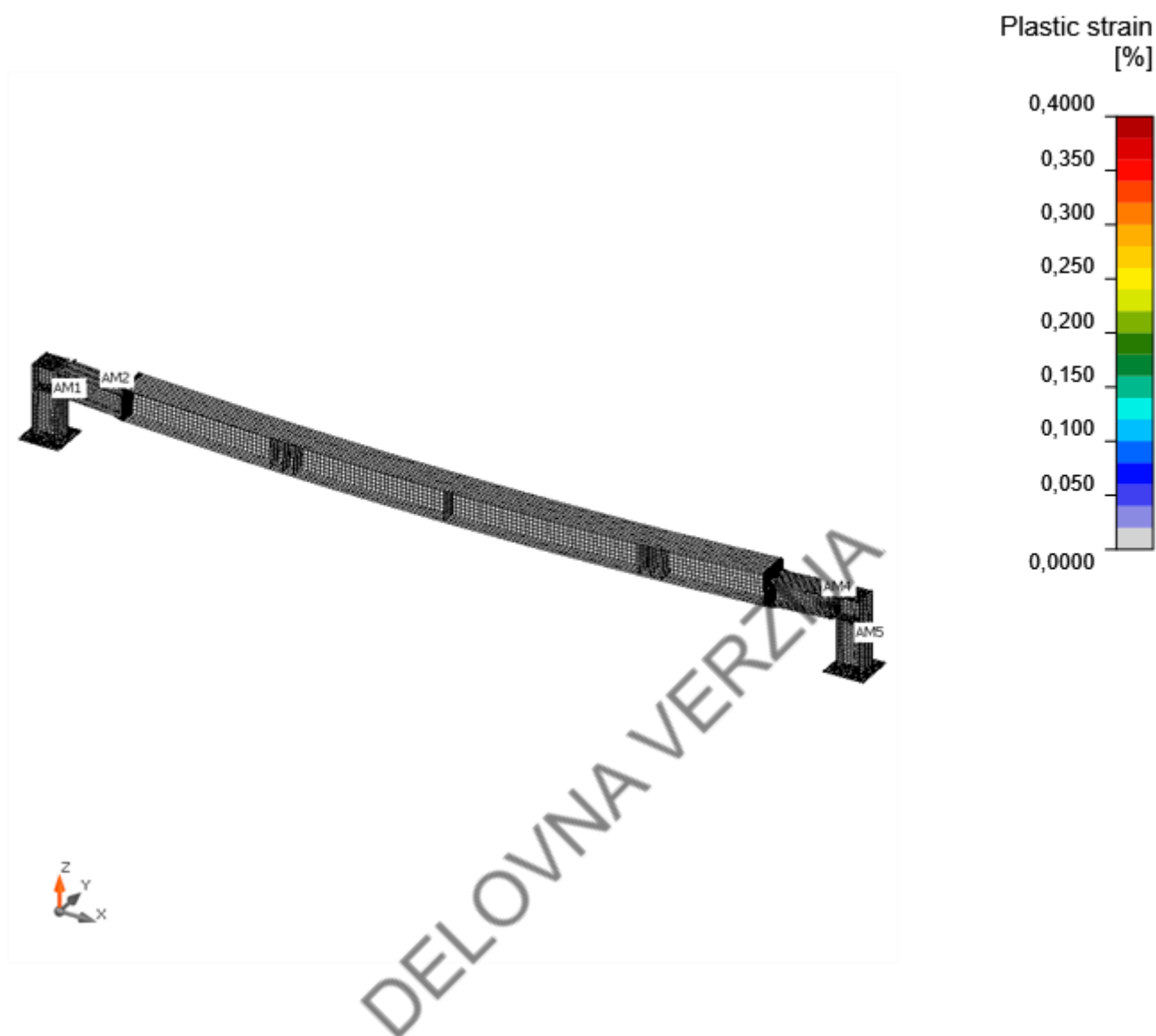
Load	Applied loads [%]
LE1	100,0



*Eq. stress ,LC1*



Project: RDC - STREHA FRI  
Project no: 24/24  
Author: Detajl infrastruktura



Plastic strain ,LC1

## Plates

Part	Name	Material	Th [mm]	Load	$\sigma_{Ed}$ [MPa]	$\epsilon_{pl}$ [%]	Check
AM1	Bottom flange 1	S 355	17	LE1	338,0	0,0	OK
	Top flange 1	S 355	17	LE1	49,4	0,0	OK
	Web 1	S 355	10	LE1	114,4	0,0	OK
AM2	Bottom flange 1	S 355	17	LE1	102,6	0,0	OK
	Top flange 1	S 355	17	LE1	165,8	0,0	OK
	Web 1	S 355	10	LE1	258,3	0,0	OK
AM3	Bottom flange 1	S 355	22	LE1	136,5	0,0	OK
	Top flange 1	S 355	22	LE1	141,9	0,0	OK
	Web 1	S 355	12	LE1	216,8	0,0	OK
STIFF T1-a	Stiffener (STIFF T1-a)	S 355	10	LE1	35,5	0,0	OK
STIFF T1-b	Stiffener (STIFF T1-b)	S 355	10	LE1	35,6	0,0	OK
STIFF T1-c	Stiffener (STIFF T1-c)	S 355	10	LE1	41,0	0,0	OK
STIFF T1-d	Stiffener (STIFF T1-d)	S 355	10	LE1	41,1	0,0	OK
STIFF T1-e	Stiffener (STIFF T1-e)	S 355	10	LE1	32,1	0,0	OK
STIFF T1-f	Stiffener (STIFF T1-f)	S 355	10	LE1	32,0	0,0	OK
STIFF T2-a	Stiffener (STIFF T2-a)	S 355	10	LE1	27,7	0,0	OK
STIFF T2-b	Stiffener (STIFF T2-b)	S 355	10	LE1	27,8	0,0	OK
STIFF T2-c	Stiffener (STIFF T2-c)	S 355	10	LE1	40,2	0,0	OK
STIFF T2-d	Stiffener (STIFF T2-d)	S 355	10	LE1	40,2	0,0	OK
STIFF T2-e	Stiffener (STIFF T2-e)	S 355	10	LE1	35,9	0,0	OK
STIFF T2-f	Stiffener (STIFF T2-f)	S 355	10	LE1	35,8	0,0	OK
STIFF T3-a	Stiffener (STIFF T3-a)	S 355	10	LE1	23,5	0,0	OK
STIFF T3-b	Stiffener (STIFF T3-b)	S 355	10	LE1	23,5	0,0	OK
AM4	Bottom flange 1	S 355	17	LE1	114,4	0,0	OK
	Top flange 1	S 355	17	LE1	187,7	0,0	OK
	Web 1	S 355	10	LE1	301,0	0,0	OK
AM5	Bottom flange 1	S 355	17	LE1	346,1	0,0	OK
	Top flange 1	S 355	17	LE1	43,8	0,0	OK
	Web 1	S 355	10	LE1	128,0	0,0	OK
CON1	Base plate (BP1)	S 355	30	LE1	66,7	0,0	OK
CON2	Stiffener (STIFF1a)	S 355	15	LE1	37,3	0,0	OK
	Stiffener (STIFF1b)	S 355	15	LE1	41,1	0,0	OK
	Stiffener (STIFF1c)	S 355	15	LE1	138,5	0,0	OK
	Stiffener (STIFF1d)	S 355	15	LE1	138,8	0,0	OK
CON3	End plate (PP1a)	S 355	20	LE1	323,0	0,0	OK
	End plate (PP1b)	S 355	20	LE1	340,1	0,0	OK
	Widener (WID1)	S 355	15	LE1	332,6	0,1	OK
	Widener (WID2a)	S 355	15	LE1	346,0	0,0	OK
	Widener (WID2b)	S 355	15	LE1	346,4	0,0	OK
	Widener (WID2c)	S 355	15	LE1	234,6	0,0	OK
	Widener (WID2d)	S 355	15	LE1	234,8	0,0	OK

Project: RDC - STREHA FRI  
Project no: 24/24  
Author: Detajl infrastruktura

Part	Name	Material	Th [mm]	Load	$\sigma_{Ed}$ [MPa]	$\epsilon_{pl}$ [%]	Check
CON4	End plate (PP1a)	S 355	20	LE1	344,2	0,0	OK
	End plate (PP1b)	S 355	20	LE1	354,7	0,0	OK
	Widener (WID1a)	S 355	15	LE1	355,1	0,1	OK
	Widener (WID1b)	S 355	15	LE1	355,1	0,1	OK
	Widener (WID1c)	S 355	15	LE1	286,5	0,0	OK
	Widener (WID1d)	S 355	15	LE1	286,7	0,0	OK
	Widener (WID2)	S 355	15	LE1	344,4	0,2	OK
CON5	Stiffener (STIFF1a)	S 355	18	LE1	54,1	0,0	OK
	Stiffener (STIFF1b)	S 355	18	LE1	48,9	0,0	OK
	Stiffener (STIFF1c)	S 355	18	LE1	129,2	0,0	OK
	Stiffener (STIFF1d)	S 355	18	LE1	128,8	0,0	OK
CON6	Base plate (BP1)	S 355	30	LE1	40,7	0,0	OK

## Design data

Material	$f_y$ [MPa]	$\epsilon_{lim}$ [%]
S 355	355,0	5,0

Linear buckling analysis (LBA)



Normalized deflection, LE1, Buckling shape 1

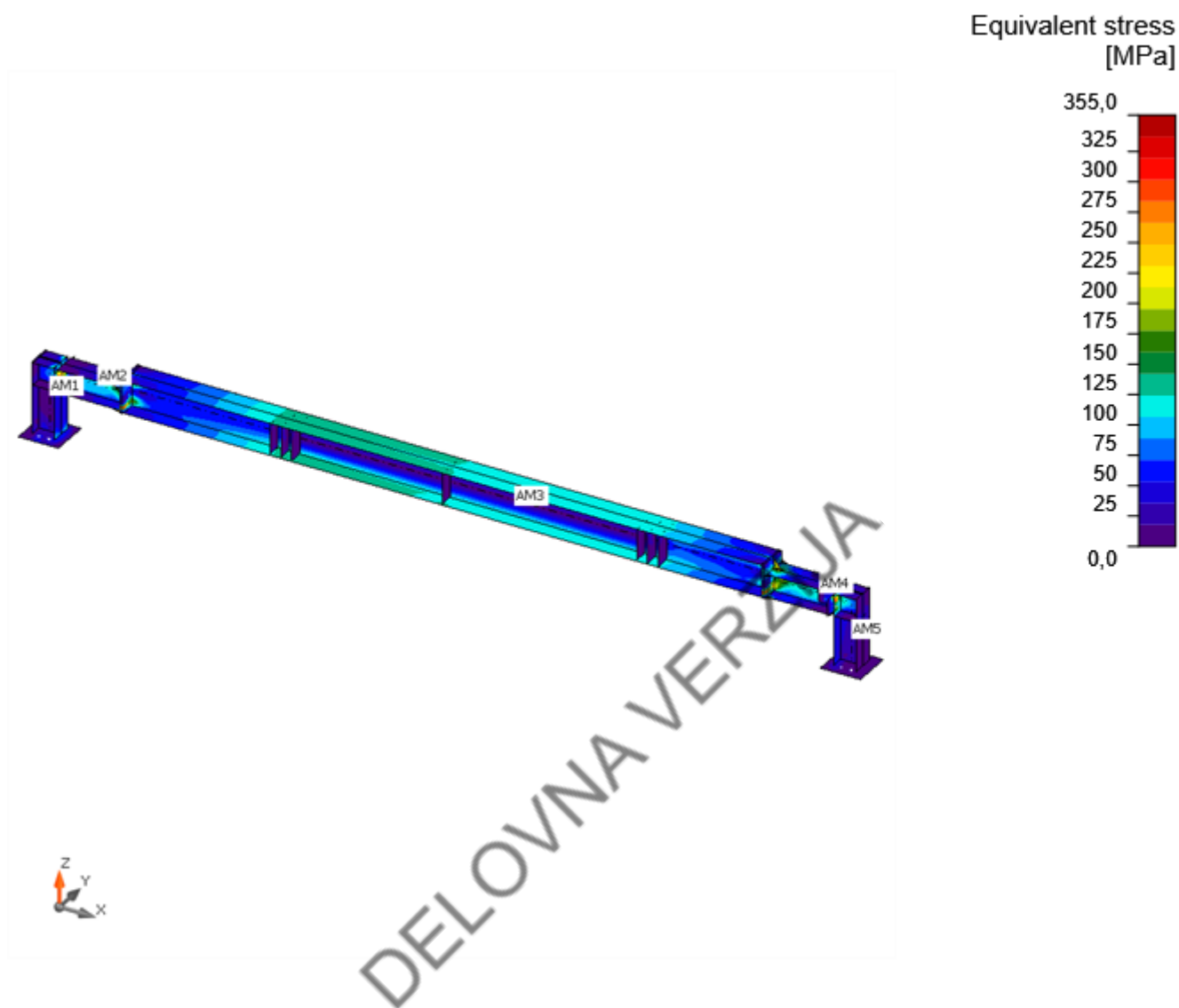
Geometrically and materially non-linear analysis with imperfections (GMNIA)

Summary

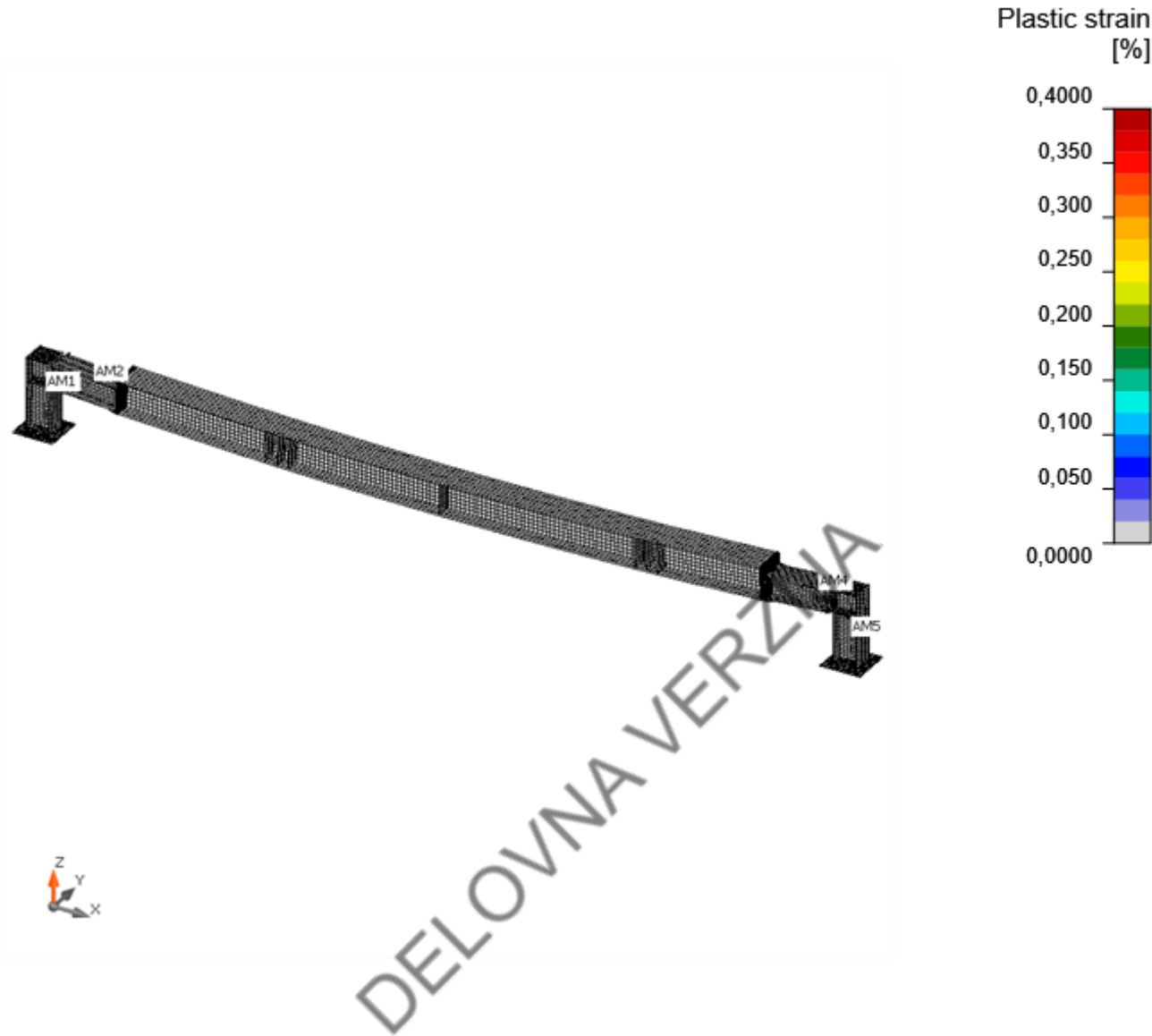
Load	Applied loads [%]
LE1	100,0

Imperfections

Loads		1	2	3	4	5	6
LE1	Buckling factor [-]	2,30	6,89	14,65	19,09	19,15	19,72
	Amplitude [mm]	31	31	1	1	0	0



Eq. stress ,LC1



Plastic strain ,LC1

Design data

Material	$f_y$ [MPa]	$\epsilon_{lim}$ [%]
S 355	355,0	5,0

Symbol explanation

Symbol	Explanation
$f_y$	Yield strength
$\epsilon_{lim}$	Limit of plastic strain used in 2D plate element check

Code settings

Stop at limit strain	No	
Pretension force factor k	0,70	-

**Project:** RDC - STREHA FRI  
**Project no:** 24/24  
**Author:** Detajl infrastruktura

Friction coefficient in slip-resistance	0,30	-
$\gamma_{M2}$	1,25	-
$\gamma_{M,fi}$	1,00	-
Anchor length for stiffness calculation [d]	8	
Limit plastic strain	500,0	1e-4
Division of surface of the biggest circular hollow member	64	
Division of arc of rectangular hollow member	3	
Number of elements on biggest member web or flange	8	
Number of elements on biggest web of RHS member	16	
Number of elements on individual plates	20	
Number of analysis iterations	25	
Divergent iterations count	6	
Minimal size of element	10	mm
Maximal size of element	50	mm
Number of buckling modes	6	

## Software info

Application: IDEA StatiCa Member  
Version: 24.0.0.4380  
Developed by: IDEA StatiCa

DELOVNA VERZIJA

**Project:** RDC - STREHA FRI  
**Project no:** 24/24  
**Author:** Detajl infrastruktura

## Project data

Project name	RDC - STREHA FRI
Project number	24/24
Author	Detajl infrastruktura
Description	
Date	4/22/2024
Code	EN

## Material

Steel	S 235, S 355
Concrete	C25/30

DELOVNA VERZIJA



Project: RDC - STREHA FRI  
 Project no: 24/24  
 Author: Detajl infrastruktura

## Project item DETAJL D1

### Design

Name DETAJL D1  
 Description  
 Analysis Stress, strain/ loads in equilibrium

### Members

#### Geometry

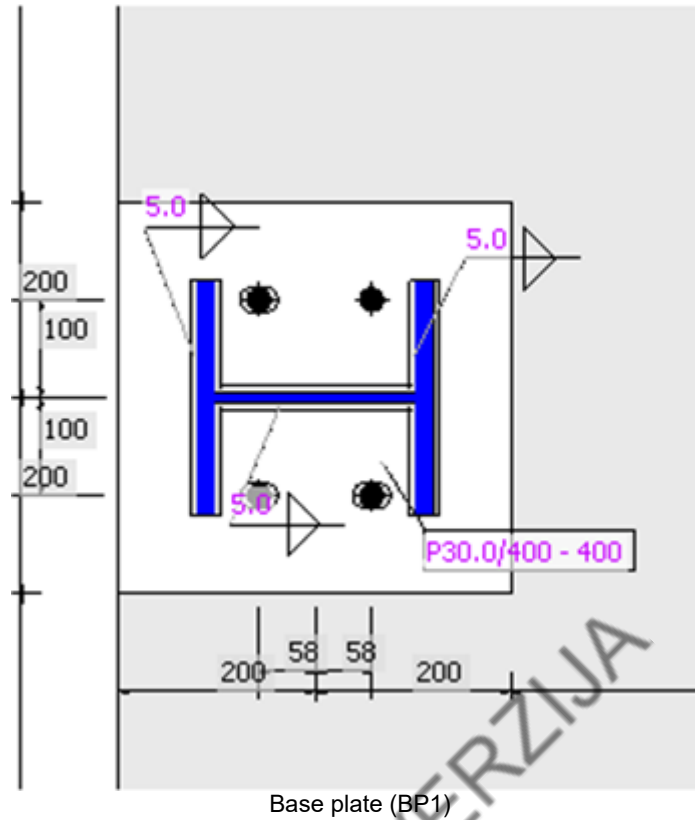
Name	Cross-section	$\beta$ – Direction [°]	$\gamma$ - Pitch [°]	$\alpha$ - Rotation [°]	Offset ex [mm]	Offset ey [mm]	Offset ez [mm]
AM3	1 - HEB240	0.0	-90.0	0.0	0	0	0

#### Supports and forces

Name	Support	Forces in	X [mm]
AM3 / begin		Position	0



Project: RDC - STREHA FRI  
Project no: 24/24  
Author: Detajl infrastruktura



### Cross-sections

Name	Material
1 - HEB240	S 355

### Cross-sections

Name	Material	Drawing
1 - HEB240	S 355	

### Anchors

Name	Diameter [mm]	$f_y$ [MPa]	$f_u$ [MPa]	Gross area [mm <sup>2</sup> ]
M24 8.8	24	640.0	800.0	452

## Load effects (forces in equilibrium)

Name	Member	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
LE1	AM3 / Begin	56.0	0.0	20.0	0.0	8.0	0.0
LE2	AM3 / Begin	150.0	0.0	5.0	0.0	35.0	0.0
LE3	AM3 / Begin	150.0	0.0	12.0	0.0	12.0	0.0

## Unbalanced forces

Name	X [kN]	Y [kN]	Z [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
LE1	20.0	0.0	-56.0	0.0	8.0	0.0
LE2	5.0	0.0	-150.0	0.0	35.0	0.0
LE3	12.0	0.0	-150.0	0.0	12.0	0.0

## Foundation block

Item	Value	Unit
<b>CB 1</b>		
Dimensions	1400 x 2400	mm
Depth	300	mm
Anchor	M24 8.8	
Anchoring length	150	mm
Shear force transfer	Anchors	

## Check

### Summary

Name	Value	Check status
Analysis	100.0%	OK
Plates	0.0 < 5.0%	OK
Anchors	28.1 < 100%	OK
Welds	84.4 < 100%	OK
Concrete block	17.5 < 100%	OK
Buckling	Not calculated	

## Plates

Name	t <sub>p</sub> [mm]	Loads	σ <sub>Ed</sub> [MPa]	ε <sub>pl</sub> [%]	σ <sub>c,Ed</sub> [MPa]	Status
AM3-bfl 1	17.0	LE2	60.2	0.0	0.0	OK
AM3-tfl 1	17.0	LE2	133.1	0.0	0.0	OK
AM3-w 1	10.0	LE2	78.8	0.0	0.0	OK
BP1	30.0	LE2	73.8	0.0	0.0	OK

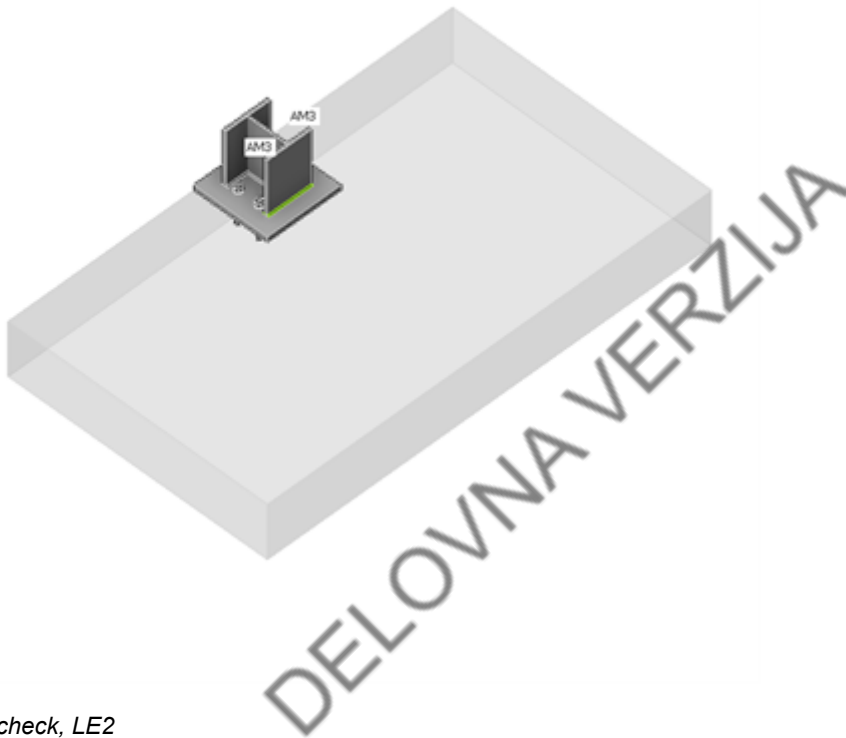
## Design data

Material	f <sub>y</sub> [MPa]	ε <sub>lim</sub> [%]
S 355	355.0	5.0

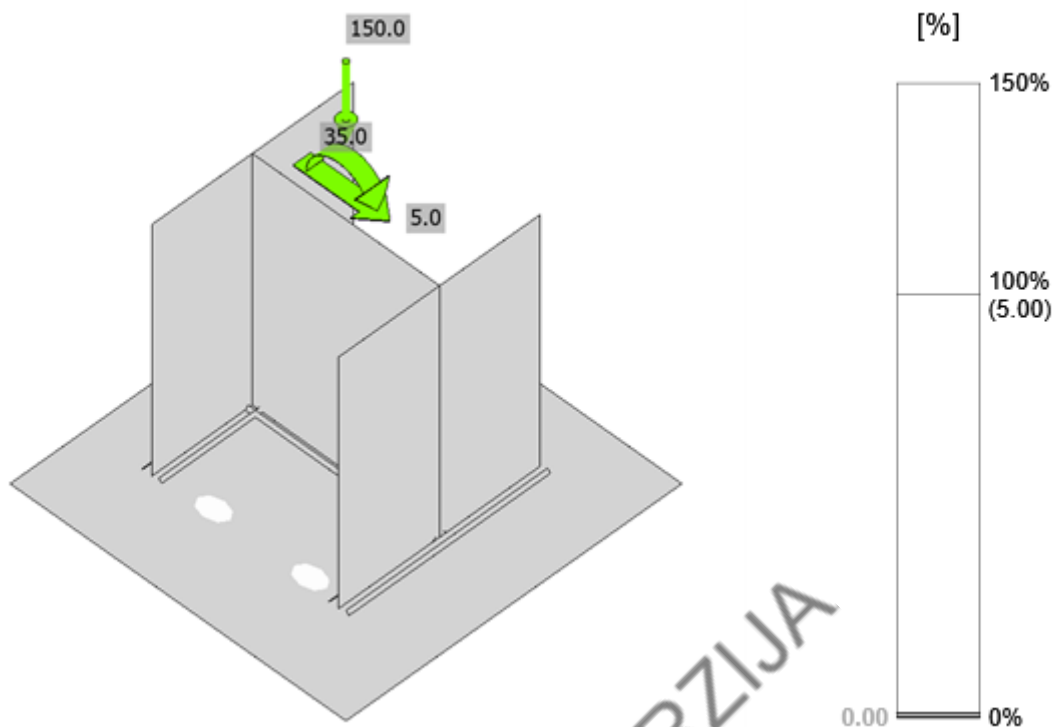
Project: RDC - STREHA FRI  
Project no: 24/24  
Author: Detajl infrastruktura

### Symbol explanation

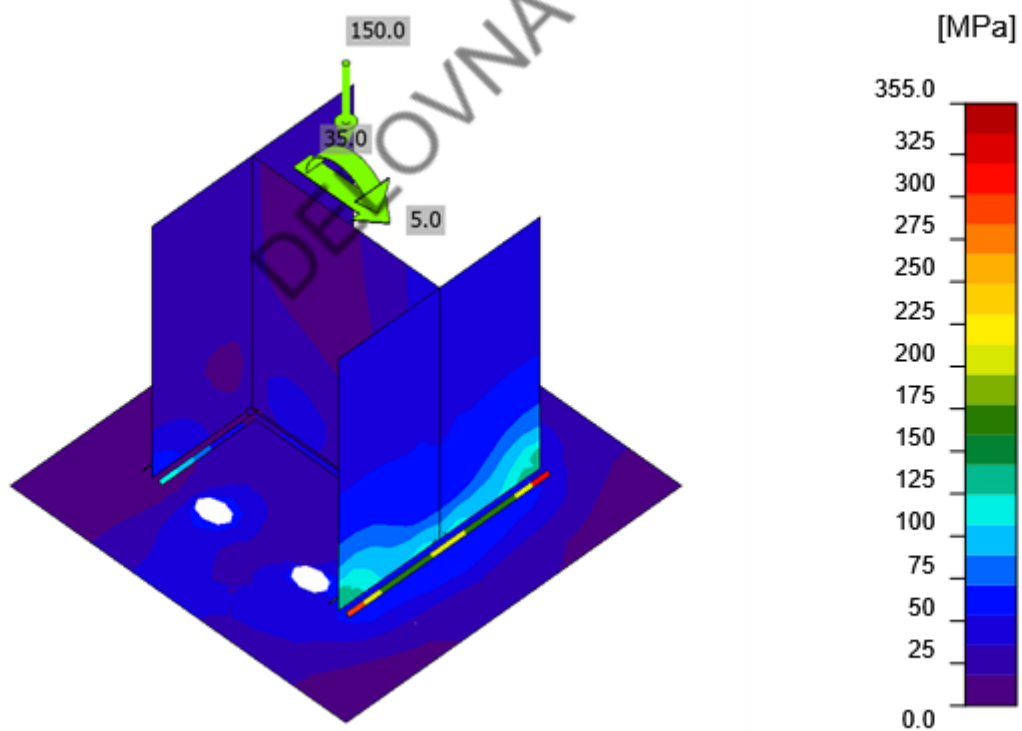
$t_p$	Plate thickness
$\sigma_{Ed}$	Equivalent stress
$\epsilon_{pl}$	Plastic strain
$\sigma_{c,Ed}$	Contact stress
$f_y$	Yield strength
$\epsilon_{lim}$	Limit of plastic strain



Overall check, LE2

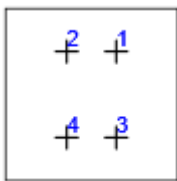


Strain check, LE2



Equivalent stress, LE2

Project: RDC - STREHA FRI  
Project no: 24/24  
Author: Detajl infrastruktura

Shape	Item	Loads	$N_{Ed}$ [kN]	$V_{Ed}$ [kN]	$V_{Rd,c}$ [kN]	$V_{Rd,cp}$ [kN]	$U_t$ [%]	$U_s$ [%]	$U_{ts}$ [%]	Detailing	Status
	A1	LE1	0.0	21.9	95.4	129.7	0.0	21.0	9.6	OK	OK
	A2	LE2	45.0	2.3	-	129.7	28.1	3.9	7.9	OK	OK
	A3	LE1	0.0	8.6	95.4	129.7	0.0	21.0	9.6	OK	OK
	A4	LE2	44.9	2.0	-	129.7	28.0	3.9	7.9	OK	OK

#### Design data

Grade	$N_{Rd,s}$ [kN]	$V_{Rd,s}$ [kN]
M24 8.8 - 1	160.0	113.0

#### Symbol explanation

$N_{Ed}$	Tension force
$V_{Ed}$	Resultant of bolt shear forces $V_y$ and $V_z$ in shear planes
$V_{Rd,c}$	Design resistance in case of concrete cone failure under shear load - EN 1992-4 – 7.2.2.5
$V_{Rd,cp}$	Design resistance in case of concrete pryout failure - EN 1992-4 – 7.2.2.4
$U_t$	Utilization in tension
$U_s$	Utilization in shear
$U_{ts}$	Utilization in tension and shear
$N_{Rd,s}$	Design tensile resistance of a fastener in case of steel failure - EN 1992-4 – 7.2.1.3
$V_{Rd,s}$	Design shear resistance of a fastener in case of steel failure - EN 1992-4 – 7.2.2.3.1

#### Welds

Item	Edge	$T_w$ [mm]	L [mm]	Loads	$\sigma_{w,Ed}$ [MPa]	$\epsilon_{pl}$ [%]	$\sigma_{\perp}$ [MPa]	$\tau_{\perp}$ [MPa]	$\tau_{\parallel}$ [MPa]	$U_t$ [%]	$U_c$ [%]	Detailing	Status
BP1	AM3-bfl 1	▲ 5.0 ▼	239	LE2	118.6	0.0	56.5	53.0	-28.6	32.9	30.9	OK	OK
		▲ 5.0 ▼	239	LE2	82.2	0.0	36.0	-39.6	15.9	22.8	21.7	OK	OK
BP1	AM3-tfl 1	▲ 5.0 ▼	239	LE2	304.0	0.0	-133.1	-125.7	95.3	84.4	73.4	OK	OK
		▲ 5.0 ▼	239	LE2	223.8	0.0	-89.3	96.6	-68.7	62.2	56.5	OK	OK
BP1	AM3-w 1	▲ 5.0 ▼	222	LE2	47.0	0.0	21.0	21.2	11.8	13.0	10.8	OK	OK
		▲ 5.0 ▼	222	LE2	46.6	0.0	21.2	-21.0	-11.5	12.9	11.0	OK	OK

#### Design data

Material	$f_u$ [MPa]	$\beta_w$ [-]	$\sigma_{w,Rd}$ [MPa]	$0.9 \sigma$ [MPa]
S 235	360.0	0.80	360.0	259.2

Project: RDC - STREHA FRI  
 Project no: 24/24  
 Author: Detajl infrastruktura

### Symbol explanation

$T_w$	Throat thickness a
L	Length
$\sigma_{w,Ed}$	Equivalent stress
$\epsilon_{Pl}$	Strain
$\sigma_{\perp}$	Perpendicular stress
$\tau_{\perp}$	Shear stress perpendicular to weld axis
$\tau_{  }$	Shear stress parallel to weld axis
Ut	Utilization
$U_{tC}$	Weld capacity estimation
▲	Fillet weld
$f_u$	Ultimate strength of weld
$\beta_w$	Correlation factor EN 1993-1-8 – Tab. 4.1
$\sigma_{w,Rd}$	Equivalent stress resistance
$0.9 \sigma$	Perpendicular stress resistance: $0.9 \cdot f_u / \gamma_{M2}$

Item	Loads	c [mm]	$A_{eff}$ [mm <sup>2</sup> ]	$\sigma$ [MPa]	$k_j$ [-]	$f_{jd}$ [MPa]	Ut [%]	Status
CB 1	LE2	64	53770	4.5	2.30	25.7	17.5	OK

### Symbol explanation

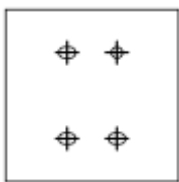
c	Bearing width
$A_{eff}$	Effective area
$\sigma$	Average stress in concrete
$k_j$	Concentration factor
$f_{jd}$	The ultimate bearing strength of the concrete block
Ut	Utilization

### Buckling

Buckling analysis was not calculated.

## Bill of material

### Manufacturing operations

Name	Plates [mm]	Shape	Nr.	Welds Throat thickness [mm]	Length [mm]	Bolts	Nr.
BP1	P30.0x400.0-400.0 (S 355)		1	Double fillet: 5.0	703.0	M24 8.8	4

### Welds

Type	Material	Throat thickness [mm]	Leg size [mm]	Length [mm]
Double fillet	S 235	5.0	7.1	703.0

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Name	Length [mm]	Drill length [mm]	Count
M24 8.8	180	150	4

**BP1**

Technical drawing of a square plate with a central H-shaped hole. The drawing includes four views: top, front, side, and bottom. Dimensions are given in millimeters.

- Top View:** Shows a square plate with a total width of 400 mm and a total height of 400 mm. The central hole has a width of 251 mm and a height of 287 mm. The distance from the left edge to the center of the hole is 136 mm, and the distance from the right edge to the center is 136 mm. The distance from the top edge to the center of the hole is 287 mm, and the distance from the bottom edge to the center is 287 mm. The thickness of the plate is 26 mm.
- Front View:** Shows the profile of the hole. The width of the hole is 251 mm, and the height is 287 mm. The distance from the left edge to the center of the hole is 136 mm, and the distance from the right edge to the center is 136 mm. The thickness of the plate is 26 mm.
- Side View:** Shows the profile of the hole. The width of the hole is 136 mm, and the height is 287 mm. The distance from the top edge to the center of the hole is 287 mm, and the distance from the bottom edge to the center is 287 mm. The thickness of the plate is 26 mm.
- Bottom View:** Shows the profile of the hole. The width of the hole is 251 mm, and the height is 287 mm. The distance from the left edge to the center of the hole is 136 mm, and the distance from the right edge to the center is 136 mm. The thickness of the plate is 26 mm.

A diagonal dimension of 26.0 is also shown, indicating the thickness of the plate.



Project: RDC - STREHA FRI  
 Project no: 24/24  
 Author: Detalj infrastruktura

## Code settings

Item	Value	Unit	Reference
Safety factor $\gamma_{M0}$	1.00	-	EN 1993-1-1: 6.1
Safety factor $\gamma_{M1}$	1.00	-	EN 1993-1-1: 6.1
Safety factor $\gamma_{M2}$	1.25	-	EN 1993-1-1: 6.1
Safety factor $\gamma_{M3}$	1.25	-	EN 1993-1-8: 2.2
Safety factor $\gamma_C$	1.50	-	EN 1992-1-1: 2.4.2.4
Safety factor $\gamma_{Inst}$	1.20	-	EN 1992-4: Table 4.1
Joint coefficient $\beta_j$	0.67	-	EN 1993-1-8: 6.2.5
Effective area - influence of mesh size	0.10	-	
Friction coefficient - concrete	0.25	-	EN 1993-1-8
Friction coefficient in slip-resistance	0.30	-	EN 1993-1-8 tab 3.7
Limit plastic strain	0.05	-	EN 1993-1-5
Detailing	Yes		
Distance between bolts [d]	2.20	-	EN 1993-1-8: tab 3.3
Distance between bolts and edge [d]	1.20	-	EN 1993-1-8: tab 3.3
Concrete breakout resistance check	Shear		EN 1992-4: 7.2.1.4 and 7.2.2.5
Use calculated $a_b$ in bearing check.	Yes		EN 1993-1-8: tab 3.4
Cracked concrete	Yes		EN 1992-4
Local deformation check	No		CIDECT DG 1, 3 - 1.1
Local deformation limit	0.03	-	CIDECT DG 1, 3 - 1.1
Geometrical nonlinearity (GMNA)	Yes		Analysis with large deformations for hollow section joints
Braced system	No		EN 1993-1-8: 5.2.2.5

**Project:** RDC - STREHA FRI  
**Project no:** 24/24  
**Author:** Detajl infrastruktura

## Project data

Project name	RDC - STREHA FRI
Project number	24/24
Author	Detajl infrastruktura
Description	
Date	4/22/2024
Code	EN

## Material

Steel	S 235, S 355
Concrete	C25/30

DELOVNA VERZIJA

Project item **DETAJL D2**

Design

Name	DETAJL D2
Description	
Analysis	Stress, strain/ loads in equilibrium

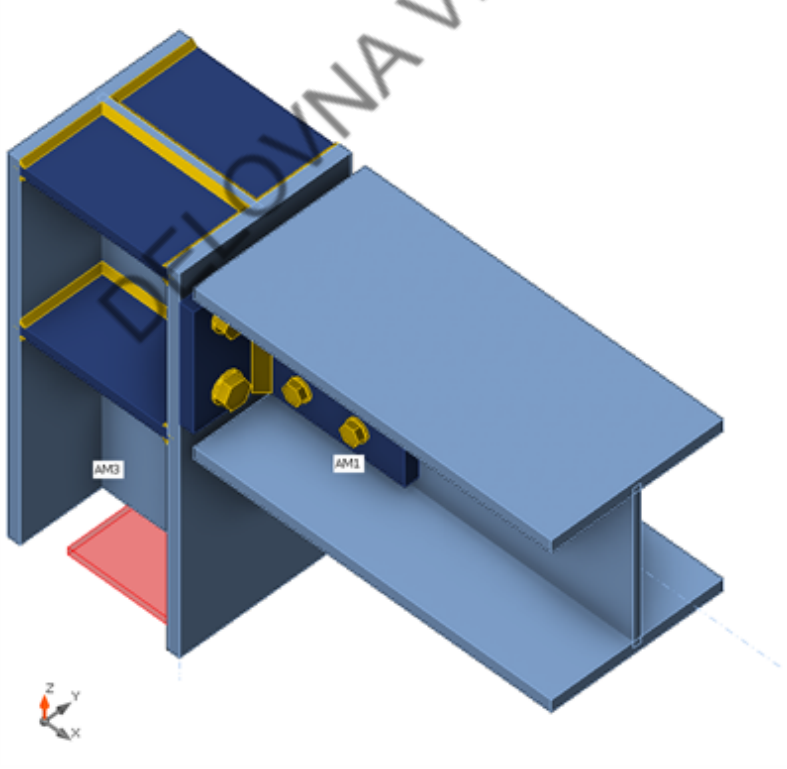
Members

Geometry

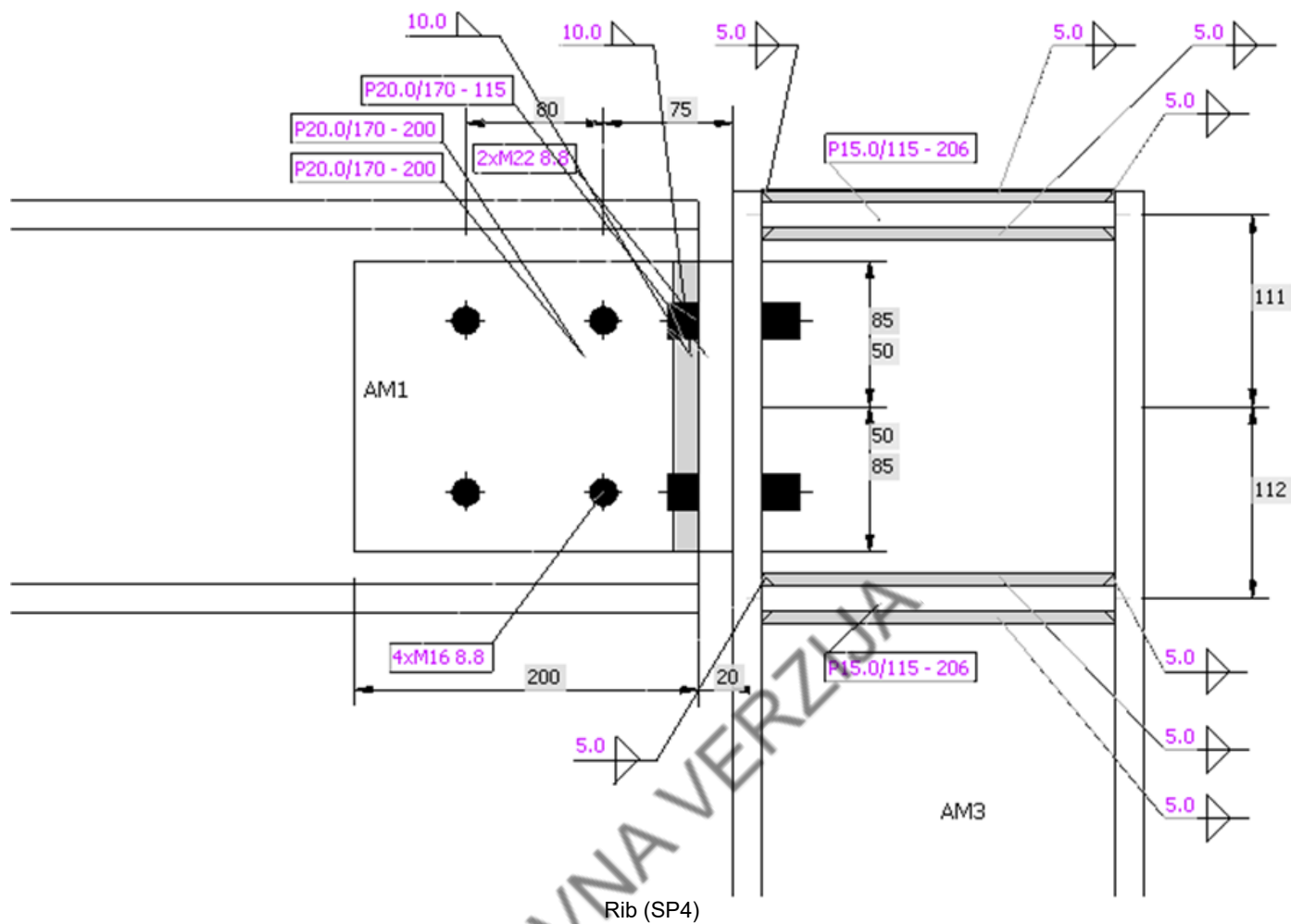
Name	Cross-section	$\beta$ – Direction [°]	$\gamma$ - Pitch [°]	$\alpha$ - Rotation [°]	Offset ex [mm]	Offset ey [mm]	Offset ez [mm]
AM1	1 - HEB240	0.0	0.0	0.0	0	0	0
AM3	1 - HEB240	0.0	-90.0	0.0	0	0	0

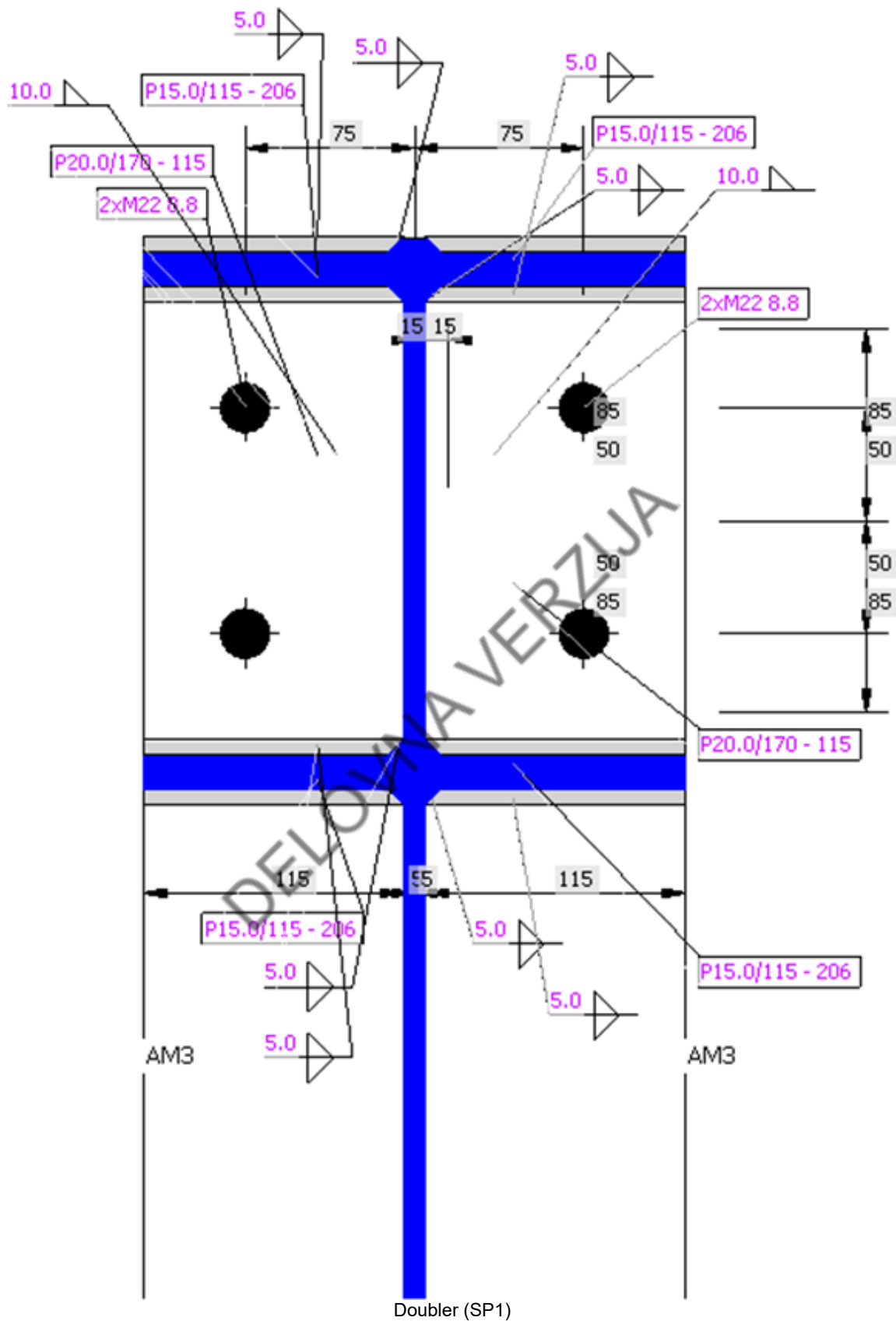
Supports and forces

Name	Support	Forces in	X [mm]
AM1 / end		Bolts	235
AM3 / end	N-Vy-Vz-Mx-My-Mz	Node	0



Project: RDC - STREHA FRI  
 Project no: 24/24  
 Author: Detajl infrastruktura

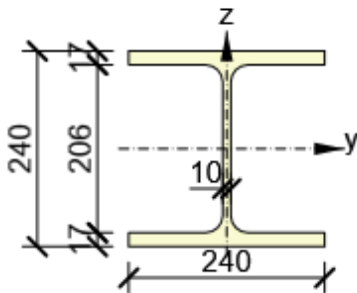




Cross-sections

Name	Material
1 - HEB240	S 355

## Cross-sections

Name	Material	Drawing
1 - HEB240	S 355	

## Bolts

Name	Diameter [mm]	$f_y$ [MPa]	$f_u$ [MPa]	Gross area [mm <sup>2</sup> ]
M16 8.8	16	640.0	800.0	201
M22 8.8	22	640.0	800.0	380

## Load effects (forces in equilibrium)

Name	Member	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
TDR Tower	AM1 / End	11.0	0.0	-143.0	0.0	1.0	0.0
	AM3 / End	-143.0	0.0	-11.0	0.0	-33.0	0.0
GMNIA	AM1 / End	150.0	0.0	-150.0	0.0	0.0	0.0
	AM3 / End	-150.0	0.0	-150.0	0.0	-35.0	0.0

## Unbalanced forces

Name	X [kN]	Y [kN]	Z [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
TDR Tower	0.0	0.0	0.0	0.0	1.6	0.0
GMNIA	0.0	0.0	0.0	0.0	0.2	0.0

## Check

## Summary

Name	Value	Check status
Analysis	100.0%	OK
Plates	2.7 < 5.0%	OK
Bolts	96.6 < 100%	OK
Welds	98.3 < 100%	OK
Buckling	Not calculated	

## Plates

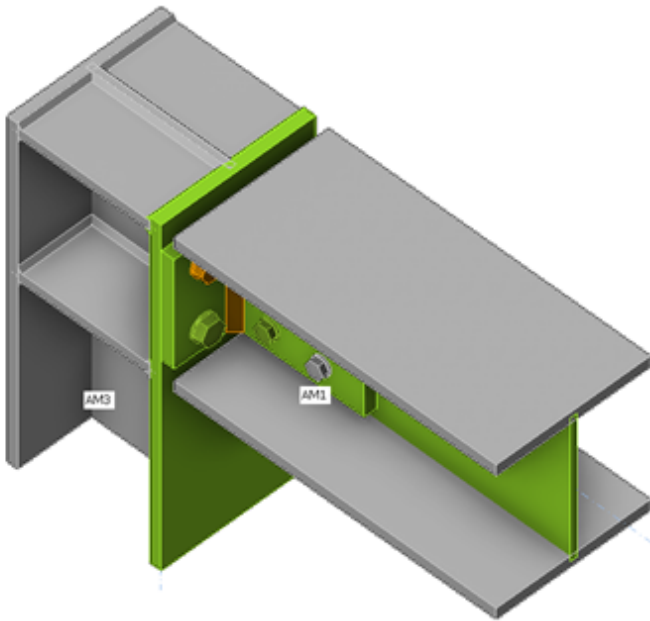
Name	$t_p$ [mm]	Loads	$\sigma_{Ed}$ [MPa]	$\epsilon_{pl}$ [%]	$\sigma_{c,Ed}$ [MPa]	Status
AM1-bfl 1	17.0	GMNIA	84.0	0.0	0.0	OK
AM1-tfl 1	17.0	TDR Tower	64.9	0.0	0.0	OK
AM1-w 1	10.0	GMNIA	300.3	0.0	12.5	OK
AM3-bfl 1	17.0	GMNIA	93.4	0.0	0.0	OK
AM3-tfl 1	17.0	GMNIA	355.4	0.2	74.3	OK
AM3-w 1	10.0	GMNIA	201.0	0.0	0.0	OK
STIFF1a	15.0	GMNIA	86.4	0.0	0.0	OK
STIFF1b	15.0	GMNIA	86.4	0.0	0.0	OK
STIFF1c	15.0	GMNIA	201.3	0.0	0.0	OK
STIFF1d	15.0	GMNIA	201.2	0.0	0.0	OK
SP1	20.0	GMNIA	360.7	2.7	213.6	OK
SP2	20.0	GMNIA	360.7	2.7	220.9	OK
SP3	20.0	GMNIA	318.2	0.0	32.3	OK
SP4	20.0	GMNIA	318.4	0.0	32.3	OK

## Design data

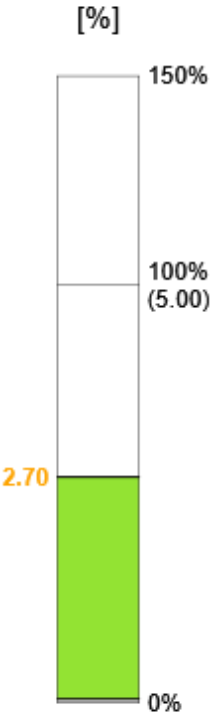
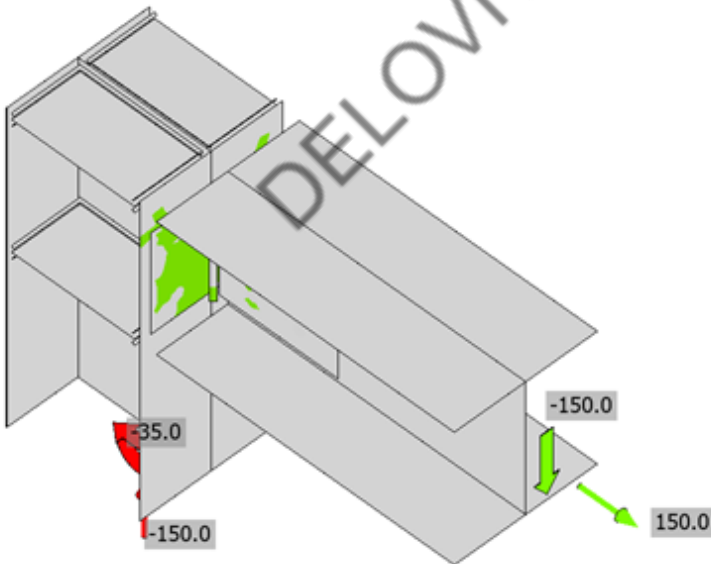
Material	$f_y$ [MPa]	$\epsilon_{lim}$ [%]
S 355	355.0	5.0

## Symbol explanation

$t_p$	Plate thickness
$\sigma_{Ed}$	Equivalent stress
$\epsilon_{pl}$	Plastic strain
$\sigma_{c,Ed}$	Contact stress
$f_y$	Yield strength
$\epsilon_{lim}$	Limit of plastic strain

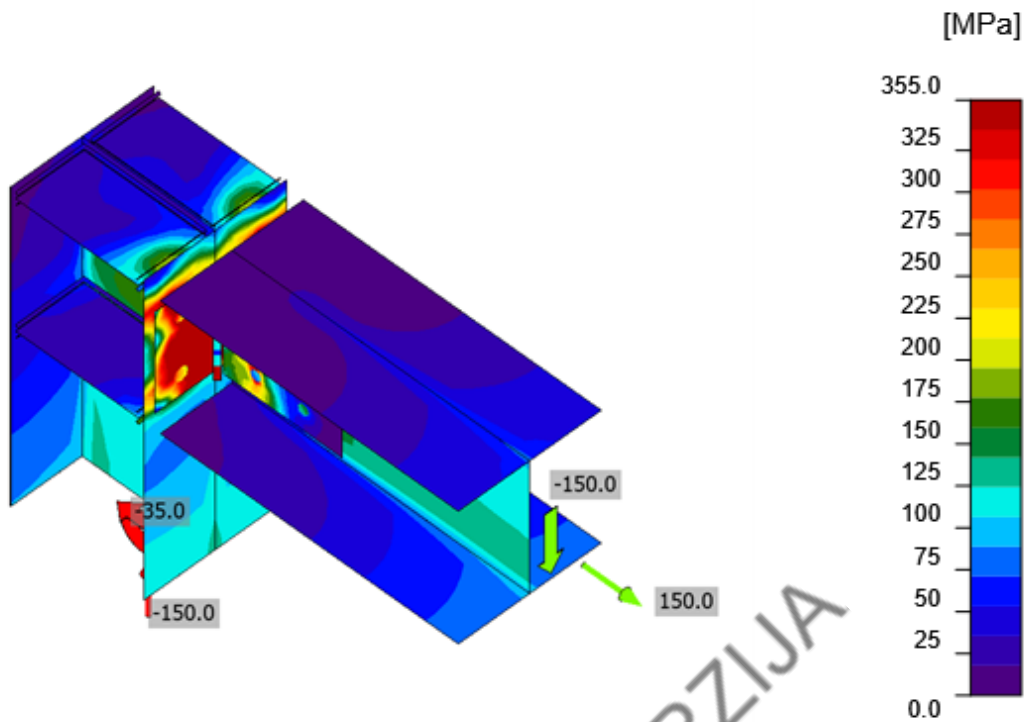


Overall check, GMNIA



Strain check, GMNIA





Equivalent stress, GMNIA

**Bolts**

Shape	Item	Grade	Loads	$F_{t,Ed}$ [kN]	$F_{v,Ed}$ [kN]	$F_{b,Rd}$ [kN]	$U_{t_t}$ [%]	$U_{t_s}$ [%]	$U_{t_{ts}}$ [%]	Status
	B1	M16 8.8 - 1	GMNIA	47.3	27.0	156.8	52.3	44.9	82.2	OK
	B2	M16 8.8 - 1	GMNIA	15.1	25.8	156.8	16.7	42.8	54.7	OK
	B3	M16 8.8 - 1	GMNIA	0.0	26.7	156.8	0.0	44.3	44.3	OK
	B4	M16 8.8 - 1	GMNIA	0.6	26.6	156.8	0.7	44.1	44.6	OK
	B5	M22 8.8 - 2	GMNIA	138.2	46.6	231.6	79.2	40.0	96.6	OK
	B6	M22 8.8 - 2	GMNIA	107.4	52.4	366.5	61.5	45.1	89.0	OK
	B7	M22 8.8 - 2	GMNIA	138.3	46.6	231.6	79.2	40.0	96.6	OK
	B8	M22 8.8 - 2	GMNIA	107.4	52.5	366.5	61.5	45.1	89.0	OK

**Design data**

Grade	$F_{t,Rd}$ [kN]	$B_{p,Rd}$ [kN]	$F_{v,Rd}$ [kN]
M16 8.8 - 1	90.4	375.0	60.3
M22 8.8 - 2	174.5	450.4	116.4

Project: RDC - STREHA FRI  
Project no: 24/24  
Author: Detalj infrastruktura

## Symbol explanation

$F_{t,Ed}$	Tension force
$F_{v,Ed}$	Resultant of bolt shear forces $V_y$ and $V_z$ in shear planes
$F_{b,Rd}$	Plate bearing resistance EN 1993-1-8 – Tab. 3.4
$U_t$	Utilization in tension
$U_s$	Utilization in shear
$U_{ts}$	Interaction of tension and shear EN 1993-1-8 – Tab. 3.4
$F_{t,Rd}$	Bolt tension resistance EN 1993-1-8 – Tab. 3.4
$B_{p,Rd}$	Punching shear resistance EN 1993-1-8 – Tab. 3.4
$F_{v,Rd}$	Bolt shear resistance EN 1993-1-8 – Tab. 3.4

## Welds

Item	Edge	$T_w$ [mm]	L [mm]	Loads	$\sigma_{w,Ed}$ [MPa]	$\epsilon_{pl}$ [%]	$\sigma_{\perp}$ [MPa]	$\tau_{\perp}$ [MPa]	$\tau_{\parallel}$ [MPa]	Ut [%]	Ut <sub>c</sub> [%]	Status
AM3-bfl 1	STIFF1a	▲ 5.0 ▼	115	GMNIA	51.0	0.0	41.8	-9.6	-13.8	16.1	12.4	OK
		▲ 5.0 ▼	115	GMNIA	52.7	0.0	-51.9	0.5	-5.2	20.0	12.6	OK
AM3-w 1	STIFF1a	▲ 5.0 ▼	206	GMNIA	42.3	0.0	35.9	-4.0	12.3	13.9	13.1	OK
		▲ 5.0 ▼	206	GMNIA	72.3	0.0	-12.2	-27.7	-30.3	20.1	18.2	OK
AM3-tfl 1	STIFF1a	▲ 5.0 ▼	115	GMNIA	171.0	0.0	-41.5	-95.6	-6.2	47.5	37.1	OK
		▲ 5.0 ▼	115	GMNIA	192.8	0.0	-115.5	61.5	64.5	53.6	40.7	OK
AM3-bfl 1	STIFF1b	▲ 5.0 ▼	115	GMNIA	52.7	0.0	-51.9	-0.5	5.2	20.0	12.6	OK
		▲ 5.0 ▼	115	GMNIA	50.9	0.0	41.8	9.6	13.8	16.1	12.4	OK
AM3-w 1	STIFF1b	▲ 5.0 ▼	206	GMNIA	72.4	0.0	-12.4	28.0	30.2	20.1	18.2	OK
		▲ 5.0 ▼	206	GMNIA	42.3	0.0	36.0	4.4	-12.1	13.9	13.1	OK
AM3-tfl 1	STIFF1b	▲ 5.0 ▼	115	GMNIA	191.4	0.0	-114.7	-60.9	-64.2	53.2	40.5	OK
		▲ 5.0 ▼	115	GMNIA	169.4	0.0	-40.8	94.7	6.1	47.0	37.0	OK
AM3-bfl 1	STIFF1c	▲ 5.0 ▼	115	GMNIA	32.1	0.0	25.4	8.8	7.2	9.8	9.0	OK
		▲ 5.0 ▼	115	GMNIA	44.5	0.0	-8.2	-8.3	-23.8	12.4	11.0	OK
AM3-w 1	STIFF1c	▲ 5.0 ▼	205	GMNIA	42.8	0.0	-35.4	-12.4	-6.3	13.7	11.4	OK
		▲ 5.0 ▼	205	GMNIA	54.2	0.0	34.0	-11.0	21.8	15.1	13.8	OK
AM3-tfl 1	STIFF1c	▲ 5.0 ▼	114	GMNIA	247.5	0.0	119.1	62.8	108.3	68.7	39.1	OK
		▲ 5.0 ▼	114	GMNIA	132.0	0.0	-33.9	35.1	64.8	36.7	26.5	OK
AM3-bfl 1	STIFF1d	▲ 5.0 ▼	115	GMNIA	44.6	0.0	-8.1	8.4	23.9	12.4	11.0	OK
		▲ 5.0 ▼	115	GMNIA	32.2	0.0	25.4	-8.9	-7.3	9.8	9.0	OK
AM3-w 1	STIFF1d	▲ 5.0 ▼	205	GMNIA	54.5	0.0	34.1	11.0	-21.9	15.1	13.7	OK
		▲ 5.0 ▼	205	GMNIA	42.7	0.0	-35.4	12.3	6.4	13.6	11.4	OK
AM3-tfl 1	STIFF1d	▲ 5.0 ▼	114	GMNIA	129.1	0.0	-33.2	-33.0	-64.0	35.9	26.7	OK
		▲ 5.0 ▼	114	GMNIA	247.3	0.0	116.7	-61.4	-109.9	68.7	38.9	OK
SP1	SP3	▲ 10.0	168	GMNIA	353.8	0.7	-29.6	-188.1	77.9	98.3	98.2	OK
SP2	SP4	▲ 10.0	168	GMNIA	353.8	0.7	-30.2	188.0	-78.0	98.3	98.3	OK

Project: RDC - STREHA FRI  
 Project no: 24/24  
 Author: Detajl infrastruktura

#### Design data

Material	$f_u$ [MPa]	$\beta_w$ [-]	$\sigma_{w,Rd}$ [MPa]	$0.9 \sigma$ [MPa]
S 235	360.0	0.80	360.0	259.2

#### Symbol explanation





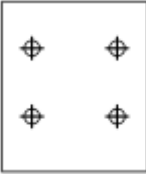
$T_w$	Throat thickness a
L	Length
$\sigma_{w,Ed}$	Equivalent stress
$\epsilon_{Pl}$	Strain
$\sigma_{\perp}$	Perpendicular stress
$\tau_{\perp}$	Shear stress perpendicular to weld axis
$\tau_{  }$	Shear stress parallel to weld axis
Ut	Utilization
$U_{tC}$	Weld capacity estimation
▲	Fillet weld
$f_u$	Ultimate strength of weld
$\beta_w$	Correlation factor EN 1993-1-8 – Tab. 4.1
$\sigma_{w,Rd}$	Equivalent stress resistance
$0.9 \sigma$	Perpendicular stress resistance: $0.9 \cdot f_u / \gamma_{M2}$

#### Buckling

Buckling analysis was not calculated.

## Bill of material

### Manufacturing operations

Name	Plates [mm]	Shape	Nr.	Welds Throat thickness [mm]	Length [mm]	Bolts	Nr.
CUT1							
CUT2							
STIFF1	P15.0x115.0-206.0 (S 355)		4	Double fillet: 5.0	1744.0		
SP1	P20.0x170.0-115.0 (S 355)		1			M22 8.8	2
SP2	P20.0x170.0-115.0 (S 355)		1			M22 8.8	2
SP3	P20.0x170.0-200.0 (S 355)		1	Fillet: 10.0	170.0	M16 8.8	4
SP4	P20.0x170.0-200.0 (S 355)		1	Fillet: 10.0	170.0	M16 8.8	4

### Welds

Type	Material	Throat thickness [mm]	Leg size [mm]	Length [mm]
Double fillet	S 235	5.0	7.1	1744.0
Fillet	S 235	10.0	14.1	170.0
Fillet	S 235	10.0	14.1	170.0

### Bolts

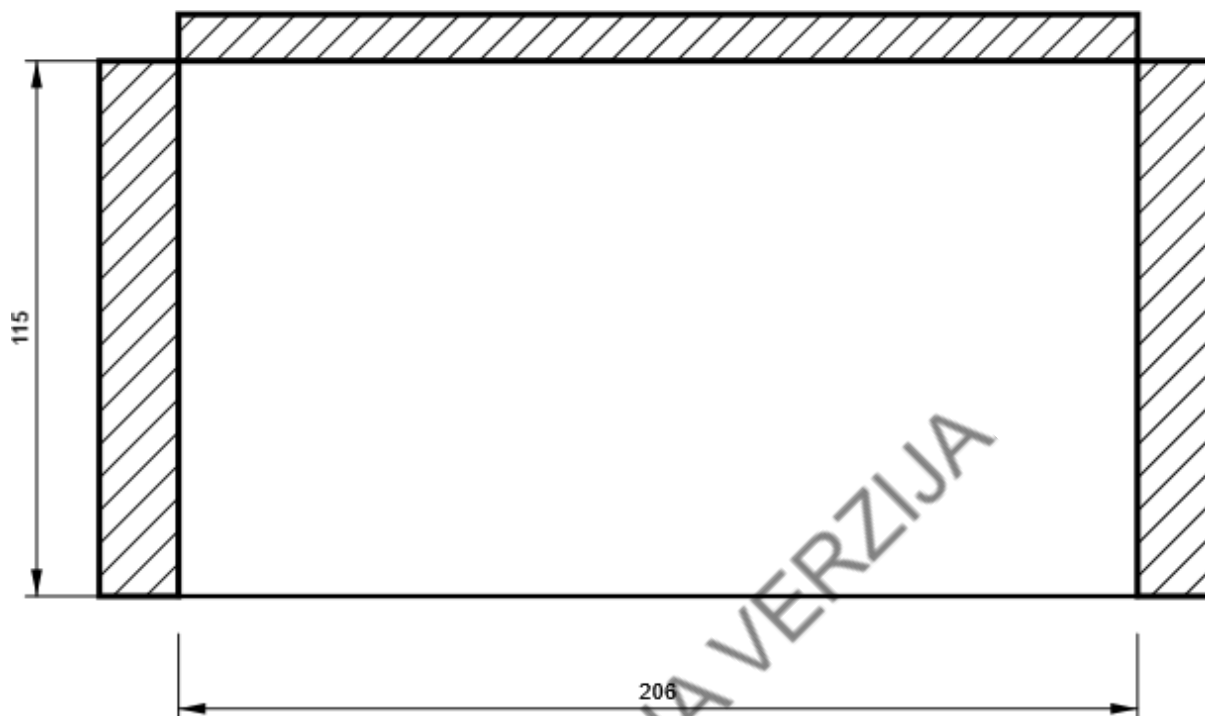
Name	Grip length [mm]	Count
M16 8.8	50	4
M22 8.8	37	4

Project: RDC - STREHA FRI  
Project no: 24/24  
Author: Detaji infrastruktura

## Drawing

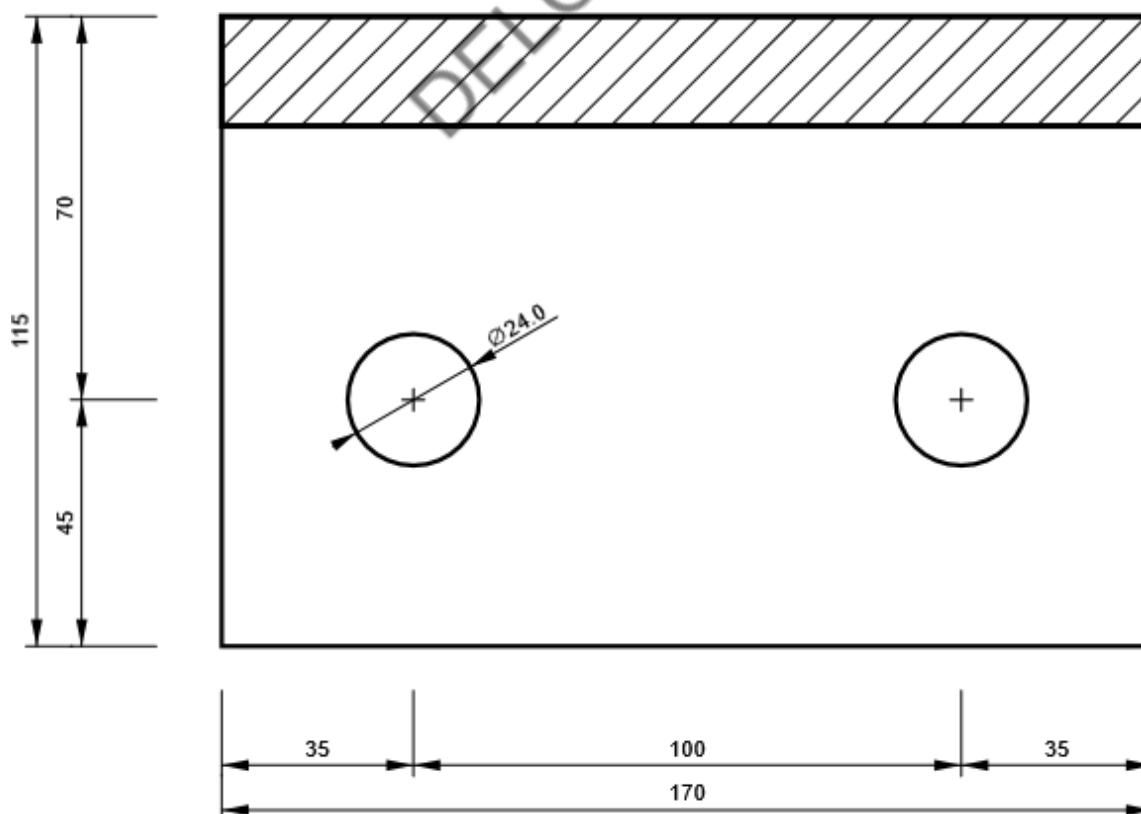
### STIFF1

P15.0x206-115 (S 355)



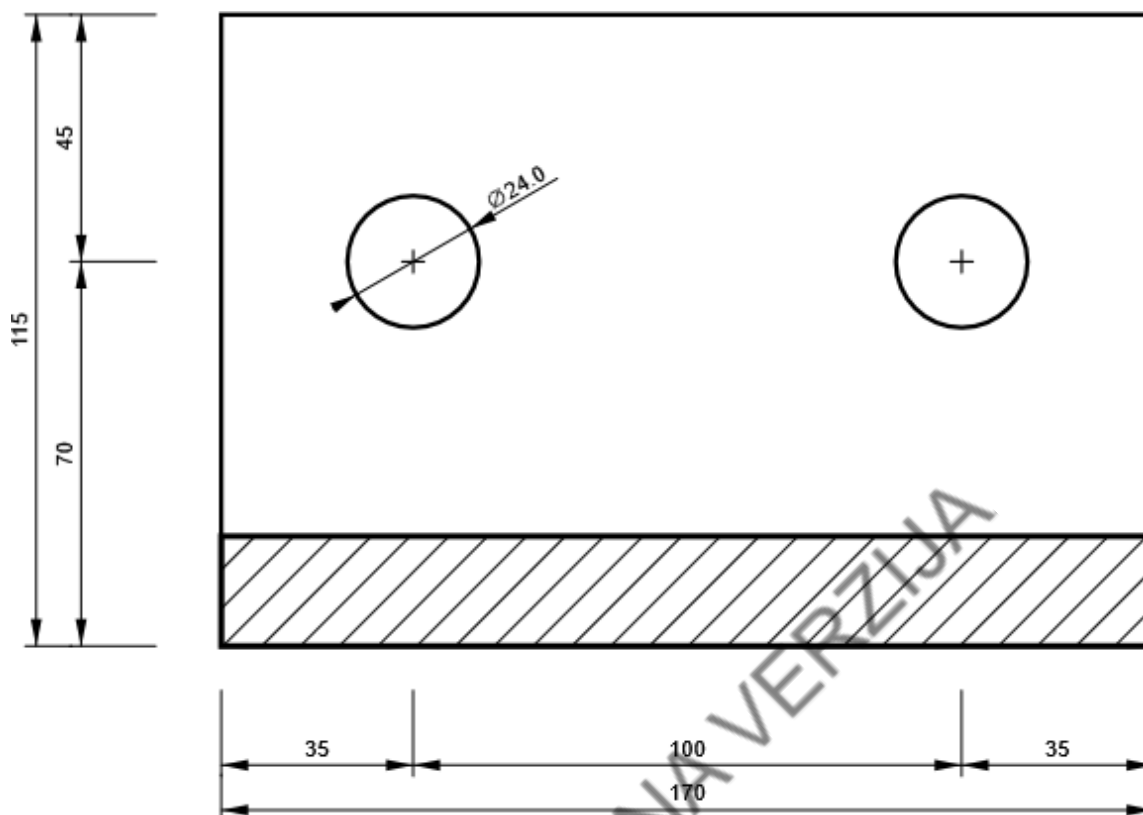
### SP1

P20.0x115-170 (S 355)



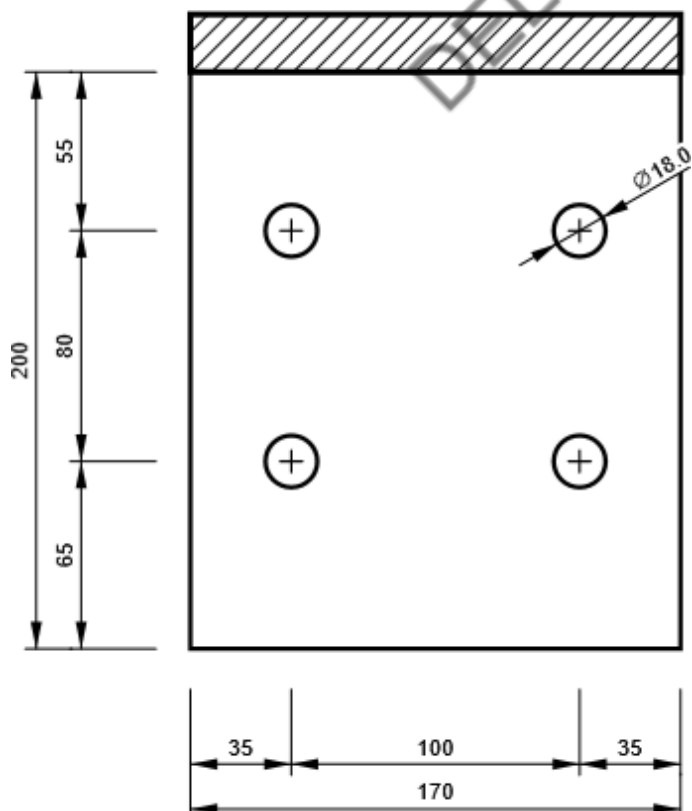
## SP2

P20.0x115-170 (S 355)



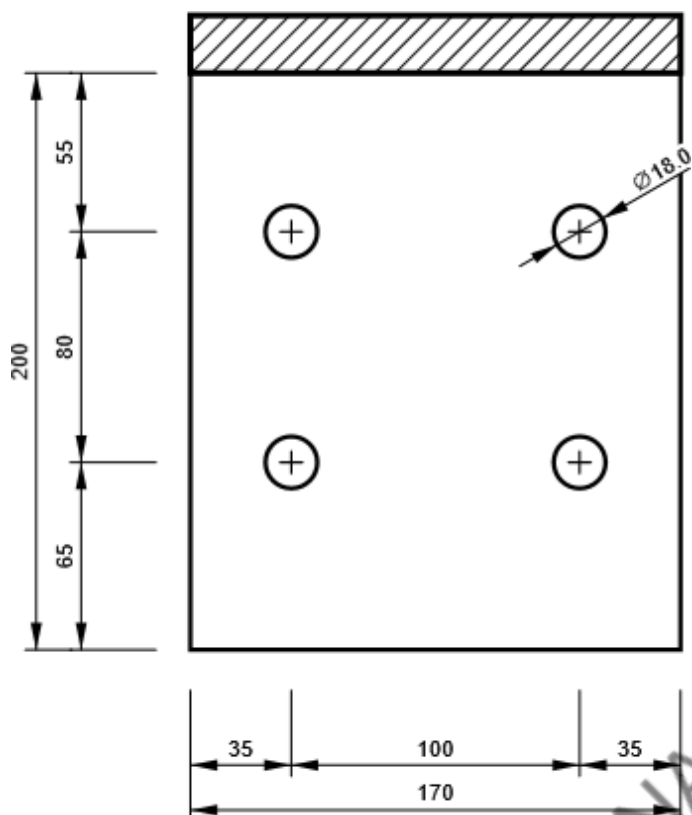
## SP3

P20.0x200-170 (S 355)



## SP4

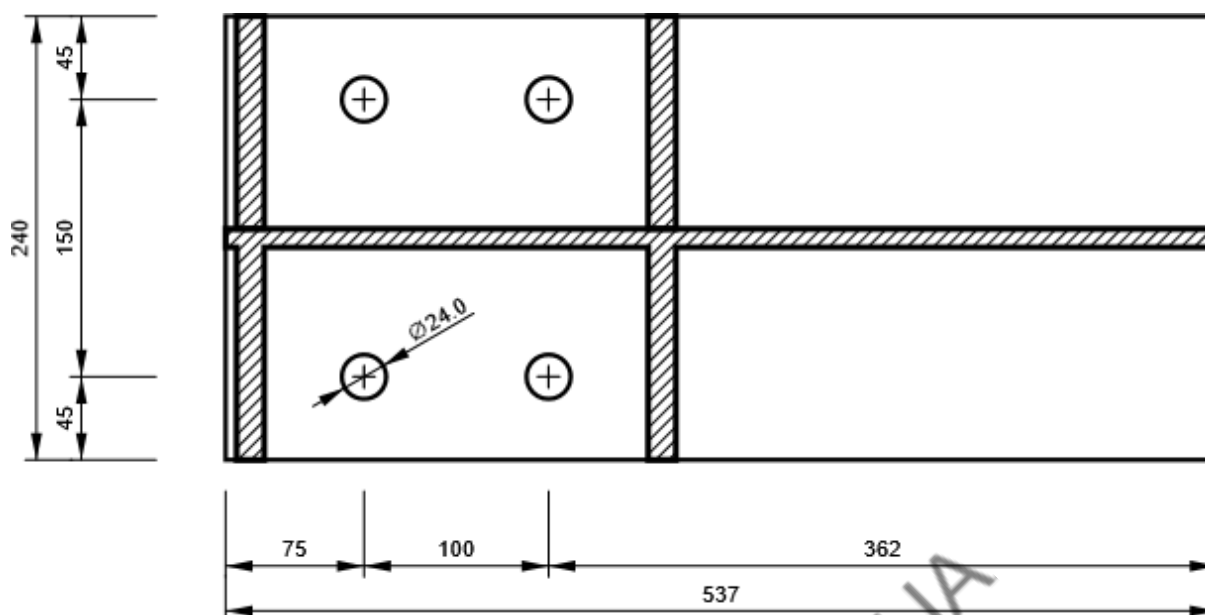
P20.0x200-170 (S 355)



AM1, HEB240 - Web 1:



### AM3, HEB240 - Top flange 1:



### Code settings

Item	Value	Unit	Reference
Safety factor $\gamma_{M0}$	1.00	-	EN 1993-1-1: 6.1
Safety factor $\gamma_{M1}$	1.00	-	EN 1993-1-1: 6.1
Safety factor $\gamma_{M2}$	1.25	-	EN 1993-1-1: 6.1
Safety factor $\gamma_{M3}$	1.25	-	EN 1993-1-8: 2.2
Safety factor $\gamma_C$	1.50	-	EN 1992-1-1: 2.4.2.4
Safety factor $\gamma_{Inst}$	1.20	-	EN 1992-4: Table 4.1
Joint coefficient $\beta_j$	0.67	-	EN 1993-1-8: 6.2.5
Effective area - influence of mesh size	0.10	-	
Friction coefficient - concrete	0.25	-	EN 1993-1-8
Friction coefficient in slip-resistance	0.30	-	EN 1993-1-8 tab 3.7
Limit plastic strain	0.05	-	EN 1993-1-5
Detailing	No		
Distance between bolts [d]	2.20	-	EN 1993-1-8: tab 3.3
Distance between bolts and edge [d]	1.20	-	EN 1993-1-8: tab 3.3
Concrete breakout resistance check	Both		EN 1992-4: 7.2.1.4 and 7.2.2.5
Use calculated $\alpha_b$ in bearing check.	Yes		EN 1993-1-8: tab 3.4
Cracked concrete	Yes		EN 1992-4
Local deformation check	No		CIDECT DG 1, 3 - 1.1
Local deformation limit	0.03	-	CIDECT DG 1, 3 - 1.1
Geometrical nonlinearity (GMNA)	Yes		Analysis with large deformations for hollow section joints
Braced system	No		EN 1993-1-8: 5.2.2.5



**Project:** RDC - STREHA FRI  
**Project no:** 24/24  
**Author:** Detajl infrastruktura

## Project data

Project name	RDC - STREHA FRI
Project number	24/24
Author	Detajl infrastruktura
Description	
Date	5/10/2024
Code	EN

## Material

Steel	S 235, S 355
Concrete	C25/30

DELOVNA VERZIJA

## Project item DETAJL D3

### Design

Name	DETAJL D3
Description	
Analysis	Stress, strain/ loads in equilibrium

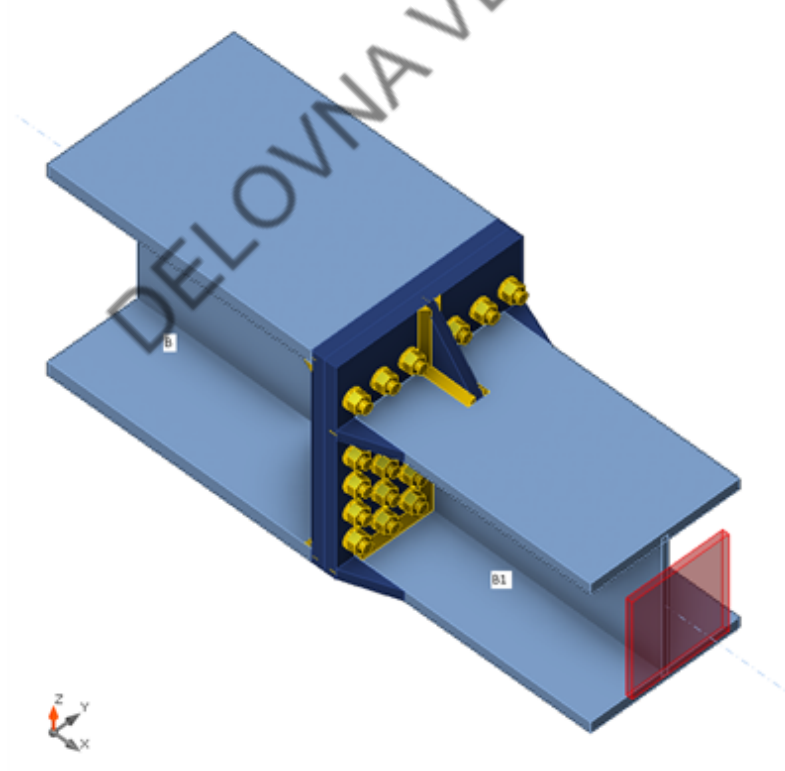
### Members

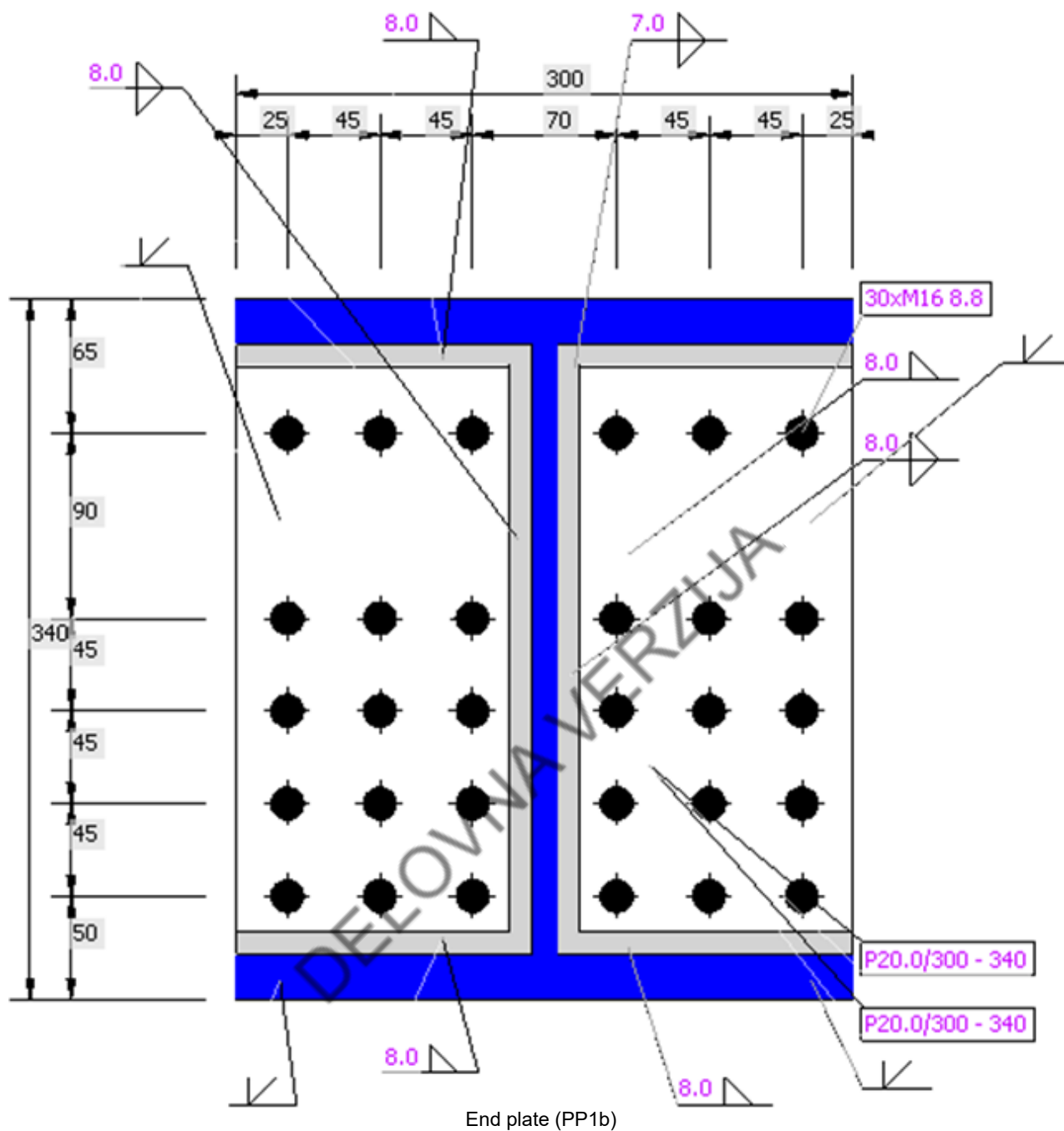
#### Geometry

Name	Cross-section	$\beta$ - Direction [°]	$\gamma$ - Pitch [°]	$\alpha$ - Rotation [°]	Offset ex [mm]	Offset ey [mm]	Offset ez [mm]
B	1 - CON1(HEB340)	180.0	0.0	0.0	0	0	20
B1	2 - CON1(HEB240)	0.0	0.0	0.0	0	0	-30

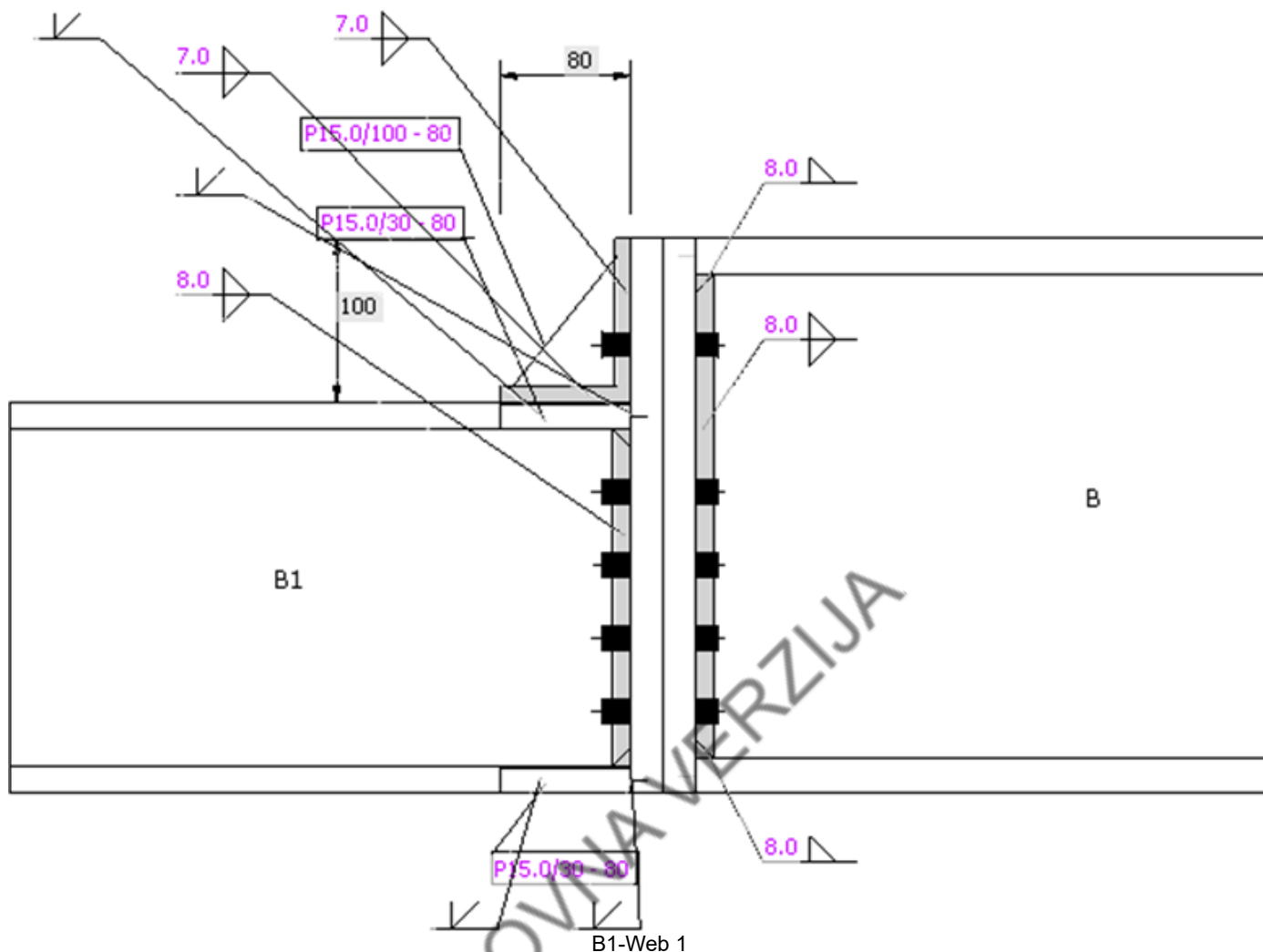
#### Supports and forces

Name	Support	Forces in	X [mm]
B / end		Node	0
B1 / end	N-Vy-Vz-Mx-My-Mz	Bolts	0





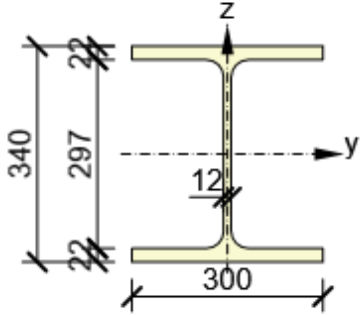
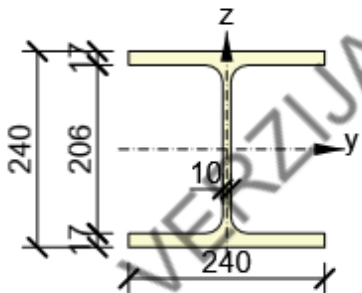
Project: RDC - STREHA FRI  
 Project no: 24/24  
 Author: Detajl infrastruktura



## Cross-sections

Name	Material
1 - CON1(HEB340)	S 355
2 - CON1(HEB240)	S 355

## Cross-sections

Name	Material	Drawing
1 - CON1(HEB340)	S 355	
2 - CON1(HEB240)	S 355	

## Bolts

Name	Diameter [mm]	$f_y$ [MPa]	$f_u$ [MPa]	Gross area [mm <sup>2</sup> ]
M16 8.8	16	640.0	800.0	201

## Load effects (forces in equilibrium)

Name	Member	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
TDR Tower	B / End	0.0	0.0	-148.0	0.0	-118.0	0.0
	B1 / End	0.0	0.0	148.0	0.0	-118.0	0.0
GMNIA	B / End	0.0	0.0	-150.0	0.0	-92.0	0.0
	B1 / End	0.0	0.0	150.0	0.0	-92.0	0.0

## Unbalanced forces

Name	X [kN]	Y [kN]	Z [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
TDR Tower	0.0	0.0	0.0	0.0	0.0	0.0
GMNIA	0.0	0.0	0.0	0.0	0.0	0.0

## Check

### Summary

Name	Value	Check status
Analysis	100.0%	OK
Plates	$1.2 < 5.0\%$	OK
Bolts	$89.5 < 100\%$	OK
Welds	$99.4 < 100\%$	OK
Buckling	Not calculated	

### Plates

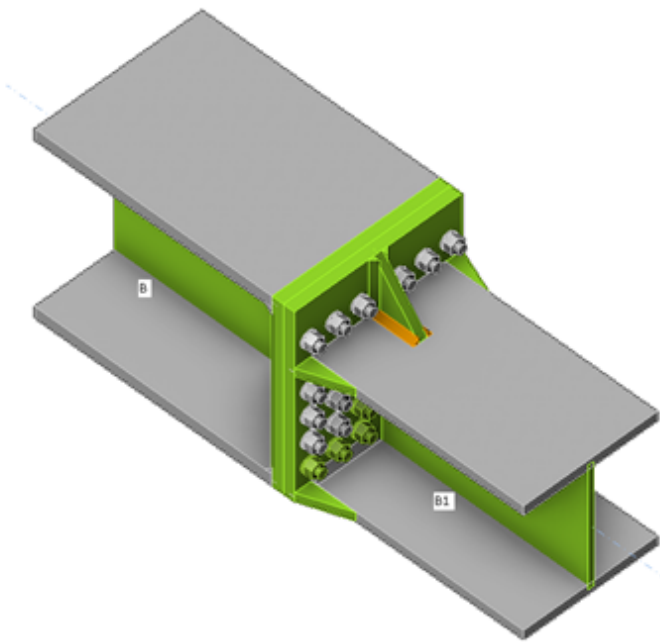
Name	$t_p$ [mm]	Loads	$\sigma_{Ed}$ [MPa]	$\epsilon_{pl}$ [%]	$\sigma_{c,Ed}$ [MPa]	Status
B-bfl 1	21.5	TDR Tower	92.8	0.0	0.0	OK
B-tfl 1	21.5	TDR Tower	89.7	0.0	0.0	OK
B-w 1	12.0	TDR Tower	317.5	0.0	0.0	OK
B1-bfl 1	17.0	TDR Tower	214.1	0.0	0.0	OK
B1-tfl 1	17.0	TDR Tower	318.0	0.0	0.0	OK
B1-w 1	10.0	TDR Tower	353.7	0.0	0.0	OK
PP1a	20.0	TDR Tower	355.9	0.4	85.4	OK
PP1b	20.0	TDR Tower	355.5	0.3	85.4	OK
WID1	15.0	TDR Tower	357.5	1.2	0.0	OK
WID2a	15.0	TDR Tower	356.1	0.5	0.0	OK
WID2b	15.0	TDR Tower	356.1	0.5	0.0	OK
WID2c	15.0	TDR Tower	355.2	0.1	0.0	OK
WID2d	15.0	TDR Tower	355.2	0.1	0.0	OK

### Design data

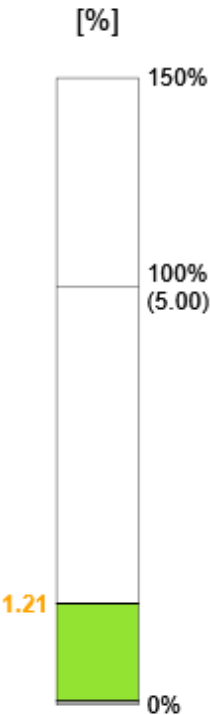
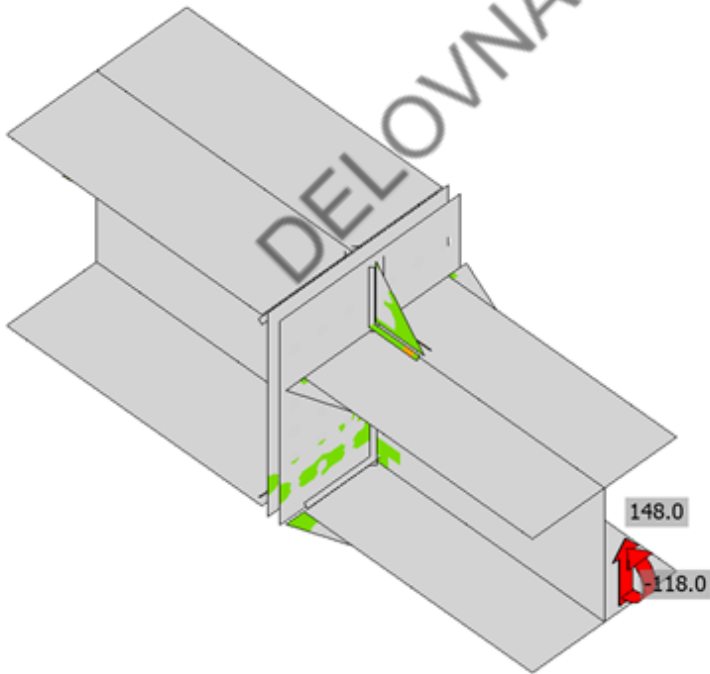
Material	$f_y$ [MPa]	$\epsilon_{lim}$ [%]
S 355	355.0	5.0

### Symbol explanation

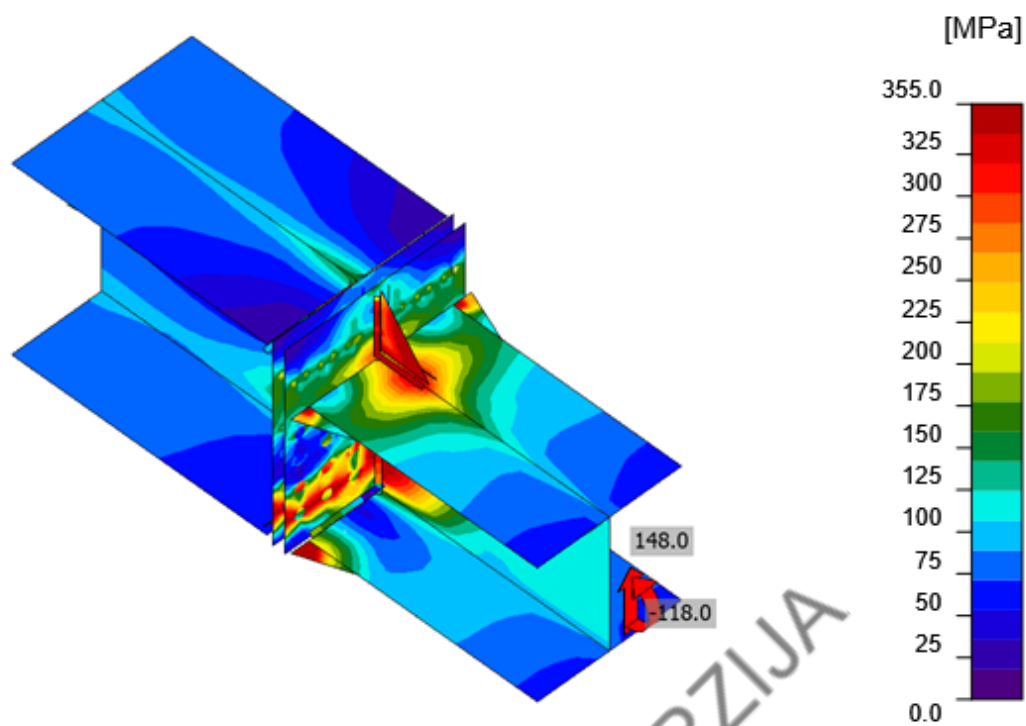
$t_p$	Plate thickness
$\sigma_{Ed}$	Equivalent stress
$\epsilon_{pl}$	Plastic strain
$\sigma_{c,Ed}$	Contact stress
$f_y$	Yield strength
$\epsilon_{lim}$	Limit of plastic strain



Overall check, TDR Tower



Strain check, TDR Tower



Equivalent stress, TDR Tower



## Bolts

Shape	Item	Grade	Loads	$F_{t,Ed}$ [kN]	$F_{v,Ed}$ [kN]	$F_{b,Rd}$ [kN]	$U_{t_t}$ [%]	$U_{t_s}$ [%]	$U_{t_{ts}}$ [%]	Detailing	Status
	B1	M16 8.8 - 1	TDR Tower	0.0	12.6	225.8	0.0	20.9	20.9	OK	OK
	B2	M16 8.8 - 1	TDR Tower	0.0	13.2	225.8	0.0	21.9	21.9	OK	OK
	B3	M16 8.8 - 1	TDR Tower	0.0	14.2	225.8	0.0	23.5	23.5	OK	OK
	B4	M16 8.8 - 1	TDR Tower	0.0	12.6	225.8	0.0	20.9	20.9	OK	OK
	B5	M16 8.8 - 1	TDR Tower	0.0	13.2	225.8	0.0	21.9	21.9	OK	OK
	B6	M16 8.8 - 1	TDR Tower	0.0	14.2	225.8	0.0	23.5	23.5	OK	OK
	B7	M16 8.8 - 1	TDR Tower	1.3	4.7	157.7	1.5	7.9	8.9	OK	OK
	B8	M16 8.8 - 1	TDR Tower	0.0	4.9	313.6	0.0	8.1	8.1	OK	OK
	B9	M16 8.8 - 1	TDR Tower	5.9	5.3	313.6	6.5	8.9	13.5	OK	OK
	B10	M16 8.8 - 1	TDR Tower	1.4	4.7	157.6	1.5	7.9	8.9	OK	OK
	B11	M16 8.8 - 1	TDR Tower	0.0	4.9	313.6	0.0	8.1	8.1	OK	OK
	B12	M16 8.8 - 1	TDR Tower	5.9	5.3	313.6	6.5	8.9	13.5	OK	OK
	B13	M16 8.8 - 1	TDR Tower	74.9	1.7	131.7	82.9	2.9	62.1	OK	OK
	B14	M16 8.8 - 1	TDR Tower	76.3	2.1	131.7	84.3	3.5	63.8	OK	OK
	B15	M16 8.8 - 1	TDR Tower	80.9	1.8	131.7	89.5	3.0	66.9	OK	OK
	B16	M16 8.8 - 1	TDR Tower	75.0	1.7	131.7	82.9	2.9	62.1	OK	OK
	B17	M16 8.8 - 1	TDR Tower	76.2	2.1	131.7	84.3	3.5	63.8	OK	OK
	B18	M16 8.8 - 1	TDR Tower	80.9	1.8	131.7	89.5	3.0	66.9	OK	OK
	B19	M16 8.8 - 1	GMNIA	0.0	2.7	131.7	0.0	4.4	4.4	OK	OK
	B20	M16 8.8 - 1	TDR Tower	6.0	2.7	313.6	6.6	4.4	9.2	OK	OK
	B21	M16 8.8 - 1	TDR Tower	73.9	2.9	131.7	81.7	4.8	63.1	OK	OK
	B22	M16 8.8 - 1	GMNIA	0.0	2.7	131.7	0.0	4.4	4.4	OK	OK
	B23	M16 8.8 - 1	TDR Tower	5.9	2.7	313.6	6.6	4.4	9.1	OK	OK
	B24	M16 8.8 - 1	TDR Tower	73.9	2.9	131.7	81.7	4.8	63.1	OK	OK
	B25	M16 8.8 - 1	GMNIA	0.2	3.2	131.7	0.2	5.3	5.5	OK	OK
	B26	M16 8.8 - 1	GMNIA	0.0	3.7	131.7	0.0	6.2	6.2	OK	OK
	B27	M16 8.8 - 1	TDR Tower	44.2	3.9	313.6	48.9	6.5	41.4	OK	OK
	B28	M16 8.8 - 1	GMNIA	0.2	3.2	131.7	0.2	5.3	5.5	OK	OK
	B29	M16 8.8 - 1	GMNIA	0.0	3.7	131.7	0.0	6.2	6.2	OK	OK
	B30	M16 8.8 - 1	TDR Tower	44.1	3.9	313.6	48.8	6.5	41.3	OK	OK

4	5	6	3	2	1
10	11	12	9	8	7
28	29	30	27	26	25
22	23	24	21	20	19
16	17	18	15	14	13

## Design data

Grade	$F_{t,Rd}$ [kN]	$B_{p,Rd}$ [kN]	$F_{v,Rd}$ [kN]
M16 8.8 - 1	90.4	375.0	60.3

## Symbol explanation

$F_{t,Ed}$	Tension force
$F_{v,Ed}$	Resultant of bolt shear forces $V_y$ and $V_z$ in shear planes
$F_{b,Rd}$	Plate bearing resistance EN 1993-1-8 – Tab. 3.4
$U_t$	Utilization in tension
$U_s$	Utilization in shear
$U_{ts}$	Interaction of tension and shear EN 1993-1-8 – Tab. 3.4
$F_{t,Rd}$	Bolt tension resistance EN 1993-1-8 – Tab. 3.4
$B_{p,Rd}$	Punching shear resistance EN 1993-1-8 – Tab. 3.4
$F_{v,Rd}$	Bolt shear resistance EN 1993-1-8 – Tab. 3.4

## Welds

Item	Edge	$T_w$ [mm]	L [mm]	Loads	$\sigma_{w,Ed}$ [MPa]	$\epsilon_{pl}$ [%]	$\sigma_{\perp}$ [MPa]	$\tau_{\perp}$ [MPa]	$\tau_{\parallel}$ [MPa]	$U_t$ [%]	$U_c$ [%]	Detailing	Status
PP1a	B-bfl 1	▲ 8.0	298	TDR Tower	191.9	0.0	96.1	95.5	-9.2	44.1	38.8	OK	OK
PP1a	B-tfl 1	▲ 8.0	298	TDR Tower	173.3	0.0	-76.8	71.5	-54.1	39.8	24.0	OK	OK
PP1a	B-w 1	▲ 8.0 ▼	317	TDR Tower	368.8	0.0	-180.2	-180.2	-45.4	84.7	37.7	OK	OK
		▲ 8.0 ▼	317	TDR Tower	368.7	0.0	-180.2	180.1	45.3	84.7	37.7	OK	OK
PP1b	B1-bfl 1	▲ 8.0	239	TDR Tower	178.7	0.0	31.4	98.2	26.0	41.0	38.5	OK	OK
PP1b	B1-tfl 1	▲ 8.0	239	TDR Tower	427.2	0.2	-164.8	226.9	17.1	98.1	44.9	OK	OK
PP1b	B1-w 1	▲ 8.0 ▼	222	TDR Tower	303.8	0.0	151.8	150.7	-19.4	69.7	40.9	OK	OK
		▲ 8.0 ▼	222	TDR Tower	304.5	0.0	150.5	-151.7	18.6	69.9	40.7	OK	OK
PP1b	WID1	▲ 7.0 ▼	99	TDR Tower	403.5	0.0	-97.3	-97.6	204.0	92.6	67.9	OK	OK
		▲ 7.0 ▼	99	TDR Tower	403.7	0.0	-97.8	97.5	-204.0	92.7	67.9	OK	OK
B1-tfl 1	WID1	▲ 7.0 ▼	79	TDR Tower	433.0	3.5	-175.5	-175.5	-146.4	99.4	99.4	OK	OK
		▲ 7.0 ▼	79	TDR Tower	433.0	3.5	-175.5	175.5	146.4	99.4	99.4	OK	OK
PP1b	WID2a	-	30	-	-	-	-	-	-	-	-	OK	OK
B1-bfl 1	WID2a	-	80	-	-	-	-	-	-	-	-	OK	OK
PP1b	WID2b	-	30	-	-	-	-	-	-	-	-	OK	OK
B1-bfl 1	WID2b	-	80	-	-	-	-	-	-	-	-	OK	OK
PP1b	WID2c	-	30	-	-	-	-	-	-	-	-	OK	OK
B1-tfl 1	WID2c	-	80	-	-	-	-	-	-	-	-	OK	OK
PP1b	WID2d	-	30	-	-	-	-	-	-	-	-	OK	OK
B1-tfl 1	WID2d	-	80	-	-	-	-	-	-	-	-	OK	OK

## Design data

Material	$f_u$ [MPa]	$\beta_w$ [-]	$\sigma_{w,Rd}$ [MPa]	$0.9 \sigma$ [MPa]
S 355	490.0	0.90	435.6	352.8

## Symbol explanation

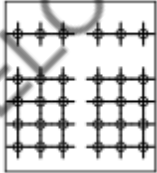
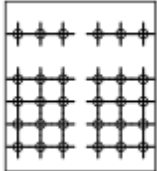


$T_w$	Throat thickness a
L	Length
$\sigma_{w,Ed}$	Equivalent stress
$\epsilon_{pl}$	Strain
$\sigma_{\perp}$	Perpendicular stress
$\tau_{\perp}$	Shear stress perpendicular to weld axis
$\tau_{  }$	Shear stress parallel to weld axis
Ut	Utilization
Ut <sub>c</sub>	Weld capacity estimation
▲	Fillet weld
f <sub>u</sub>	Ultimate strength of weld
$\beta_w$	Correlation factor EN 1993-1-8 – Tab. 4.1
$\sigma_{w,Rd}$	Equivalent stress resistance
0.9 $\sigma$	Perpendicular stress resistance: 0.9*f <sub>u</sub> /γ <sub>M2</sub>

## Buckling

Buckling analysis was not calculated.

## Bill of material

### Manufacturing operations

Name	Plates [mm]	Shape	Nr.	Welds Throat thickness [mm]	Length [mm]	Bolts	Nr.
PP1	P20.0x300.0-340.0 (S 355)		1	Fillet: 8.0 Fillet: 8.0 Double fillet: 8.0	540.0 540.0 541.5	M16 8.8	30
	P20.0x300.0-340.0 (S 355)		1				
WID1	P15.0x100.0-80.0 (S 355)		1	Double fillet: 7.0	180.0		
WID2	P15.0x30.0-80.0 (S 355)		4	Butt: 15.0	440.0		

Project: RDC - STREHA FRI  
 Project no: 24/24  
 Author: Detajl infrastruktura

## Welds

Type	Material	Throat thickness [mm]	Leg size [mm]	Length [mm]
Fillet	S 355	8.0	11.3	540.0
Fillet	S 355	8.0	11.3	540.0
Double fillet	S 355	8.0	11.3	541.5
Double fillet	S 355	7.0	9.9	180.0
Butt	S 355	-	-	440.0

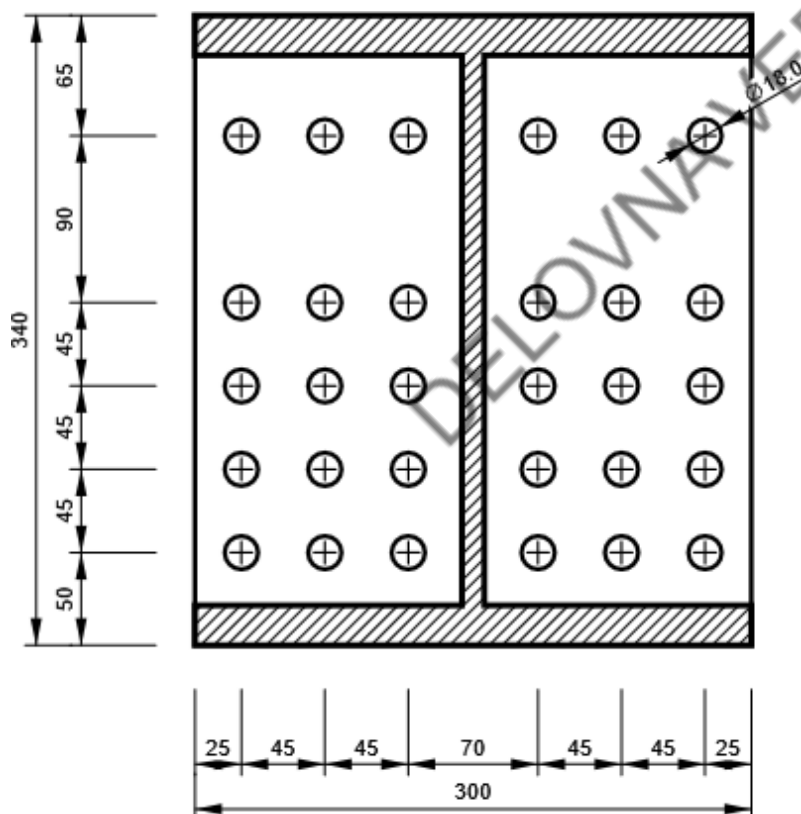
## Bolts

Name	Grip length [mm]	Count
M16 8.8	40	30

## Drawing

PP1 - PP1a

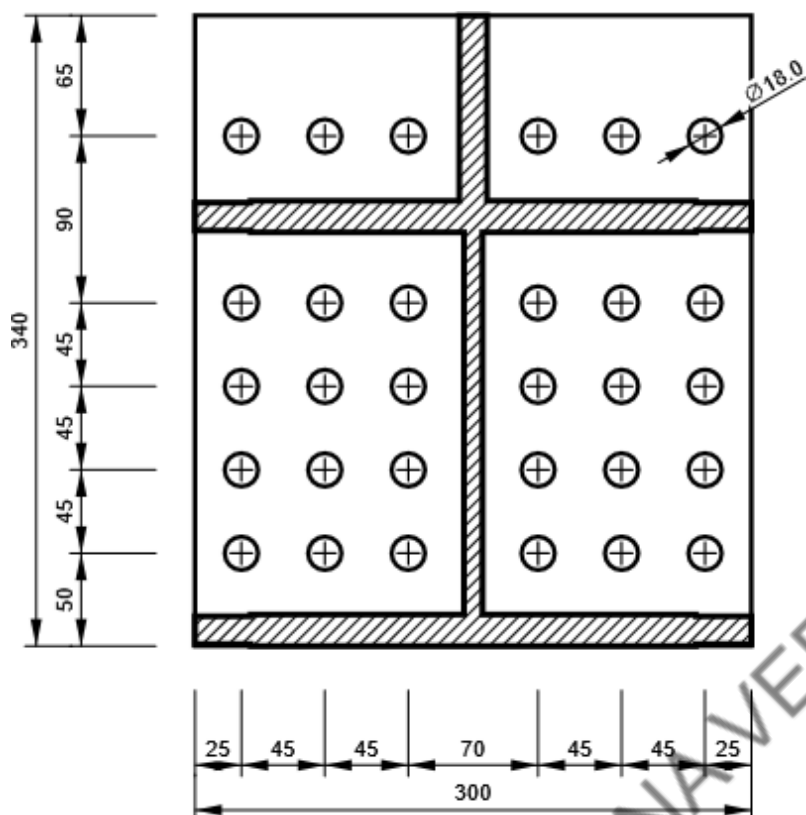
P20.0x340-300 (S 355)



Project: RDC - STREHA FRI  
 Project no: 24/24  
 Author: Detajl infrastruktura

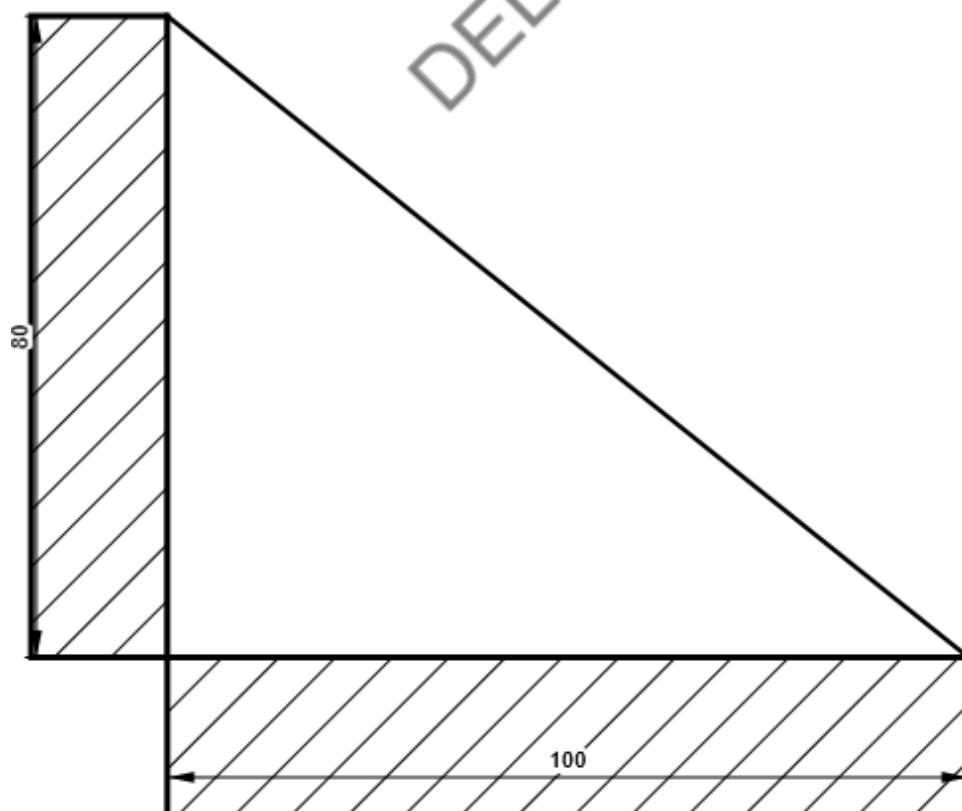
## PP1 - PP1b

P20.0x340-300 (S 355)



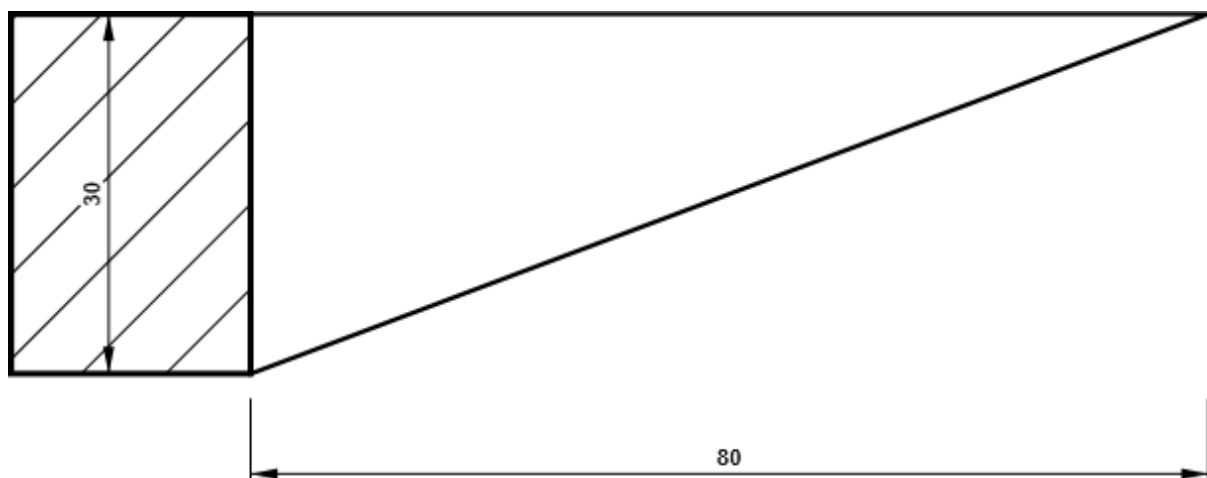
## WID1

P15.0x80-100 (S 355)



## WID2

P15.0x80-30 (S 355)



## Code settings

Item	Value	Unit	Reference
Safety factor $\gamma_{M0}$	1.00	-	EN 1993-1-1: 6.1
Safety factor $\gamma_{M1}$	1.00	-	EN 1993-1-1: 6.1
Safety factor $\gamma_{M2}$	1.25	-	EN 1993-1-1: 6.1
Safety factor $\gamma_{M3}$	1.25	-	EN 1993-1-8: 2.2
Safety factor $\gamma_C$	1.50	-	EN 1992-1-1: 2.4.2.4
Safety factor $\gamma_{Inst}$	1.20	-	EN 1992-4: Table 4.1
Joint coefficient $\beta_j$	0.67	-	EN 1993-1-8: 6.2.5
Effective area - influence of mesh size	0.10	-	
Friction coefficient - concrete	0.25	-	EN 1993-1-8
Friction coefficient in slip-resistance	0.30	-	EN 1993-1-8 tab 3.7
Limit plastic strain	0.05	-	EN 1993-1-5
Detailing	Yes		
Distance between bolts [d]	2.20	-	EN 1993-1-8: tab 3.3
Distance between bolts and edge [d]	1.20	-	EN 1993-1-8: tab 3.3
Concrete breakout resistance check	Both		EN 1992-4: 7.2.1.4 and 7.2.2.5
Use calculated $a_b$ in bearing check.	Yes		EN 1993-1-8: tab 3.4
Cracked concrete	Yes		EN 1992-4
Local deformation check	Yes		CIDECT DG 1, 3 - 1.1
Local deformation limit	0.03	-	CIDECT DG 1, 3 - 1.1
Geometrical nonlinearity (GMNA)	Yes		Analysis with large deformations for hollow section joints
Braced system	No		EN 1993-1-8: 5.2.2.5

**Project:** RDC - STREHA FRI  
**Project no:** 24/24  
**Author:** Detajl infrastruktura

## Project data

Project name	RDC - STREHA FRI
Project number	24/24
Author	Detajl infrastruktura
Description	
Date	5/10/2024
Code	EN

## Material

Steel	S 235, S 355
Concrete	C25/30

DELOVNA VERZIJA

Project: RDC - STREHA FRI  
Project no: 24/24  
Author: Detajl infrastruktura

## Project item DETAJL D4

### Design

Name: DETAJL D4  
Description:  
Analysis: Stress, strain/ loads in equilibrium

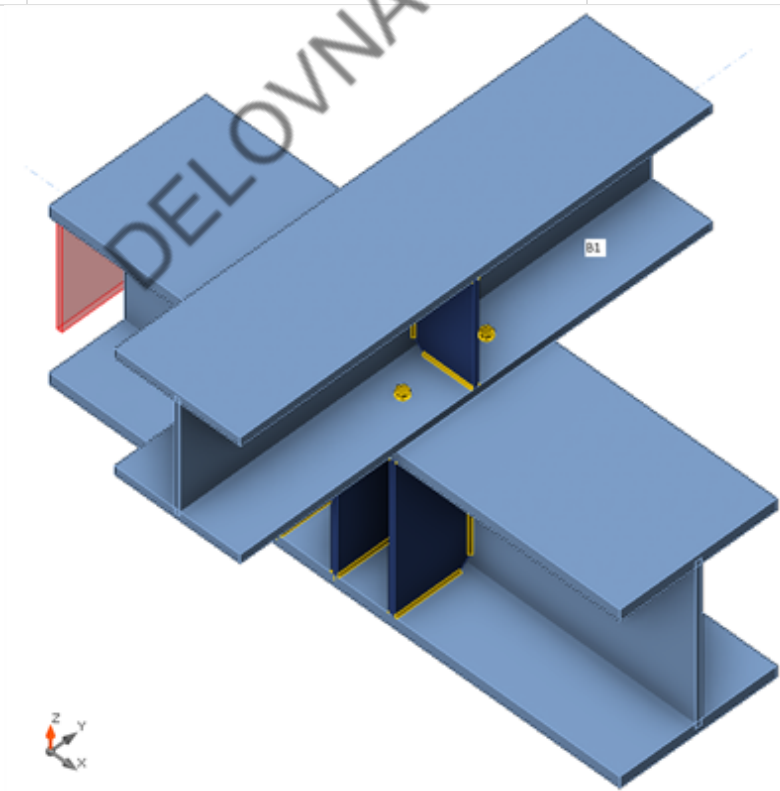
### Members

#### Geometry

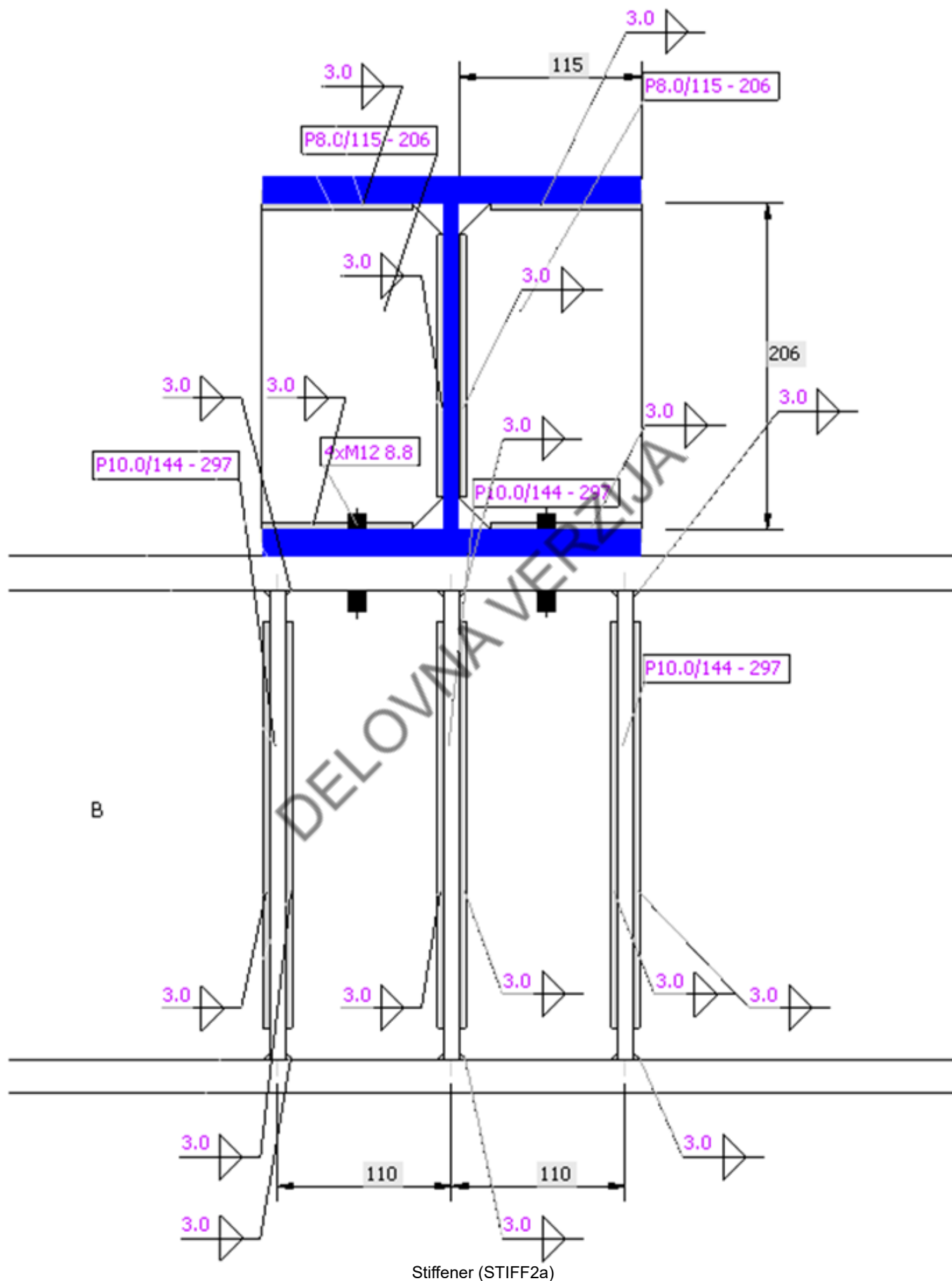
Name	Cross-section	$\beta$ - Direction [°]	$\gamma$ - Pitch [°]	$\alpha$ - Rotation [°]	Offset ex [mm]	Offset ey [mm]	Offset ez [mm]
B	1 - CON1(HEB340)	0.0	0.0	0.0	0	0	0
B1	2 - CON1(HEB240)	-90.0	0.0	0.0	0	0	290

#### Supports and forces

Name	Support	Forces in	X [mm]
B / begin	N-Vy-Vz-Mx-My-Mz	Node	0
B / end		Node	0
B1 / begin		Bolts	0
B1 / end		Bolts	0





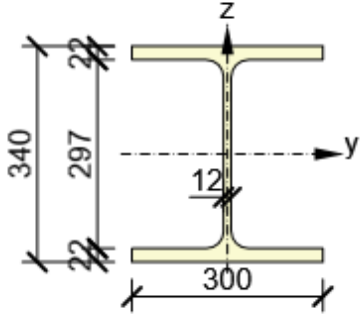
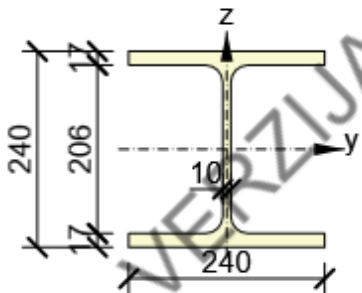


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Name	Material
1 - CON1(HEB340)	S 355
2 - CON1(HEB240)	S 355

## Cross-sections

Name	Material	Drawing
1 - CON1(HEB340)	S 355	
2 - CON1(HEB240)	S 355	

## Bolts

Name	Diameter [mm]	$f_y$ [MPa]	$f_u$ [MPa]	Gross area [mm <sup>2</sup> ]
M12 8.8	12	640.0	800.0	113

## Load effects (forces in equilibrium)

Name	Member	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
LE1	B / Begin	0.0	0.0	2.0	0.0	280.0	0.0
	B / End	0.0	0.0	142.0	0.0	-280.0	0.0
	B1 / End	0.0	0.0	-72.0	0.0	96.0	0.0
	B1 / Begin	0.0	0.0	-72.0	0.0	-96.0	0.0

## Unbalanced forces

Name	X [kN]	Y [kN]	Z [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
LE1	0.0	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	10.3 < 100%	OK
Welds	36.0 < 100%	OK
Buckling	Not calculated	

### Plates

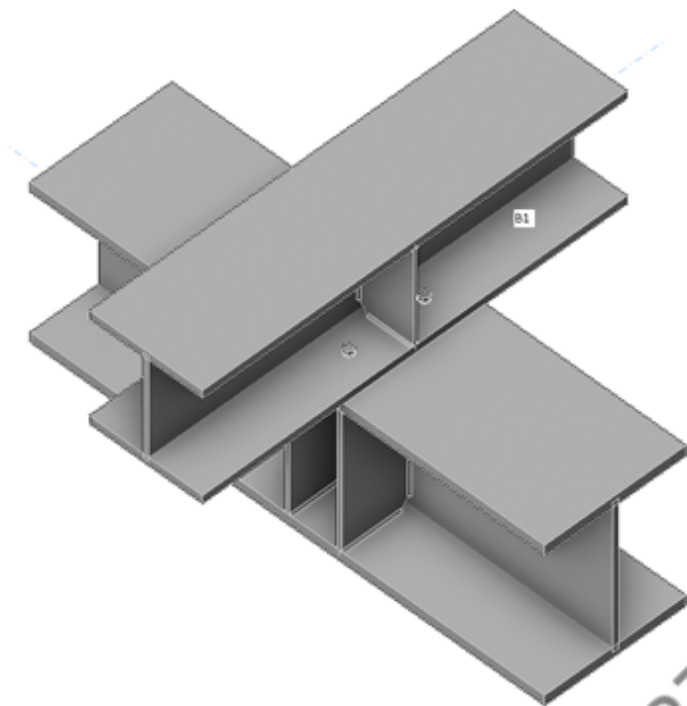
Name	$t_p$ [mm]	Loads	$\sigma_{Ed}$ [MPa]	$\epsilon_{Pl}$ [%]	$\sigma_{c,Ed}$ [MPa]	Status
B-bfl 1	21.5	LE1	145.5	0.0	0.0	OK
B-tfl 1	21.5	LE1	158.6	0.0	14.9	OK
B-w 1	12.0	LE1	120.6	0.0	0.0	OK
B1-bfl 1	17.0	LE1	121.4	0.0	14.1	OK
B1-tfl 1	17.0	LE1	120.2	0.0	0.0	OK
B1-w 1	10.0	LE1	94.0	0.0	0.0	OK
STIFF1a	10.0	LE1	32.4	0.0	0.0	OK
STIFF1b	10.0	LE1	32.3	0.0	0.0	OK
STIFF1c	10.0	LE1	64.9	0.0	0.0	OK
STIFF1d	10.0	LE1	65.1	0.0	0.0	OK
STIFF1e	10.0	LE1	39.3	0.0	0.0	OK
STIFF1f	10.0	LE1	39.0	0.0	0.0	OK
STIFF2a	8.0	LE1	58.2	0.0	0.0	OK
STIFF2b	8.0	LE1	58.5	0.0	0.0	OK

### Design data

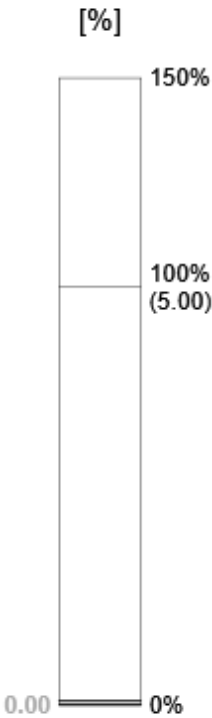
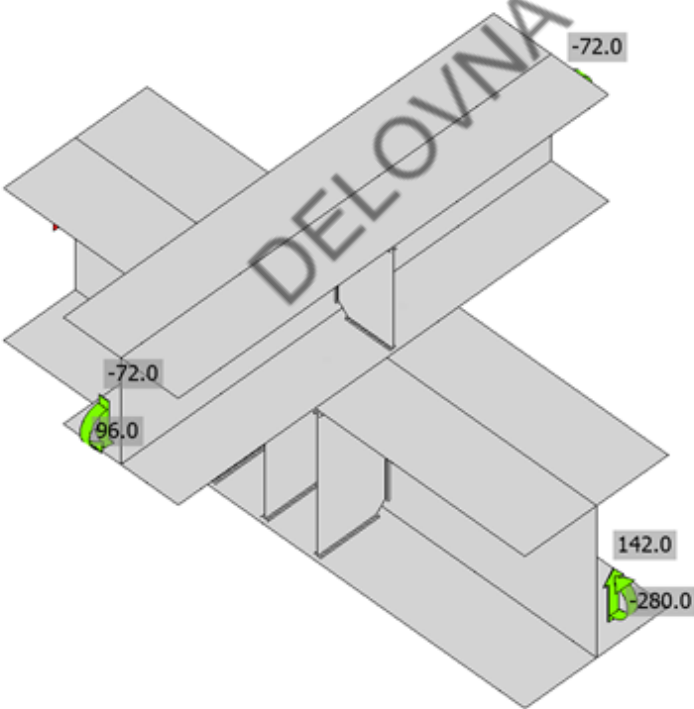
Material	$f_y$ [MPa]	$\epsilon_{lim}$ [%]
S 355	355.0	5.0

### Symbol explanation

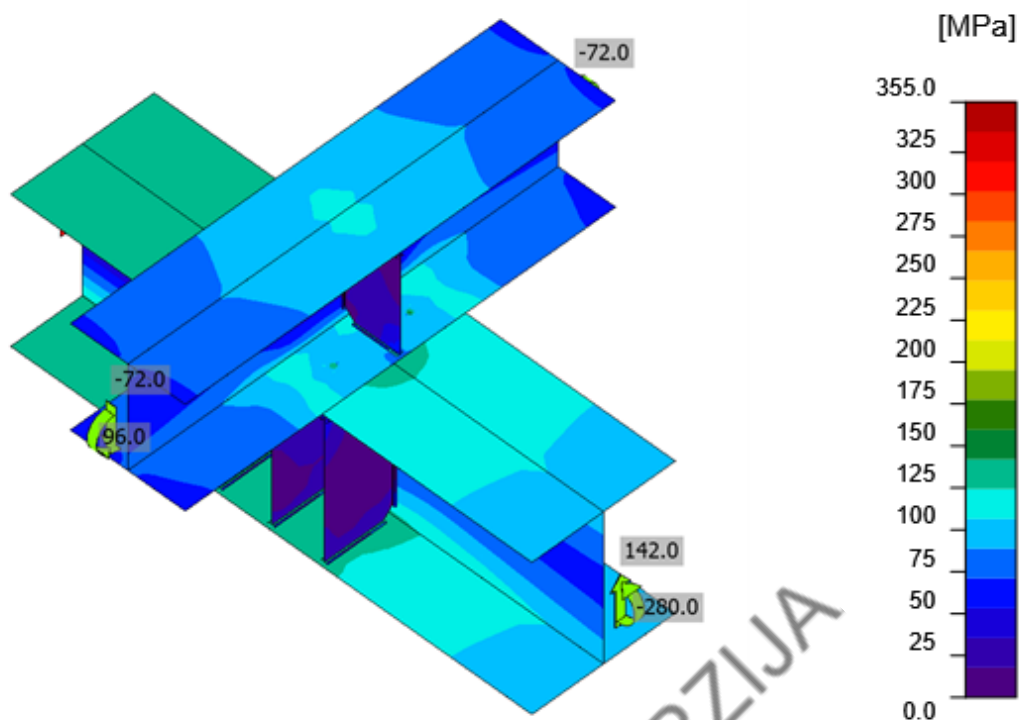
$t_p$	Plate thickness
$\sigma_{Ed}$	Equivalent stress
$\epsilon_{Pl}$	Plastic strain
$\sigma_{c,Ed}$	Contact stress
$f_y$	Yield strength
$\epsilon_{lim}$	Limit of plastic strain



Overall check, LE1




Strain check, LE1



Equivalent stress, LE1

## Bolts

Shape	Item	Grade	Loads	$F_{t,Ed}$ [kN]	$F_{v,Ed}$ [kN]	$F_{b,Rd}$ [kN]	$U_{t_t}$ [%]	$U_{t_s}$ [%]	$U_{t_{ts}}$ [%]	Status
	B1	M12 8.8 - 1	LE1	0.7	3.0	199.9	1.4	9.3	10.3	OK
	B2	M12 8.8 - 1	LE1	0.7	3.0	199.9	1.5	9.3	10.3	OK
	B3	M12 8.8 - 1	LE1	0.7	3.0	199.9	1.4	9.2	10.2	OK
	B4	M12 8.8 - 1	LE1	0.7	3.0	199.9	1.4	9.2	10.2	OK

## Design data

Grade	$F_{t,Rd}$ [kN]	$B_{p,Rd}$ [kN]	$F_{v,Rd}$ [kN]
M12 8.8 - 1	48.6	238.9	32.4

## Symbol explanation

$F_{t,Ed}$	Tension force
$F_{v,Ed}$	Resultant of bolt shear forces $V_y$ and $V_z$ in shear planes
$F_{b,Rd}$	Plate bearing resistance EN 1993-1-8 – Tab. 3.4
$U_{t_t}$	Utilization in tension
$U_{t_s}$	Utilization in shear
$U_{t_{ts}}$	Interaction of tension and shear EN 1993-1-8 – Tab. 3.4
$F_{t,Rd}$	Bolt tension resistance EN 1993-1-8 – Tab. 3.4
$B_{p,Rd}$	Punching shear resistance EN 1993-1-8 – Tab. 3.4
$F_{v,Rd}$	Bolt shear resistance EN 1993-1-8 – Tab. 3.4

## Welds

Item	Edge	T <sub>w</sub> [mm]	L [mm]	Loads	$\sigma_{w,Ed}$ [MPa]	$\epsilon_{PI}$ [%]	$\sigma_{\perp}$ [MPa]	$\tau_{\perp}$ [MPa]	$\tau_{\parallel}$ [MPa]	Ut [%]	Ut <sub>c</sub> [%]	Status
B-bfl 1	STIFF1a	▲ 3.0 ▼	124	LE1	64.1	0.0	-24.5	-22.1	-26.1	14.7	13.6	OK
		▲ 3.0 ▼	124	LE1	60.9	0.0	-20.2	22.6	24.3	14.0	13.1	OK
B-w 1	STIFF1a	▲ 3.0 ▼	257	LE1	63.5	0.0	-28.4	-28.9	15.4	14.6	13.6	OK
		▲ 3.0 ▼	257	LE1	65.3	0.0	-30.3	29.8	-15.2	15.0	13.6	OK
B-tfl 1	STIFF1a	▲ 3.0 ▼	124	LE1	49.0	0.0	-29.2	-22.1	5.5	11.3	11.2	OK
		▲ 3.0 ▼	124	LE1	51.0	0.0	-16.9	23.9	-14.2	11.7	11.7	OK
B-bfl 1	STIFF1b	▲ 3.0 ▼	124	LE1	60.9	0.0	-20.2	-22.6	-24.3	14.0	13.1	OK
		▲ 3.0 ▼	124	LE1	64.1	0.0	-24.4	22.1	26.1	14.7	13.6	OK
B-w 1	STIFF1b	▲ 3.0 ▼	257	LE1	65.3	0.0	-30.3	-29.8	15.2	15.0	13.7	OK
		▲ 3.0 ▼	257	LE1	63.5	0.0	-28.4	28.9	-15.4	14.6	13.6	OK
B-tfl 1	STIFF1b	▲ 3.0 ▼	124	LE1	51.3	0.0	-17.0	-24.0	14.4	11.8	11.8	OK
		▲ 3.0 ▼	124	LE1	49.4	0.0	-29.2	22.2	-5.9	11.3	11.2	OK
B-bfl 1	STIFF1c	▲ 3.0 ▼	124	LE1	86.8	0.0	-35.3	-32.2	-32.5	19.9	17.1	OK
		▲ 3.0 ▼	124	LE1	73.2	0.0	-18.2	21.2	35.0	16.8	14.9	OK
B-w 1	STIFF1c	▲ 3.0 ▼	257	LE1	82.6	0.0	-28.8	-32.2	30.9	19.0	16.1	OK
		▲ 3.0 ▼	257	LE1	90.8	0.0	-40.5	37.0	-28.8	20.8	17.8	OK
B-tfl 1	STIFF1c	▲ 3.0 ▼	124	LE1	150.6	0.0	-72.7	-72.4	-23.5	34.6	26.6	OK
		▲ 3.0 ▼	124	LE1	156.7	0.0	-75.4	75.6	24.1	36.0	27.4	OK
B-bfl 1	STIFF1d	▲ 3.0 ▼	124	LE1	73.3	0.0	-18.1	-21.2	-35.1	16.8	14.9	OK
		▲ 3.0 ▼	124	LE1	86.8	0.0	-35.2	32.2	32.6	19.9	17.1	OK
B-w 1	STIFF1d	▲ 3.0 ▼	257	LE1	90.9	0.0	-40.5	-37.0	28.9	20.9	17.8	OK
		▲ 3.0 ▼	257	LE1	82.7	0.0	-28.8	32.2	-31.0	19.0	16.2	OK
B-tfl 1	STIFF1d	▲ 3.0 ▼	124	LE1	156.9	0.0	-75.8	-75.5	-24.4	36.0	27.5	OK
		▲ 3.0 ▼	124	LE1	150.7	0.0	-72.5	72.7	23.3	34.6	26.5	OK
B-bfl 1	STIFF1e	▲ 3.0 ▼	124	LE1	76.4	0.0	-36.4	-32.4	-21.3	17.5	15.5	OK
		▲ 3.0 ▼	124	LE1	51.6	0.0	-6.2	10.3	27.7	11.8	11.8	OK
B-w 1	STIFF1e	▲ 3.0 ▼	257	LE1	53.6	0.0	-17.2	-23.6	17.3	12.3	11.2	OK
		▲ 3.0 ▼	257	LE1	71.8	0.0	-38.7	32.2	-13.5	16.5	14.9	OK
B-tfl 1	STIFF1e	▲ 3.0 ▼	124	LE1	56.1	0.0	27.1	23.9	-15.2	12.9	12.9	OK
		▲ 3.0 ▼	124	LE1	55.4	0.0	-32.8	25.6	-2.8	12.7	11.6	OK
B-bfl 1	STIFF1f	▲ 3.0 ▼	124	LE1	51.4	0.0	-6.2	-10.2	-27.6	11.8	11.8	OK
		▲ 3.0 ▼	124	LE1	76.3	0.0	-36.4	32.3	21.2	17.5	15.5	OK
B-w 1	STIFF1f	▲ 3.0 ▼	257	LE1	71.8	0.0	-38.7	-32.2	13.5	16.5	14.9	OK
		▲ 3.0 ▼	257	LE1	53.6	0.0	-17.2	23.7	-17.3	12.3	11.2	OK
B-tfl 1	STIFF1f	▲ 3.0 ▼	124	LE1	54.4	0.0	-32.1	-25.1	3.5	12.5	11.4	OK
		▲ 3.0 ▼	124	LE1	56.1	0.0	26.9	-24.0	15.2	12.9	12.9	OK
B1-bfl 1	STIFF2a	▲ 3.0 ▼	95	LE1	113.6	0.0	-56.0	-56.0	11.4	26.1	21.3	OK
		▲ 3.0 ▼	95	LE1	113.6	0.0	-55.9	56.0	-11.3	26.1	21.3	OK
B1-w 1	STIFF2a	▲ 3.0 ▼	166	LE1	70.0	0.0	-26.8	-26.8	-26.0	16.1	15.0	OK
		▲ 3.0 ▼	166	LE1	70.0	0.0	-26.8	26.8	26.0	16.1	15.0	OK

Project: RDC - STREHA FRI  
Project no: 24/24  
Author: Detajl infrastruktura

Item	Edge	$T_w$ [mm]	L [mm]	Loads	$\sigma_{w,Ed}$ [MPa]	$\epsilon_{PI}$ [%]	$\sigma_{\perp}$ [MPa]	$\tau_{\perp}$ [MPa]	$\tau_{  }$ [MPa]	Ut [%]	Ut <sub>c</sub> [%]	Status
B1-tfl 1	STIFF2a	▲ 3.0 ▼	95	LE1	76.8	0.0	-26.6	-26.6	32.0	17.6	13.2	OK
		▲ 3.0 ▼	95	LE1	76.8	0.0	-26.6	26.6	-32.0	17.6	13.2	OK
B1-bfl 1	STIFF2b	▲ 3.0 ▼	95	LE1	115.0	0.0	-56.5	-56.5	12.0	26.4	21.6	OK
		▲ 3.0 ▼	95	LE1	115.0	0.0	-56.6	56.5	-12.0	26.4	21.6	OK
B1-w 1	STIFF2b	▲ 3.0 ▼	166	LE1	70.1	0.0	-26.8	-26.8	-26.0	16.1	15.0	OK
		▲ 3.0 ▼	166	LE1	70.1	0.0	-26.8	26.8	26.0	16.1	15.0	OK
B1-tfl 1	STIFF2b	▲ 3.0 ▼	95	LE1	76.8	0.0	-26.6	-26.6	32.0	17.6	13.2	OK
		▲ 3.0 ▼	95	LE1	76.8	0.0	-26.6	26.6	-32.0	17.6	13.2	OK

#### Design data

Material	$f_u$ [MPa]	$\beta_w$ [-]	$\sigma_{w,Rd}$ [MPa]	0.9 $\sigma$ [MPa]
S 355	490.0	0.90	435.6	352.8

#### Symbol explanation

$T_w$	Throat thickness a
L	Length
$\sigma_{w,Ed}$	Equivalent stress
$\epsilon_{PI}$	Strain
$\sigma_{\perp}$	Perpendicular stress
$\tau_{\perp}$	Shear stress perpendicular to weld axis
$\tau_{  }$	Shear stress parallel to weld axis
Ut	Utilization
Ut <sub>c</sub>	Weld capacity estimation
▲	Fillet weld
$f_u$	Ultimate strength of weld
$\beta_w$	Correlation factor EN 1993-1-8 – Tab. 4.1
$\sigma_{w,Rd}$	Equivalent stress resistance
0.9 $\sigma$	Perpendicular stress resistance: 0.9*f <sub>u</sub> /γ <sub>M2</sub>

#### Buckling



Buckling analysis was not calculated.



Project: RDC - STREHA FRI  
 Project no: 24/24  
 Author: Detalj infrastruktura

## Bill of material

### Manufacturing operations

Name	Plates [mm]	Shape	Nr.	Welds Throat thickness [mm]	Length [mm]	Bolts	Nr.
STIFF1	P10.0x144.0-297.0 (S 355)		6	Double fillet: 3.0	3030.0		
STIFF2	P8.0x115.0-206.0 (S 355)		2	Double fillet: 3.0	712.0		

### Welds

Type	Material	Throat thickness [mm]	Leg size [mm]	Length [mm]
Double fillet	S 355	3.0	4.2	3742.0

### Bolts

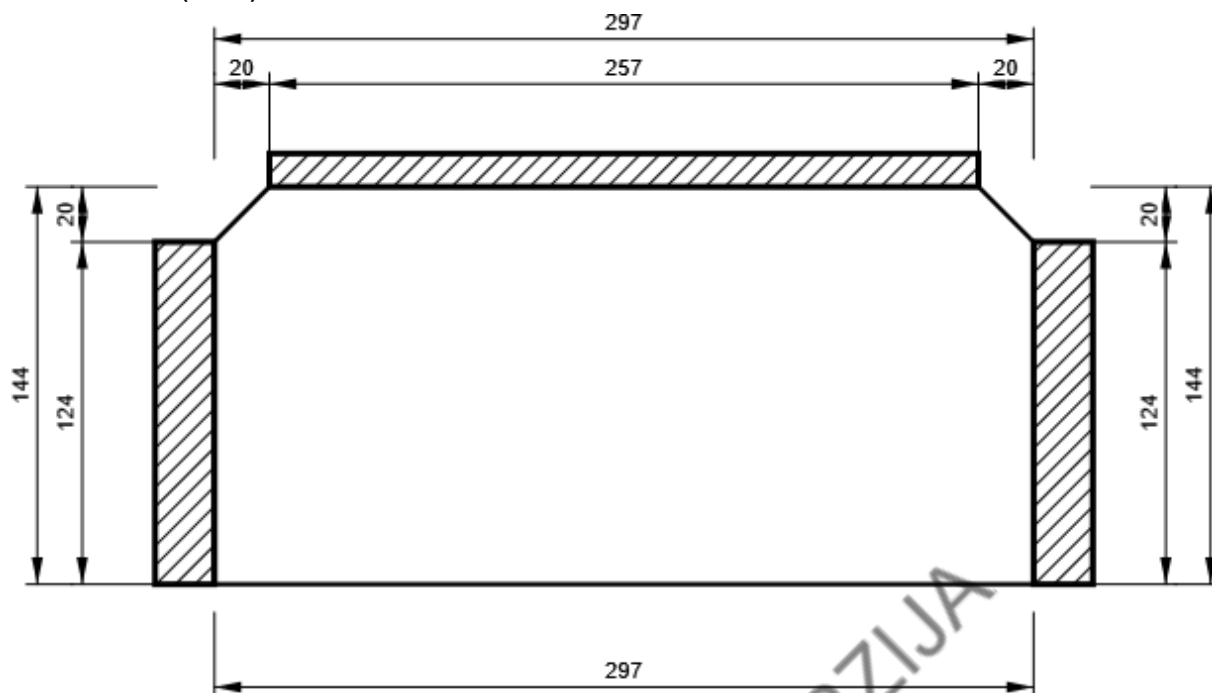
Name	Grip length [mm]	Count
M12 8.8	39	4

### Drawing

#### STIFF1

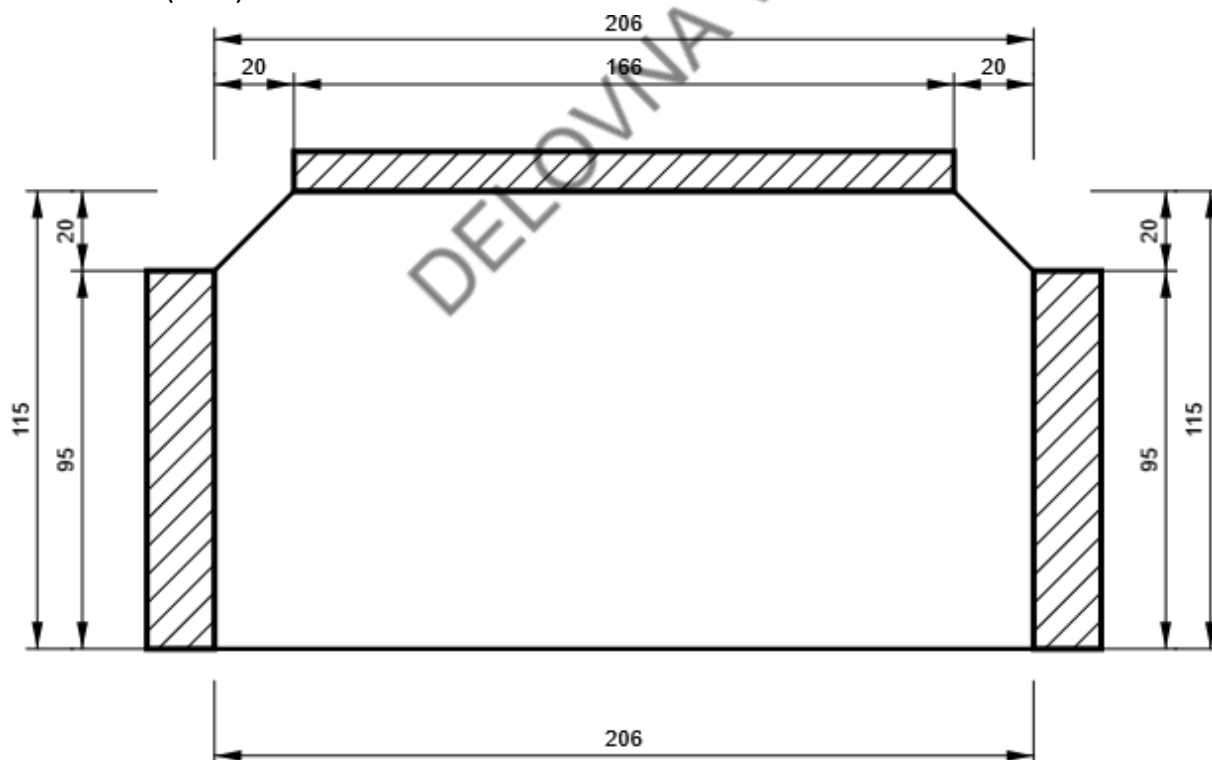
Project: RDC - STREHA FRI  
Project no: 24/24  
Author: Detajl infrastruktura

P10.0x297-144 (S 355)

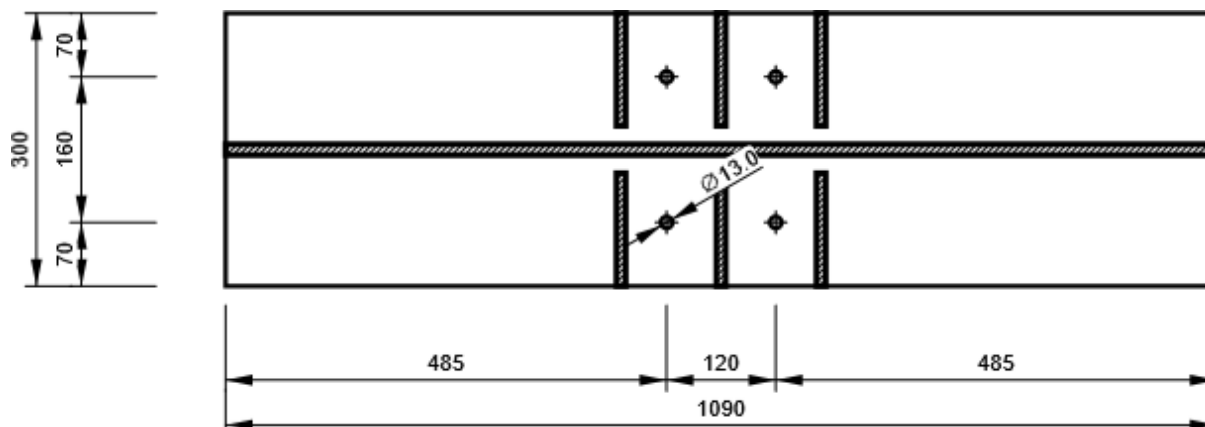


STIFF2

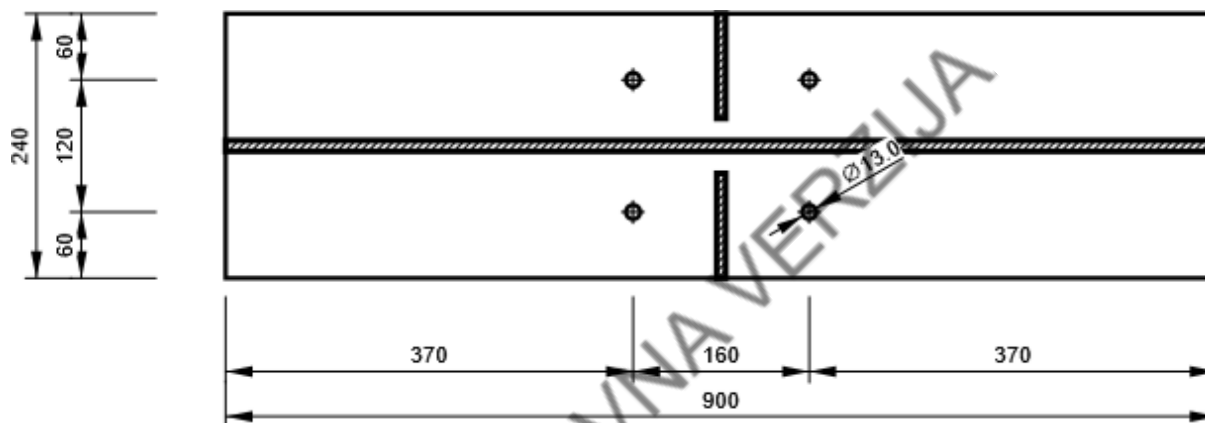
P8.0x206-115 (S 355)



**B, CON1(HEB340) - Top flange 1:**



**B1, CON1(HEB240) - Bottom flange 1:**



## Code settings

Item	Value	Unit	Reference
Safety factor $\gamma_{M0}$	1.00	-	EN 1993-1-1: 6.1
Safety factor $\gamma_{M1}$	1.00	-	EN 1993-1-1: 6.1
Safety factor $\gamma_{M2}$	1.25	-	EN 1993-1-1: 6.1
Safety factor $\gamma_{M3}$	1.25	-	EN 1993-1-8: 2.2
Safety factor $\gamma_C$	1.50	-	EN 1992-1-1: 2.4.2.4
Safety factor $\gamma_{Inst}$	1.20	-	EN 1992-4: Table 4.1
Joint coefficient $\beta_j$	0.67	-	EN 1993-1-8: 6.2.5
Effective area - influence of mesh size	0.10	-	
Friction coefficient - concrete	0.25	-	EN 1993-1-8
Friction coefficient in slip-resistance	0.30	-	EN 1993-1-8 tab 3.7
Limit plastic strain	0.05	-	EN 1993-1-5
Detailing	No		
Distance between bolts [d]	2.20	-	EN 1993-1-8: tab 3.3
Distance between bolts and edge [d]	1.20	-	EN 1993-1-8: tab 3.3
Concrete breakout resistance check	Both		EN 1992-4: 7.2.1.4 and 7.2.2.5
Use calculated $\alpha_b$ in bearing check.	Yes		EN 1993-1-8: tab 3.4
Cracked concrete	Yes		EN 1992-4
Local deformation check	Yes		CIDECT DG 1, 3 - 1.1
Local deformation limit	0.03	-	CIDECT DG 1, 3 - 1.1
Geometrical nonlinearity (GMNA)	Yes		Analysis with large deformations for hollow section joints
Braced system	No		EN 1993-1-8: 5.2.2.5

**Project:** RDC - STREHA FRI  
**Project no:** 24/24  
**Author:** Detajl infrastruktura

## Project data

Project name	RDC - STREHA FRI
Project number	24/24
Author	Detajl infrastruktura
Description	
Date	5/10/2024
Code	EN

## Material

Steel	S 235, S 355
Concrete	C25/30

DELOVNA VERZIJA

## Project item DETAJL D5

### Design

Name	DETAJL D5
Description	
Analysis	Stress, strain/ loads in equilibrium

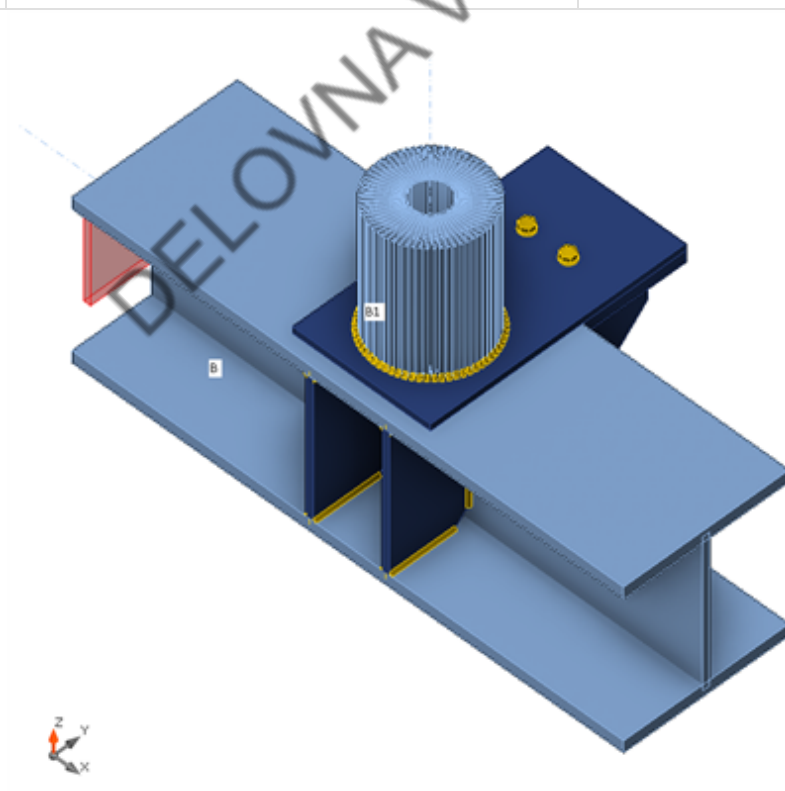
### Members

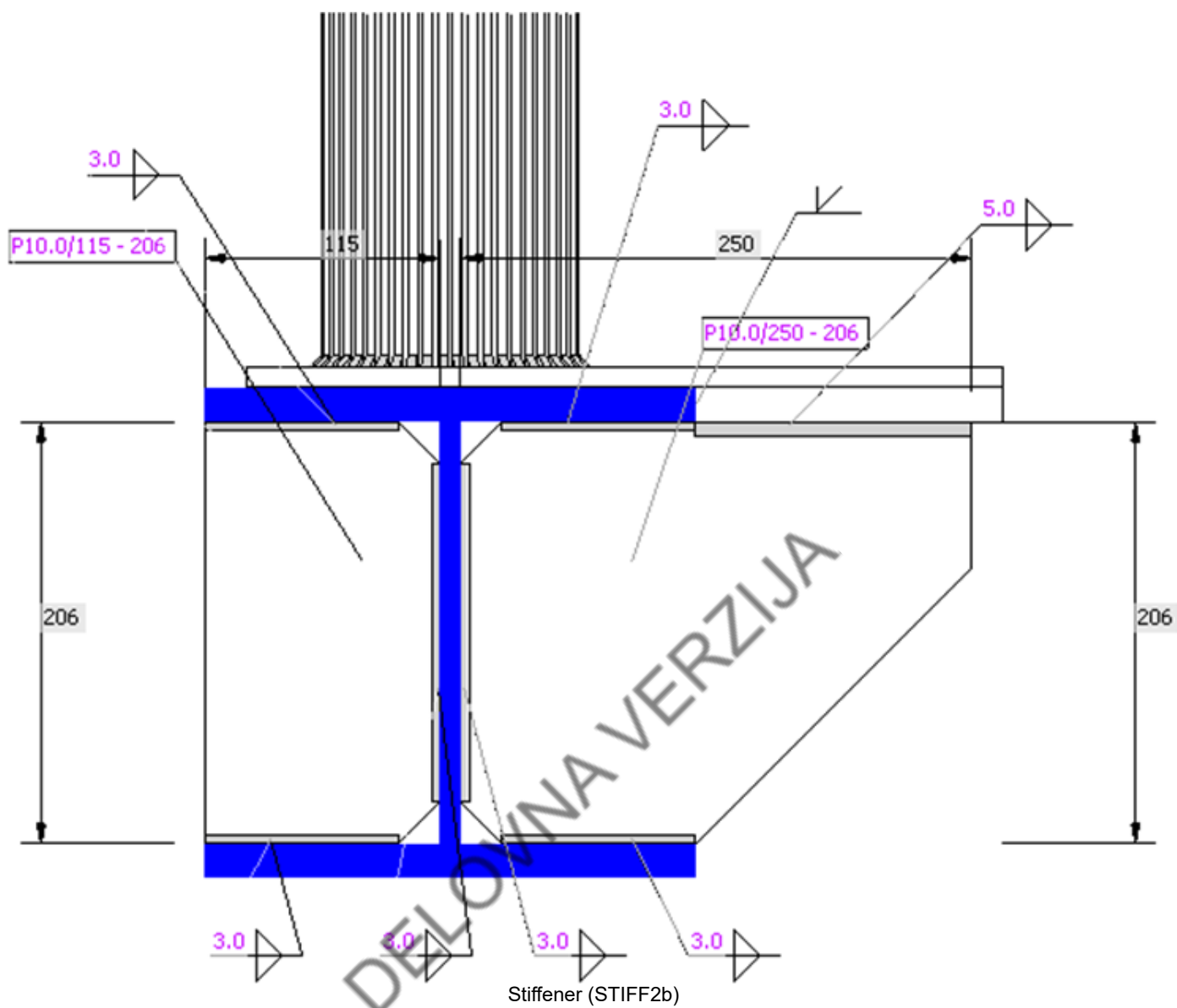
#### Geometry

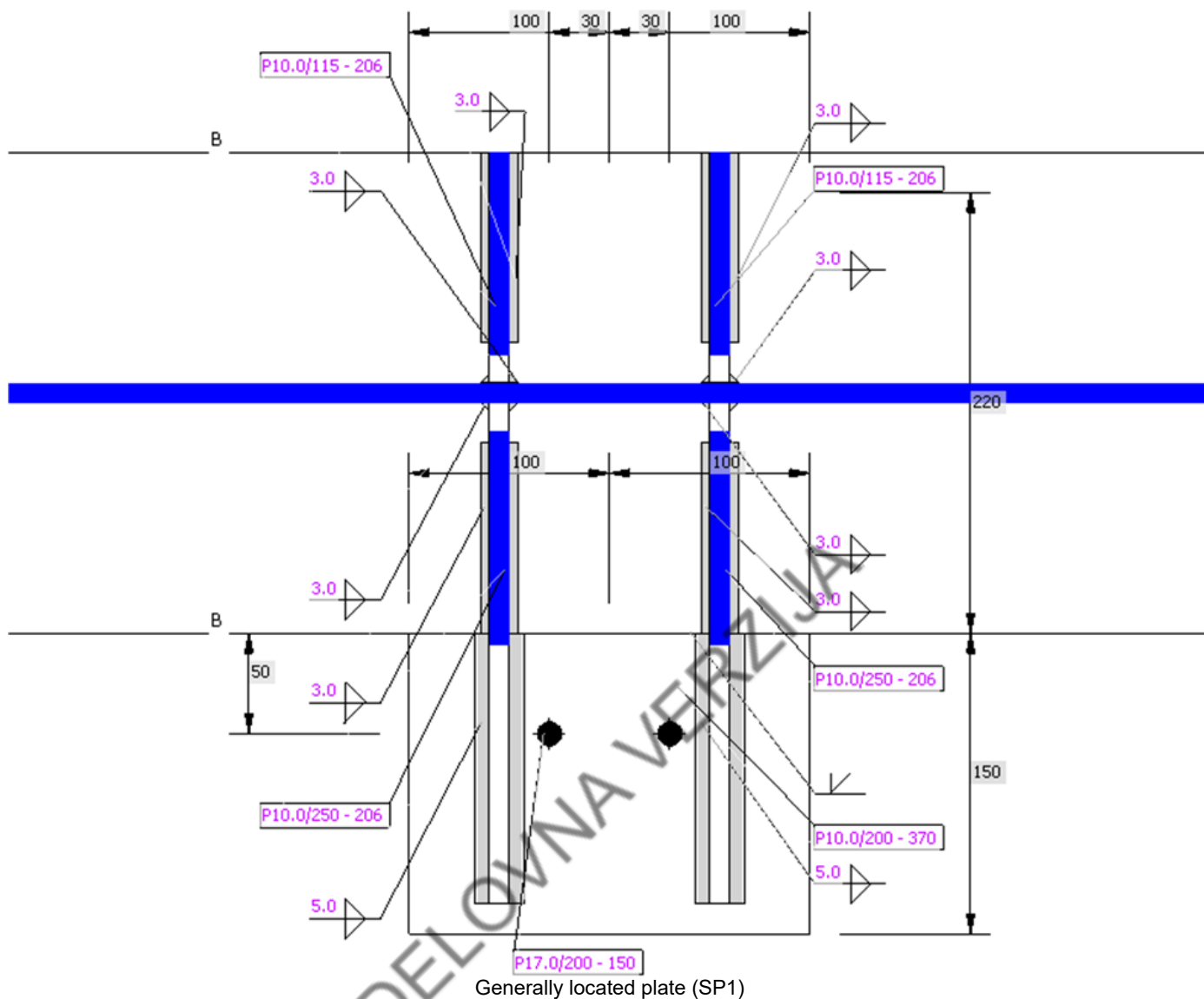
Name	Cross-section	$\beta$ - Direction [°]	$\gamma$ - Pitch [°]	$\alpha$ - Rotation [°]	Offset ex [mm]	Offset ey [mm]	Offset ez [mm]
B	1 - CON1(HEB240)	0.0	0.0	0.0	0	0	0
B1	4 - CHS150,50	0.0	90.0	0.0	0	0	0

#### Supports and forces

Name	Support	Forces in	X [mm]
B / begin	N-Vy-Vz-Mx-My-Mz	Node	0
B / end		Node	0
B1 / end		Bolts	0





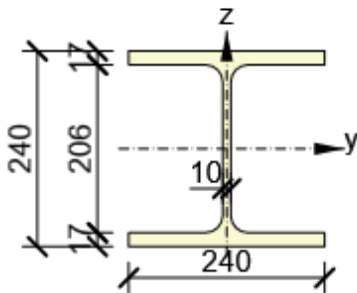
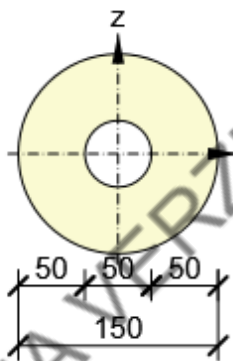


## Cross-sections

Name	Material
1 - CON1(HEB240)	S 355
4 - CHS150,50	S 235



## Cross-sections

Name	Material	Drawing
1 - CON1(HEB240)	S 355	
4 - CHS150,50	S 235	

## Bolts

Name	Diameter [mm]	$f_y$ [MPa]	$f_u$ [MPa]	Gross area [mm <sup>2</sup> ]
M12 8.8	12	640.0	800.0	113

## Load effects (forces in equilibrium)

Name	Member	N [kN]	V <sub>y</sub> [kN]	V <sub>z</sub> [kN]	M <sub>x</sub> [kNm]	M <sub>y</sub> [kNm]	M <sub>z</sub> [kNm]
LE1	B / Begin	2.5	-2.5	40.0	0.0	78.0	0.0
	B / End	2.5	-2.5	40.0	0.0	-78.0	0.0
	B1 / End	-80.0	5.0	5.0	0.0	0.0	0.0

## Unbalanced forces

Name	X [kN]	Y [kN]	Z [kN]	M <sub>x</sub> [kNm]	M <sub>y</sub> [kNm]	M <sub>z</sub> [kNm]
LE1	0.0	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
Loc. deformation	0.0 < 3%	OK
Bolts	54.5 < 100%	OK
Welds	68.4 < 100%	OK
Buckling	Not calculated	

### Plates

Name	Material	$t_p$ [mm]	Loads	$\sigma_{Ed}$ [MPa]	$\epsilon_{pl}$ [%]	$\sigma_{c,Ed}$ [MPa]	Status
B-bfl 1	S 355	17.0	LE1	93.9	0.0	0.0	OK
B-tfl 1	S 355	17.0	LE1	100.3	0.0	12.9	OK
B-w 1	S 355	10.0	LE1	73.7	0.0	0.0	OK
B1	S 235	50.0	LE1	13.0	0.0	0.0	OK
STIFF1a	S 355	10.0	LE1	26.0	0.0	0.0	OK
STIFF1b	S 355	10.0	LE1	27.0	0.0	0.0	OK
SP1	S 355	17.0	LE1	76.0	0.0	5.8	OK
STIFF2a	S 355	10.0	LE1	19.3	0.0	0.0	OK
STIFF2b	S 355	10.0	LE1	18.1	0.0	0.0	OK
SP2	S 355	10.0	LE1	126.3	0.0	12.7	OK

### Design data

Material	$f_y$ [MPa]	$\epsilon_{lim}$ [%]
S 355	355.0	5.0
S 235	215.0	5.0

### Symbol explanation

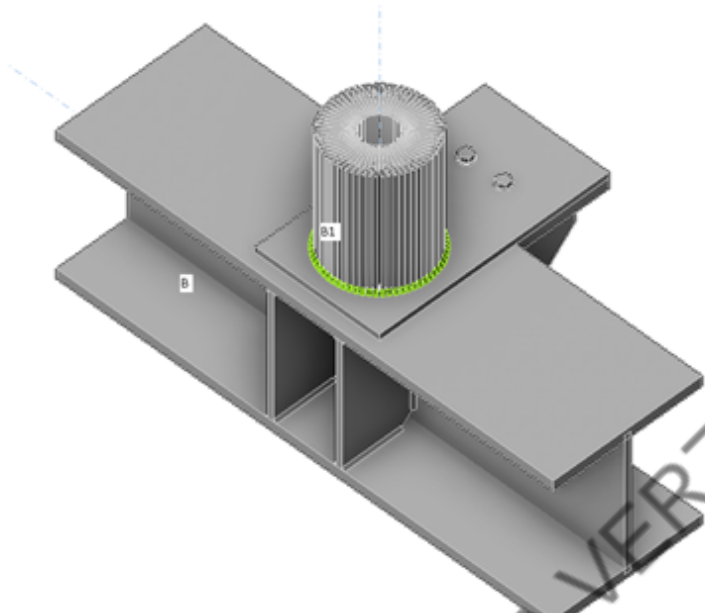
$t_p$	Plate thickness
$\sigma_{Ed}$	Equivalent stress
$\epsilon_{pl}$	Plastic strain
$\sigma_{c,Ed}$	Contact stress
$f_y$	Yield strength
$\epsilon_{lim}$	Limit of plastic strain

### Loc. deformation

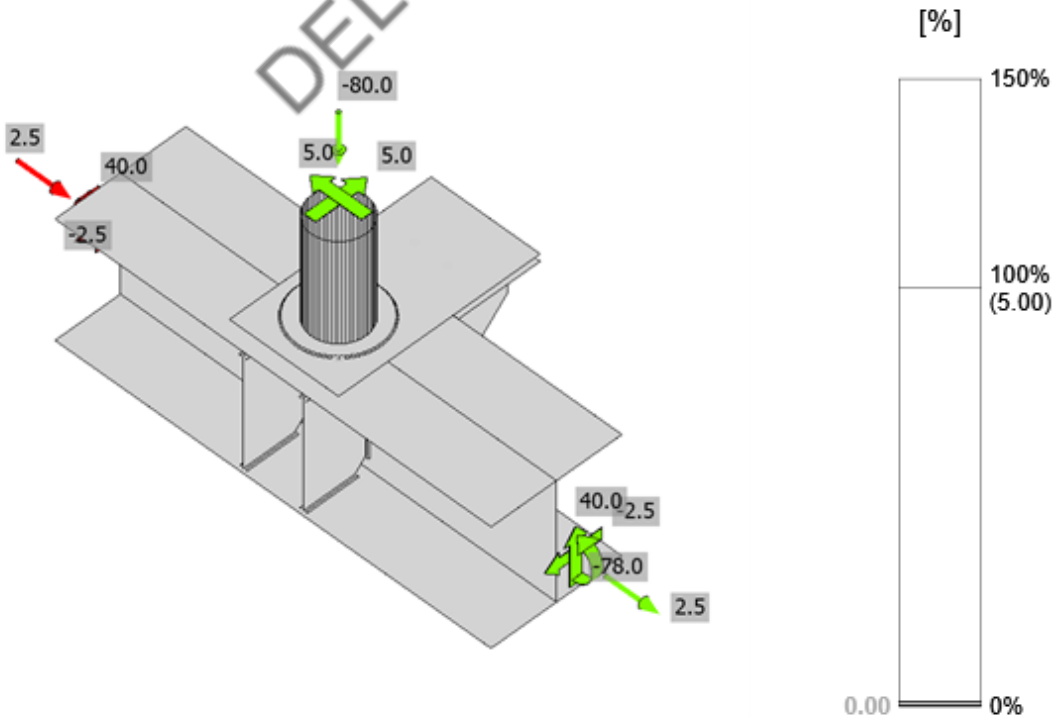
Name	$d_0$ [mm]	Loads	$\delta$ [mm]	$\delta_{lim}$ [mm]	$\delta/d_0$ [%]	Check status
B1	150	LE1	0	5	0.0	OK

Symbol explanation

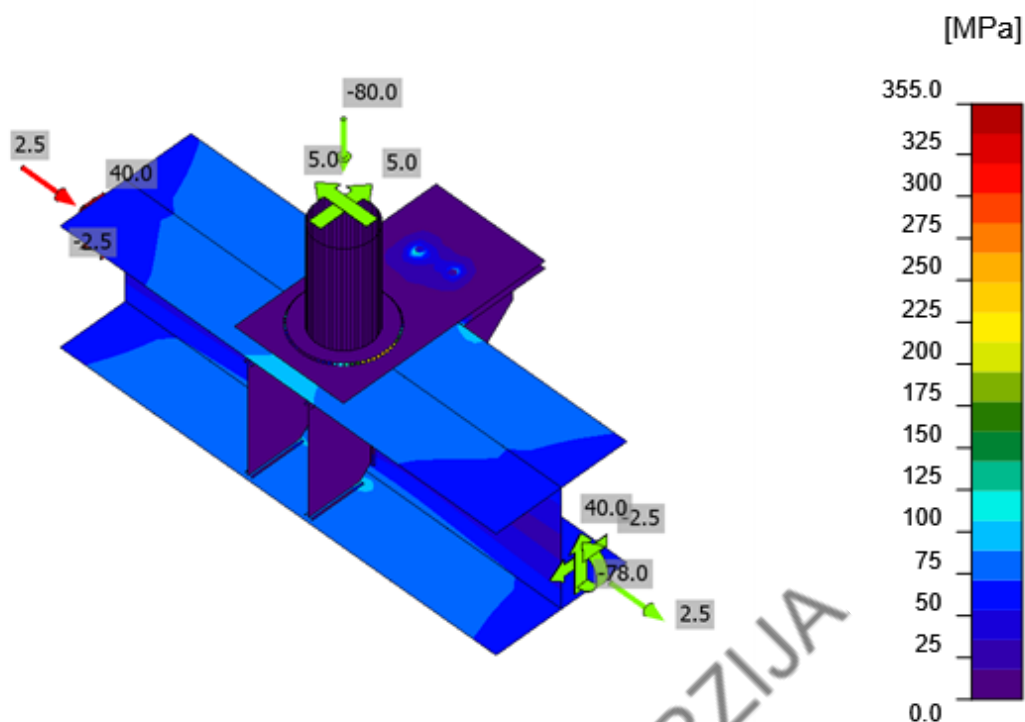
$d_0$	Cross-section size
$\delta$	Local cross-section deformation
$\delta_{lim}$	Allowed deformation



Overall check, LE1

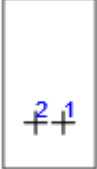


Strain check, LE1



Equivalent stress, LE1

## Bolts

Shape	Item	Grade	Loads	$F_{t,Ed}$ [kN]	$F_{v,Ed}$ [kN]	$F_{b,Rd}$ [kN]	$U_{t_t}$ [%]	$U_{t_s}$ [%]	$U_{t_{ts}}$ [%]	Status
	B1	M12 8.8 - 1	LE1	1.5	11.9	117.6	3.2	36.8	39.1	OK
	B2	M12 8.8 - 1	LE1	1.6	16.9	117.6	3.4	52.1	54.5	OK

## Design data

Grade	$F_{t,Rd}$ [kN]	$B_{p,Rd}$ [kN]	$F_{v,Rd}$ [kN]
M12 8.8 - 1	48.6	140.5	32.4

## Symbol explanation

$F_{t,Ed}$	Tension force
$F_{v,Ed}$	Resultant of bolt shear forces $V_y$ and $V_z$ in shear planes
$F_{b,Rd}$	Plate bearing resistance EN 1993-1-8 – Tab. 3.4
$U_{t_t}$	Utilization in tension
$U_{t_s}$	Utilization in shear
$U_{t_{ts}}$	Interaction of tension and shear EN 1993-1-8 – Tab. 3.4
$F_{t,Rd}$	Bolt tension resistance EN 1993-1-8 – Tab. 3.4
$B_{p,Rd}$	Punching shear resistance EN 1993-1-8 – Tab. 3.4
$F_{v,Rd}$	Bolt shear resistance EN 1993-1-8 – Tab. 3.4

Project: RDC - STREHA FRI  
Project no: 24/24  
Author: Detalj infrastruktura

## Welds

Item	Edge	Material	T <sub>w</sub> [mm]	L [mm]	Loads	$\sigma_{w,Ed}$ [MPa]	$\epsilon_{pl}$ [%]	$\sigma_{\perp}$ [MPa]	$\tau_{\perp}$ [MPa]	$\tau_{\parallel}$ [MPa]	U <sub>t</sub> [%]	U <sub>t,c</sub> [%]	Status
B-bfl 1	STIFF1a	S 355	▲ 3.0 ▼	95	LE1	64.1	0.0	-26.0	-23.8	-24.1	14.7	14.1	OK
		S 355	▲ 3.0 ▼	95	LE1	54.1	0.0	-15.0	17.2	24.6	12.4	12.1	OK
B-w 1	STIFF1a	S 355	▲ 3.0 ▼	166	LE1	42.3	0.0	-16.2	-18.0	13.6	9.7	9.5	OK
		S 355	▲ 3.0 ▼	166	LE1	49.8	0.0	26.8	-23.9	3.6	11.4	11.3	OK
B-tfl 1	STIFF1a	S 355	▲ 3.0 ▼	95	LE1	35.3	0.0	-3.5	-7.8	-18.7	8.1	8.1	OK
		S 355	▲ 3.0 ▼	95	LE1	54.8	0.0	-25.0	20.5	19.2	12.6	11.3	OK
B-bfl 1	STIFF1b	S 355	▲ 3.0 ▼	95	LE1	59.2	0.0	-17.5	-19.8	-26.0	13.6	13.1	OK
		S 355	▲ 3.0 ▼	95	LE1	66.9	0.0	-26.1	23.9	26.4	15.4	14.6	OK
B-w 1	STIFF1b	S 355	▲ 3.0 ▼	166	LE1	49.2	0.0	-21.9	-20.4	15.2	11.3	11.2	OK
		S 355	▲ 3.0 ▼	166	LE1	45.2	0.0	-17.0	18.4	-15.7	10.4	9.7	OK
B-tfl 1	STIFF1b	S 355	▲ 3.0 ▼	95	LE1	67.1	0.0	-32.5	-27.7	-19.7	15.4	12.5	OK
		S 355	▲ 3.0 ▼	95	LE1	48.1	0.0	-12.6	17.4	20.4	11.0	10.4	OK
B-tfl 1	SP1	S 235	-	200	-	-	-	-	-	-	-	-	OK
B-bfl 1	STIFF2a	S 355	▲ 3.0 ▼	95	LE1	52.5	0.0	-13.5	-16.4	-24.2	12.0	11.8	OK
		S 355	▲ 3.0 ▼	95	LE1	63.7	0.0	-25.9	23.0	24.5	14.6	14.2	OK
B-w 1	STIFF2a	S 355	▲ 3.0 ▼	166	LE1	49.1	0.0	-24.0	-22.3	10.6	11.3	11.3	OK
		S 355	▲ 3.0 ▼	166	LE1	42.0	0.0	-16.9	18.6	-12.2	9.7	9.7	OK
B-tfl 1	STIFF2a	S 355	▲ 3.0 ▼	95	LE1	31.8	0.0	-10.1	-5.2	-16.6	7.3	7.3	OK
		S 355	▲ 3.0 ▼	95	LE1	35.7	0.0	6.6	-1.7	20.2	8.2	7.3	OK
B-bfl 1	STIFF2b	S 355	▲ 3.0 ▼	95	LE1	63.4	0.0	-25.9	-23.8	-23.5	14.6	14.0	OK
		S 355	▲ 3.0 ▼	95	LE1	53.6	0.0	-15.5	17.6	23.9	12.3	12.3	OK
B-w 1	STIFF2b	S 355	▲ 3.0 ▼	166	LE1	42.9	0.0	-17.2	-18.4	13.2	9.9	9.8	OK
		S 355	▲ 3.0 ▼	166	LE1	48.7	0.0	-23.2	21.9	-11.5	11.2	11.0	OK
B-tfl 1	STIFF2b	S 355	▲ 3.0 ▼	95	LE1	32.1	0.0	-5.6	-9.8	-15.4	7.4	7.4	OK
		S 355	▲ 3.0 ▼	95	LE1	39.0	0.0	-19.6	15.4	11.8	8.9	8.3	OK
SP1	STIFF2a	S 355	▲ 5.0 ▼	134	LE1	22.6	0.0	2.5	3.2	12.6	5.2	5.2	OK
		S 355	▲ 5.0 ▼	134	LE1	14.9	0.0	-2.0	6.6	-5.4	3.4	0.0	OK
SP1	STIFF2b	S 355	▲ 5.0 ▼	134	LE1	9.0	0.0	0.4	-2.2	4.7	2.1	0.0	OK
		S 355	▲ 5.0 ▼	134	LE1	17.1	0.0	-3.9	0.3	-9.6	3.9	3.9	OK
SP2	B1	S 235	▲ 4.0	314	LE1	246.4	0.0	-146.1	114.4	5.6	68.4	24.6	OK

## Design data

Material	f <sub>u</sub> [MPa]	β <sub>w</sub> [-]	σ <sub>w,Rd</sub> [MPa]	0.9 σ [MPa]
S 355	490.0	0.90	435.6	352.8
S 235	360.0	0.80	360.0	259.2

Project: RDC - STREHA FRI  
 Project no: 24/24  
 Author: Detalj infrastruktura

## Symbol explanation





$T_w$	Throat thickness a
L	Length
$\sigma_{w,Ed}$	Equivalent stress
$\epsilon_{pl}$	Strain
$\sigma_{\perp}$	Perpendicular stress
$\tau_{\perp}$	Shear stress perpendicular to weld axis
$\tau_{  }$	Shear stress parallel to weld axis
Ut	Utilization
Ut <sub>c</sub>	Weld capacity estimation
▲	Fillet weld
f <sub>u</sub>	Ultimate strength of weld
$\beta_w$	Correlation factor EN 1993-1-8 – Tab. 4.1
$\sigma_{w,Rd}$	Equivalent stress resistance
0.9 $\sigma$	Perpendicular stress resistance: 0.9*f <sub>u</sub> /γ <sub>M2</sub>

## Buckling

Buckling analysis was not calculated.

## Bill of material

## Manufacturing operations

Name	Plates [mm]	Shape	Nr.	Welds Throat thickness [mm]	Length [mm]	Bolts	Nr.
STIFF1	P10.0x115.0-206.0 (S 355)		2	Double fillet: 3.0	712.0		
SP1	P17.0x200.0-150.0 (S 355)		1	Butt: 17.0	200.0	M12 8.8	2
STIFF2	P10.0x250.0-206.0 (S 355)		2	Double fillet: 3.0	712.0		
SP2	P10.0x200.0-370.0 (S 355)		1			M12 8.8	2
CUT2				Fillet: 4.0	314.0		

Project: RDC - STREHA FRI  
 Project no: 24/24  
 Author: Detajl infrastruktura

## Welds

Type	Material	Throat thickness [mm]	Leg size [mm]	Length [mm]
Double fillet	S 355	3.0	4.2	1424.0
Butt	S 235	-	-	200.0
Double fillet	S 355	5.0	7.1	270.0
Fillet	S 235	4.0	5.7	314.0

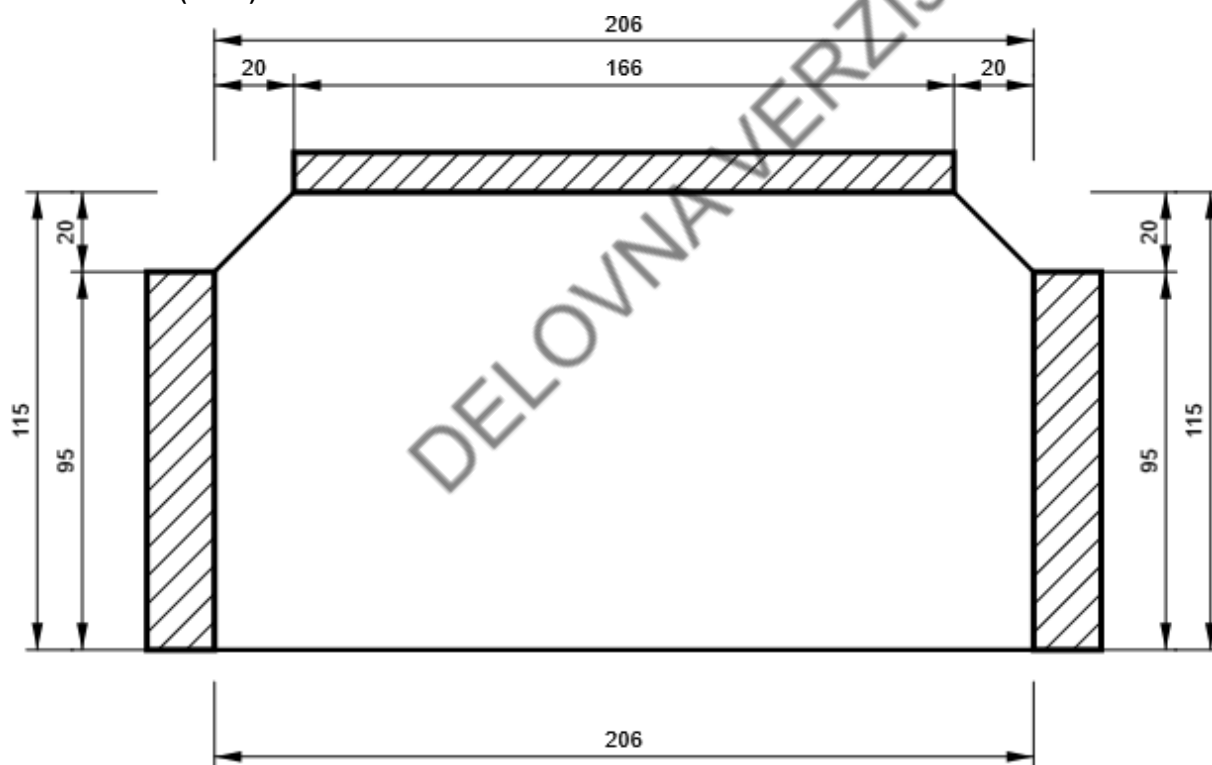
## Bolts

Name	Grip length [mm]	Count
M12 8.8	27	2

## Drawing

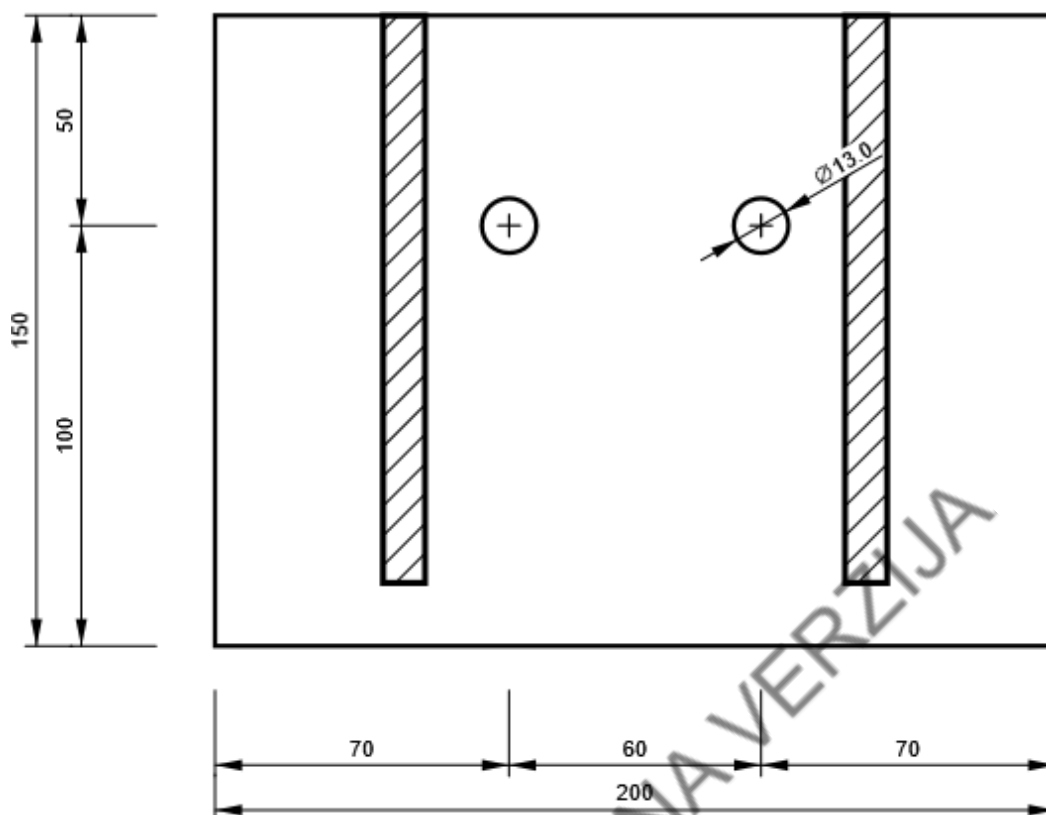
### STIFF1

P10.0x206-115 (S 355)



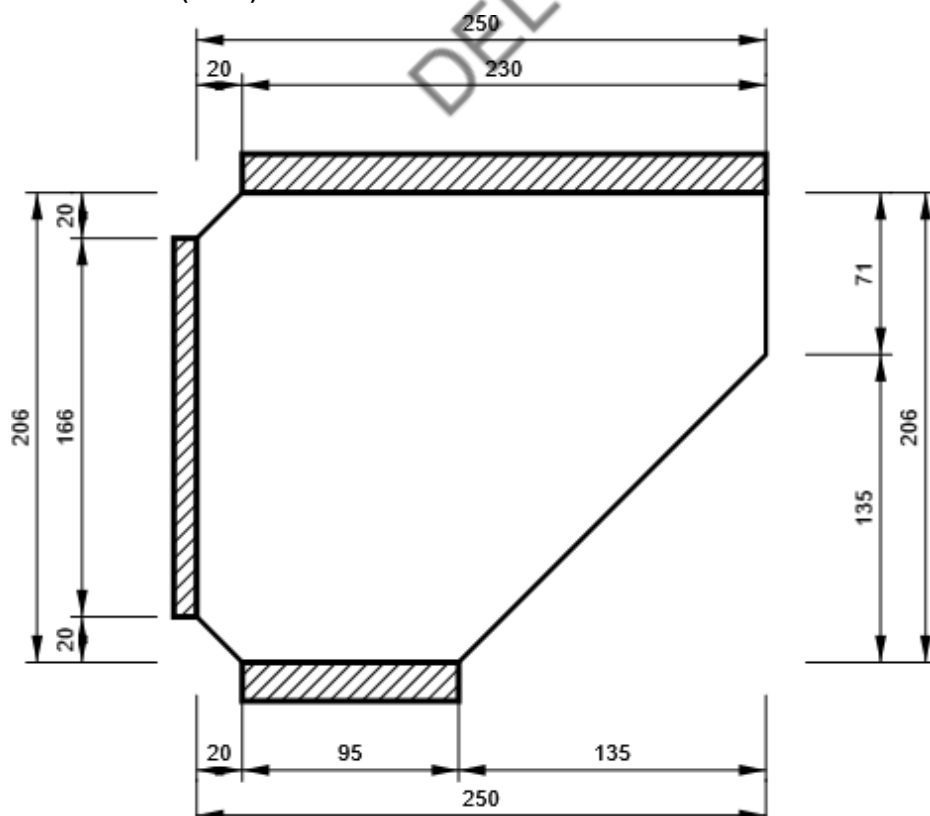
## SP1

P17.0x150-200 (S 355)



## STIFF2

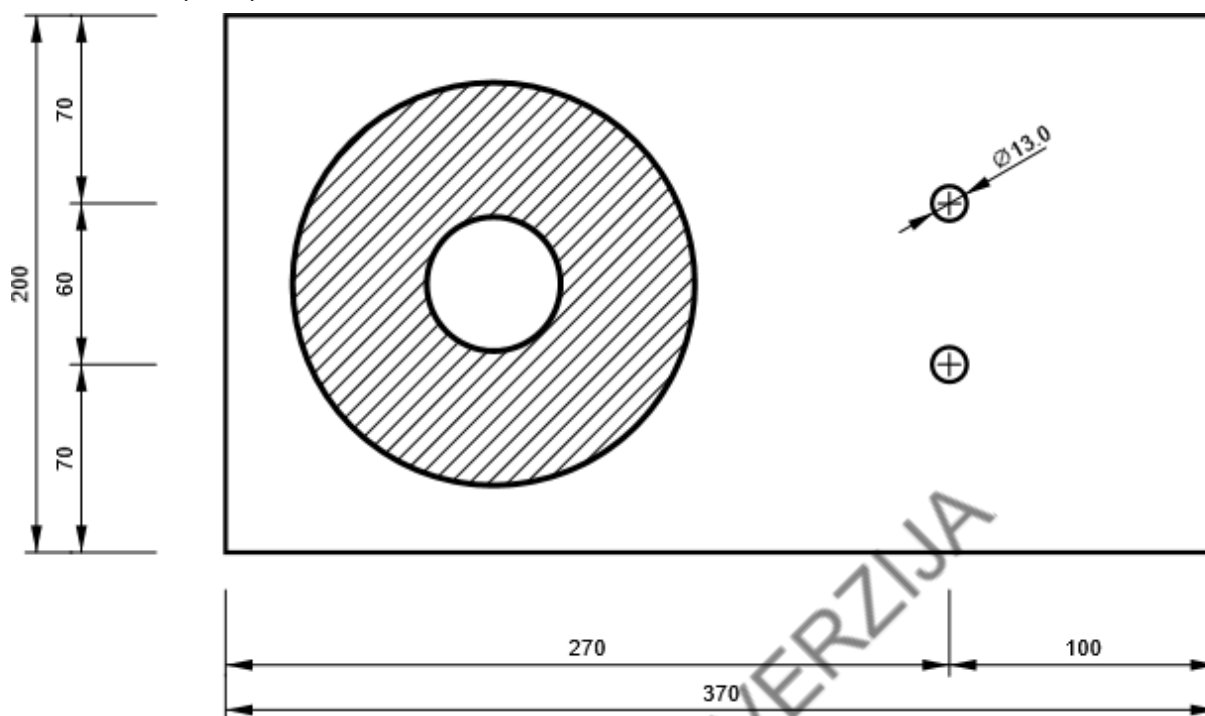
P10.0x206-250 (S 355)



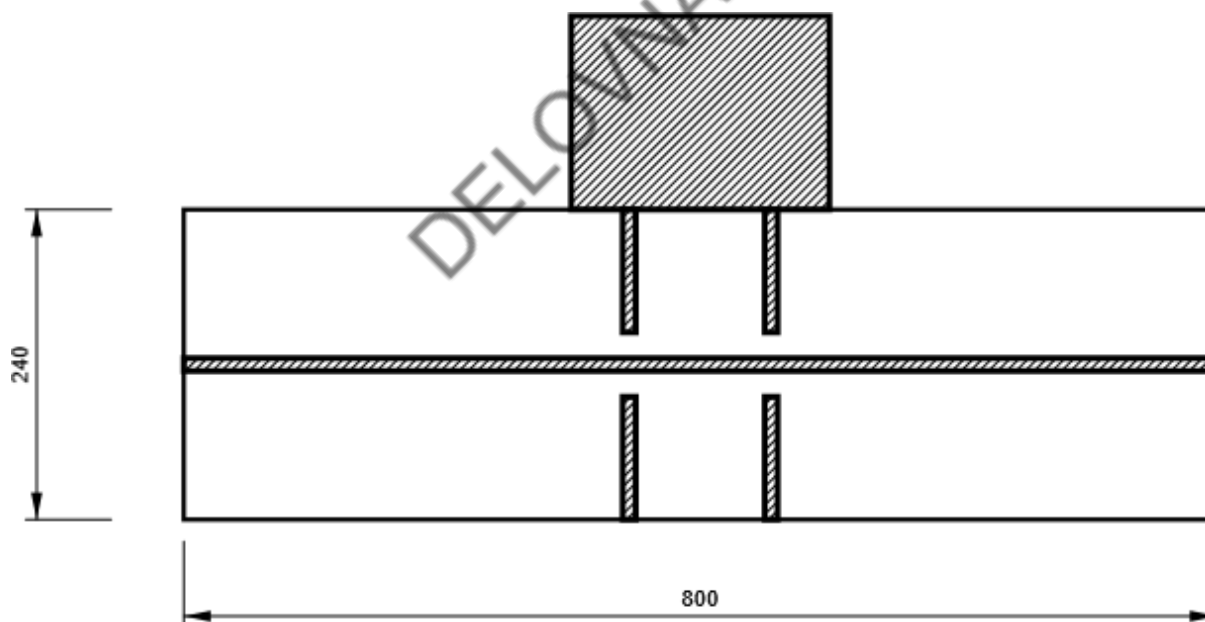


## SP2

P10.0x370-200 (S 355)



B, CON1(HEB240) - Top flange 1:



## Code settings

Item	Value	Unit	Reference
Safety factor $\gamma_{M0}$	1.00	-	EN 1993-1-1: 6.1
Safety factor $\gamma_{M1}$	1.00	-	EN 1993-1-1: 6.1
Safety factor $\gamma_{M2}$	1.25	-	EN 1993-1-1: 6.1
Safety factor $\gamma_{M3}$	1.25	-	EN 1993-1-8: 2.2
Safety factor $\gamma_C$	1.50	-	EN 1992-1-1: 2.4.2.4
Safety factor $\gamma_{Inst}$	1.20	-	EN 1992-4: Table 4.1
Joint coefficient $\beta_j$	0.67	-	EN 1993-1-8: 6.2.5
Effective area - influence of mesh size	0.10	-	
Friction coefficient - concrete	0.25	-	EN 1993-1-8
Friction coefficient in slip-resistance	0.30	-	EN 1993-1-8 tab 3.7
Limit plastic strain	0.05	-	EN 1993-1-5
Detailing	No		
Distance between bolts [d]	2.20	-	EN 1993-1-8: tab 3.3
Distance between bolts and edge [d]	1.20	-	EN 1993-1-8: tab 3.3
Concrete breakout resistance check	Both		EN 1992-4: 7.2.1.4 and 7.2.2.5
Use calculated $\alpha_b$ in bearing check.	Yes		EN 1993-1-8: tab 3.4
Cracked concrete	Yes		EN 1992-4
Local deformation check	Yes		CIDECT DG 1, 3 - 1.1
Local deformation limit	0.03	-	CIDECT DG 1, 3 - 1.1
Geometrical nonlinearity (GMNA)	Yes		Analysis with large deformations for hollow section joints
Braced system	No		EN 1993-1-8: 5.2.2.5

**Project:** RDC - STREHA FRI  
**Project no:** 24/24  
**Author:** Detaji infrastruktura

## Project data

Project name	RDC - STREHA FRI
Project number	24/24
Author	Detaji infrastruktura
Description	
Date	5/10/2024
Code	EN

## Material

Steel	S 235, S 355
Concrete	C25/30

DELOVNA VERZIJA

Project: RDC - STREHA FRI  
 Project no: 24/24  
 Author: Detajl infrastruktura

## Project item DETAJL D6

### Design

Name: DETAJL D6  
 Description:  
 Analysis: Stress, strain/ loads in equilibrium

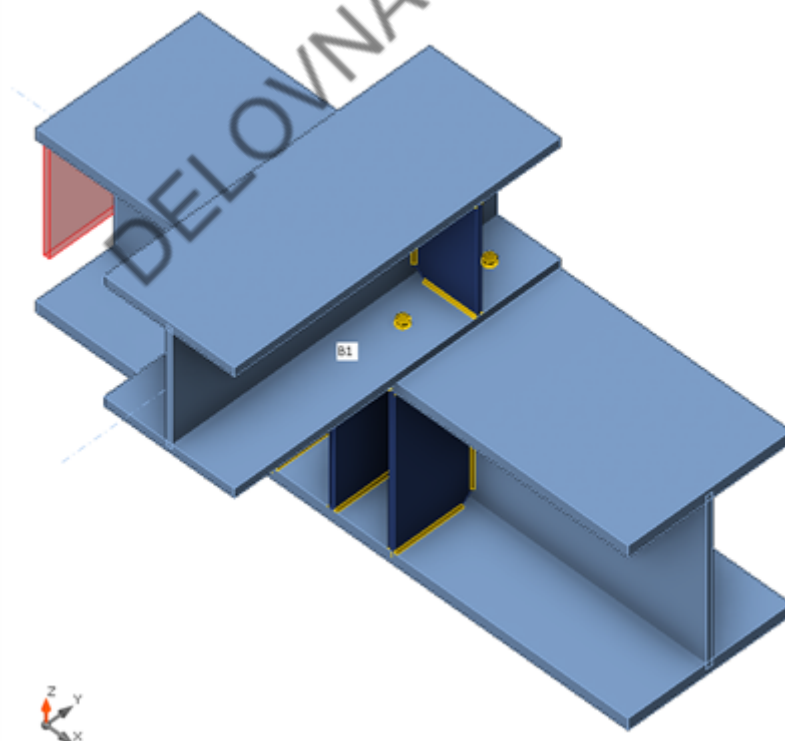
### Members

#### Geometry

Name	Cross-section	$\beta$ - Direction [°]	$\gamma$ - Pitch [°]	$\alpha$ - Rotation [°]	Offset ex [mm]	Offset ey [mm]	Offset ez [mm]
B	1 - CON1(HEB340)	0.0	0.0	0.0	0	0	0
B1	2 - CON1(HEB240)	-90.0	0.0	0.0	0	0	290

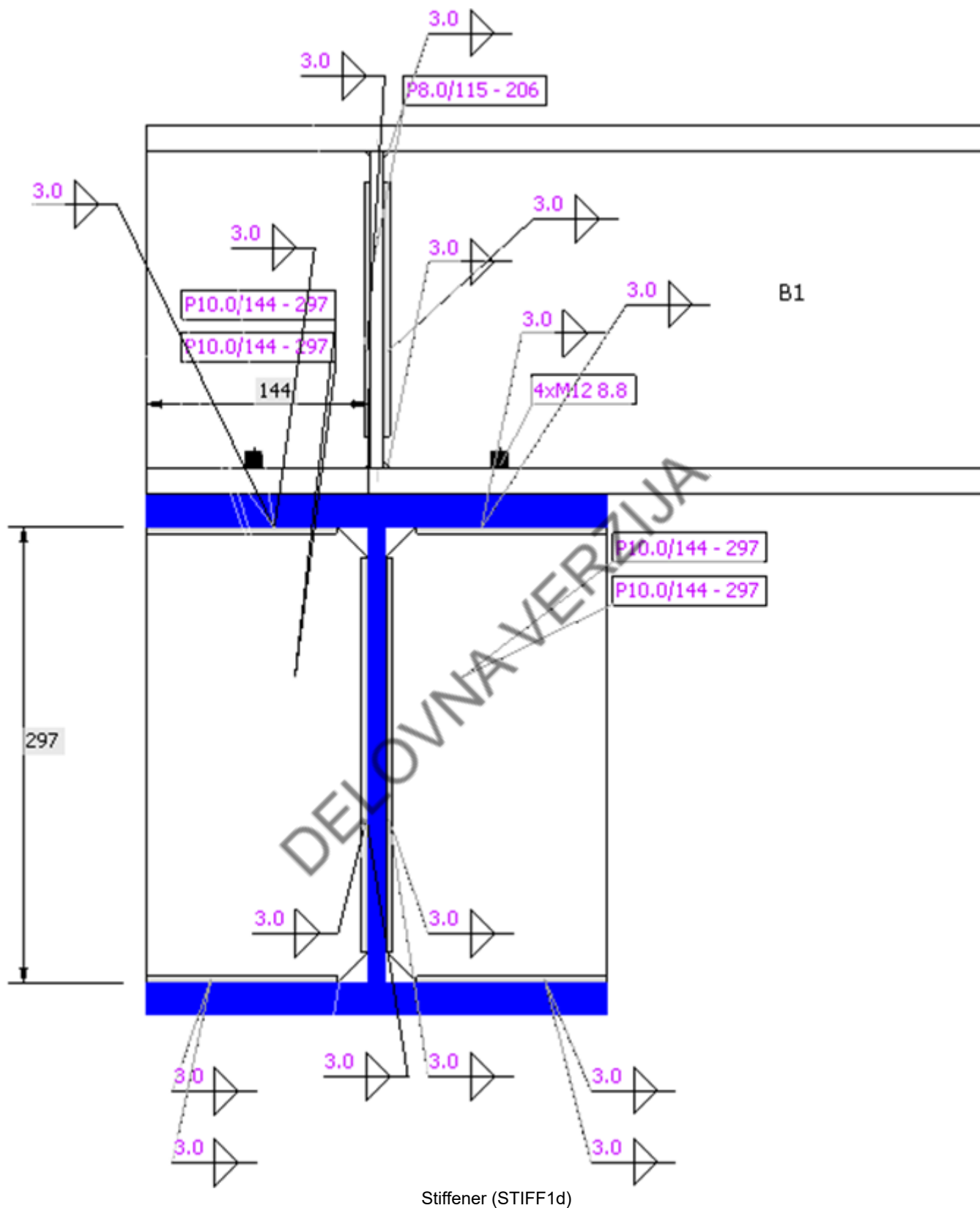
#### Supports and forces

Name	Support	Forces in	X [mm]
B / begin	N-Vy-Vz-Mx-My-Mz	Node	0
B / end		Node	0
B1 / end		Bolts	0



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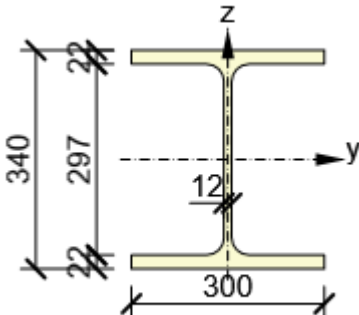
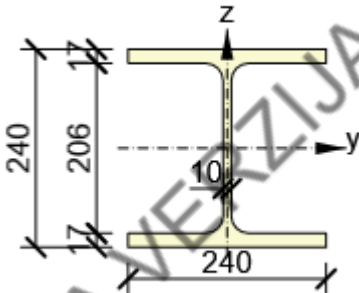




## Cross-sections

Name	Material
1 - CON1(HEB340)	S 355
2 - CON1(HEB240)	S 355

## Cross-sections

Name	Material	Drawing
1 - CON1(HEB340)	S 355	
2 - CON1(HEB240)	S 355	

## Bolts

Name	Diameter [mm]	$f_y$ [MPa]	$f_u$ [MPa]	Gross area [mm <sup>2</sup> ]
M12 8.8	12	640.0	800.0	113

## Load effects (forces in equilibrium)

Name	Member	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
LE1	B / Begin	0.0	0.0	2.0	0.0	280.0	0.0
	B / End	0.0	0.0	142.0	0.0	-280.0	0.0
	B1 / End	0.0	0.0	-50.0	0.0	0.0	0.0

## Unbalanced forces

Name	X [kN]	Y [kN]	Z [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
LE1	0.0	0.0	94.0	0.0	0.0	0.0

## Check

### Summary

Name	Value	Check status
Analysis	100.0%	OK
Plates	0.0 < 5.0%	OK
Bolts	5.8 < 100%	OK
Welds	24.3 < 100%	OK
Buckling	Not calculated	

### Plates

Name	$t_p$ [mm]	Loads	$\sigma_{Ed}$ [MPa]	$\epsilon_{pl}$ [%]	$\sigma_{c,Ed}$ [MPa]	Status
B-bfl 1	21.5	LE1	155.6	0.0	0.0	OK
B-tfl 1	21.5	LE1	155.7	0.0	6.9	OK
B-w 1	12.0	LE1	138.1	0.0	0.0	OK
B1-bfl 1	17.0	LE1	25.6	0.0	8.3	OK
B1-tfl 1	17.0	LE1	25.7	0.0	0.0	OK
B1-w 1	10.0	LE1	41.7	0.0	0.0	OK
STIFF1a	10.0	LE1	28.1	0.0	0.0	OK
STIFF1b	10.0	LE1	28.1	0.0	0.0	OK
STIFF1c	10.0	LE1	27.7	0.0	0.0	OK
STIFF1d	10.0	LE1	27.9	0.0	0.0	OK
STIFF1e	10.0	LE1	28.8	0.0	0.0	OK
STIFF1f	10.0	LE1	28.6	0.0	0.0	OK
STIFF2a	8.0	LE1	43.6	0.0	0.0	OK
STIFF2b	8.0	LE1	44.0	0.0	0.0	OK

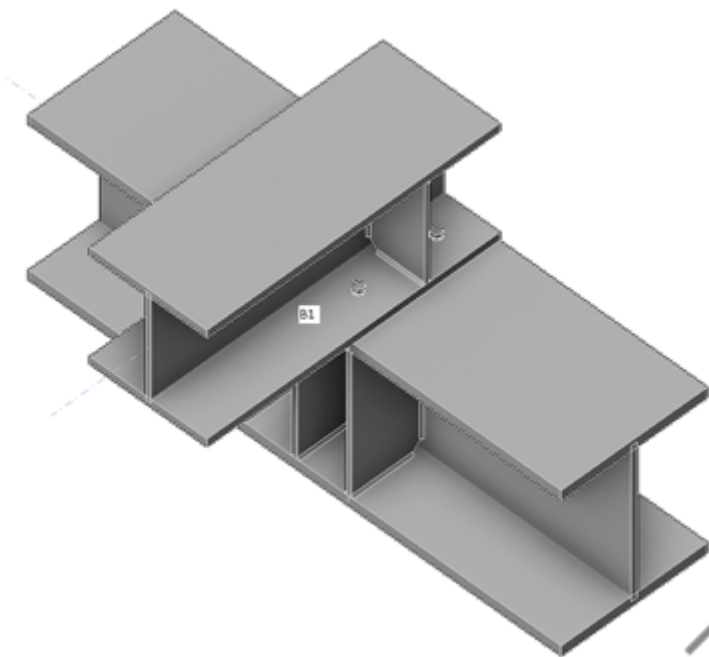
### Design data

Material	$f_y$ [MPa]	$\epsilon_{lim}$ [%]
S 355	355.0	5.0

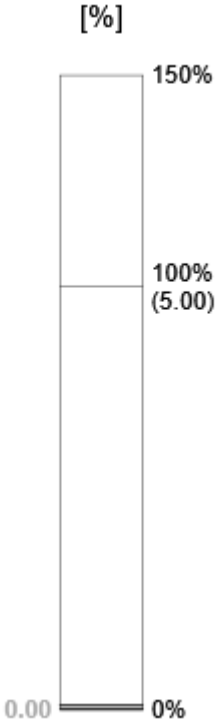
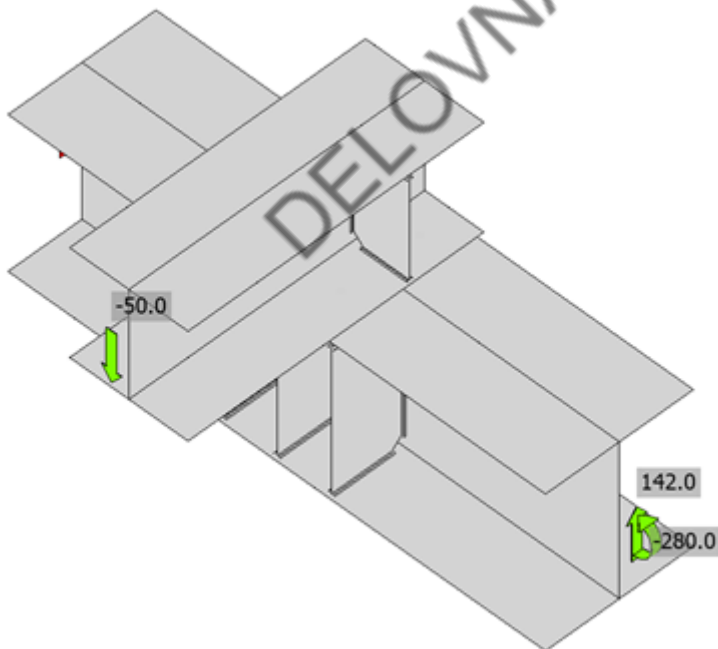
### Symbol explanation

$t_p$	Plate thickness
$\sigma_{Ed}$	Equivalent stress
$\epsilon_{pl}$	Plastic strain
$\sigma_{c,Ed}$	Contact stress
$f_y$	Yield strength
$\epsilon_{lim}$	Limit of plastic strain

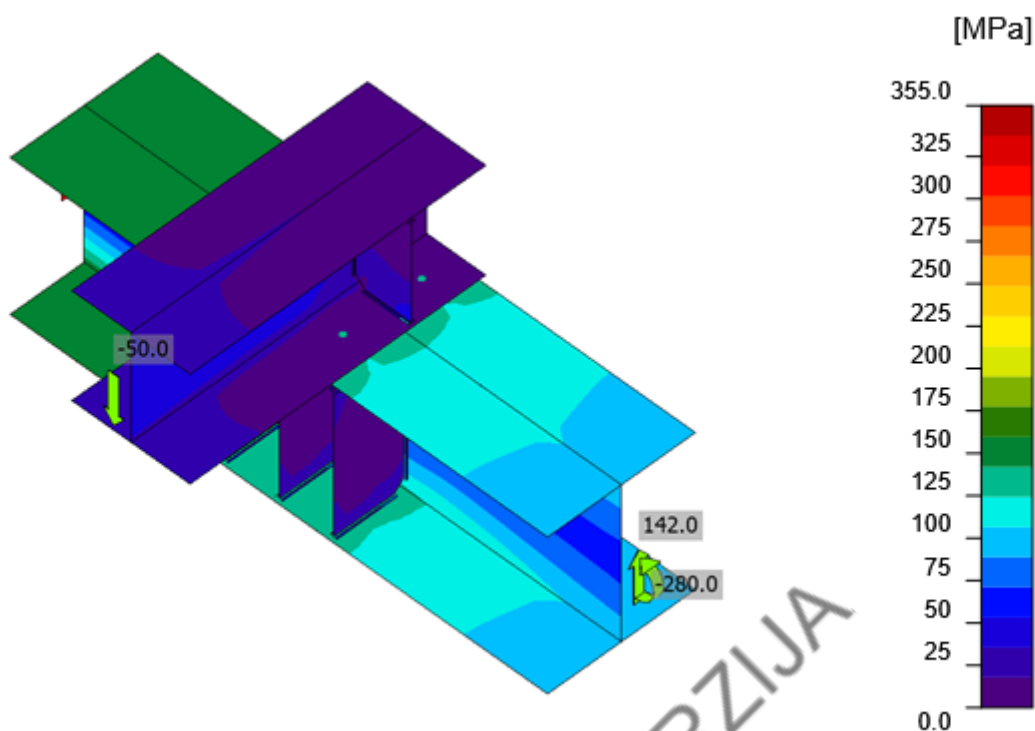




Overall check, LE1



Strain check, LE1



Equivalent stress, LE1

## Bolts

Shape	Item	Grade	Loads	$F_{t,Ed}$ [kN]	$F_{v,Ed}$ [kN]	$F_{b,Rd}$ [kN]	$U_t$ [%]	$U_s$ [%]	$U_{ts}$ [%]	Status
	B1	M12 8.8 - 1	LE1	0.4	1.7	199.9	0.7	5.2	5.7	OK
	B2	M12 8.8 - 1	LE1	0.4	1.7	199.9	0.7	5.2	5.8	OK
	B3	M12 8.8 - 1	LE1	0.2	1.7	199.9	0.5	5.1	5.5	OK
	B4	M12 8.8 - 1	LE1	0.3	1.7	199.9	0.5	5.2	5.6	OK

## Design data

Grade	$F_{t,Rd}$ [kN]	$B_{p,Rd}$ [kN]	$F_{v,Rd}$ [kN]
M12 8.8 - 1	48.6	238.9	32.4

## Symbol explanation

$F_{t,Ed}$	Tension force
$F_{v,Ed}$	Resultant of bolt shear forces $V_y$ and $V_z$ in shear planes
$F_{b,Rd}$	Plate bearing resistance EN 1993-1-8 – Tab. 3.4
$U_t$	Utilization in tension
$U_s$	Utilization in shear
$U_{ts}$	Interaction of tension and shear EN 1993-1-8 – Tab. 3.4
$F_{t,Rd}$	Bolt tension resistance EN 1993-1-8 – Tab. 3.4
$B_{p,Rd}$	Punching shear resistance EN 1993-1-8 – Tab. 3.4
$F_{v,Rd}$	Bolt shear resistance EN 1993-1-8 – Tab. 3.4

## Welds

Item	Edge	T <sub>w</sub> [mm]	L [mm]	Loads	$\sigma_{w,Ed}$ [MPa]	$\epsilon_{Pl}$ [%]	$\sigma_{\perp}$ [MPa]	$\tau_{\perp}$ [MPa]	$\tau_{\parallel}$ [MPa]	U <sub>t</sub> [%]	U <sub>t,c</sub> [%]	Status
B-bfl 1	STIFF1a	▲ 3.0 ▼	124	LE1	70.6	0.0	-34.2	-28.7	-21.2	16.2	14.6	OK
		▲ 3.0 ▼	124	LE1	50.7	0.0	7.1	-8.1	-27.8	11.7	11.7	OK
B-w 1	STIFF1a	▲ 3.0 ▼	257	LE1	50.9	0.0	-19.7	-24.6	11.3	11.7	11.7	OK
		▲ 3.0 ▼	257	LE1	67.2	0.0	36.8	-32.1	-5.1	15.4	15.4	OK
B-tfl 1	STIFF1a	▲ 3.0 ▼	124	LE1	52.4	0.0	24.0	19.9	-18.1	12.0	12.0	OK
		▲ 3.0 ▼	124	LE1	46.6	0.0	-6.0	5.9	-26.0	10.7	10.7	OK
B-bfl 1	STIFF1b	▲ 3.0 ▼	124	LE1	50.7	0.0	7.1	8.1	27.8	11.6	11.6	OK
		▲ 3.0 ▼	124	LE1	70.8	0.0	-34.2	28.7	21.4	16.3	14.6	OK
B-w 1	STIFF1b	▲ 3.0 ▼	257	LE1	67.4	0.0	36.9	32.1	5.1	15.5	15.5	OK
		▲ 3.0 ▼	257	LE1	51.1	0.0	-19.7	24.7	-11.6	11.7	11.7	OK
B-tfl 1	STIFF1b	▲ 3.0 ▼	124	LE1	45.6	0.0	-7.3	-7.0	25.0	10.5	10.5	OK
		▲ 3.0 ▼	124	LE1	52.4	0.0	24.1	-20.4	17.5	12.0	12.0	OK
B-bfl 1	STIFF1c	▲ 3.0 ▼	124	LE1	73.2	0.0	-35.4	-30.3	-21.2	16.8	15.0	OK
		▲ 3.0 ▼	124	LE1	49.0	0.0	-6.8	11.9	25.4	11.3	11.3	OK
B-w 1	STIFF1c	▲ 3.0 ▼	257	LE1	49.4	0.0	-17.1	-22.9	13.8	11.3	11.3	OK
		▲ 3.0 ▼	257	LE1	67.3	0.0	37.2	-31.6	-7.2	15.5	15.1	OK
B-tfl 1	STIFF1c	▲ 3.0 ▼	124	LE1	57.7	0.0	27.1	22.0	-19.6	13.3	12.5	OK
		▲ 3.0 ▼	124	LE1	43.9	0.0	-8.6	8.5	-23.3	10.1	10.1	OK
B-bfl 1	STIFF1d	▲ 3.0 ▼	124	LE1	48.1	0.0	-6.7	-11.8	-24.8	11.0	11.0	OK
		▲ 3.0 ▼	124	LE1	72.6	0.0	-35.3	30.2	20.6	16.7	14.9	OK
B-w 1	STIFF1d	▲ 3.0 ▼	257	LE1	67.2	0.0	37.1	31.6	6.6	15.4	15.2	OK
		▲ 3.0 ▼	257	LE1	48.9	0.0	-17.1	22.9	-13.3	11.2	11.2	OK
B-tfl 1	STIFF1d	▲ 3.0 ▼	124	LE1	43.4	0.0	-8.0	-7.7	23.4	10.0	10.0	OK
		▲ 3.0 ▼	124	LE1	57.8	0.0	27.4	-22.3	19.2	13.3	12.6	OK
B-bfl 1	STIFF1e	▲ 3.0 ▼	124	LE1	71.9	0.0	-36.1	-30.9	-18.3	16.5	14.8	OK
		▲ 3.0 ▼	124	LE1	44.7	0.0	9.4	-8.6	-23.7	10.3	10.3	OK
B-w 1	STIFF1e	▲ 3.0 ▼	257	LE1	44.5	0.0	-14.4	-21.1	12.1	10.2	10.2	OK
		▲ 3.0 ▼	257	LE1	66.7	0.0	37.9	-31.3	-4.6	15.3	15.1	OK
B-tfl 1	STIFF1e	▲ 3.0 ▼	124	LE1	55.3	0.0	28.5	21.8	-16.6	12.7	12.3	OK
		▲ 3.0 ▼	124	LE1	42.1	0.0	-7.5	7.5	-22.7	9.7	9.7	OK
B-bfl 1	STIFF1f	▲ 3.0 ▼	124	LE1	44.6	0.0	9.3	8.6	23.7	10.2	10.2	OK
		▲ 3.0 ▼	124	LE1	72.1	0.0	-36.1	30.9	18.5	16.5	14.9	OK
B-w 1	STIFF1f	▲ 3.0 ▼	257	LE1	66.4	0.0	37.7	31.2	4.6	15.2	15.1	OK
		▲ 3.0 ▼	257	LE1	44.7	0.0	-14.4	21.1	-12.3	10.3	10.3	OK
B-tfl 1	STIFF1f	▲ 3.0 ▼	124	LE1	42.7	0.0	-8.5	-8.7	22.6	9.8	9.8	OK
		▲ 3.0 ▼	124	LE1	55.4	0.0	28.4	-21.9	16.5	12.7	12.3	OK
B1-bfl 1	STIFF2a	▲ 3.0 ▼	95	LE1	100.2	0.0	-44.8	-44.8	26.0	23.0	17.9	OK
		▲ 3.0 ▼	95	LE1	104.5	0.0	-46.9	47.0	-26.5	24.0	18.4	OK
B1-w 1	STIFF2a	▲ 3.0 ▼	166	LE1	31.0	0.0	-4.2	-5.5	-16.9	7.1	7.1	OK

Item	Edge	$T_w$ [mm]	L [mm]	Loads	$\sigma_{w,Ed}$ [MPa]	$\epsilon_{Pl}$ [%]	$\sigma_{\perp}$ [MPa]	$\tau_{\perp}$ [MPa]	$\tau_{  }$ [MPa]	Ut [%]	Ut <sub>c</sub> [%]	Status
		▲ 3.0 ▼	166	LE1	33.4	0.0	-10.1	8.8	16.2	7.7	7.7	OK
B1-tfl 1	STIFF2a	▲ 3.0 ▼	95	LE1	29.4	0.0	-12.0	-10.2	11.7	6.8	6.8	OK
		▲ 3.0 ▼	95	LE1	22.5	0.0	-2.9	4.6	-12.0	5.2	5.2	OK
B1-bfl 1	STIFF2b	▲ 3.0 ▼	95	LE1	106.0	0.0	-47.6	-47.6	27.0	24.3	18.6	OK
		▲ 3.0 ▼	95	LE1	101.7	0.0	-45.4	45.4	-26.4	23.4	18.0	OK
B1-w 1	STIFF2b	▲ 3.0 ▼	166	LE1	33.4	0.0	-10.1	-8.8	-16.2	7.7	7.7	OK
		▲ 3.0 ▼	166	LE1	31.0	0.0	-4.2	5.5	16.9	7.1	7.1	OK
B1-tfl 1	STIFF2b	▲ 3.0 ▼	95	LE1	22.5	0.0	-2.9	-4.6	12.0	5.2	5.2	OK
		▲ 3.0 ▼	95	LE1	29.4	0.0	-11.9	10.2	-11.7	6.7	6.7	OK

#### Design data

Material	$f_u$ [MPa]	$\beta_w$ [-]	$\sigma_{w,Rd}$ [MPa]	$0.9 \sigma$ [MPa]
S 355	490.0	0.90	435.6	352.8

#### Symbol explanation

$T_w$	Throat thickness a
L	Length
$\sigma_{w,Ed}$	Equivalent stress
$\epsilon_{Pl}$	Strain
$\sigma_{\perp}$	Perpendicular stress
$\tau_{\perp}$	Shear stress perpendicular to weld axis
$\tau_{  }$	Shear stress parallel to weld axis
Ut	Utilization
Ut <sub>c</sub>	Weld capacity estimation
▲	Fillet weld
$f_u$	Ultimate strength of weld
$\beta_w$	Correlation factor EN 1993-1-8 – Tab. 4.1
$\sigma_{w,Rd}$	Equivalent stress resistance
$0.9 \sigma$	Perpendicular stress resistance: $0.9 \cdot f_u / \gamma_{M2}$



#### Buckling

Buckling analysis was not calculated.

Project: RDC - STREHA FRI  
 Project no: 24/24  
 Author: Detalj infrastruktura

## Bill of material

### Manufacturing operations

Name	Plates [mm]	Shape	Nr.	Welds Throat thickness [mm]	Length [mm]	Bolts	Nr.
STIFF1	P10.0x144.0-297.0 (S 355)		6	Double fillet: 3.0	3030.0		
STIFF2	P8.0x115.0-206.0 (S 355)		2	Double fillet: 3.0	712.0		
CUT1							

### Welds

Type	Material	Throat thickness [mm]	Leg size [mm]	Length [mm]
Double fillet	S 355	3.0	4.2	3742.0

### Bolts

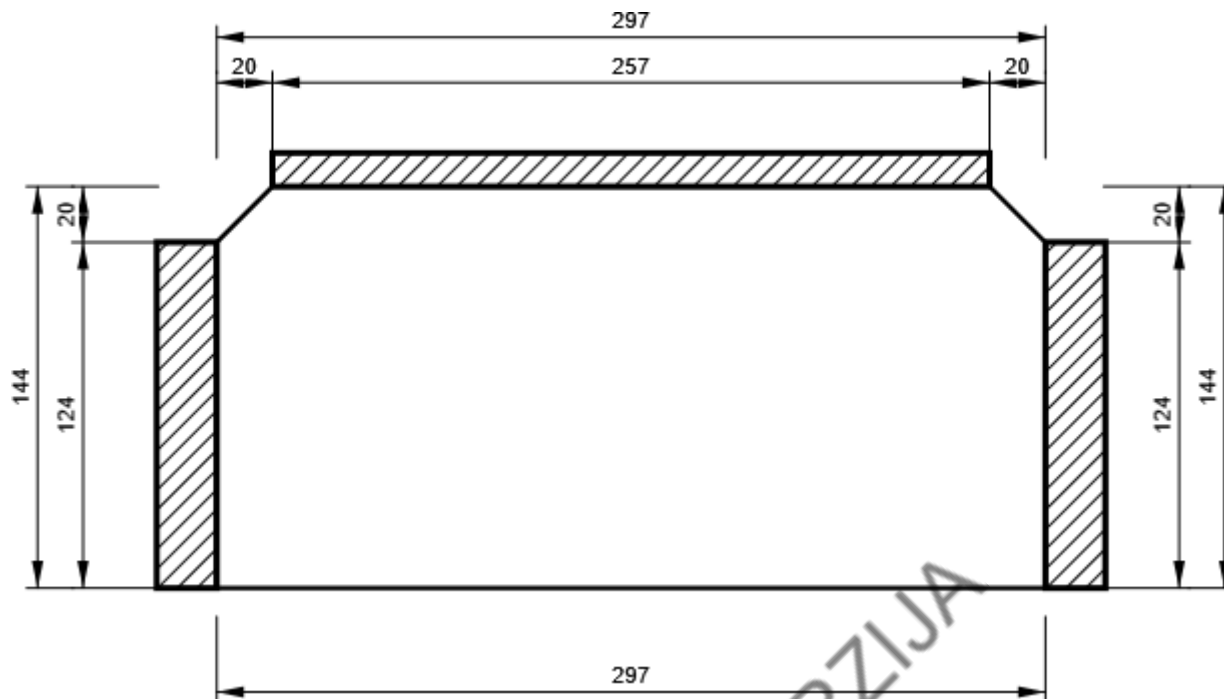
Name	Grip length [mm]	Count
M12 8.8	39	4

### Drawing

#### STIFF1

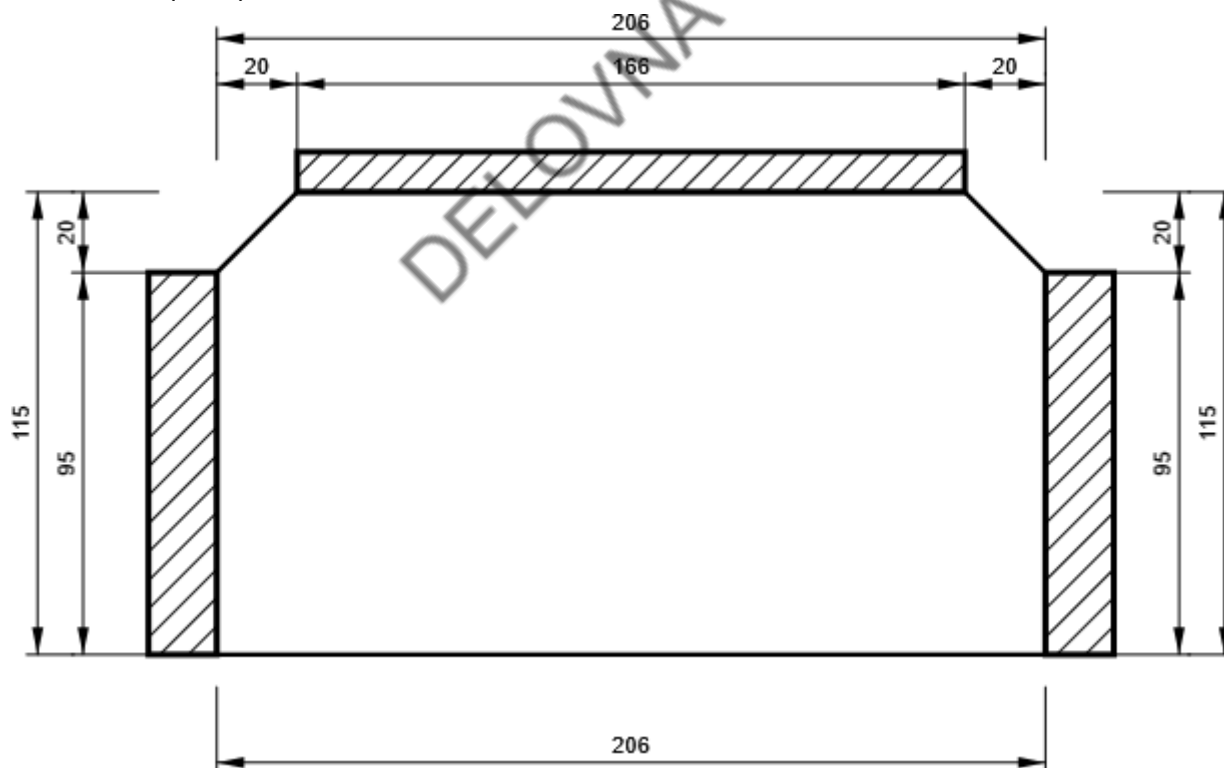
Project: RDC - STREHA FRI  
Project no: 24/24  
Author: Detaji infrastruktura

P10.0x297-144 (S 355)

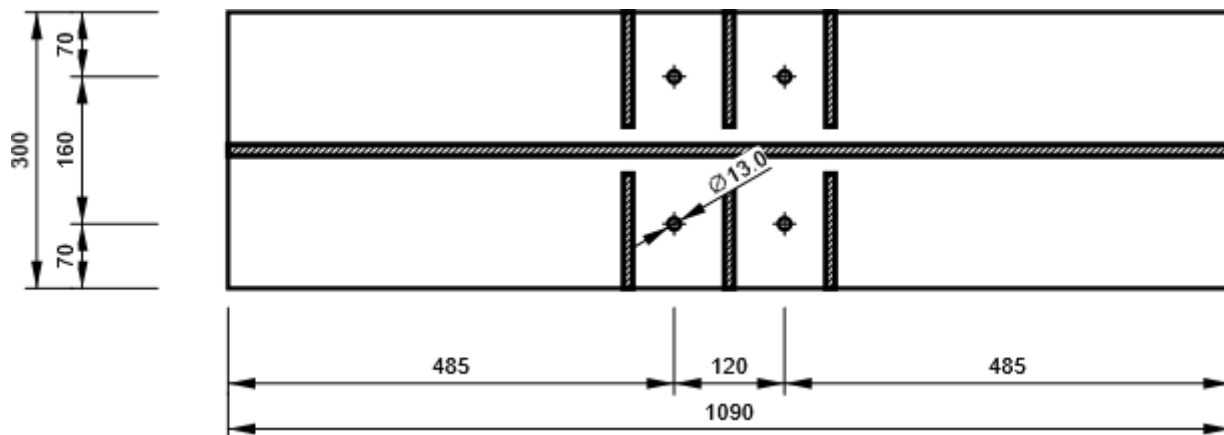


STIFF2

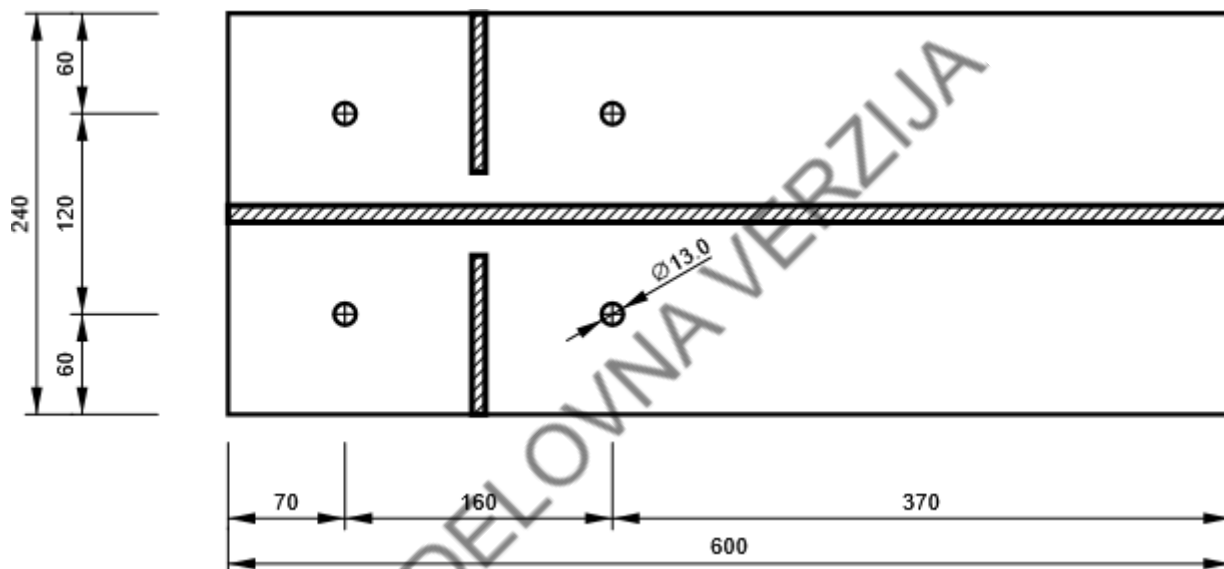
P8.0x206-115 (S 355)



**B, CON1(HEB340) - Top flange 1:**



**B1, CON1(HEB240) - Bottom flange 1:**



Project: RDC - STREHA FRI  
Project no: 24/24  
Author: Detalj infrastruktura

## Code settings

Item	Value	Unit	Reference
Safety factor $\gamma_{M0}$	1.00	-	EN 1993-1-1: 6.1
Safety factor $\gamma_{M1}$	1.00	-	EN 1993-1-1: 6.1
Safety factor $\gamma_{M2}$	1.25	-	EN 1993-1-1: 6.1
Safety factor $\gamma_{M3}$	1.25	-	EN 1993-1-8: 2.2
Safety factor $\gamma_C$	1.50	-	EN 1992-1-1: 2.4.2.4
Safety factor $\gamma_{Inst}$	1.20	-	EN 1992-4: Table 4.1
Joint coefficient $\beta_j$	0.67	-	EN 1993-1-8: 6.2.5
Effective area - influence of mesh size	0.10	-	
Friction coefficient - concrete	0.25	-	EN 1993-1-8
Friction coefficient in slip-resistance	0.30	-	EN 1993-1-8 tab 3.7
Limit plastic strain	0.05	-	EN 1993-1-5
Detailing	No		
Distance between bolts [d]	2.20	-	EN 1993-1-8: tab 3.3
Distance between bolts and edge [d]	1.20	-	EN 1993-1-8: tab 3.3
Concrete breakout resistance check	Both		EN 1992-4: 7.2.1.4 and 7.2.2.5
Use calculated $a_b$ in bearing check.	Yes		EN 1993-1-8: tab 3.4
Cracked concrete	Yes		EN 1992-4
Local deformation check	Yes		CIDECT DG 1, 3 - 1.1
Local deformation limit	0.03	-	CIDECT DG 1, 3 - 1.1
Geometrical nonlinearity (GMNA)	Yes		Analysis with large deformations for hollow section joints
Braced system	No		EN 1993-1-8: 5.2.2.5



**Project:** RDC - STREHA FRI  
**Project no:** 24/24  
**Author:** Detajl infrastruktura

## Project data

Project name	RDC - STREHA FRI
Project number	24/24
Author	Detajl infrastruktura
Description	
Date	5/10/2024
Code	EN

## Material

Steel	S 235, S 355
Concrete	C25/30

DELOVNA VERZIJA

Project: RDC - STREHA FRI  
Project no: 24/24  
Author: Detajl infrastruktura

## Project item DETAJL D7

### Design

Name: DETAJL D7  
Description:  
Analysis: Stress, strain/ loads in equilibrium

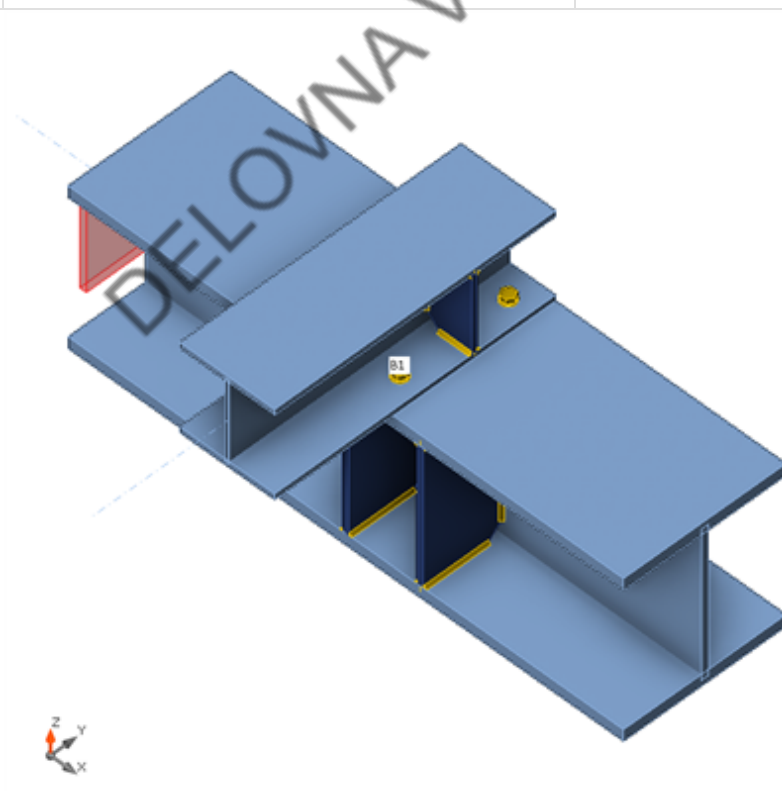
### Members

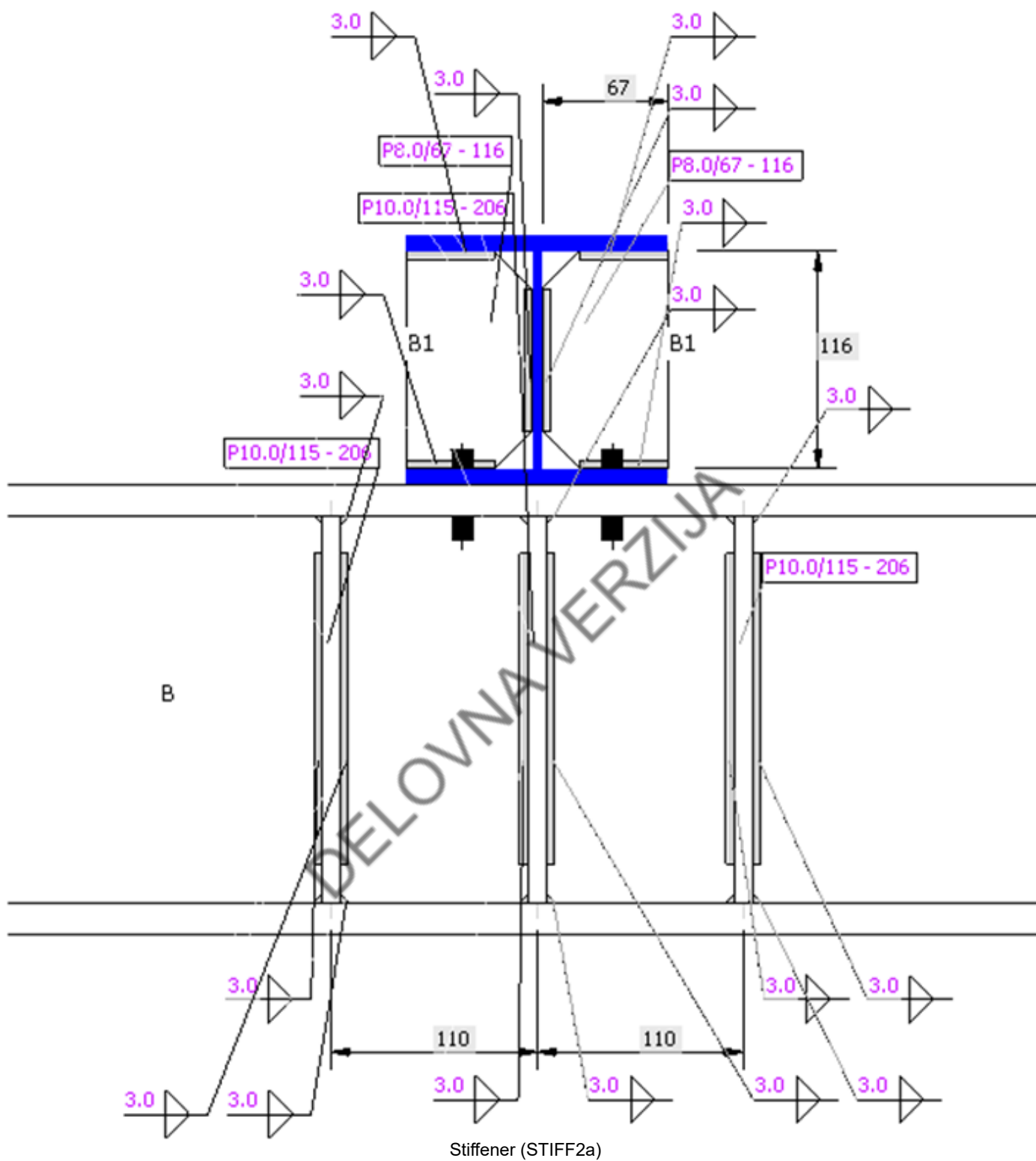
#### Geometry

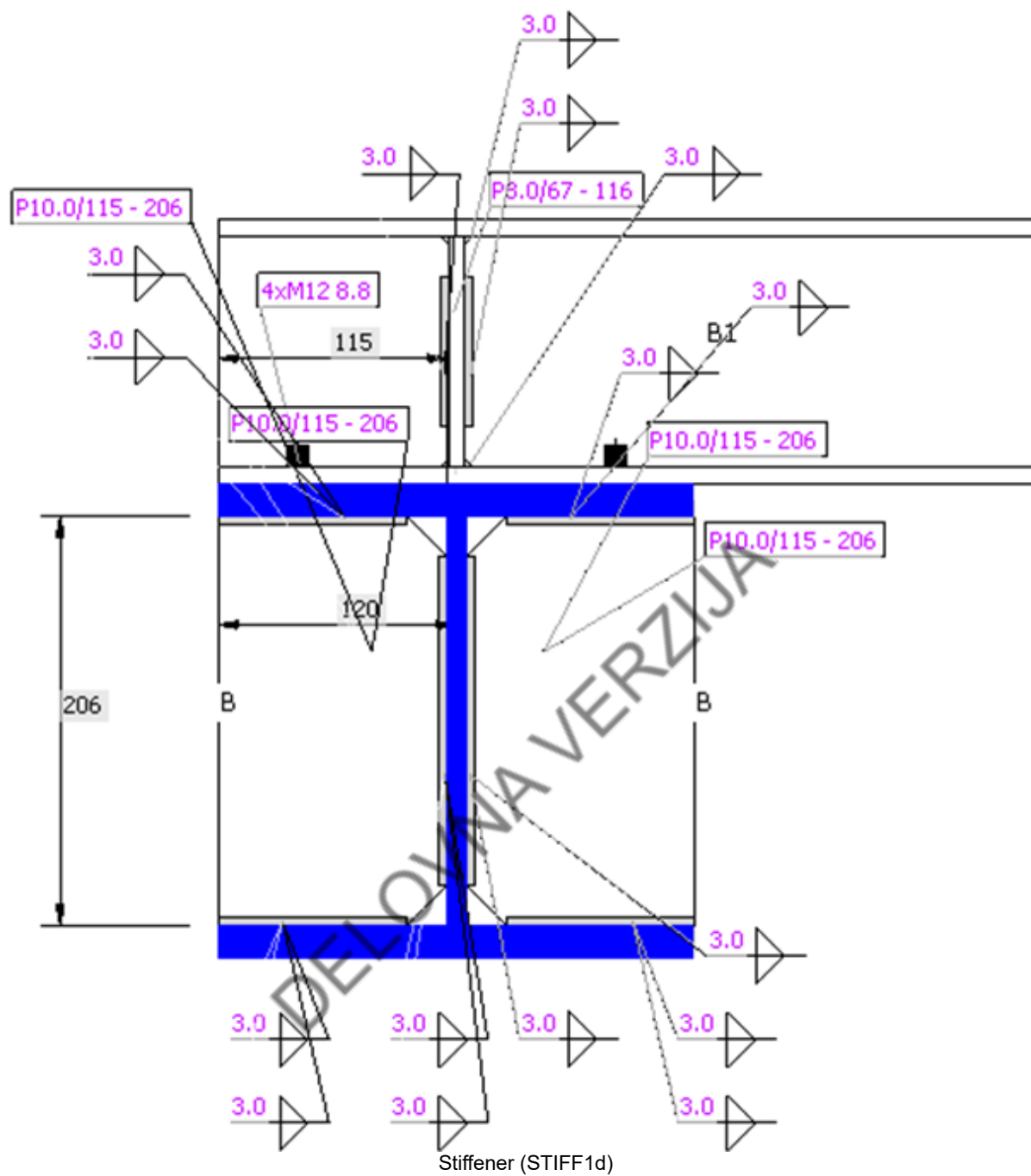
Name	Cross-section	$\beta$ - Direction [°]	$\gamma$ - Pitch [°]	$\alpha$ - Rotation [°]	Offset ex [mm]	Offset ey [mm]	Offset ez [mm]
B	4 - HEB240	0.0	0.0	0.0	0	0	0
B1	3 - HEA140	-90.0	0.0	0.0	-120	0	186

#### Supports and forces

Name	Support	Forces in	X [mm]
B / begin	N-Vy-Vz-Mx-My-Mz	Node	0
B / end		Node	0
B1 / end		Bolts	120



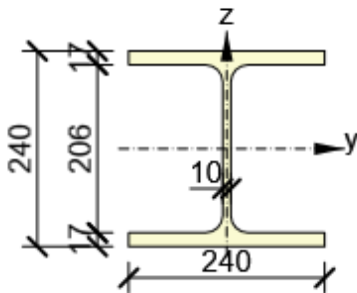
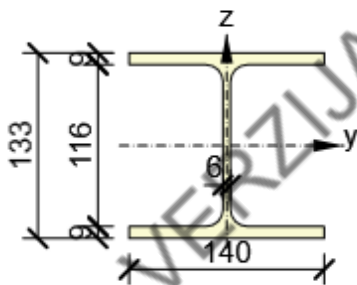




## Cross-sections

Name	Material
4 - HEB240	S 355
3 - HEA140	S 235

## Cross-sections

Name	Material	Drawing
4 - HEB240	S 355	
3 - HEA140	S 235	

## Bolts

Name	Diameter [mm]	$f_y$ [MPa]	$f_u$ [MPa]	Gross area [mm <sup>2</sup> ]
M12 8.8	12	640.0	800.0	113

## Load effects (forces in equilibrium)

Name	Member	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
LE1	B / Begin	0.0	0.0	2.0	0.0	280.0	0.0
	B / End	0.0	0.0	142.0	0.0	-280.0	0.0
	B1 / End	0.0	0.0	-50.0	0.0	0.0	0.0

## Unbalanced forces

Name	X [kN]	Y [kN]	Z [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
LE1	0.0	0.0	94.0	0.0	0.0	0.0

## Check

### Summary

Name	Value	Check status
Analysis	100.0%	OK
Plates	0.0 < 5.0%	OK
Bolts	6.0 < 100%	OK
Welds	53.1 < 100%	OK
Buckling	Not calculated	

### Plates

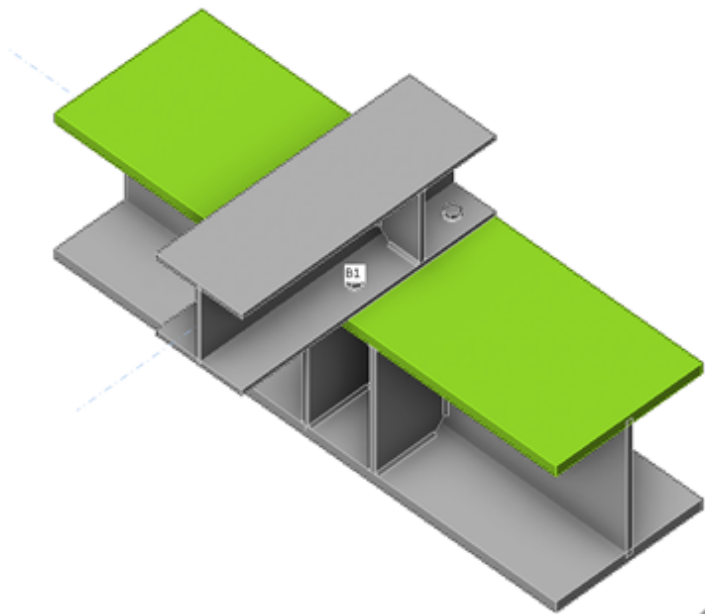
Name	Material	$t_p$ [mm]	Loads	$\sigma_{Ed}$ [MPa]	$\epsilon_{pl}$ [%]	$\sigma_{c,Ed}$ [MPa]	Status
B-bfl 1	S 355	17.0	LE1	343.3	0.0	0.0	OK
B-tfl 1	S 355	17.0	LE1	343.6	0.0	13.6	OK
B-w 1	S 355	10.0	LE1	297.7	0.0	0.0	OK
B1-bfl 1	S 235	8.5	LE1	100.8	0.0	38.7	OK
B1-tfl 1	S 235	8.5	LE1	100.9	0.0	0.0	OK
B1-w 1	S 235	5.5	LE1	143.5	0.0	0.0	OK
STIFF1a	S 355	10.0	LE1	62.3	0.0	0.0	OK
STIFF1b	S 355	10.0	LE1	62.3	0.0	0.0	OK
STIFF1c	S 355	10.0	LE1	64.5	0.0	0.0	OK
STIFF1d	S 355	10.0	LE1	64.5	0.0	0.0	OK
STIFF1e	S 355	10.0	LE1	66.4	0.0	0.0	OK
STIFF1f	S 355	10.0	LE1	65.9	0.0	0.0	OK
STIFF2a	S 355	8.0	LE1	87.7	0.0	0.0	OK
STIFF2b	S 355	8.0	LE1	88.9	0.0	0.0	OK

### Design data

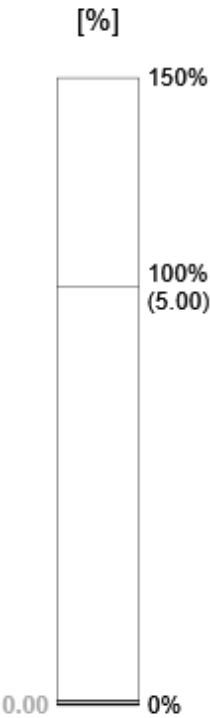
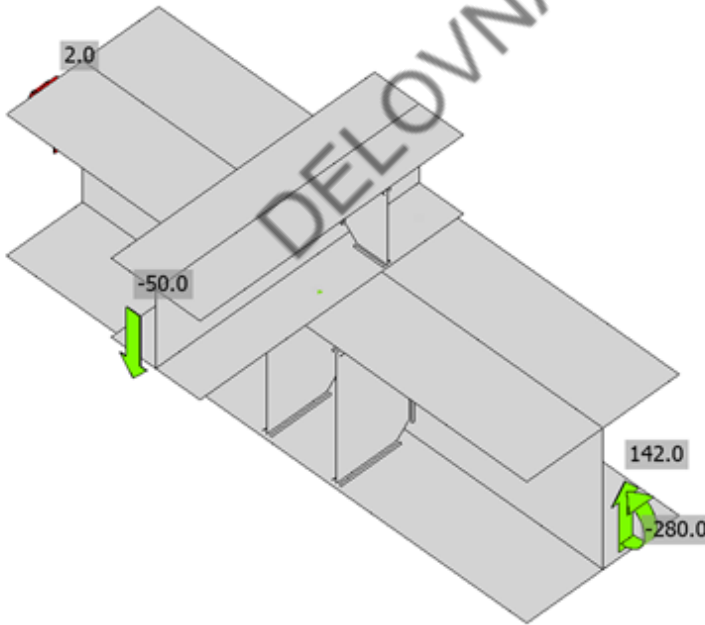
Material	$f_y$ [MPa]	$\epsilon_{lim}$ [%]
S 355	355.0	5.0
S 235	235.0	5.0

### Symbol explanation

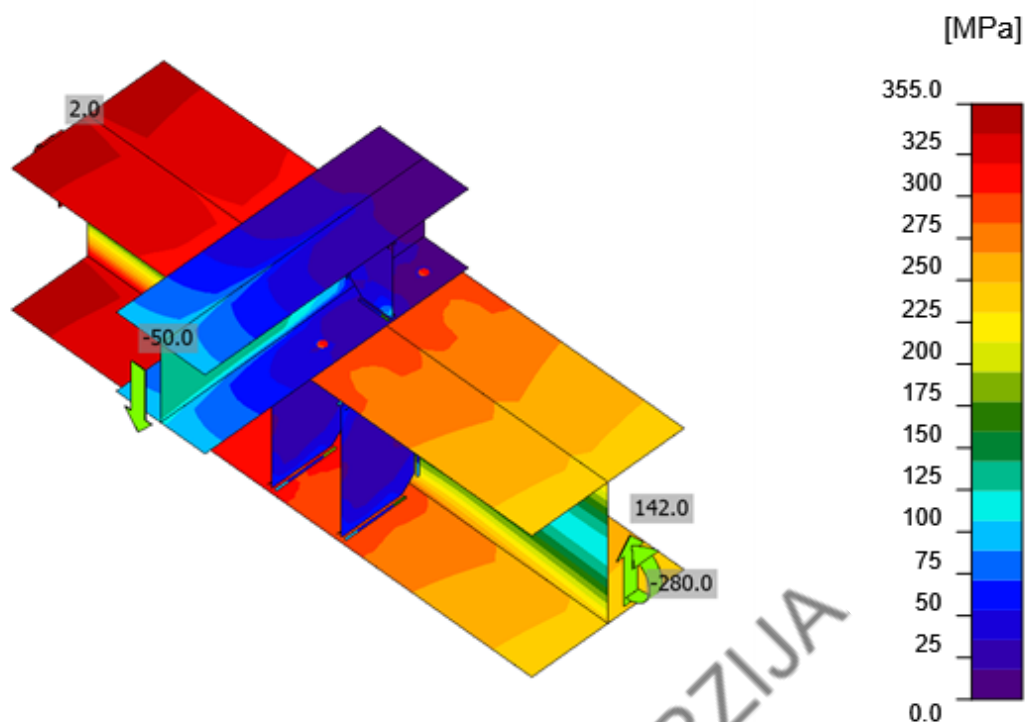
$t_p$	Plate thickness
$\sigma_{Ed}$	Equivalent stress
$\epsilon_{pl}$	Plastic strain
$\sigma_{c,Ed}$	Contact stress
$f_y$	Yield strength
$\epsilon_{lim}$	Limit of plastic strain



Overall check, LE1

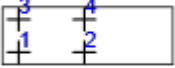


Strain check, LE1



Equivalent stress, LE1

## Bolts

Shape	Item	Grade	Loads	$F_{t,Ed}$ [kN]	$F_{v,Ed}$ [kN]	$F_{b,Rd}$ [kN]	$U_{t_t}$ [%]	$U_{t_s}$ [%]	$U_{t_{ts}}$ [%]	Status
	B1	M12 8.8 - 1	LE1	0.3	1.8	73.4	0.6	5.5	6.0	OK
	B2	M12 8.8 - 1	LE1	0.3	1.8	73.4	0.6	5.5	5.9	OK
	B3	M12 8.8 - 1	LE1	0.3	1.8	73.4	0.7	5.5	6.0	OK
	B4	M12 8.8 - 1	LE1	0.3	1.8	73.4	0.7	5.4	5.9	OK

## Design data

Grade	$F_{t,Rd}$ [kN]	$B_{p,Rd}$ [kN]	$F_{v,Rd}$ [kN]
M12 8.8 - 1	48.6	87.7	32.4

## Symbol explanation

$F_{t,Ed}$	Tension force
$F_{v,Ed}$	Resultant of bolt shear forces $V_y$ and $V_z$ in shear planes
$F_{b,Rd}$	Plate bearing resistance EN 1993-1-8 – Tab. 3.4
$U_{t_t}$	Utilization in tension
$U_{t_s}$	Utilization in shear
$U_{t_{ts}}$	Interaction of tension and shear EN 1993-1-8 – Tab. 3.4
$F_{t,Rd}$	Bolt tension resistance EN 1993-1-8 – Tab. 3.4
$B_{p,Rd}$	Punching shear resistance EN 1993-1-8 – Tab. 3.4
$F_{v,Rd}$	Bolt shear resistance EN 1993-1-8 – Tab. 3.4



Project: RDC - STREHA FRI  
Project no: 24/24  
Author: Detalj infrastruktura

## Welds

Item	Edge	Material	T <sub>w</sub> [mm]	L [mm]	Loads	$\sigma_{w,Ed}$ [MPa]	$\epsilon_{pl}$ [%]	$\sigma_{\perp}$ [MPa]	$\tau_{\perp}$ [MPa]	$\tau_{\parallel}$ [MPa]	U <sub>t</sub> [%]	U <sub>t,c</sub> [%]	Status
B-bfl 1	STIFF1a	S 355	▲ 3.0 ▼	95	LE1	172.1	0.0	-79.1	-67.7	-56.7	39.5	33.4	OK
		S 355	▲ 3.0 ▼	95	LE1	127.1	0.0	-30.4	41.8	57.7	29.2	26.8	OK
B-w 1	STIFF1a	S 355	▲ 3.0 ▼	166	LE1	112.2	0.0	-49.1	-56.9	12.3	25.8	24.4	OK
		S 355	▲ 3.0 ▼	166	LE1	147.6	0.0	-79.4	71.4	-7.9	33.9	30.5	OK
B-tfl 1	STIFF1a	S 355	▲ 3.0 ▼	95	LE1	159.3	0.0	71.5	61.5	-54.5	36.6	27.3	OK
		S 355	▲ 3.0 ▼	95	LE1	121.1	0.0	28.3	-38.2	56.3	27.8	24.1	OK
B-bfl 1	STIFF1b	S 355	▲ 3.0 ▼	95	LE1	127.1	0.0	-30.4	-41.8	-57.8	29.2	26.8	OK
		S 355	▲ 3.0 ▼	95	LE1	172.2	0.0	-79.1	67.7	56.7	39.5	33.4	OK
B-w 1	STIFF1b	S 355	▲ 3.0 ▼	166	LE1	147.6	0.0	-79.4	-71.4	8.0	33.9	30.5	OK
		S 355	▲ 3.0 ▼	166	LE1	112.3	0.0	-49.1	57.0	-12.5	25.8	24.4	OK
B-tfl 1	STIFF1b	S 355	▲ 3.0 ▼	95	LE1	122.1	0.0	28.8	37.7	-57.2	28.0	24.2	OK
		S 355	▲ 3.0 ▼	95	LE1	160.1	0.0	71.4	-62.4	54.4	36.8	27.4	OK
B-bfl 1	STIFF1c	S 355	▲ 3.0 ▼	95	LE1	185.6	0.0	-86.0	-74.3	-59.2	42.6	35.3	OK
		S 355	▲ 3.0 ▼	95	LE1	132.0	0.0	-27.6	39.4	63.3	30.3	26.8	OK
B-w 1	STIFF1c	S 355	▲ 3.0 ▼	166	LE1	111.2	0.0	-44.9	-54.5	21.8	25.5	23.7	OK
		S 355	▲ 3.0 ▼	166	LE1	152.9	0.0	-82.3	72.7	-16.0	35.1	30.6	OK
B-tfl 1	STIFF1c	S 355	▲ 3.0 ▼	95	LE1	143.3	0.0	60.9	49.9	-55.9	32.9	24.5	OK
		S 355	▲ 3.0 ▼	95	LE1	108.6	0.0	3.2	-14.1	61.1	24.9	20.7	OK
B-bfl 1	STIFF1d	S 355	▲ 3.0 ▼	95	LE1	131.6	0.0	-27.5	-39.4	-63.0	30.2	26.8	OK
		S 355	▲ 3.0 ▼	95	LE1	185.3	0.0	-86.0	74.2	58.9	42.6	35.2	OK
B-w 1	STIFF1d	S 355	▲ 3.0 ▼	166	LE1	152.9	0.0	-82.3	-72.7	15.8	35.1	30.6	OK
		S 355	▲ 3.0 ▼	166	LE1	111.1	0.0	-44.9	54.5	-21.6	25.5	23.7	OK
B-tfl 1	STIFF1d	S 355	▲ 3.0 ▼	95	LE1	109.5	0.0	3.9	13.9	-61.6	25.1	20.4	OK
		S 355	▲ 3.0 ▼	95	LE1	143.6	0.0	60.5	-50.6	55.6	33.0	24.4	OK
B-bfl 1	STIFF1e	S 355	▲ 3.0 ▼	95	LE1	174.2	0.0	-85.1	-71.6	-50.7	40.0	33.1	OK
		S 355	▲ 3.0 ▼	95	LE1	110.9	0.0	-15.9	29.5	56.1	25.5	23.5	OK
B-w 1	STIFF1e	S 355	▲ 3.0 ▼	166	LE1	94.6	0.0	-36.8	-48.1	14.5	21.7	20.9	OK
		S 355	▲ 3.0 ▼	166	LE1	145.7	0.0	-80.9	69.6	-7.5	33.5	30.2	OK
B-tfl 1	STIFF1e	S 355	▲ 3.0 ▼	95	LE1	167.6	0.0	82.4	67.6	-50.3	38.5	27.3	OK
		S 355	▲ 3.0 ▼	95	LE1	103.9	0.0	8.7	-23.5	55.0	23.9	21.5	OK
B-bfl 1	STIFF1f	S 355	▲ 3.0 ▼	95	LE1	111.1	0.0	-15.9	-29.6	-56.2	25.5	23.5	OK
		S 355	▲ 3.0 ▼	95	LE1	174.5	0.0	-85.2	71.7	50.9	40.1	33.1	OK
B-w 1	STIFF1f	S 355	▲ 3.0 ▼	166	LE1	145.7	0.0	-80.9	-69.6	7.6	33.5	30.2	OK
		S 355	▲ 3.0 ▼	166	LE1	94.6	0.0	-36.8	48.1	-14.6	21.7	21.0	OK
B-tfl 1	STIFF1f	S 355	▲ 3.0 ▼	95	LE1	102.8	0.0	9.6	23.7	-54.1	23.6	21.3	OK
		S 355	▲ 3.0 ▼	95	LE1	167.4	0.0	82.4	-68.3	49.1	38.4	27.2	OK
B1-bfl 1	STIFF2a	S 235	▲ 3.0 ▼	47	LE1	170.0	0.0	-71.6	-71.7	52.8	47.2	32.0	OK
		S 235	▲ 3.0 ▼	47	LE1	189.2	0.0	-81.0	80.9	-56.6	52.5	35.4	OK
B1-w 1	STIFF2a	S 235	▲ 3.0 ▼	76	LE1	85.1	0.0	-12.5	-17.3	-45.5	23.7	20.8	OK
		S 235	▲ 3.0 ▼	76	LE1	86.5	0.0	-27.2	22.4	41.7	24.0	20.8	OK

Item	Edge	Material	$T_w$ [mm]	L [mm]	Loads	$\sigma_{w,Ed}$ [MPa]	$\epsilon_{PI}$ [%]	$\sigma_{\perp}$ [MPa]	$\tau_{\perp}$ [MPa]	$\tau_{\parallel}$ [MPa]	Ut [%]	Ut <sub>c</sub> [%]	Status
B1-tfl 1	STIFF2a	S 235	▲ 3.0 ▼	47	LE1	56.4	0.0	-22.6	-16.8	24.7	15.7	12.4	OK
		S 235	▲ 3.0 ▼	47	LE1	40.7	0.0	2.5	3.4	-23.2	11.3	10.1	OK
B1-bfl 1	STIFF2b	S 235	▲ 3.0 ▼	47	LE1	191.3	0.0	-82.4	-81.0	58.1	53.1	35.7	OK
		S 235	▲ 3.0 ▼	47	LE1	170.3	0.0	-70.8	72.2	-52.8	47.3	32.0	OK
B1-w 1	STIFF2b	S 235	▲ 3.0 ▼	76	LE1	86.4	0.0	-27.1	-22.4	-41.7	24.0	20.8	OK
		S 235	▲ 3.0 ▼	76	LE1	85.2	0.0	-12.5	17.3	45.5	23.7	20.8	OK
B1-tfl 1	STIFF2b	S 235	▲ 3.0 ▼	47	LE1	40.7	0.0	2.5	-3.4	23.2	11.3	10.1	OK
		S 235	▲ 3.0 ▼	47	LE1	56.5	0.0	-22.7	16.8	-24.7	15.7	12.5	OK

## Design data

Material	$f_u$ [MPa]	$\beta_w$ [-]	$\sigma_{w,Rd}$ [MPa]	$0.9 \sigma$ [MPa]
S 355	490.0	0.90	435.6	352.8
S 235	360.0	0.80	360.0	259.2

## Symbol explanation

$T_w$	Throat thickness a
L	Length
$\sigma_{w,Ed}$	Equivalent stress
$\epsilon_{PI}$	Strain
$\sigma_{\perp}$	Perpendicular stress
$\tau_{\perp}$	Shear stress perpendicular to weld axis
$\tau_{\parallel}$	Shear stress parallel to weld axis
Ut	Utilization
Ut <sub>c</sub>	Weld capacity estimation
▲	Fillet weld
$f_u$	Ultimate strength of weld
$\beta_w$	Correlation factor EN 1993-1-8 – Tab. 4.1
$\sigma_{w,Rd}$	Equivalent stress resistance
$0.9 \sigma$	Perpendicular stress resistance: $0.9 \cdot f_u / \gamma_{M2}$



## Buckling

Buckling analysis was not calculated.

Project: RDC - STREHA FRI  
 Project no: 24/24  
 Author: Detalj infrastruktura

## Bill of material

### Manufacturing operations

Name	Plates [mm]	Shape	Nr.	Welds Throat thickness [mm]	Length [mm]	Bolts	Nr.
STIFF1	P10.0x115.0-206.0 (S 355)		6	Double fillet: 3.0	2136.0		
STIFF2	P8.0x67.3-116.0 (S 355)		2	Double fillet: 3.0	341.0		

### Welds

Type	Material	Throat thickness [mm]	Leg size [mm]	Length [mm]
Double fillet	S 355	3.0	4.2	2136.0
Double fillet	S 235	3.0	4.2	341.0

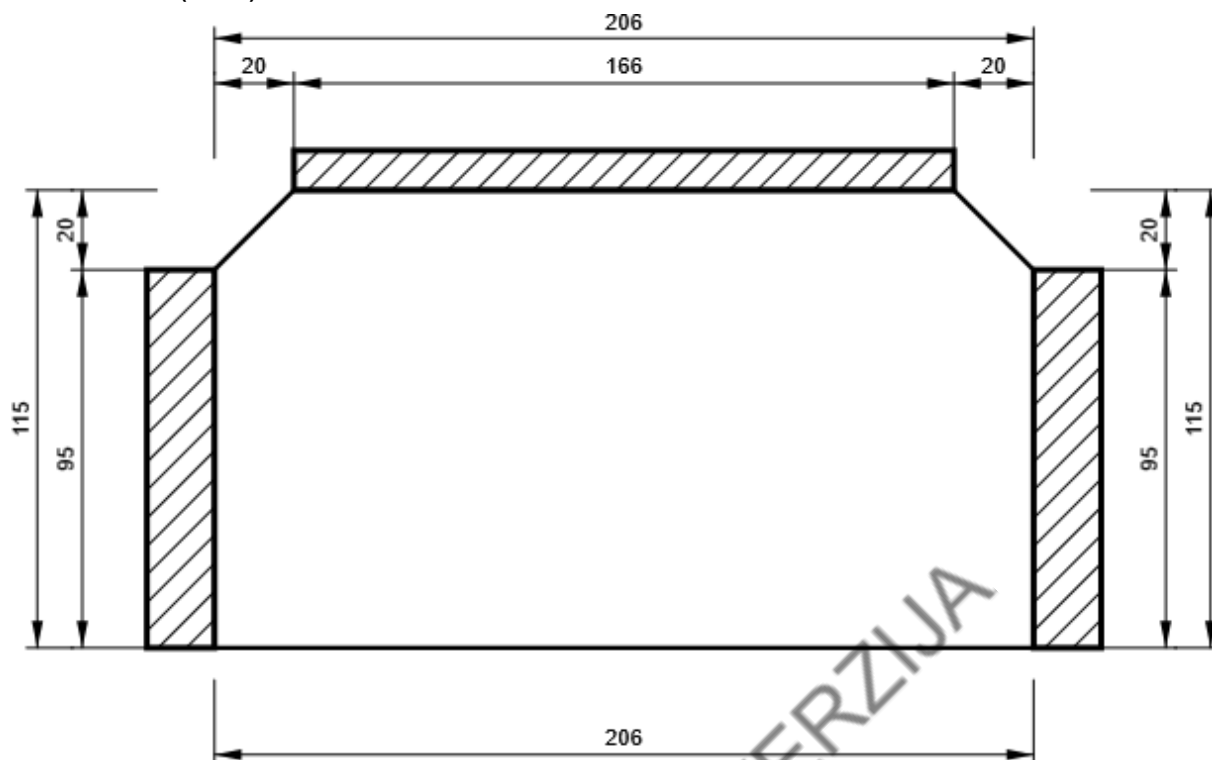
### Bolts

Name	Grip length [mm]	Count
M12 8.8	26	4

### Drawing

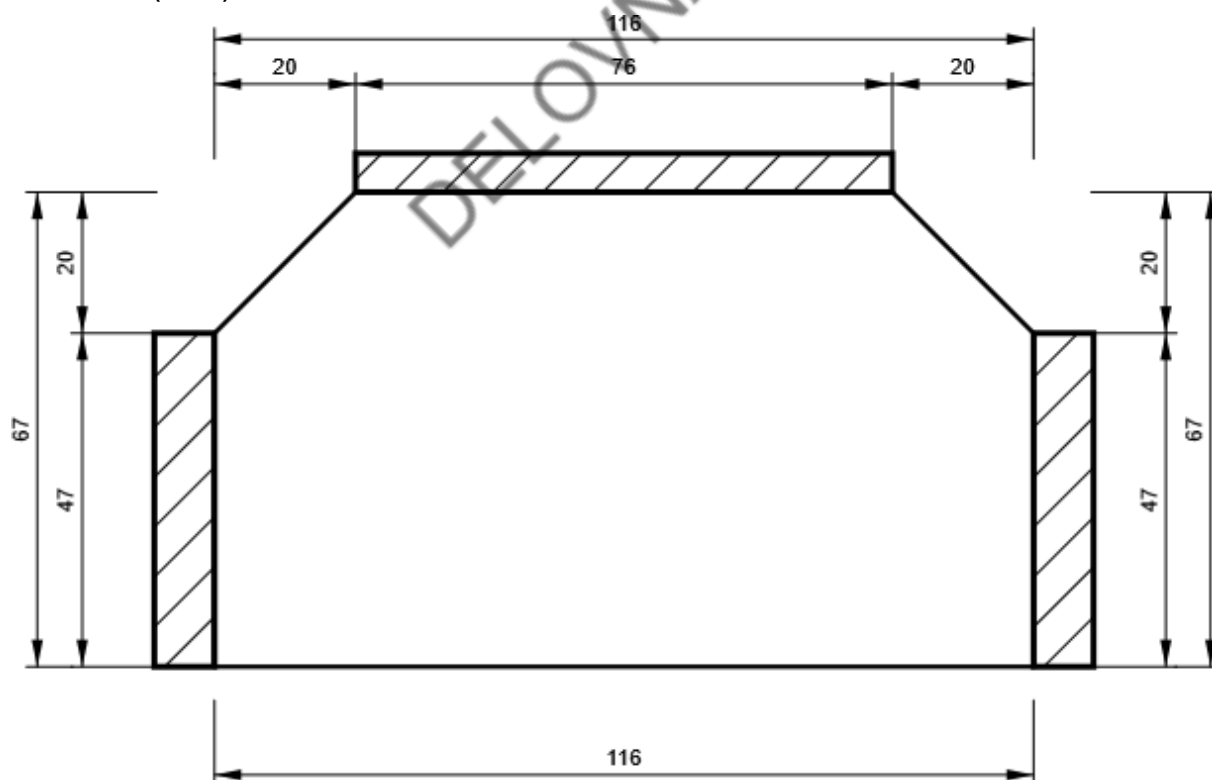
#### STIFF1

P10.0x206-115 (S 355)

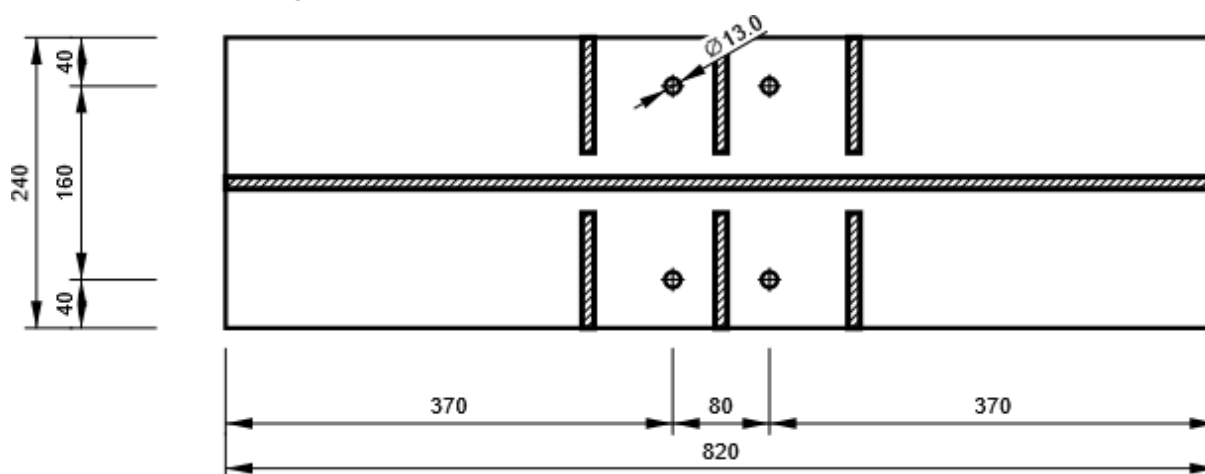


STIFF2

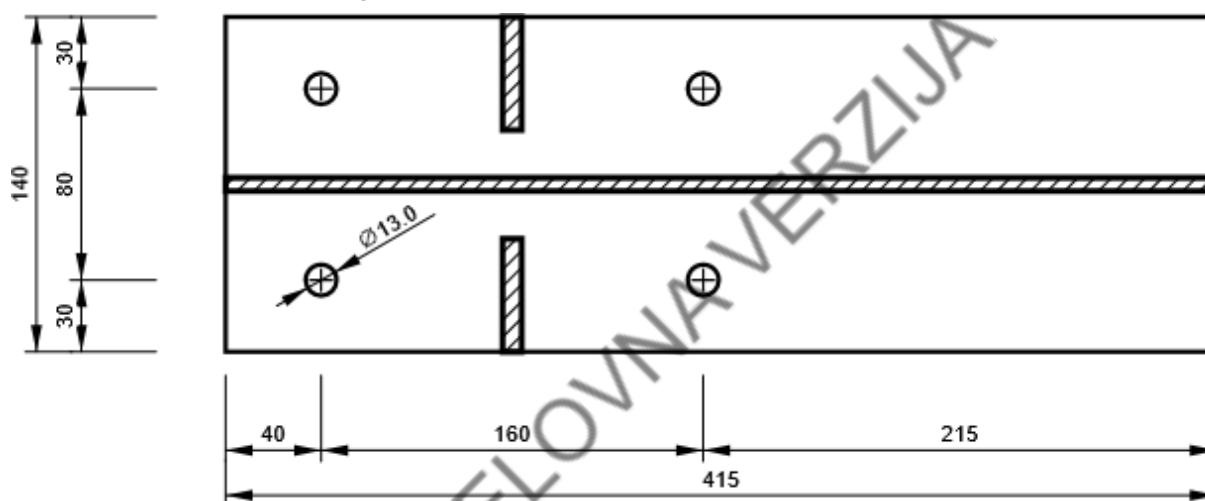
P8.0x116-67 (S 355)



**B, HEB240 - Top flange 1:**



**B1, HEA140 - Bottom flange 1:**



## Code settings

Item	Value	Unit	Reference
Safety factor $\gamma_{M0}$	1.00	-	EN 1993-1-1: 6.1
Safety factor $\gamma_{M1}$	1.00	-	EN 1993-1-1: 6.1
Safety factor $\gamma_{M2}$	1.25	-	EN 1993-1-1: 6.1
Safety factor $\gamma_{M3}$	1.25	-	EN 1993-1-8: 2.2
Safety factor $\gamma_C$	1.50	-	EN 1992-1-1: 2.4.2.4
Safety factor $\gamma_{Inst}$	1.20	-	EN 1992-4: Table 4.1
Joint coefficient $\beta_j$	0.67	-	EN 1993-1-8: 6.2.5
Effective area - influence of mesh size	0.10	-	
Friction coefficient - concrete	0.25	-	EN 1993-1-8
Friction coefficient in slip-resistance	0.30	-	EN 1993-1-8 tab 3.7
Limit plastic strain	0.05	-	EN 1993-1-5
Detailing	No		
Distance between bolts [d]	2.20	-	EN 1993-1-8: tab 3.3
Distance between bolts and edge [d]	1.20	-	EN 1993-1-8: tab 3.3
Concrete breakout resistance check	Both		EN 1992-4: 7.2.1.4 and 7.2.2.5
Use calculated $\alpha_b$ in bearing check.	Yes		EN 1993-1-8: tab 3.4
Cracked concrete	Yes		EN 1992-4
Local deformation check	Yes		CIDECT DG 1, 3 - 1.1
Local deformation limit	0.03	-	CIDECT DG 1, 3 - 1.1
Geometrical nonlinearity (GMNA)	Yes		Analysis with large deformations for hollow section joints
Braced system	No		EN 1993-1-8: 5.2.2.5

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Točka pritrdjevanja:

Sidranje nad steno

Stran: 1  
Projektant:  
E-mail:  
Datum: 17. 05. 2024

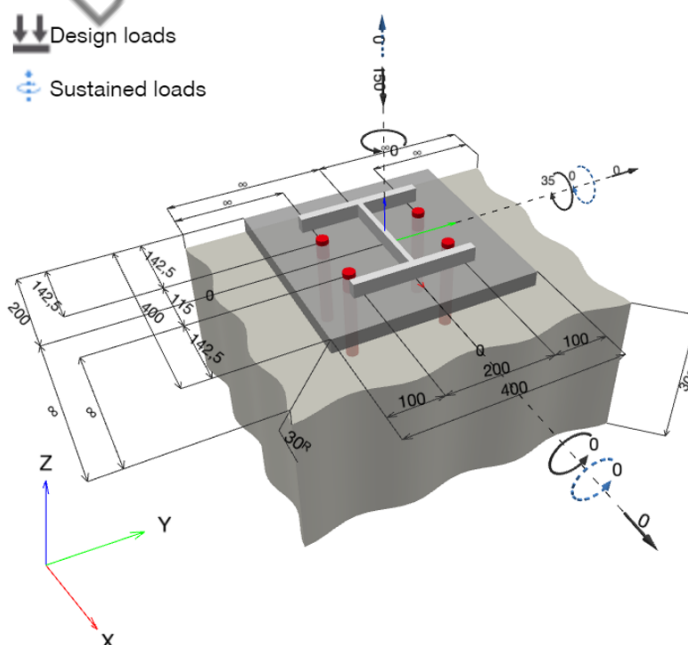
Komentar projektanta:

## 1 Vhodni podatki

Tip in velikost sidra:	HIT-RE 500 V4 + HAS Meter 8.8 M24
Povratna doba (življenjska doba v letih):	50
Številka artikla:	2390170 HAS 8.8 M24x1000 (element) / 2287552 HIT-RE 500 V4 (kemično sidro)
Efektivna sidrna globina:	$h_{ef,opti} = 150,0 \text{ mm}$ ( $h_{ef,limit} = 244,0 \text{ mm}$ )
Material:	8.8
Tehnična ocena artikla:	ETA 20/0541
Izdano I Veljavno:	9. 06. 2023   -
Kontrola:	SOFA based on EN 1992-4, Chemical
Vgradnja z nadvišanjem:	$e_b = 0,0 \text{ mm}$ (brez nadvišanja); $t = 30,0 \text{ mm}$
Ležiščna pločevina <sup>R</sup> :	$l_x \times l_y \times t = 400,0 \text{ mm} \times 400,0 \text{ mm} \times 30,0 \text{ mm}$ ; (Priporočena debelina ležiščne pločevine: ni izračunano)
Profil:	IPB/HEB, IPB 240 / HE 240 B; ( $L \times W \times T \times FT$ ) = $240,0 \text{ mm} \times 240,0 \text{ mm} \times 10,0 \text{ mm} \times 17,0 \text{ mm}$
Osnovni material:	razpokan beton, C25/30, $f_{c,axl} = 25,00 \text{ N/mm}^2$ ; $h = 300,0 \text{ mm}$ , Temp. kratko./dolgo.: 0/0 °C, Delni varnostni faktor materiala, ki ga določi uporabnik $\gamma_c = 1,500$
Vgradnja:	izvrtina izvrtana z udarnim svedrom, Pogoji vgradnje: Suho
Ojačitev:	brez armature ali razmak med armaturo $\geq 150 \text{ mm}$ (any $\emptyset$ ) or $\geq 100 \text{ mm}$ ( $\emptyset \leq 10 \text{ mm}$ ) brez vzdolžne armature po robu betona


<sup>R</sup> - Izdelan izračun je zasnovan ob predpostavki toge ležiščne pločevine

### Geometrija [mm] & Obtežba [kN, kNm]



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### 1.1 Obtežna kombinacija

Primer	Opis	Sile [kN] / Momenti [kNm]	Potresno	požar	Izkoriščenost [%]
<b>1</b>	<b>MSN 1</b>	<b><math>N = -150,000; V_x = 0,000; V_y = 0,000;</math> <math>M_x = 0,000; M_y = 35,000; M_z = 0,000;</math> <math>N_{sus} = 0,000; M_{x,sus} = 0,000; M_{y,sus} = 0,000;</math></b>	<b>ne</b>	<b>ne</b>	<b>100</b>
2	MSN 2	$N = -56,000; V_x = -20,000; V_y = 0,000;$ $M_x = 0,000; M_y = 8,000; M_z = 0,000;$ $N_{sus} = 0,000; M_{x,sus} = 0,000; M_{y,sus} = 0,000;$	ne	ne	72
3	MSN 3	$N = -150,000; V_x = -12,000; V_y = 0,000;$ $M_x = 0,000; M_y = 12,000; M_z = 0,000;$ $N_{sus} = 0,000; M_{x,sus} = 0,000; M_{y,sus} = 0,000;$	ne	ne	44

## 2 Obtežni primer/Rezultante sil v sidru

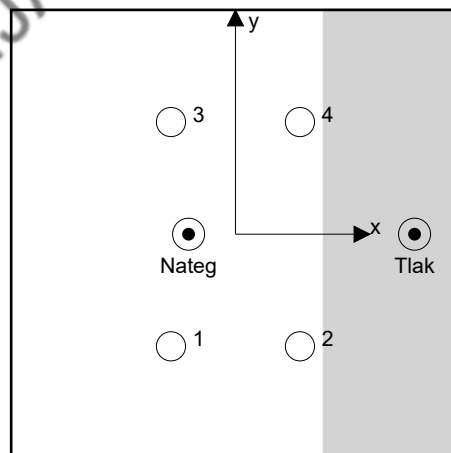
Kontroliran obtežni primer: 1 MSN 1

### Reakcije v sidru [kN]

Natezna sila: (+Nateg, -Tlak)

Sidro	Natezna sila	Strižna sila	Strižna sila x	Strižna sila y
1	23,660	0,000	0,000	0,000
2	3,745	0,000	0,000	0,000
3	23,660	0,000	0,000	0,000
4	3,745	0,000	0,000	0,000

maks. tlačna deformacija betona: 0,28 [‰]  
maks. tlačna trdnost betona: 8,47 [N/mm<sup>2</sup>]  
rezultirajoče natezne obremenitve v (x/y)=(-41,8/0,0): 54,810 [kN]  
rezultirajoče tlačne obremenitve v (x/y)=(159,7/0,0): 204,810 [kN]



Sile v sidrih so preračunane ob predpostavki toge ležiščne pločevine



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Točka pritrdjevanja:

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Stran:

Projektant:

E-mail:

Datum:

3

17. 05. 2024

### 3 Natezna obremenitev EN 1992-4, Točka 7.2.1

	Obtežba [kN]	Kapaciteta [kN]	Izkoriščenost $\beta_N$ [%]	Status
Nosilnost jekla*	23,660	188,267	13	OK
Kombinacija izvleka sidra in betonskega konusa**	54,810	85,147	65	OK
Porušitev po konusu betona**	54,810	54,815	100	OK
Cepitev betona**	54,810	105,659	52	OK

\*najbolj obremenjeno sidro \*\*skupina sider (natezno obremenjena sidra)

#### 3.1 Nosilnost jekla

$$N_{Ed} \leq N_{Rd,s} = \frac{N_{Rk,s}}{\gamma_{M,s}} \quad \text{EN 1992-4, Tabela 7.1}$$

$N_{Rk,s}$ [kN]	$\gamma_{M,s}$	$N_{Rd,s}$ [kN]	$N_{Ed}$ [kN]
282,400	1,500	188,267	23,660

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Projektiranje: Sidranje nad steno  
Točka pritrdjevanja:

Stran: 4  
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E-mail:  
Datum: 17. 05. 2024

### 3.2 Kombinacija izvleka sidra in betonskega konusa

$$N_{Ed} \leq N_{Rd,p} = \frac{N_{Rk,p}}{\gamma_{M,p}} \quad \text{EN 1992-4, Tabela 7.1}$$

$$N_{Rk,p} = N_{Rk,p}^0 \cdot \frac{A_{p,N}}{A_{p,N}^0} \cdot \psi_{g,Np} \cdot \psi_{s,Np} \cdot \psi_{re,Np} \cdot \psi_{ec1,Np} \cdot \psi_{ec2,Np} \quad \text{EN 1992-4, Enačba (7.13)}$$

$$N_{Rk,p}^0 = \psi_{sus} \cdot \tau_{Rk} \cdot \pi \cdot d \cdot h_{ef} \quad \text{EN 1992-4, Enačba (7.14)}$$

$$\psi_{sus} = 1 \quad \text{EN 1992-4, Enačba (7.14a)}$$

$$s_{cr,Np} = 7,3 \cdot d \cdot \sqrt{\psi_{sus} \cdot \tau_{Rk}} \leq 3 \cdot h_{ef} \quad \text{EN 1992-4, Enačba (7.15)}$$

$$\psi_{g,Np} = \psi_{g,Np}^0 \cdot \left( \frac{s}{s_{cr,Np}} \right)^{0,5} \cdot (\psi_{g,Np}^0 - 1) \geq 1,00 \quad \text{EN 1992-4, Enačba (7.17)}$$

$$\psi_{g,Np}^0 = \sqrt{n} - (\sqrt{n} - 1) \cdot \left( \frac{\tau_{Rk}}{\tau_{Rk,c}} \right)^{1,5} \geq 1,00 \quad \text{EN 1992-4, Enačba (7.18)}$$

$$\tau_{Rk,c} = \frac{k_3}{\pi \cdot d} \cdot \sqrt{h_{ef} \cdot f_{ck}} \quad \text{EN 1992-4, Enačba (7.19)}$$

$$\psi_{s,Np} = 0,7 + 0,3 \cdot \frac{c}{c_{cr,Np}} \leq 1,00 \quad \text{EN 1992-4, Enačba (7.20)}$$

$$\psi_{ec1,Np} = \frac{1}{1 + \left( \frac{2 \cdot e_{c1,N}}{s_{cr,Np}} \right)} \leq 1,00 \quad \text{EN 1992-4, Enačba (7.21)}$$

$$\psi_{ec2,Np} = \frac{1}{1 + \left( \frac{2 \cdot e_{c2,N}}{s_{cr,Np}} \right)} \leq 1,00 \quad \text{EN 1992-4, Enačba (7.21)}$$

$A_{p,N} [\text{mm}^2]$	$A_{p,N}^0 [\text{mm}^2]$	$\tau_{Rk,ucr,20} [\text{N/mm}^2]$	$s_{cr,Np} [\text{mm}]$	$c_{cr,Np} [\text{mm}]$	$c_{min} [\text{mm}]$	$f_{c,cyl} [\text{N/mm}^2]$
313.625	202.500	15,00	450,0	225,0	142,5	25,00
$\psi_c$	$\tau_{Rk,cr} [\text{N/mm}^2]$	$k_3$	$\tau_{Rk,c} [\text{N/mm}^2]$	$\psi_{g,Np}^0$	$\psi_{g,Np}$	
1,023	9,71	7,700	6,25	1,000	1,000	
$e_{c1,N} [\text{mm}]$	$\psi_{ec1,Np}$	$e_{c2,N} [\text{mm}]$	$\psi_{ec2,Np}$	$\psi_{s,Np}$	$\psi_{re,Np}$	
41,8	0,843	0,0	1,000	0,890	1,000	
$\psi_{sus}^0$	$\alpha_{sus}$	$\psi_{sus}$				
0,880	0,000	1,000				
$N_{Rk,p}^0 [\text{kN}]$	$N_{Rk,p} [\text{kN}]$	$\gamma_{M,p}$	$N_{Rd,p} [\text{kN}]$	$N_{Ed} [\text{kN}]$		
109,867	127,721	1,500	85,147	54,810		

ID skupine sider

1-4

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Projektiranje:

Točka pritrdjevanja:

|  
Sidranje nad steno

Stran:

Projektant:

E-mail:

Datum:

5

17. 05. 2024

### 3.3 Porušitev po konusu betona

$$N_{Ed} \leq N_{Rd,c} = \frac{N_{Rk,c}}{\gamma_{M,c}} \quad \text{EN 1992-4, Tabela 7.1}$$

$$N_{Rk,c} = N_{Rk,c}^0 \cdot \frac{A_{c,N}}{A_{c,N}^0} \cdot \psi_{s,N} \cdot \psi_{re,N} \cdot \psi_{ec1,N} \cdot \psi_{ec2,N} \cdot \psi_{M,N} \quad \text{EN 1992-4, Enačba (7.1)}$$

$$N_{Rk,c}^0 = k_1 \cdot \sqrt{f_{ck}} \cdot h_{ef}^{1,5} \quad \text{EN 1992-4, Enačba (7.2)}$$

$$A_{c,N}^0 = s_{cr,N} \cdot s_{cr,N} \quad \text{EN 1992-4, Enačba (7.3)}$$

$$\psi_{s,N} = 0,7 + 0,3 \cdot \frac{c}{c_{cr,N}} \leq 1,00 \quad \text{EN 1992-4, Enačba (7.4)}$$

$$\psi_{ec1,N} = \frac{1}{1 + \left( \frac{2 \cdot e_{N,1}}{s_{cr,N}} \right)} \leq 1,00 \quad \text{EN 1992-4, Enačba (7.6)}$$

$$\psi_{ec2,N} = \frac{1}{1 + \left( \frac{2 \cdot e_{N,2}}{s_{cr,N}} \right)} \leq 1,00 \quad \text{EN 1992-4, Enačba (7.6)}$$

$$\psi_{M,N} = 1 \quad \text{EN 1992-4, Enačba (7.7)}$$

$A_{c,N} [\text{mm}^2]$	$A_{c,N}^0 [\text{mm}^2]$	$c_{cr,N} [\text{mm}]$	$s_{cr,N} [\text{mm}]$	$f_{c,cyl} [\text{N/mm}^2]$		
313.625	202.500	225,0	450,0	25,00		
$e_{c1,N} [\text{mm}]$	$\psi_{ec1,N}$	$e_{c2,N} [\text{mm}]$	$\psi_{ec2,N}$	$\psi_{s,N}$	$\psi_{re,N}$	
41,8	0,843	0,0	1,000	0,890	1,000	
$z [\text{mm}]$	$\psi_{M,N}$	$k_1$	$N_{Rk,c}^0 [\text{kN}]$	$\gamma_{M,c}$	$N_{Rd,c} [\text{kN}]$	$N_{Ed} [\text{kN}]$
201,5	1,000	7,700	70,729	1,500	54,815	54,810
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1-4						

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Naslov:  
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Projektiranje: | Sidranje nad steno  
Točka pritrdjevanja:

Stran: 6  
Projektant:  
E-mail:  
Datum: 17. 05. 2024

### 3.4 Cepitev betona

$$N_{Ed} \leq N_{Rd,sp} = \frac{N_{Rk,sp}}{\gamma_{Msp}} \quad \text{EN 1992-4, Tabela 7.1}$$

$$N_{Rk,sp} = N_{Rk,sp}^0 \cdot \frac{A_{c,N}}{A_{c,N}^0} \cdot \psi_{s,N} \cdot \psi_{re,N} \cdot \psi_{ec1,N} \cdot \psi_{ec2,N} \cdot \psi_{h,sp} \quad \text{EN 1992-4, Enačba (7.23)}$$

$$N_{Rk,sp}^0 = \min(N_{Rk,p}^0, N_{Rk,c}^0)$$

$$A_{c,N}^0 = s_{cr,sp} \cdot s_{cr,sp} \quad \text{EN 1992-4, Enačba (7.3)}$$

$$\psi_{s,N} = 0,7 + 0,3 \cdot \frac{c}{c_{cr,sp}} \leq 1,00 \quad \text{EN 1992-4, Enačba (7.4)}$$

$$\psi_{ec1,N} = \frac{1}{1 + \left( \frac{2 \cdot e_{N,1}}{s_{cr,sp}} \right)} \leq 1,00 \quad \text{EN 1992-4, Enačba (7.6)}$$

$$\psi_{ec2,N} = \frac{1}{1 + \left( \frac{2 \cdot e_{N,2}}{s_{cr,sp}} \right)} \leq 1,00 \quad \text{EN 1992-4, Enačba (7.6)}$$

$$\psi_{h,sp} = \left( \frac{h}{h_{min}} \right)^{2/3} \leq \max \left\{ 1; \left( \frac{h_{ef} + 1,5 \cdot c_1}{h_{min}} \right)^{2/3} \right\} \leq 2,00 \quad \text{EN 1992-4, Enačba (7.24)}$$

$A_{c,N} [\text{mm}^2]$	$A_{c,N}^0 [\text{mm}^2]$	$c_{cr,sp} [\text{mm}]$	$s_{cr,sp} [\text{mm}]$	$h_{min} [\text{mm}]$	$\psi_{h,sp}$	$f_{c,cyl} [\text{N/mm}^2]$
203.750	90.000	150,0	300,0	206,0	1,285	25,00
$e_{c1,N} [\text{mm}]$	$\psi_{ec1,N}$	$e_{c2,N} [\text{mm}]$	$\psi_{ec2,N}$	$\psi_{s,N}$	$\psi_{re,N}$	$k_1$
41,8	0,782	0,0	1,000	0,985	1,000	7,700
$N_{Rk,sp}^0 [\text{kN}]$	$\gamma_{Msp}$	$N_{Rd,sp} [\text{kN}]$	$N_{Ed} [\text{kN}]$			
70,729	1,500	105,659	54,810			

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1-4

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Naslov:		Projektant:	
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Projektiranje:	Sidranje nad steno	Datum:	17. 05. 2024
Točka pritrdjevanja:			

## 4 Strižna obremenitev EN 1992-4, Točka 7.2.2

	Obtežba [kN]	Kapaciteta [kN]	Izkoriščenost $\beta_v$ [%]	Status
Nosilnost jekla (brez nadvišanja)*	N/A	N/A	N/A	N/A
Porušitev po jeklu (z nadvišanjem)*	N/A	N/A	N/A	N/A
Nosilnost na iztrga betona*	N/A	N/A	N/A	N/A
Porušitev po robu betona v smeri **	N/A	N/A	N/A	N/A

\*najbolj obremenjeno sidro \*\*skupina sider (relevantna sidra)

## 5 Pomik (najbolj obremenjeno sidro)

Kratkotrajna obremenitev

$N_{Sk}$	=	17,526 [kN]	$\delta_N$	=	0,2015 [mm]
$V_{Sk}$	=	0,000 [kN]	$\delta_V$	=	0,0000 [mm]
			$\delta_{NV}$	=	0,2015 [mm]

Dolgotrajna obremenitev:

$N_{Sk}$	=	17,526 [kN]	$\delta_N$	=	0,2479 [mm]
$V_{Sk}$	=	0,000 [kN]	$\delta_V$	=	0,0000 [mm]
			$\delta_{NV}$	=	0,2479 [mm]

Komentarji: Pomiki zaradi izvlečne sile veljajo, če je sidro pritegnjeno s polovico potrebnega priteznega momenta za nerazpokan beton! Pomiki zaradi strižne obremenitve ne upoštevajo trenja med betonom in ležiščno pločevino. V izračunu niso vključene tolerance vrzeli med premerom izvrtine in luknje v ležiščni plošči.

Sprejemljivi pomiki sidra so odvisni od pritrjene konstrukcije, ki jih mora definirati odgovorni projektant!

## 6 Opozorila

- Projektne metode v programski opremi PROFIS Engineering zahtevajo uporabo absolutno toge ležiščne pločevine v skladu z regulativami (ETAG 001/Annex C, EOTA TR029, itd.). To pomeni, da se porazdelitev obremenitve na sidra zaradi elastičnih deformacij sidrne plošče ne upošteva - predpostavlja se, da je ležiščna pločevina toga, da se ne deformira, v primeru delovanja projektne obtežbe. PROFIS Engineering izračuna najmanjšo potrebno debelino ležiščne pločevine s FEM metodo za omejitve napetosti v ležiščni pločevini na podlagi zgornjih predpostavk. PROFIS Engineering ne dokazuje, da je predpostavka o togi ležiščni pločevini pravilna. Vhodne podatke in rezultate je potrebno preveriti, da so v skladu z obstoječimi pogoji in verodostojnosti!
- Potrebno je opraviti kontrolo prenosa obtežbe v osnovni material po EN 1992-4, Dodatek A!
- Izračun je veljaven samo v primeru, če luknja v ležiščni pločevini ni večja od vrednosti podane v Tabeli 6.1 of EN 1992-4!! Za večje premere izvrtin glej točko 6.2.2 of EN 1992-4!
- Seznam dodatne opreme v tem poročilu je samo za informacije uporabnika. V vsakem primeru je potrebno upoštevati navodila za uporabo, ki so priložena izdelku, da zagotovite pravilno vgradnjo.
- For the determination of the  $\psi_{re,v}$  (concrete edge failure) the minimum concrete cover defined in the design settings is used as the concrete cover of the edge reinforcement.
- Karakteristična sprijena trdnost je odvisna od kratkotrajnih in dolgotrajnih temperaturnih obremenitev.
- Armiranje roba betona ni potrebno, da se izognemo cepitvi betona
- Karakteristična sprijemna trdnost je odvisna od povratne dobe (servisna doba v letih): 50

**Izbrano pritrdjevanje ustreza projektnim pogojem!**

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Datum: 17. 05. 2024

## 7 Podatki za vgradnjo

Ležiščna pločevina, jeklo: S 235;  $E = 210.000,00 \text{ N/mm}^2$ ;  $f_{yk} = 235,00 \text{ N/mm}^2$   
Profil: IPB/HEB, IPB 240 / HE 240 B; (L x W x T x FT) = 240,0 mm x 240,0 mm  
x 10,0 mm x 17,0 mm

Premjer luknje v ležiščni plošči:  $d_f = 26,0 \text{ mm}$

Debelina ležiščne pločevine (vnos): 30,0 mm

Priporočena debelina ležiščne pločevine: ni izračunano

Metoda vrtanja: Udarno vrtanje

Čiščenje: Potrebno je čiščenje izvrtine z uporabo stisnjenega zraka v skladu z navodili za uporabo.

Tip in velikost sidra: HIT-RE 500 V4 + HAS Meter 8.8 M24  
Številka artikla: 2390170 HAS 8.8 M24x1000 (element) /  
2287552 HIT-RE 500 V4 (kemično sidro)

Maximum installation torque: 200 Nm

Globina izvrtine v osnovnem materialu: 28,0 mm

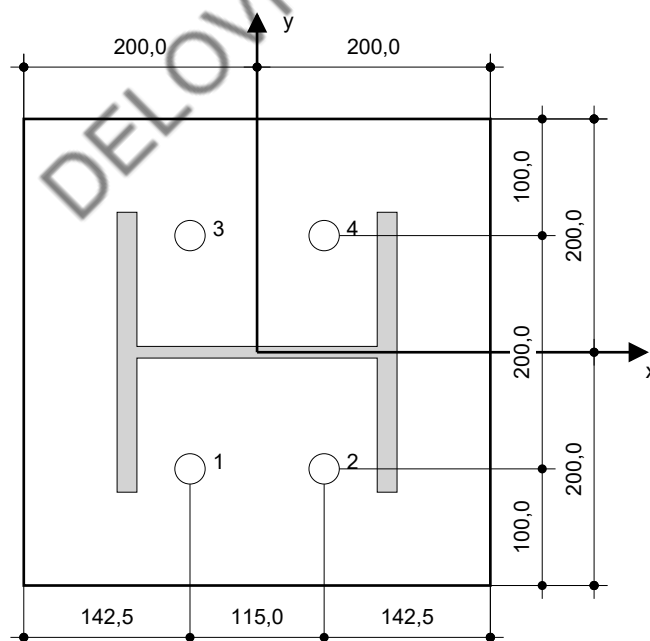
Globina izvrtine v osnovnem materialu: 150,0 mm

Minimalna debelina osnovnega materiala: 206,0 mm

Hilti AM threaded rod with HIT-RE 500 V4 injection mortar with 150 mm embedment  $h_{ef}$ , M24, Steel galvanized, Hammer drilled installation per ETA 20/0541

### 7.1 Priporočeni dodatki

Vrtanje	Čiščenje	Vgradnja
<ul style="list-style-type: none"> <li>Primerno vrtno udarno kladivo</li> <li>Ustrezen sveder</li> </ul>	<ul style="list-style-type: none"> <li>Zahtevano izpihovanje s komprimiranim zrakom in ustreznimi pripomočki, za izpihovanje prahu iz dna izvrtine.</li> <li>Okrogla jeklena ščetka ustreznega premera</li> </ul>	<ul style="list-style-type: none"> <li>Dozirnik s kaseto in mešalcem</li> <li>Momentni ključ</li> </ul>



#### Koordinate sidra [mm]

Sidro	x	y	c <sub>-x</sub>	c <sub>+x</sub>	c <sub>-y</sub>	c <sub>+y</sub>
1	-57,5	-100,0	142,5	-	-	-
2	57,5	-100,0	257,5	-	-	-
3	-57,5	100,0	142,5	-	-	-
4	57,5	100,0	257,5	-	-	-

**www.hilti.si**

Podjetje:		Stran:	9
Naslov:		Projektant:	
Telefon I Faks:		E-mail:	
Projektiranje:	Sidranje nad steno	Datum:	17. 05. 2024
Točka pritrjevanja:			

## 8 Opombe; Vaše dolžnosti sodelovanja

- Vse informacije in podatki, ki jih vsebuje programska oprema, se nanašajo izključno na uporabo izdelkov Hilti in temeljijo na načelih, formulah in varnostnih predpisih v skladu s tehničnimi navodili podjetja Hilti ter navodili za uporabo, montažo in montažo itd. ki jih mora uporabnik dosledno upoštevati. Vse vsebovane vrednosti so povprečne številke, zato je treba pred uporabo ustreznega izdelka Hilti opraviti preskuse, specifične za uporabo. Rezultati izračunov s programsko opremo v osnovi temeljijo na podatkih, ki jih vnesete. Zato prevzimate vso odgovornost za odsotnost napak, popolnost in ustreznost podatkov, ki jih morate vnesti. Poleg tega prevzimate vso odgovornost za to, da rezultate izračunov pregleda in popravi strokovnjak, zlasti glede skladnosti z veljavnimi normativi in dovoljenji, preden jih uporabite za svoj specifični objekt. Programska oprema služi le kot pomoč pri razlagi norm in dovoljenj brez kakršnega koli jamstva o odsotnosti napak, pravilnosti in ustreznosti rezultatov ali primernosti za določeno aplikacijo.
- Za preprečevanje ali omejitev škode, ki jo povzroča programska oprema, morate sprejeti vse potrebne in razumne ukrepe. Zlasti morate poskrbeti za redno varnostno kopiranje izračunov in podatkov ter po potrebi redno posodabljanje programske opreme, ki jo ponuja Hilti. Če ne uporabljate funkcije AutoUpdate programske opreme, morate z uporabo ročnih posodobitev prek spletnega mesta Hilti zagotoviti, da uporabljate trenutno in posodobljeno različico programske opreme. Hilti ne bo odgovoren za posledice, kot so obnovitev izgubljenih ali poškodovanih podatkov ali programov, ki so posledica krivdne kršitve dolžnosti.

DELOVNA VERZIJA

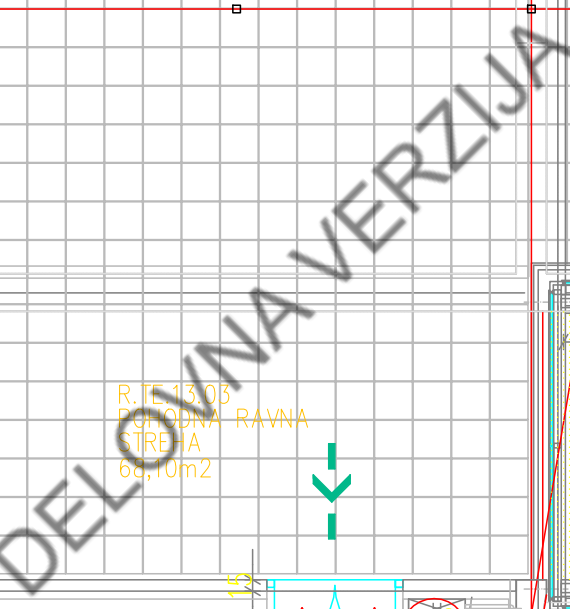



	<b>RISBE</b>
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1	Situacija obstoječega stanja strehe	M 1:100
2	Prikaz sprejemljivih lokacij postavitve RDC	M 1:100
3	Prerez obstoječega ovoja stavbe	M 1:25
4	Tloris in prerez A – A konstrukcije podesta za postavitve RDC	M 1:50
5	Prerez B - B	M 1:25
6	Prerez C - C	M 1:25

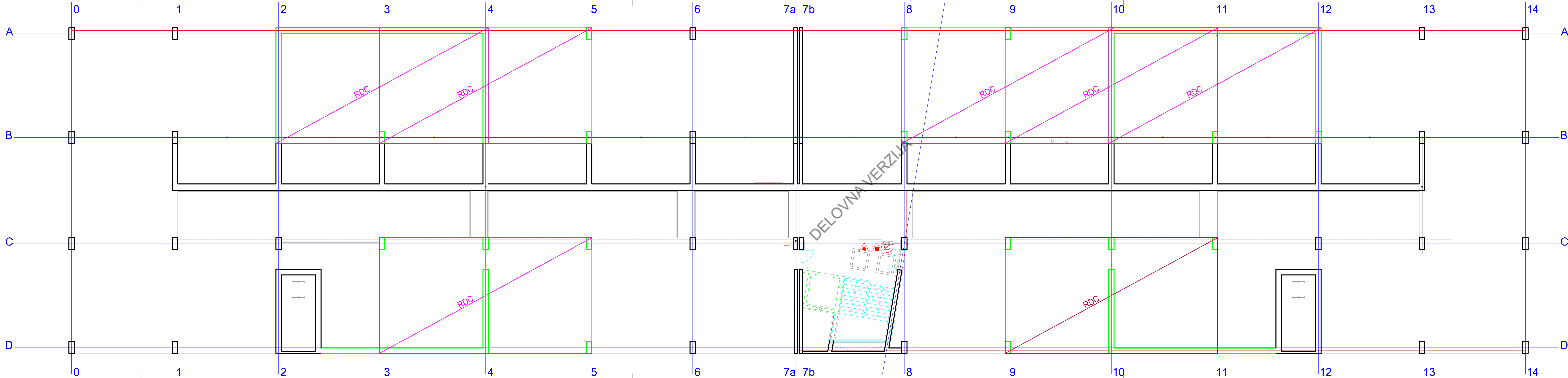
DELOVNA VERZIJA

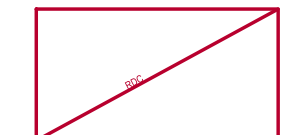


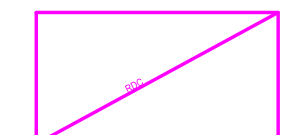


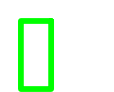
 <b>DETAJL</b> <b>INFRASTRUKTURA</b>	Detalj infrastruktura d.o.o. Na prodaj 13 5271 Vipava Slovenija	T 05 36 550 12 F 05 36 550 14 E <a href="mailto:info@detajl.eu">info@detajl.eu</a> www.detajl.eu	<b>STATIČNA PRESOJA</b> <b>NAMESTITVE RDC - STREHA FRI</b>







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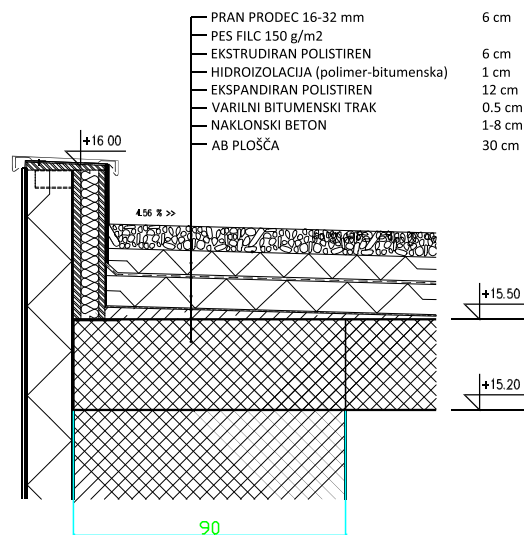
LOKACIJA POSTAVITVE RDC, KI JE PRIKAZANA NA RISBAH 4 - 6
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SPREJEMLJIVE LOKACIJE POSTAVITVE RDC
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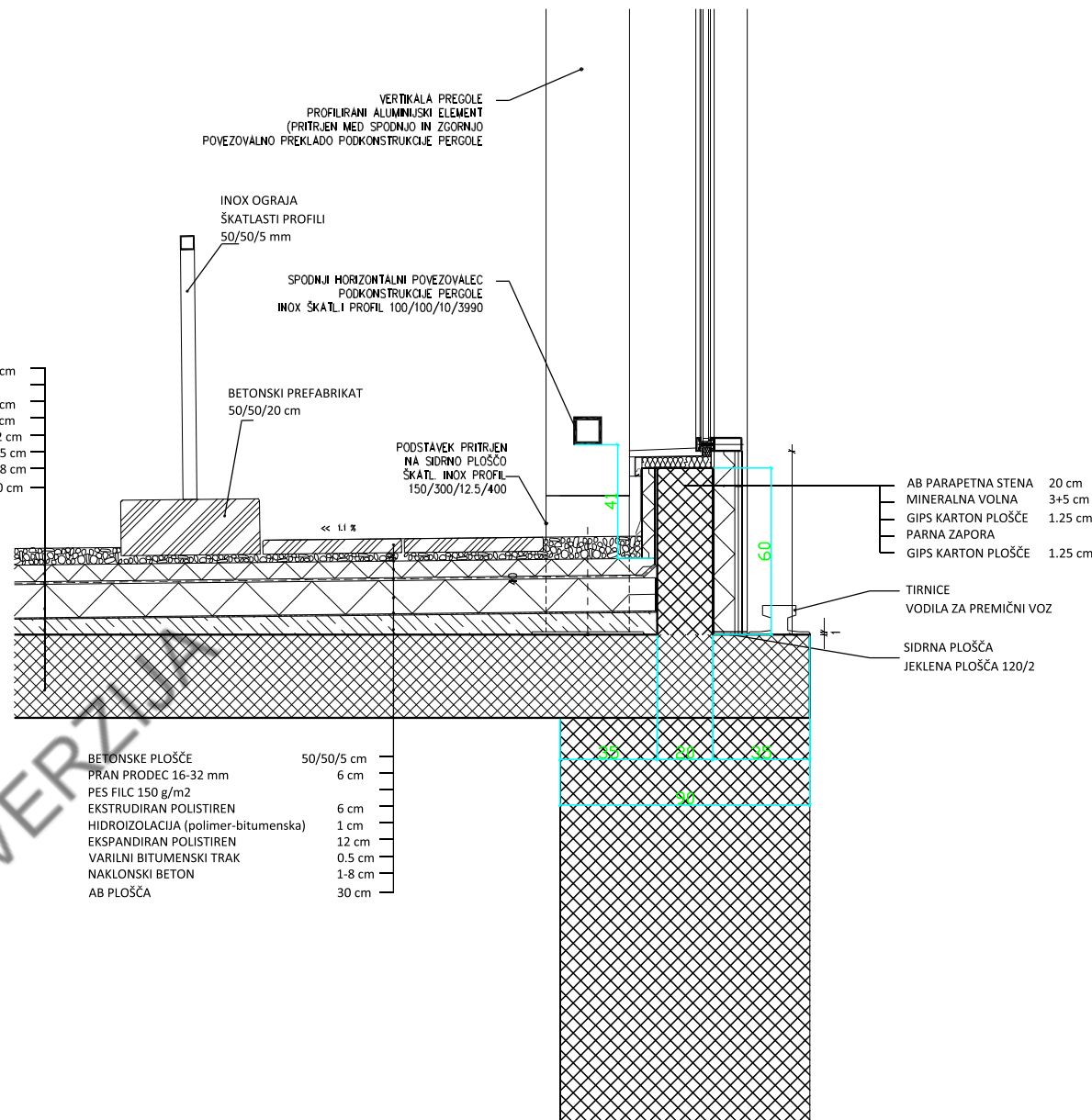
AB STEBRI/STENE, KI JIH JE SPREJEMLJIVO DODATNO OBREMENTI
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OSTALI AB STEBRI/STENE, KI JIH NI SPREJEMLJIVO DODATNO OBREMENTI

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Pooblaščen inženir:		dr. Marko Lavrenčič mag. inž. gr.		G - 4843
Izdela:		dr. Marko Lavrenčič mag. inž. gr.		
Sodelavec:				
Vrsta projekta:		št. projekta:	datum:	merilo:
		24/24	maj 2024	1:100
STATIČNA PRESOJA NAMESTITVE RDC - STREHA FRI				Številka lista:
				2



PRAN PRODEC 16-32 mm 6 cm  
PES FILC 150 g/m2 6 cm  
EKSTRUDIRAN POLISTIREN 1 cm  
HIDROIZOLACIJA 12 cm  
EKSPANDIRAN POLISTIREN 0.5 cm  
VARILNI BITUMENSKI TRAK 1-8 cm  
NAKLONSKI BETON 30 cm  
AB PLOŠČA



BETONSKE PLOŠČE 50/50/5 cm  
PRAN PRODEC 16-32 mm 6 cm  
PES FILC 150 g/m2 6 cm  
EKSTRUDIRAN POLISTIREN 1 cm  
HIDROIZOLACIJA (polimer-bitumenska) 12 cm  
EKSPANDIRAN POLISTIREN 0.5 cm  
VARILNI BITUMENSKI TRAK 1-8 cm  
NAKLONSKI BETON 30 cm  
AB PLOŠČA

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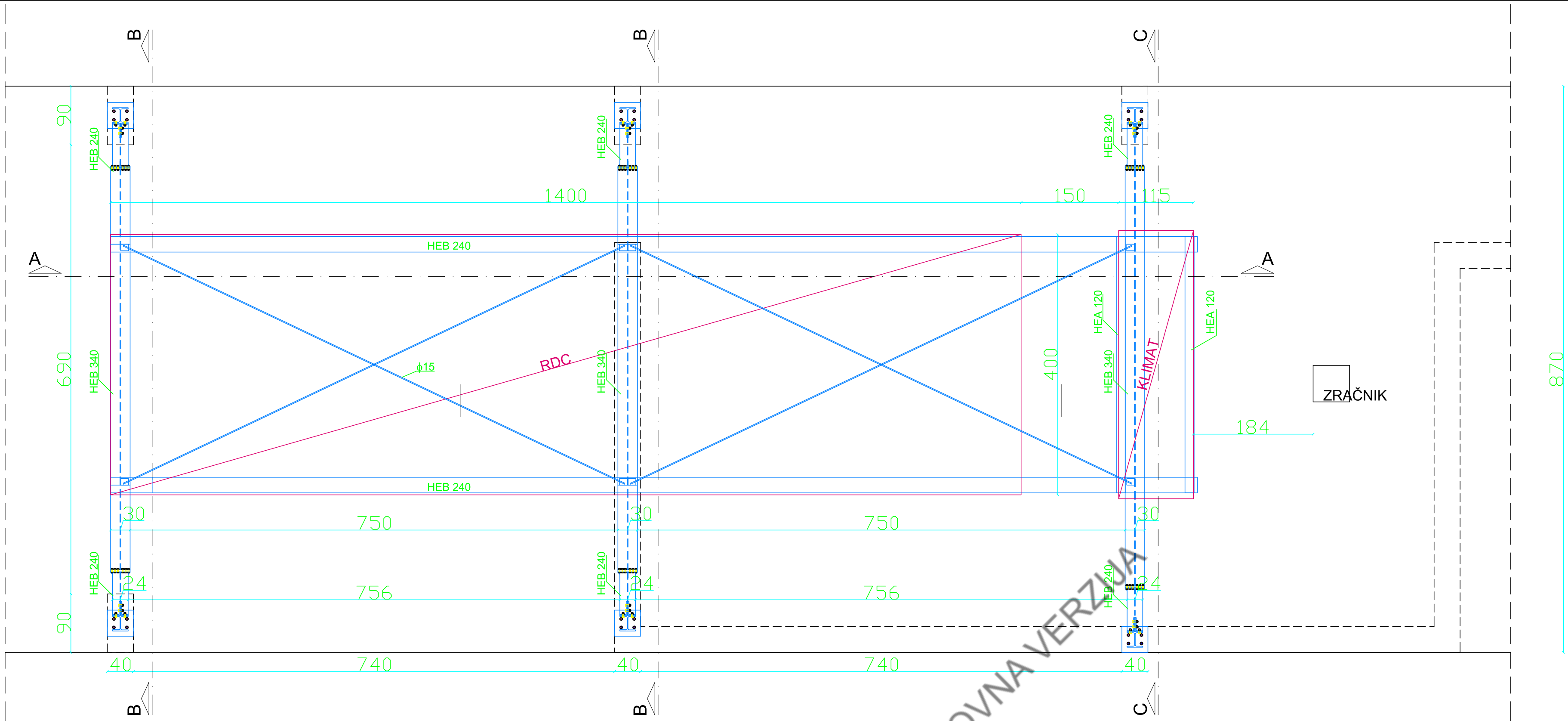


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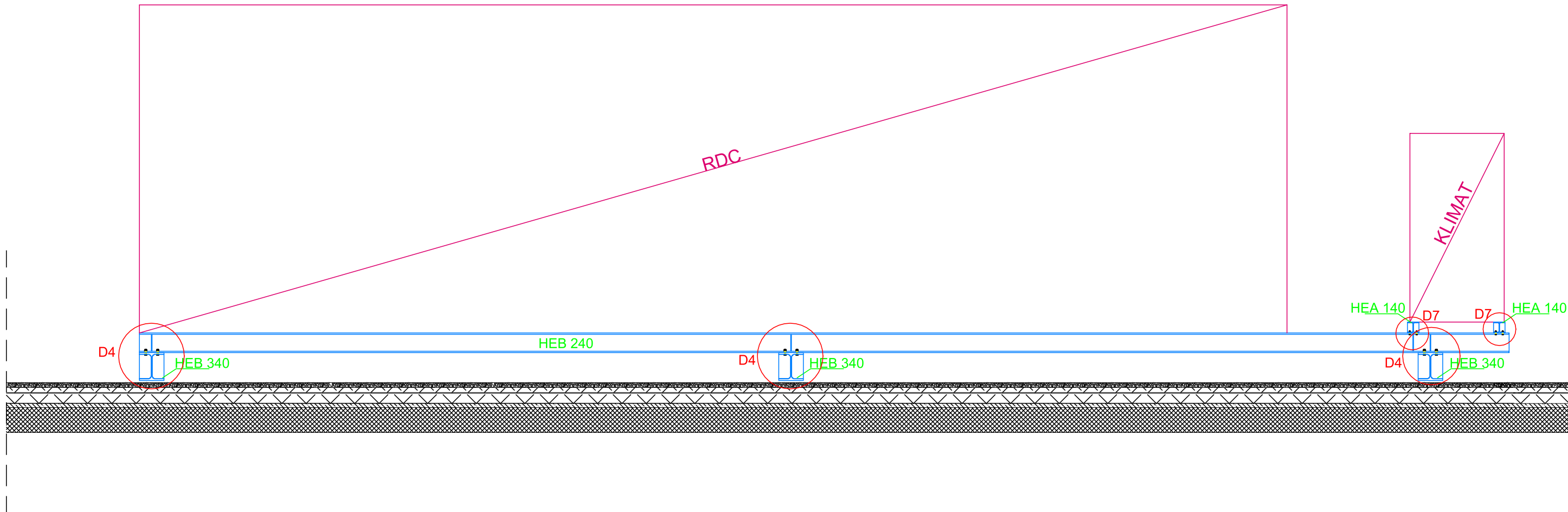
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Izdela:	dr. Marko Lavrenčič mag. inž. gr.		PREREZ OBSTOJEČEGA OVOJA STAVBE	
Sodelavec:				
Vrsta projekta:	št. projekta:	datum:	merilo:	številka lista:
	24/24	maj 2024	1:25	3



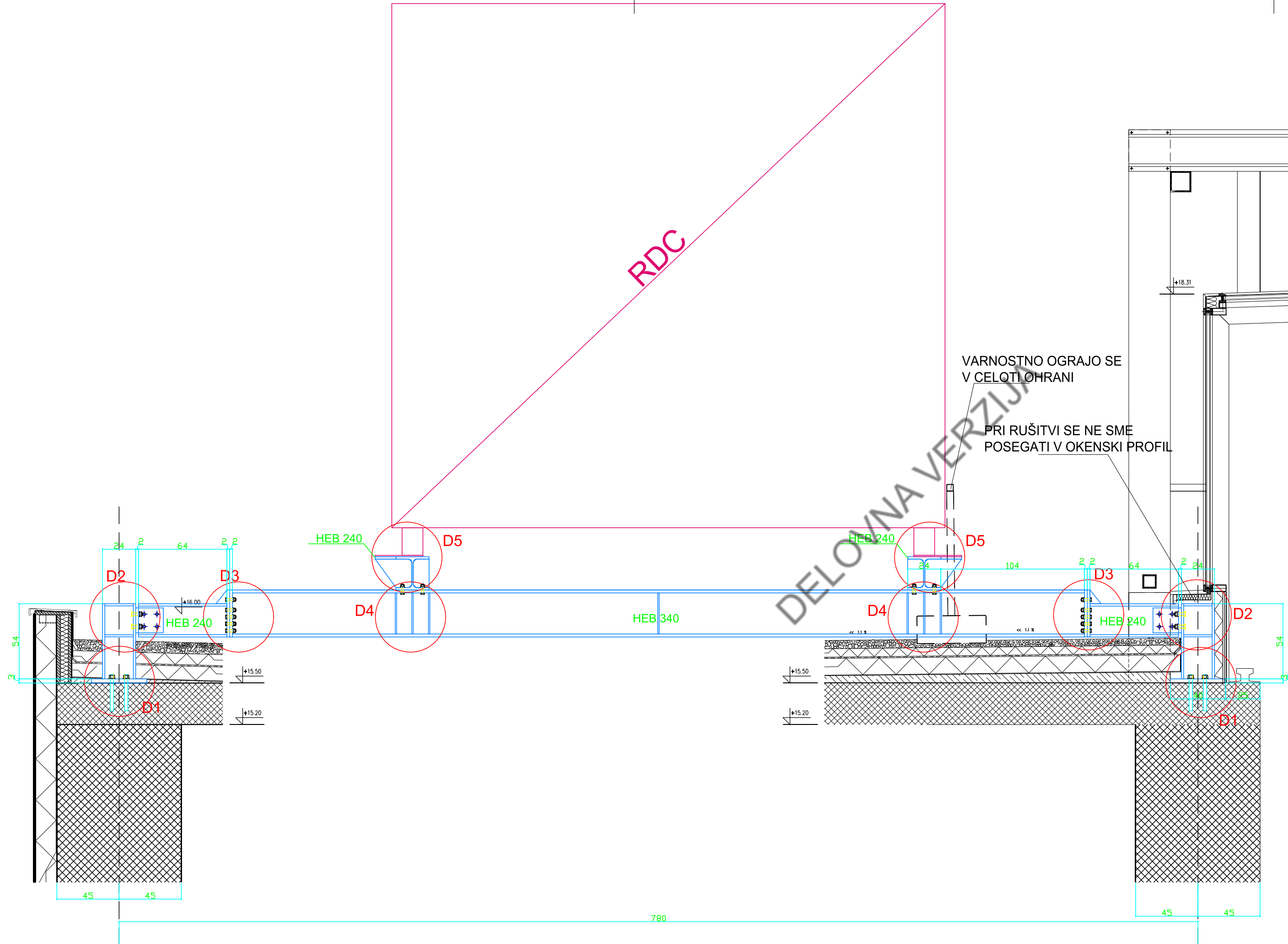
PREREZ A-A



VZDOLŽNI RAZMAKI MED PREČNIMI PROFILI HEB 340 SO FIKSNI, PRILAGOJENI RASTRU STEBROV OSNOVNE KONSTRUKCIJE.

PREČNI RAZMAK MED VZDOLŽNIMA PROFILOMA HEB240 SE PRILAGODI POTREBAM IZBRANEGA KONTEJNERJA

UNIVERZA V LJUBLJANI, FAKULTETA ZA RAČUNALNIŠTVO IN INFORMATIKO, Naročnik: Večna pot 113, 1000 Ljubljana				
<b>di</b> DETAIL INFRASTRUKTURA		Detail infrastruktura d.o.o. Na prodaj 13 5271 Vipava Slovenija		T 05 36 550 12 F 05 36 550 14 E info@detail.eu www.detail.eu
Vodja projekta:		ime in priimek – naziv	id. št. IZS	STATIČNA PRESOJA NAMESTITVE RDC - STREHA FRI
Pooblaščen inženir:		dr. Marko Lavrenčič mag. inž. gr.	G - 4843	Elaborat:
Izdela:		dr. Marko Lavrenčič mag. inž. gr.	G - 4843	Nočrt/vsebinska lista
Sodelavec:				TLORIS IN PREREZ A-A KONSTRUKCIJE PODESTA ZA POSTAVITEV RDC
Vrsta projekta:		št. projekta:	datum:	merilo:
		24/24	maj 2024	1:50
				število lista:
				4



PRED IZVEDBO SIDRANJA JE POTREBNO V MINIMALNI POTREBNI ŠIRINI ODSTRANITI VSE SLOJE HIDROIZOLACIJE, TOPLOTNE IZOLACIJE, PODLOŽNEGA BETONA, PARAPETNEGA ZIDU.

LOKACIJO ODPRTIN ZA SIDRA ZNOTRAJ SIDRNE PLOŠČICE SE MINIMALNO PRILAGODI GLEDE NA LOKACIJO VGRAJENE ARMATURE.

DETAJLI D1 - D6 SE IZVEDEJO V SKLADU Z DETAJLI PRIKAZANIMI V POROČILIH IZ PROGRAMA IDEA STATICA. IZVAJALEC JE PRED IZVEDBO DOLŽAN IZDELATI DELAVNIŠKE NAČRTE.

PO IZVEDBI PODESTA SE NA MESTU PARAPETNEGA ZIDU DOBETONIRA DEL, KI JE BIL ODSTRANJEN. OVOJ STAVBE SE NA MESTIH VSEH POSEGOV USTREZNO SANIRA!

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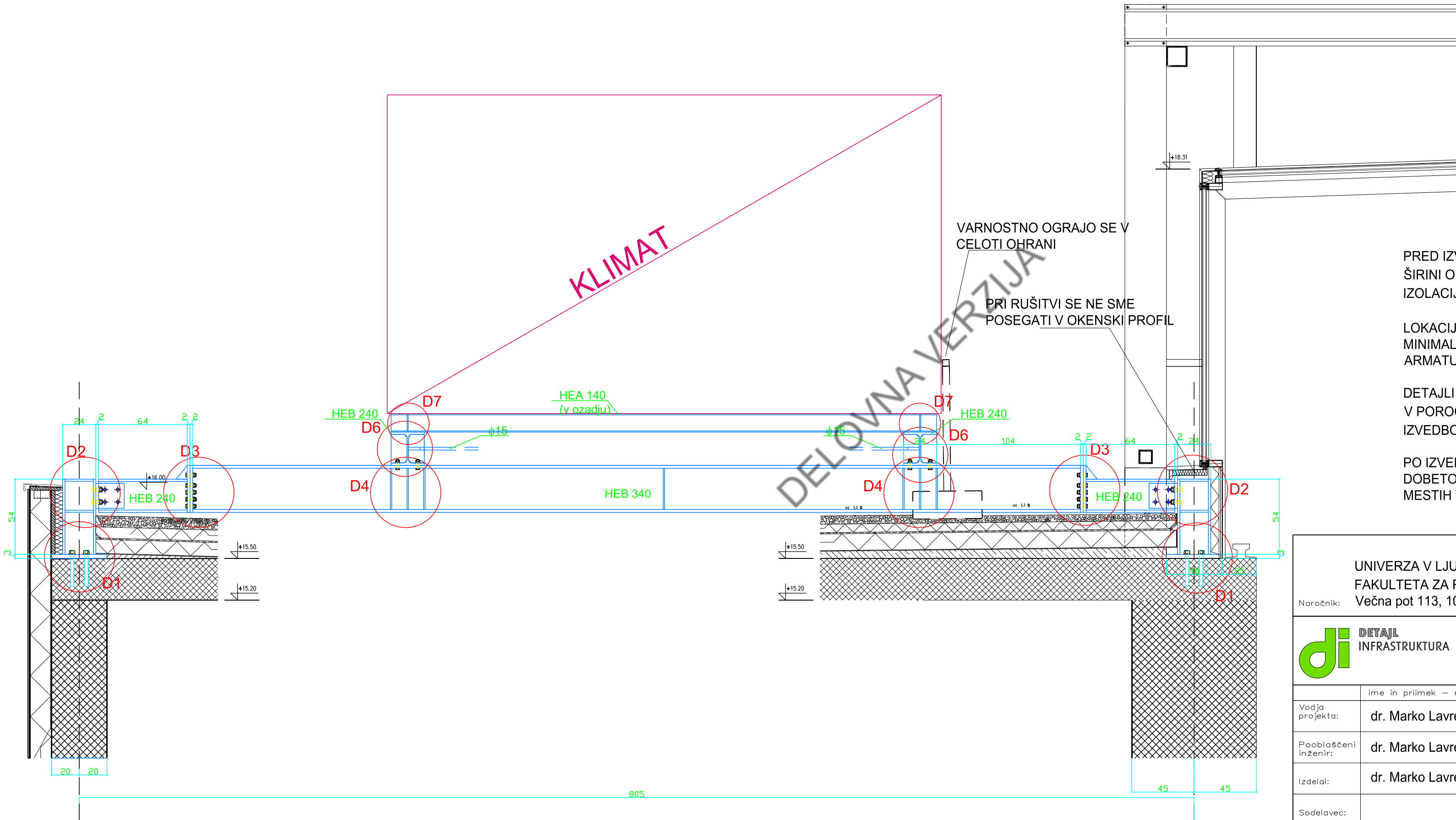
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Vodja projekta:	dr. Marko Lavrenčič mag. inž. gr.	G - 4843	STATIČNA PRESOJA		
Pooblaščen inženir:	dr. Marko Lavrenčič mag. inž. gr.	G - 4843			
Izdelal:	dr. Marko Lavrenčič mag. inž. gr.		PREREZ B - B		
Sodelavec:					
Vrsta projekta:	št. projekta:	datum:	merilo:	številka lista:	
	24/24	maj 2024	1:25	5	





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Izdelal:	dr. Marko Lavrenčič mag. inž. gr.		PREREZ C - C		
Sodelavec:					
Vrsta projekta:	št. projekta:	datum:	merilo:	številka lista:	
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