

Podnositelj zahtjeva/Investitor:
ZRAKOPLOVNO TEHNIČKI CENTAR d.d.
10410 VELIKA GORICA, Sisačka 39E
OIB: 16283450040

Naziv zahvata u prostoru/građevina:
POMOĆNA GRAĐEVINA - SPREMIŠTE

Lokacija:
K.Č.BR. 5240 K.O. VELIKA GORICA

Zajednička oznaka mapa (ZOP):
ZTC-ST

Oznaka mape (TD):
05-07/2023

Redni broj mape:
MAPA II

Razina razrade: **GLAVNI PROJEKT**

Strukovna odrednica projekta: **PROJEKT KONSTRUKCIJE**

Projektant:
Miroslav Kopčinović dipl.ing.građ. - G 6702

Glavni projektant:
Miroslav Kopčinović dipl.ing.građ. - G 6702

Direktor:
Dalibor Stamenković, mag.ing.aedif.

Mjesto i datum izrade projekta:
Zagreb, srpanj 2023.

Elektronički potpis:

Elektronički potpis:

Elektronički potpis:

POMOĆNA GRAĐEVINA - SPREMIŠTE

GLAVNI PROJEKT – PROJEKT KONSTRUKCIJE

PODNOŠITELJ ZAHTJEVA:
ZRAKOPLOVNO TEHNIČKI CENTAR d.d.
OIB 34378227174
Sisačka 39E, Velika Gorica
Zagreb, srpanj 2023.

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1 OPĆI DIO

1.1 POPIS MAPA GLAVNOG PROJEKTA

Sastavni dijelovi glavnog projekta (popis mapa)

MAPA 1/ ARHITEKTONSKI PROJEKT

LOADING d.o.o.
Zagreb, Maksimirska cesta 32
Projektant: Miroslav Kopčinović, dipl.ing.građ.

MAPA 2/ PROJEKT KONSTRUKCIJE

ArhiArhProjekt d.o.o.-
Zagreb, Oporovečka 125
Projektant: Miroslav Kopčinović, dipl.ing.građ

1.2 POPIS SVIH PROJEKTANATA I SURADNIKA KOJI SU SUDJELOVALI U IZRADI GLAVNOG PROJEKTA

Projektant glavnog projekta TD 05-07/2023

Miroslav Kopčinović, dipl.ing.građ.

Upisana u imenik ovlaštenih inženjera građevinarstva u Hrvatskoj komori inženjera građevinarstva

Redni broj upisa: G – 6702

Suradnik:

Dalibor Stamenković, mag.ing.aedif.

POMOĆNA GRAĐEVINA - SPREMIŠTE

GLAVNI PROJEKT – PROJEKT KONSTRUKCIJE

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POMOĆNA GRAĐEVINA - SPREMIŠTE

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1.4 IZJAVA PROJEKTANTA O USKLAĐENOSTI PROJEKATA

Temeljem članka 70. Zakona o gradnji ("Narodne novine" br. 153/13, 20/17, 39/19, 125/19) donosi se sljedeća:

IZJAVA PROJEKTANTA O USKLAĐENOSTI PROJEKATA

Za

PODNOŠITELJ ZAHTJEVA: ZRAKOPLOVNO TEHNIČKI CENTAR d.d.
SISAČKA 39E, 10410 VELIKA GORICA
OIB 34378227174

GRAĐEVINA: POMOĆNA GRAĐEVINA - SPREMIŠTE

LOKACIJA: K.Č. 5240, K.O. VELIKA GORICA

ZOP: ZTC - ST

MAPA 2/ GRAĐEVINSKI PROJEKT KONSTRUKCIJE

ARHIARHPROJEKT d.o.o., Oporovečka 125, Zagreb

PROJEKTANT: MIROSLAV KOPČINOVIĆ, dipl.ing.građ... G-6702

OZNAKA PROJEKTA: 04-07/2023, Zagreb, srpanj 2023.

Ovaj glavni projekt za potrebe ishoda građevinske dozvole je usklađen s propisima, uvjetima i pravilima iz članka 68. stavka 2. Zakona o gradnji (NN br. 153/13, 20/17, 39/19, 125/19) kako slijedi:

1. Prostornim planom Zagrebačke županije (GZZ 3/02, 6/02 (ispravak), 8/05, 8/07, 4/10, 10/11, 14/12

(pročišćeni tekst), 27/15, 31/15 (pročišćeni tekst), 43/20, 46/20 (ispravak Odluke) i 2/21 (pročišćeni tekst)

2. Odlukom o donošenju Prostornog plana uređenja Grada Velike Gorice (SG GVG 10/06, 06/08, 05/14, 06/14, 02/15, 03/15- pročišćeni tekst)

3. Urbanističkim planom uređenja naselja Velika Gorica (SG GVG 06/08, 04/12)

4. Zakon o prostornom uređenju (NN 153/13, 65/17, 114/18, 39/19, 98/19)

5. Zakon o gradnji (NN 153/13, 20/17, 39/19, 125/19)

6. Zakon o poslovanju i djelatnostima prostornog uređenja i gradnje (NN 78/15, 118/18, 110/19)

7. Zakon o zaštiti od požara (NN 92/10)

8. Zakon o zapaljivim tekućinama i plinovima (NN 108/95, 56/10)

9. Zakon o zaštiti od buke (NN 30/09, 55/13, 41/16, 114/18, 14/21)

10. Zakon o zaštiti na radu (NN 71/14, 118/14, 154/14, 94/18, 96/18)

11. Zakon o zaštiti okoliša (NN 80/13, 78/15, 12/18, 118/18)

12. Zakon o održivom gospodarenju otpadom (NN 94/13, 73/17, 14/19, 98/19)

13. Zakon o tehničkim zahtjevima za proizvode i ocjenjivanju sukladnosti (NN 126/21)

14. Zakon o normizaciji (NN 80/13)

15. Zakon o komunalnom gospodarstvu (NN 68/18, 110/18, 32/20)

16. Zakon o građevnim proizvodima (NN 76/13, 30/14, 130/17, 39/19, 118/20)

17. Zakon o općoj sigurnosti proizvoda (NN 30/09, 139/10, 14/14, 32/19)

18. Tehnički propis o racionalnoj uporabi energije i toplinskoj zaštiti u zgradama (NN 128/15, 70/18, 73/18, 86/18, NN 102/20)

19. Tehnički propis za građevinske konstrukcije (NN 17/17, 75/20)

20. Tehnički propis o građevnim proizvodima (NN 35/18, 104/19)

21. Pravilnik o jednostavnim i drugim građevinama i radovima (NN 112/17, 34/18, 36/19, 98/19, 31/20)

22. Pravilnik o kontroli projekata (NN 32/14, 72/20)

23. Pravilnik o obveznom sadržaju i opremanju projekata građevina (NN 64/14, 41/15, 105/15, 61/16, 20/17, 118/19)

24. Pravilniku o osiguranju pristupačnosti građevina osobama s invaliditetom i drugim osobama smanjene pokretljivosti (NN 78/13)

25. Pravilnik o zaštiti na radu na privremenim gradilištima (NN 48/18)

26. Pravilnik o razvrstavanju građevina u skupine po zahtjevanosti mjera zaštite od požara (NN 56/12, 61/12)

27. Pravilnik o otpornosti na požar i drugim zahtjevima koje građevine moraju zadovoljiti u slučaju požara (NN 29/13, 87/15)

28. Pravilnik o ocjenjivanju sukladnosti, ispravama o sukladnosti i označavanju građevnih proizvoda (NN 103/08, 147/09, 87/10, 129/11)

POMOĆNA GRAĐEVINA - SPREMIŠTE

GLAVNI PROJEKT – PROJEKT KONSTRUKCIJE

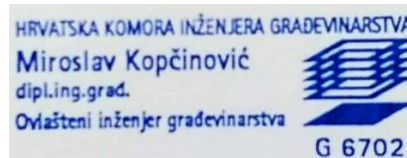
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29. Pravilnik o građevnom otpadu i otpadu koji sadrži azbest (NN 69/16)

Zagreb, srpanj 2023.

Projektant: Miroslav Kopčinović, dipl.ing.građ.



POMOĆNA GRAĐEVINA - SPREMIŠTE

GLAVNI PROJEKT – PROJEKT KONSTRUKCIJE

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1.5 RJEŠENJE O UPISU U IMENIK OVLAŠTENIH INŽENJERA GRAĐEVINARSTVA



REPUBLIKA HRVATSKA
HRVATSKA KOMORA
INŽENJERA GRAĐEVINARSTVA
10000 Zagreb, Ulica grada Vukovara 271

KLASA: UP/I-360-01/20-01/221
URBROJ: 500-03-20-3
Zagreb, 13. studenog 2020. godine

Hrvatska komora inženjera građevinarstva na temelju članka 26. stavka 3. i članka 27. Zakona o komori arhitekata i komorama inženjera u građiteljstvu i prostornom uređenju ("Narodne novine", broj 78/2015, 114/2018, 110/2019) odlučujući o zahtjevu koji je podnio **Miroslav Kopčinović, Sesvete, Ivana Gorana Kovačića 24**, donosi sljedeće

RJEŠENJE

1. U Imenik ovlaštenih inženjera građevinarstva upisuje se **Miroslav Kopčinović, dipl.ing.građ., Sesvete, Ivana Gorana Kovačića 24, OIB 90590463579**, pod rednim brojem **6702**, s danom upisa **13.11.2020.** godine.
2. Upisom u Imenik ovlaštenih inženjera građevinarstva **Miroslav Kopčinović, dipl.ing.građ.**, stječe pravo na uporabu strukovnog naziva "**ovlašten inženjer građevinarstva**" i pravo na obavljanje stručnih poslova temeljem članka 48., 50., 53. stavak 1. i 2., 55. Zakona o poslovima i djelatnostima prostornog uređenja i gradnje ("Narodne novine", broj 78/2015, 118/2018, 110/2019), te ostala prava i dužnosti sukladno ovom Zakonu, posebnim zakonima i propisima donesenim temeljem tih zakona, te općim aktima Komore.
3. Ovlaštenom inženjeru građevinarstva Hrvatska komora inženjera građevinarstva izdaje **pečat i iskaznicu ovlaštenog inženjera građevinarstva** koje su vlasništvo Komore.

Obrazloženje

Dana 05.11.2020. godine Miroslav Kopčinović, dipl.ing.građ., podnio je zahtjev za upis u Imenik ovlaštenih inženjera građevinarstva.

U prilogu zahtjeva, podnositelj zahtjeva je podnio sljedeću dokumentaciju:

- presliku važećeg osobnog dokumenta,
- presliku diplome,
- presliku Uvjerenja o položenom stručnom ispitu za obavljanje poslova prostornog uređenja i graditeljstva,
- dokaz o radnom stažu (Elektronički zapis o podacima evidentiranim u matičnoj evidenciji Hrvatskog zavoda za mirovinsko osiguranje),
- preslike rješenja o imenovanju za suradnika nadzornom inženjeru,
- dokaz o uplati upisnine u iznosu od 1.000,00 kn,
- 70,00 kn Upravne pristojbe (biljezi RH),
- jednu fotografiju veličine 35x45 mm.

POMOĆNA GRAĐEVINA - SPREMIŠTE

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Prema odredbi članka 27. Zakona o komori arhitekata i komorama inženjera u graditeljstvu i prostornom uređenju pravo na upis u imenik ovlaštenih arhitekata, ovlaštenih arhitekata urbanista, odnosno ovlaštenih inženjera Komore ima fizička osoba koja kumulativno ispunjava sljedeće uvjete:

1. da je završila odgovarajući preddiplomski i diplomski sveučilišni studij ili integrirani preddiplomski i diplomski sveučilišni studij i stekla akademski naziv magistar inženjer, ili da je završila
2. odgovarajući specijalistički diplomski stručni studij i stekla stručni naziv stručni specijalist inženjer ako je tijekom cijelog svog studija stekla najmanje 300 ECTS bodova, odnosno da je na drugi način propisan posebnim propisom stekla odgovarajući stupanj obrazovanja odgovarajuće struke,
3. da je po završetku odgovarajućeg diplomskog sveučilišnog studija ili po završetku odgovarajućeg specijalističkog diplomskog stručnog studija provela na odgovarajućim poslovima u struci najmanje dvije godine, da je po završetku odgovarajućeg diplomskog sveučilišnog studija ili odgovarajućeg specijalističkog diplomskog stručnog studija provela na odgovarajućim poslovima u struci najmanje jednu godinu, ako je uz navedeno iskustvo po završetku odgovarajućeg preddiplomskog sveučilišnog ili po završetku odgovarajućeg preddiplomskog stručnog studija stekla odgovarajuće iskustvo u struci u trajanju od najmanje tri godine, odnosno bila zaposlena na stručnim poslovima graditeljstva i/ili prostornog uređenja u tijelima državne uprave ili jedinica lokalne i područne (regionalne) samouprave, te zavodima za prostorno uređenje županije, odnosno Grada Zagreba najmanje deset godina,
4. da je ispunila uvjete sukladno posebnim propisima kojima se propisuje polaganje stručnog ispita.

Zahtjev podnosioca je osnovan.

U postupku koji je prethodio donošenju ovog rješenja izvršen je uvid u priloženu dokumentaciju i utvrđeno je da je zahtjev podnosioca osnovan, te da podnositelj udovoljava kumulativno svim uvjetima za upis u imenik ovlaštenih inženjera građevinarstva koji su propisani člankom 27. Zakona o komori arhitekata i komorama inženjera u graditeljstvu i prostornom uređenju.

Podnositelj zahtjeva stekao je pravo na uporabu strukovnog naziva „ovlaštenu inženjera građevinarstva“ i pravo na obavljanje stručnih poslova temeljem članka 48., 50., 53. stavak 1. i 2., 55. Zakona o poslovima i djelatnostima prostornog uređenja i gradnje, te ostala prava i dužnosti sukladno ovom Zakonu, posebnim zakonima i propisima donesenim temeljem tih zakona, te općim aktima Komore.

Ovlašteni inženjer građevinarstva dužan je izvršavati navedene stručne poslove sukladno zakonu te temeljnim načelima i pravilima struke koje treba poštovati ovlaštenu inženjera građevinarstva.

Pravo na obavljanje navedenih stručnih poslova prestaje s prestankom članstva u Komori, u skladu s člankom 34. i 35. Zakona o komori arhitekata i komorama inženjera u graditeljstvu i prostornom uređenju.

Ovlaštenom inženjeru građevinarstva Hrvatska komora inženjera građevinarstva izdaje pečat i iskaznicu ovlaštenog inženjera građevinarstva, sukladno članku 26. stavku 5. Zakona o komori arhitekata i komorama inženjera u graditeljstvu i prostornom uređenju.

Ovlašteni inženjer građevinarstva dužan je plaćati Hrvatskoj komori inženjera građevinarstva članarinu i ostala davanja koja utvrdi tijelo Komore, osim u slučaju mirovanja članstva i privremenog prekida obavljanja djelatnosti, a pri prestanku članstva u Komori dužan je podmiriti sve dospjele financijske obveze prema Komori, sve sukladno članku 13. stavku 1. točki 5. Statuta Hrvatske komore inženjera građevinarstva.

Ovlašteni inženjer građevinarstva dobiva putem Hrvatske komore inženjera građevinarstva Potvrdu o polici osiguranja od profesionalne odgovornosti kod odabranog osiguravatelja. Polica se izdaje na razdoblje od godine dana i obnavlja sveke godine. Premija osiguranja plaća se sa članarinom, odnosno uračunava se u iznos članarine, sve u skladu s člankom 55. Stavcima 1. i 2. Zakona o komori arhitekata i komorama inženjera u graditeljstvu i prostornom uređenju.

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Ovlašteni inženjer građevinarstva uplatio je za upis Hrvatskoj komori inženjera građevinarstva upisninu u iznosu od 1.000,00 kn sukladno članku 13. stavku 1. točki 4. Statuta Hrvatske komore inženjera građevinarstva.

Upravna pristojba u vrijednosti 20,00 kn (slovima: dvadeset kuna) prema tarifnom br. 1 i u vrijednosti od 50,00 kn (slovima: pedeset kuna), prema Tar.br. 2. stavak 1. Uredbe o tarifi upravnih pristojbi („Narodne novine“, broj 8/17, 37/17, 129/17, 18/19, 97/19, 128/19) plaćena je uplatom na račun broj HR1210010051863000160.

Slijedom navedenog, na temelju članaka 26. i 27. Zakona o komori arhitekata i komorama inženjera u graditeljstvu i prostornom uređenju, odlučeno je kao u izradi.

Uputa o pravnom lijeku:

Protiv ovog rješenja dopuštena je žalba koja se podnosi Ministarstvu prostornoga uređenja, graditeljstva i državne imovine u roku 15 dana od dana dostave rješenja. Žalba se predaje neposredno ili šalje poštom u pisanom obliku, u tri primjerka, putem tijela koje je izdalo rješenje.

Na žalbu se plaća pristojba u iznosu od 35,00 kuna prema Tar.br. 3. stavak 1. Tarife upravnih pristojbi Uredbe o tarifi upravnih pristojbi.



Predsjednica
Hrvatske komore inženjera građevinarstva

Nina Dražin Lovreć
Nina Dražin Lovreć, dipl.ing.grad.

Dostaviti:

1. **Miroslav Kopčinović**,
10360 Sesvete, Ivana Gorana Kovačica 24
2. U Zbirku isprava Komore

POMOĆNA GRAĐEVINA - SPREMIŠTE

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1.6 IZVADAK IZ SUDSKOG REGISTRA



REPUBLIKA HRVATSKA
TRGOVAČKI SUD U ZAGREBU

Elektronički zapis
Datum: 28.02.2022

IZVADAK IZ SUDSKOG REGISTRA

SUBJEKT UPISA

MBS:
081279821

OIB:
72497627548

EUID:
HRSR.081279821

TVRTKA:
1 ArhiArhProjekt d.o.o. za projektiranje
1 ArhiArhProjekt d.o.o.

SJEDIŠTE/ADRESA:
1 Zagreb (Grad Zagreb)
Oporovečka 125

ADRESA ELEKTRONIČKE POŠTE:
2 arhiarhprojekt@gmail.com

PRAVNI OBLIK:
1 društvo s ograničenom odgovornošću

PREDMET POSLOVANJA:

- 1 * - projektiranje i građenje građevina te stručni nadzor građenja
- 1 * - energetska certificiranje, energetski pregled zgrade i redoviti pregled sustava grijanja i sustava hlađenja ili klimatizacije u zgradi
- 1 * - stručni poslovi prostornog uređenja
- 1 * - djelatnost upravljanja projektom gradnje
- 1 * - djelatnost tehničkog ispitivanja i analize
- 1 * - poslovi upravljanja nekretninom i održavanje nekretnina
- 1 * - posredovanje u prometu nekretnina
- 1 * - poslovanje nekretninama
- 1 * - geodetska djelatnost
- 1 * - upravljačke djelatnosti holding-društava
- 1 * - iznajmljivanje strojeva i opreme, bez rukovatelja i predmeta za osobnu uporabu i kućanstvo
- 1 * - uređenje interijera
- 1 * - web dizajn
- 1 * - industrijski dizajn
- 1 * - organiziranje sajmova, priredbi, kongresa, koncerata, promocija, zabavnih manifestacija, izložaba, seminara, tečajeva i tribina
- 1 * - promidžba (reklama i propaganda)
- 1 * - istraživanje tržišta i ispitivanje javnog mnijenja
- 1 * - savjetovanje u vezi s poslovanjem i upravljanjem

Izrađeno: 2022-02-28 09:44:41
Podaci od: 2022-02-28

D004
Stranica: 1 od 3

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PODNOŠITELJ ZAHTJEVA:
ZRAKOPLOVNO TEHNIČKI CENTAR d.d.
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Sisačka 39E, Velika Gorica
Zagreb, srpanj 2023

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REPUBLIKA HRVATSKA
TRGOVAČKI SUD U ZAGREBU

Elektronički zapis
Datum: 28.02.2022

IZVADAK IZ SUDSKOG REGISTRA

SUBJEKT UPISA

PREDMET POSLOVANJA:

- | | | |
|---|---|---|
| 1 | * | - kupnja i prodaja robe |
| 1 | * | - pružanje usluga u trgovini |
| 1 | * | - obavljanje trgovačkog posredovanja na domaćem i inozemnom tržištu |
| 1 | * | - zastupanje inozemnih tvrtki |
| 1 | * | - usluge informacijskog društva |
| 1 | * | - prijevoz putnika u unutarnjem cestovnom prometu |
| 1 | * | - prijevoz putnika u međunarodnom cestovnom prometu |
| 1 | * | - prijevoz tereta u unutarnjem cestovnom prometu |
| 1 | * | - prijevoz tereta u međunarodnom cestovnom prometu |
| 1 | * | - prijevoz osoba i tereta za vlastite potrebe |
| 1 | * | - poslovi zaštite na radu |

OSNIVAČI/ČLANOVI DRUŠTVA:

- | | |
|---|---------------------------------------|
| 1 | Dalibor Stamenković, OIB: 58944531131 |
| | Sesvete, Ulica Brune Bjelinskog 4 |
| 1 | - jedini osnivač d.o.o. |

OSOBE OVLAŠTENE ZA ZASTUPANJE:

- | | |
|---|--|
| 1 | Dalibor Stamenković, OIB: 58944531131 |
| | Sesvete, Ulica Brune Bjelinskog 4 |
| 1 | - direktor |
| 1 | - zastupa društvo pojedinačno i samostalno |

TEMELJNI KAPITAL:

- | | |
|---|----------------|
| 1 | 20.000,00 kuna |
|---|----------------|

PRAVNI ODNOSI:

Osnivački akt:

- | | |
|---|--|
| 1 | Izjava o osnivanju d.o.o. od 05.11.2019. godine. |
|---|--|

FINANCIJSKA IZVJEŠĆA:

	Predano	God.	Za razdoblje	Vrsta izvještaja
eu	01.03.21	2020	01.01.20 - 31.12.20	GFI-POD izvještaj

Upise u glavnu knjigu proveli su:

RBU Tt	Datum	Naziv suda
0001 Tt-19/37071-2	15.11.2019	Trgovački sud u Zagrebu
0002 Tt-20/28143-2	28.08.2020	Trgovački sud u Zagrebu
eu /	17.03.2020	elektronički upis
eu /	01.03.2021	elektronički upis

Izrađeno: 2022-02-28 09:44:41
Podaci od: 2022-02-28

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Stranica: 2 od 3

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Elektronički zapis
Datum: 28.02.2022

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Sudska pristojba po Tar. br. 29. st. 3. Uredbe o tarifi sudskih pristojbi (NN br. 53/19 i 92/2021), za izvadak iz sudskog registra u iznosu od 5.00 Kn naplaćena je elektroničkim putem.



Ova isprava je u digitalnom obliku elektronički potpisana certifikatom:
CN=sudreg, L=ZAGREB,
O=MINISTARSTVO PRAVOSUĐA I UPRAVE HR72910430276, C=HR

Broj zapisa: 00Jap-s64EZ-6hMKK-9rBVb-zQI7G
Kontrolni broj: uAc8G-adJlA-V3CIt-WE5f4

Skeniranjem ovog QR koda možete provjeriti točnost podataka.
Isto možete učiniti i na web stranici
http://sudreg.pravosudje.hr/registar/kontrola_izvornika/ unosom gore navedenog broja zapisa i kontrolnog broja dokumenta.
U oba slučaja sustav će prikazati izvornik ovog dokumenta. Ukoliko je ovaj dokument identičan prikazanom izvorniku u digitalnom obliku, Ministarstvo pravosuđa i uprave potvrđuje točnost isprave i stanje podataka u trenutku izrade izvotka.
Provjera točnosti podataka može se izvršiti u roku tri mjeseca od izdavanja isprave.

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2 TEHNIČKI DIO

2.1 TEHNIČKI OPIS

Investitor, ZRAKOPLOVNO TEHNIČKI CENTAR d.d., Sisačka 39E, Velika Gorica,
OIB: 34378227174

Tlocrtne dimenzije pomoćne građevine u najširim osnim gabaritima iznose 8,78 x 5,26 m.
Visinski se sastoji od prizemlja. Visina građevine iznosi 5,37 m iznad kote terena.

Statički i seizmički proračun predmetne konstrukcije izvršen je računalnim programom SCIA Engineer. Proračun je proveden prema općim principima projektiranja definiranim normama EN 1990 i EN 1991., metodom konačnih elemenata. Karakteristike statičkog proračuna računalnog modela određene su performansama računalnog programa. Unutarnje sile i momenti te naprezanja u elementima strukture računalnog modela predmetne konstrukcije, kao statički neodređene, računalni program određuje upotrebom elastične globalne analize tako da odnos opterećenja i naprezanja materijala bude linearan, neovisno o razini naprezanja. Unutarnja naprezanja, sile i momenti određeni su upotrebom teorije prvog reda uz pretpostavku ekscentriciteta elemenata od zadane osi.

2.2 UVJETI I ZAHTJEVI KOJI MORAJU BITI ISPUNJENI PRI IZVOĐENJU RADOVA I KOJI SE NAČINI IZVOĐENJA RADOVA MORAJU ISPUNITI ZA PROJEKTIRANI DIO GRAĐEVINE

Čelična konstrukcija - opći dio

Čelična konstrukcija se sastoji od četiri okvira na međusobnom osnom razmaku 4,39 m i dvije zabatne stijene osno udaljene od rubnih okvira 8,78 m što čini ukupnu duljinu konstrukcije u iznosu od 8,78m. Okviri su raspona 5,26 m, zglobno oslonjeni na AB temelje, a sastoje se od stupova (HEA240) i prečke (HEA280).). Raspon okvira iznosi 9,64m, visina u strehi 4,34m, a u sljemenu 5,34m.

. Sekundarna krovna konstrukcija sastoji se od HEA 140 koje su postavljene između okvira na razmaku od 1,05m kako bi osigurale dostatnu torzijsku krutost elemenata okvira i smanjile liniju izvijanja.

Horizontalna stabilizacija objekta riješena je vlačnom stabilizacijom 16mm uzdužno i poprečno na objekt.

- Antikorozivna zaštita prema HRN EN 12944 klasa izloženosti C3 za trajnost >15godina
- Kvaliteta izvođenja prema HRN EN 1090, za klasu EXC 2

Temeljna konstrukcija

AB temelji sastoje se od trakastih temelja poprečnog presjeka 0,25x0,40 [m]povezanih AB pločom debljine 0,15[m]. Na vanjskom mjestima stupova nalaze se temelji samci dimenzija 1,00 x 1,00 m i visine 1,00 m. Kvaliteta betona za izvedbu temeljne konstrukcije je C25/30.

Klasa izloženosti temeljne konstrukcije je XC2, prema kojoj se odabire zaštitni sloj betona 30mm.

Pretpostavljena je nosivost tla 150 kN/m2.

Stišljivost tla od 40 Mpa potrebno je provjeriti i upisati u građevinski dnevnik.

Ovlašteni geotehničar ili nadzor treba prije izvođenja provjeriti da li pretpostavljena nosivost tla odgovara stvarnoj na lokaciji.

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Materijali:

Arm. beton kvaliteta: C25/30.

Armatura: B500B,

Čelična konstrukcija: S355JR i S275JR (EN10210-1 i EN10025-2).

Vijci: K.V. 8.8. i 10.9. (ISO 4016 i ISO 4916)

Podljev: Pagel V2/40

Kvaliteta zavarivanja i kontrola

Svi zavareni kutni spojevi izvode se u kvaliteti CK, a sučelni CS prema EN ISO 5817. Propisuje se vizualna kontrola zavar, penetracijskim bojama i magnetskim česticama ovisno o tipu i poziciji vara.

Antikorozivna zaštita

Za antikorozivnu zaštitu propisuje se vruće pocinčavanje u debljini 90,0nm.

Zaštita čelične konstrukcije od požara

Nema posebnih zahtjeva za otpornost nosive čelične konstrukcije na požarno opterećenje.

Proračun

Proračun je proveden metodom konačnih elemenata. Nosivosti i uporabivost prema EC1, EC2, EC3, EC7, odnosno propisima navedenim u točki 1. Objekt je opisan metodom konačnih elemenata kao 3D model u programskom paketu SCIA EngineerProfesional i provedena je analiza II reda.

Temelji

Temeljenje je na trakastim temeljima i temeljnoj ploči. Trakasti temelji se temelje na dubini od 80,0cm. Ispod temeljene ploče i trakastih temelja osigurati nasip u debljini od 25 - 35,0cm minimalne sabijenosti 40,0MPa.

Modul stišljivosti posteljice ispod temelja usvojen je 4000 kN/m²/m. Dimenzioniranje temelja provjereno je u programskom paketu Autodesk Robot Structural. Maksimalni dobiveni pritisak u tlu ispod temelja dobiven je 24 kN/m².

Napomene

Prije gradnje objekta potrebno je izraditi radioničku dokumentaciju čelične konstrukcije kao i dokumentaciju radioničkih pozicija i uz to izraditi dokaz nosivosti veza ako iste nisu definirane ovim projektom. Također, potrebno je izraditi projekt betona i tehnologije izvođenja armirano betonske konstrukcije.

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2.3 ANALIZA OPTEREĆENJA

2.3.1 Uvod

Opterećenja na građevinu međusobno se razlikuju s obzirom na niz gledišta usmjerenih na svojstva njihovih djelovanja i učinaka tih djelovanja na konstrukciju. S obzirom na uobičajenu podjelu opterećenja koja je u vezi s obilježjima i učestalosti njihova djelovanja s jedne i utjecajem na sigurnost konstrukcije s druge strane, proračunska opterećenja obuhvaćaju:

- stalno opterećenje od vlastite težine konstrukcije dodatno stalno opterećenje prema normi EN 1991-1-1
- opterećenje na konstrukciju izloženu požaru EN 1991-1-2
- opterećenje snijegom prema normi EN 1991-1-3
- opterećenje vjetrom prema normi EN 1991-1-4
- učinke jednolike promjene temperature prema normi EN 1991-1-5
- opterećenja uslijed izvedbe, građenja i održavanja prema normi EN 1991-1-6
- potresno opterećenje prema normi EN 1998-1-1

Konstrukcija građevine dimenzionira se tako da izdrži djelovanja realno mogućim očekivanim kombinacijama opterećenja.

Ovisno o proračunskom pristupu i konceptu sigurnosti, konstrukciju se ispituje na odgovarajuće grupe djelovanja uz pridružene koeficijente sigurnosti za različita djelovanja, a prema formulacijama danima normom EN 1990:

- Stalna/prolazna (P/T) kom. za KGS - $E_d = \sum_j (\gamma_{G,j} \cdot G_{k,j}) + \gamma_Q \cdot Q_{k,1} + \sum_{i>1} (\gamma_Q \cdot \Psi_{0,i} \cdot Q_{k,i}) + \gamma_P \cdot P_k$
- Izvanredna (A) kom. za KGS - $E_d = \sum_j (\gamma_{G,j} \cdot G_{k,j}) + \Psi_{1,1} \cdot Q_{k,1} + \sum_{i>1} (\Psi_{2,i} \cdot Q_{k,i}) + \gamma_P \cdot P_k + A_d$
- Karakteristična/rijetka (C/R) kom. za GSU - $E_d = \sum_j (G_{k,j}) + Q_{k,1} + \sum_{i>1} (\Psi_{0,i} \cdot Q_{k,i}) + P_k$

Norma EN 1990 detaljno ne definira pojedine kombinacije opterećenja, već isključivo daje preporuku za standardne kombinacije opterećenja, prema uvriježenim pravilima struke i propisima.

Preporučene vrijednosti faktora Ψ za zgrade

Djelovanje	$\Psi/0$	$\Psi/1$	$\Psi/2$
Uporabna opterećenja u zgradama kategorije (vidjeti normu EN 1991-1-1):			
Kategorija A: kuće, stambene zgrade	0,7	0,5	0,3
Kategorija B: uredi	0,7	0,5	0,3
Kategorija C: područja za skupove	0,7	0,7	0,6
Kategorija D: trgovine	0,7	0,7	0,6
Kategorija E: skladišta	1,0	0,9	0,8
Kategorija F: prometna područja, težina vozila ≤ 30 kN	0,7	0,7	0,6
Kategorija G: prometna područja, 30 kN \leq težina vozila ≤ 160 kN	0,7	0,5	0,3
Kategorija H: krovovi	0	0	0
Opterećenja snijegom u zgradama (vidjeti normu EN 1991-1-3)*:			
– Finska, Island, Norveška, Švedska	0,70	0,50	0,20
– Ostale države članice CEN-a za gradilišta na visini $H > 1000$ m n.m.	0,70	0,50	0,20
– Ostale države članice CEN-a za gradilišta na visini $H \leq 1000$ m n.m.	0,50	0,20	0
Opterećenja vjetrom na zgrade (vidjeti normu EN 1991-1-4)	0,6	0,2	0
Temperatura (osim požara) u zgradama (vidjeti normu EN 1991-1-5)	0,6	0,5	0
NAPOMENA: Vrijednosti Ψ mogu se odrediti u nacionalnom dodatku. * Za države koje nisu navedene, vidjeti odgovarajuće mjesne uvjete.			

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2.3.2 Opterećenja na konstrukciju

STALNA OPTEREĆENJA:

VLASTITA TEŽINA

Program automatski uzima u obzir vlastitu težinu elementa prema zadanim parametrima, geometriji i karakteristikama materijala.

1. Krovšte građevine

vlastita težina konstrukcije	uzima programski paket
krovni panel tipa Kingspan s poliuretanskom ispunom debljine 80 mm	0,12 kN/m ²
moгуća dodatna opterećenja i instalacije	0,13 kN/m ²
Ukupno	$\Delta g = 0,25 \text{ kN/m}^2$

SNIJEG

Lokacija	Velika Gorica
Zona opterećenja snijegom	3. područje
Nadmorska visina	108 m.n.m.
Karakteristično opterećenje snijegom na tlu	$S_k = 1,25 \text{ kN/m}^2$
Koeficijent oblika	$\mu_1 = 0,80$
Koeficijent izloženosti	$C_e = 1,0$
Koeficijent gubitka topline	$C_{it} = 1,0$



Nadmorska visina do [m]	1. područje - priobalja i otoci [kN/m ²]	2. područje - zaleđe Dalmacije, Primorja i Istre [kN/m ²]	3. područje - kontinentalna Hrvatska [kN/m ²]	4. područje - gorska Hrvatska [kN/m ²]
100	0,50	0,75	1,00	1,25
200	0,50	0,75	1,25	1,50
300	0,50	0,75	1,50	1,75
400	0,50	1,00	1,75	2,00
500	0,50	1,25	2,00	2,50
600	0,50	1,50	2,25	3,00
700	0,50	2,00	2,50	3,50
800	0,50	2,50	2,75	4,00
900	1,00	3,00	3,00	4,50
1000	2,00	4,00	3,50	5,00
1100	3,00	5,00	4,00	5,50
1200	4,00	6,00	4,50	6,00
1300	5,00	7,00		7,00
1400	6,00	8,00		8,00
1500		9,00		9,00
1600		10,00		10,00
1700		11,00		11,00
1800		12,00		

Opterećenje snijegom na krovu

$$s = 0,80 \cdot 1,0 \cdot 1,0 \cdot 1,25 \text{ kN/m}^2$$

$$s = 1,00 \text{ kN/m}^2$$

VJETAR

Osnovna brzina vjetra – očitano

$$v_{b,0} = 25 \text{ m/s}$$

Koeficijent smjera vjetra

$$C_{dir} = 1,0$$

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Koeficijent ovisan o godišnjem dobu

$$C_{tem} = 1,0$$

Koeficijent nadmorske visine

$$C_{alt} = 1,0$$

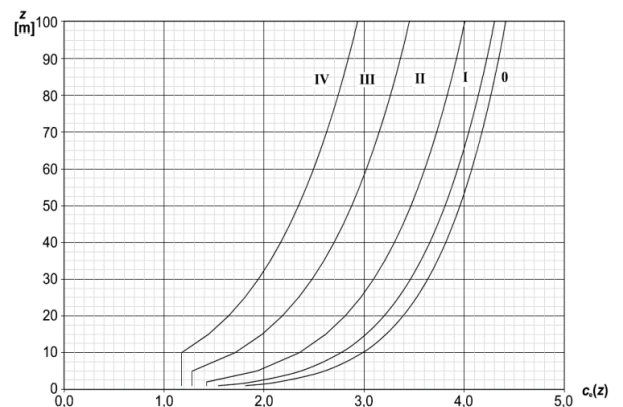
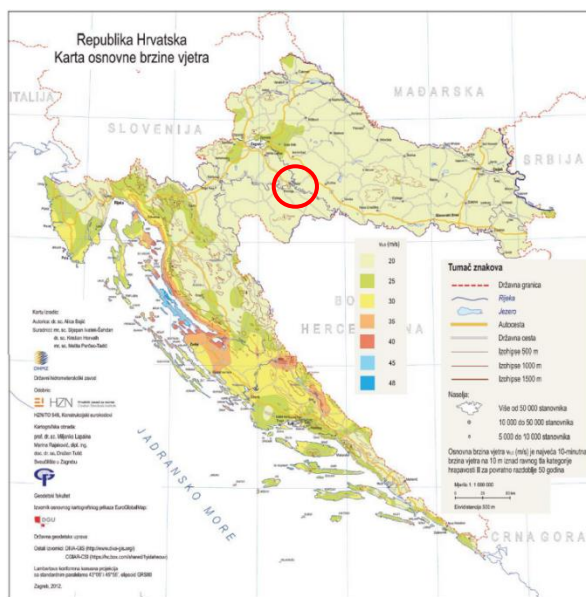
Referentna brzina vjetra

$$V_{ref} = C_{dir} \cdot C_{tem} \cdot C_{alt} \cdot V_{b,0}$$

$$V_{ref} = 25 \text{ m/s}$$

Kategorija terena	z_0 [m]	z_{min} [m]
0 More ili priobalna područja izložena otvorenom moru	0,003	1
I Jezera ili ravna i horizontalno položena područja sa zanemarivom vegetacijom i bez prepreka	0,01	1
II Područja s niskom vegetacijom, npr. travom, i izoliranim preprekama (drveće, zgrade) s razmakom najmanje 20 visina prepreke	0,05	2
III Područja sa stalnim pokrovom od vegetacije ili zgrade ili područja s izoliranim preprekama s razmakom najviše 20 visina prepreke (npr. sela, predgrađa, stalna šuma)	0,3	5
IV Područja s najmanje 15 % površine pokrivene zgradama čija prosječna visina premašuje 15 m	1,0	10

NAPOMENA: Kategorije terena prikazane su na slikama u točki A.1.



Visina objekta iznad terena: 10,10 m

Koeficijent izloženosti: $C_{e(z)} = 1,70$

UNUTARNJI PRITISAK VJETRA

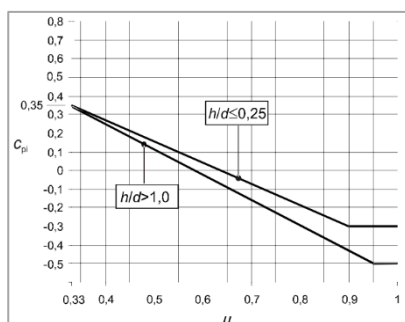
Koeficijenti pritiska:

C_{pe} = - prema površinama krova

C_{pi} = 0,35; -0,50

Tlak pri osnovnoj brzini vjetra:

$$q_{ref} = \rho \cdot V_{ref}^2 / 2 = 0,39 \text{ kN/m}^2$$



Računalni program korišten za analizu konstrukcije automatski, na temelju zadanih parametara, generira djelovanje vjetra sukladno važećoj zakonskoj regulativi odnosno normama za projektiranje.

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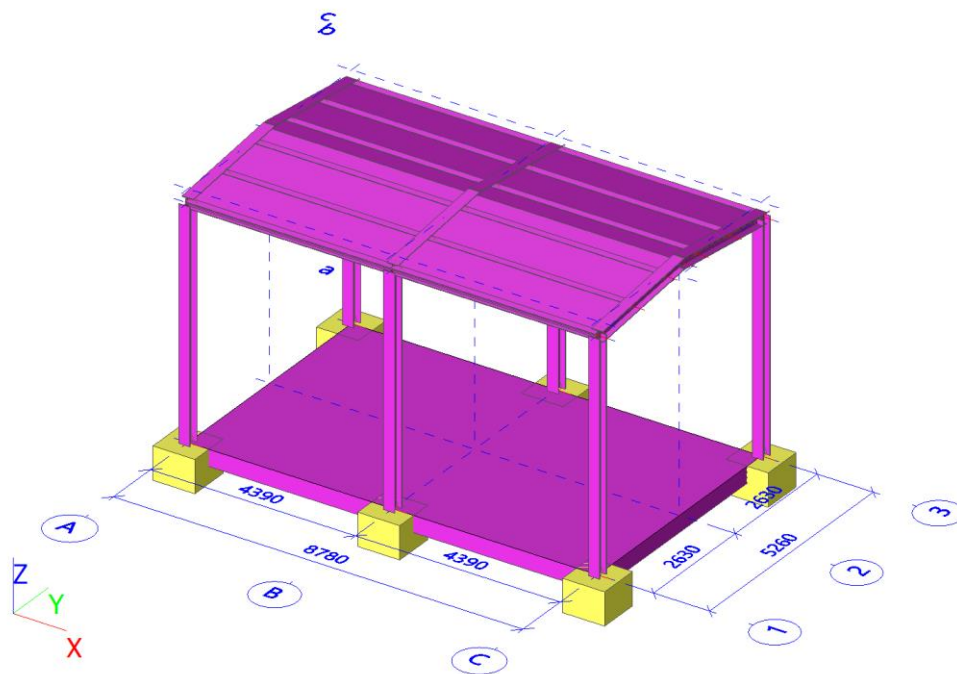
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OIB 34378227174
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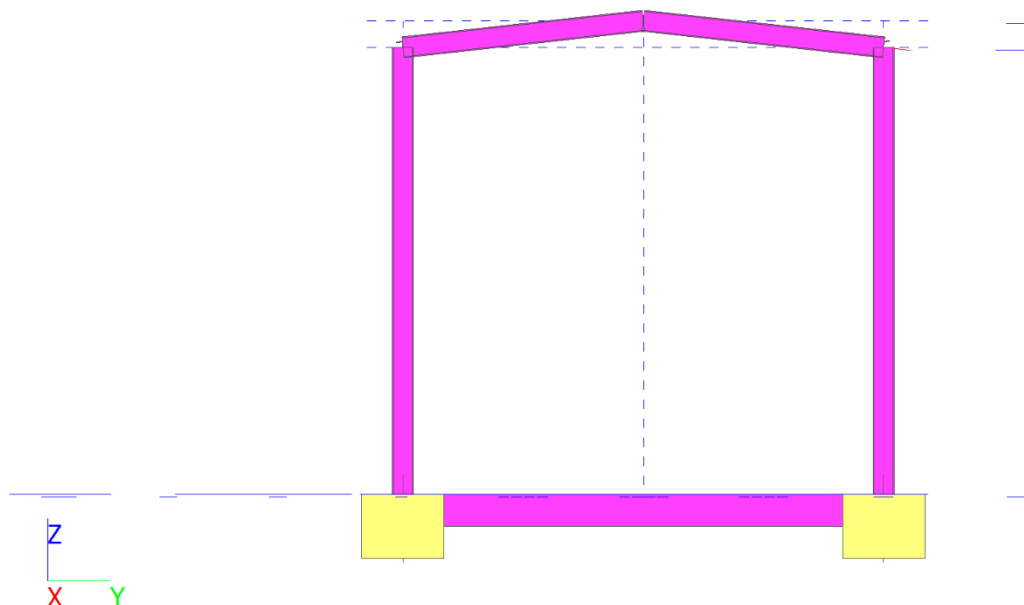
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2.4 STATIČKI PRORAČUN KONSTRUKCIJE

2.4.1 3D prikaz modela



2.4.2 Pogled na konstrukciju po osi x



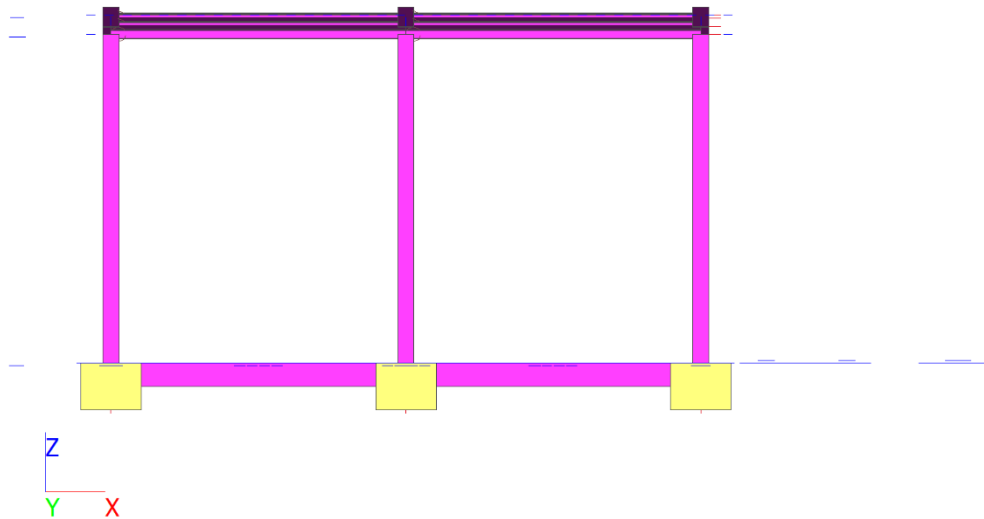
POMOĆNA GRAĐEVINA - SPREMIŠTE

GLAVNI PROJEKT – PROJEKT KONSTRUKCIJE

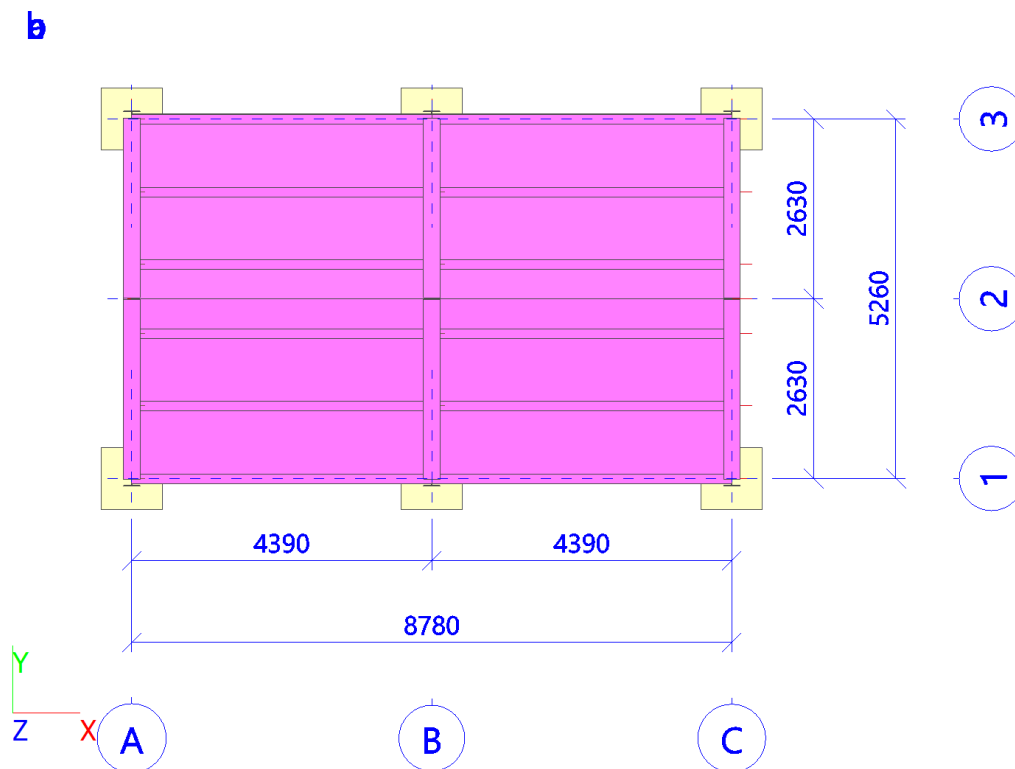
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2.4.3 Pogled na konstrukciju po osi y



2.4.4 Pogled na konstrukciju po osi z



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2.5 KOMBINACIJE DJELOVANJA

Name	Type	Load cases	Coeff. [-]
ULS-Set B (auto)	EN-ULS (STR/GEO) Set B	LC1 - Vlastita težina	1,000
		LC2 - Dodatno stalno opterećenje	1,000
		LC3 - Snijeg	1,000
		3DWind1 - 0, + CPE, + CPI	1,000
		3DWind2 - 0, + CPE, - CPI	1,000
		3DWind3 - 0, - CPE, + CPI	1,000
		3DWind4 - 0, - CPE, - CPI	1,000
		3DWind5 - 90, + CPE, + CPI	1,000
		3DWind6 - 90, + CPE, - CPI	1,000
		3DWind7 - 90, - CPE, + CPI	1,000
		3DWind8 - 90, - CPE, - CPI	1,000
		3DWind9 - 180, + CPE, + CPI	1,000
		3DWind10 - 180, + CPE, - CPI	1,000
		3DWind11 - 180, - CPE, + CPI	1,000
		3DWind12 - 180, - CPE, - CPI	1,000
		3DWind13 - 270, + CPE, + CPI	1,000
		3DWind14 - 270, + CPE, - CPI	1,000
		3DWind15 - 270, - CPE, + CPI	1,000
		3DWind16 - 270, - CPE, - CPI	1,000
		3DWind17 - 0, +/- Cpe, + CPE, + CPI	1,000
		3DWind18 - 0, -/+ Cpe, + CPE, + CPI	1,000
		3DWind19 - 0, +/- Cpe, + CPE, - CPI	1,000
		3DWind20 - 0, -/+ Cpe, + CPE, - CPI	1,000
		3DWind21 - 0, +/- Cpe, - CPE, + CPI	1,000
		3DWind22 - 0, -/+ Cpe, - CPE, + CPI	1,000
		3DWind23 - 0, +/- Cpe, - CPE, - CPI	1,000
		3DWind24 - 0, -/+ Cpe, - CPE, - CPI	1,000
		3DWind25 - 90, +/- Cpe, + CPE, + CPI	1,000
		3DWind26 - 90, -/+ Cpe, + CPE, + CPI	1,000
		3DWind27 - 90, +/- Cpe, + CPE, - CPI	1,000
		3DWind28 - 90, -/+ Cpe, + CPE, - CPI	1,000
		3DWind29 - 90, +/- Cpe, - CPE, + CPI	1,000
		3DWind30 - 90, -/+ Cpe, - CPE, + CPI	1,000
		3DWind31 - 90, +/- Cpe, - CPE, - CPI	1,000
		3DWind32 - 90, -/+ Cpe, - CPE, - CPI	1,000
		3DWind33 - 180, +/- Cpe, + CPE, + CPI	1,000
		3DWind34 - 180, -/+ Cpe, + CPE, + CPI	1,000
		3DWind35 - 180, +/- Cpe, + CPE, - CPI	1,000
		3DWind36 - 180, -/+ Cpe, + CPE, - CPI	1,000
		3DWind37 - 180, +/- Cpe, - CPE, + CPI	1,000
		3DWind38 - 180, -/+ Cpe, - CPE, + CPI	1,000
		3DWind39 - 180, +/- Cpe, - CPE, - CPI	1,000
		3DWind40 - 180, -/+ Cpe, - CPE, - CPI	1,000
		3DWind41 - 270, +/- Cpe, + CPE, + CPI	1,000
		3DWind42 - 270, -/+ Cpe, + CPE, + CPI	1,000
		3DWind43 - 270, +/- Cpe, + CPE, - CPI	1,000
		3DWind44 - 270, -/+ Cpe, + CPE, - CPI	1,000
		3DWind45 - 270, +/- Cpe, - CPE, + CPI	1,000
		3DWind46 - 270, -/+ Cpe, - CPE, + CPI	1,000
		3DWind47 - 270, +/- Cpe, - CPE, - CPI	1,000
		3DWind48 - 270, -/+ Cpe, - CPE, - CPI	1,000
SLS-Char (auto)	EN-SLS Characteristic	LC1 - Vlastita težina	1,000
		LC2 - Dodatno stalno opterećenje	1,000
		LC3 - Snijeg	1,000
		3DWind1 - 0, + CPE, + CPI	1,000
		3DWind2 - 0, + CPE, - CPI	1,000
		3DWind3 - 0, - CPE, + CPI	1,000
		3DWind4 - 0, - CPE, - CPI	1,000
		3DWind5 - 90, + CPE, + CPI	1,000
		3DWind6 - 90, + CPE, - CPI	1,000
		3DWind7 - 90, - CPE, + CPI	1,000
		3DWind8 - 90, - CPE, - CPI	1,000
		3DWind9 - 180, + CPE, + CPI	1,000
		3DWind10 - 180, + CPE, - CPI	1,000

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Zagreb, srpanj 2023

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Name	Type	Load cases	Coeff. [-]
		3DWind11 - 180, - CPE, + CPI	1,000
		3DWind12 - 180, - CPE, - CPI	1,000
		3DWind13 - 270, + CPE, + CPI	1,000
		3DWind14 - 270, + CPE, - CPI	1,000
		3DWind15 - 270, - CPE, + CPI	1,000
		3DWind16 - 270, - CPE, - CPI	1,000
		3DWind17 - 0, +/- Cpe, + CPE, + CPI	1,000
		3DWind18 - 0, -/+ Cpe, + CPE, + CPI	1,000
		3DWind19 - 0, +/- Cpe, + CPE, - CPI	1,000
		3DWind20 - 0, -/+ Cpe, + CPE, - CPI	1,000
		3DWind21 - 0, +/- Cpe, - CPE, + CPI	1,000
		3DWind22 - 0, -/+ Cpe, - CPE, + CPI	1,000
		3DWind23 - 0, +/- Cpe, - CPE, - CPI	1,000
		3DWind24 - 0, -/+ Cpe, - CPE, - CPI	1,000
		3DWind25 - 90, +/- Cpe, + CPE, + CPI	1,000
		3DWind26 - 90, -/+ Cpe, + CPE, + CPI	1,000
		3DWind27 - 90, +/- Cpe, + CPE, - CPI	1,000
		3DWind28 - 90, -/+ Cpe, + CPE, - CPI	1,000
		3DWind29 - 90, +/- Cpe, - CPE, + CPI	1,000
		3DWind30 - 90, -/+ Cpe, - CPE, + CPI	1,000
		3DWind31 - 90, +/- Cpe, - CPE, - CPI	1,000
		3DWind32 - 90, -/+ Cpe, - CPE, - CPI	1,000
		3DWind33 - 180, +/- Cpe, + CPE, + CPI	1,000
		3DWind34 - 180, -/+ Cpe, + CPE, + CPI	1,000
		3DWind35 - 180, +/- Cpe, + CPE, - CPI	1,000
		3DWind36 - 180, -/+ Cpe, + CPE, - CPI	1,000
		3DWind37 - 180, +/- Cpe, - CPE, + CPI	1,000
		3DWind38 - 180, -/+ Cpe, - CPE, + CPI	1,000
		3DWind39 - 180, +/- Cpe, - CPE, - CPI	1,000
		3DWind40 - 180, -/+ Cpe, - CPE, - CPI	1,000
		3DWind41 - 270, +/- Cpe, + CPE, + CPI	1,000
		3DWind42 - 270, -/+ Cpe, + CPE, + CPI	1,000
		3DWind43 - 270, +/- Cpe, + CPE, - CPI	1,000
		3DWind44 - 270, -/+ Cpe, + CPE, - CPI	1,000
		3DWind45 - 270, +/- Cpe, - CPE, + CPI	1,000
		3DWind46 - 270, -/+ Cpe, - CPE, + CPI	1,000
		3DWind47 - 270, +/- Cpe, - CPE, - CPI	1,000
		3DWind48 - 270, -/+ Cpe, - CPE, - CPI	1,000
SLS-Quasi (auto)	EN-SLS Quasi-permanent	LC1 - Vlastita težina	1,000
		LC2 - Dodatno stalno opterećenje	1,000
		LC3 - Snijeg	1,000
		3DWind1 - 0, + CPE, + CPI	1,000
		3DWind2 - 0, + CPE, - CPI	1,000
		3DWind3 - 0, - CPE, + CPI	1,000
		3DWind4 - 0, - CPE, - CPI	1,000
		3DWind5 - 90, + CPE, + CPI	1,000
		3DWind6 - 90, + CPE, - CPI	1,000
		3DWind7 - 90, - CPE, + CPI	1,000
		3DWind8 - 90, - CPE, - CPI	1,000
		3DWind9 - 180, + CPE, + CPI	1,000
		3DWind10 - 180, + CPE, - CPI	1,000
		3DWind11 - 180, - CPE, + CPI	1,000
		3DWind12 - 180, - CPE, - CPI	1,000
		3DWind13 - 270, + CPE, + CPI	1,000
		3DWind14 - 270, + CPE, - CPI	1,000
		3DWind15 - 270, - CPE, + CPI	1,000
		3DWind16 - 270, - CPE, - CPI	1,000
		3DWind17 - 0, +/- Cpe, + CPE, + CPI	1,000
		3DWind18 - 0, -/+ Cpe, + CPE, + CPI	1,000
		3DWind19 - 0, +/- Cpe, + CPE, - CPI	1,000
		3DWind20 - 0, -/+ Cpe, + CPE, - CPI	1,000
		3DWind21 - 0, +/- Cpe, - CPE, + CPI	1,000
		3DWind22 - 0, -/+ Cpe, - CPE, + CPI	1,000
		3DWind23 - 0, +/- Cpe, - CPE, - CPI	1,000
		3DWind24 - 0, -/+ Cpe, - CPE, - CPI	1,000
		3DWind25 - 90, +/- Cpe, + CPE, + CPI	1,000

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PODNOŠITELJ ZAHTJEVA:
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Zagreb, srpanj 2023

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Name	Type	Load cases	Coeff. [-]
		3DWind26 - 90, +/- Cpe, + CPE, + CPI	1,000
		3DWind27 - 90, +/- Cpe, + CPE, - CPI	1,000
		3DWind28 - 90, +/- Cpe, + CPE, - CPI	1,000
		3DWind29 - 90, +/- Cpe, - CPE, + CPI	1,000
		3DWind30 - 90, +/- Cpe, - CPE, + CPI	1,000
		3DWind31 - 90, +/- Cpe, - CPE, - CPI	1,000
		3DWind32 - 90, +/- Cpe, - CPE, - CPI	1,000
		3DWind33 - 180, +/- Cpe, + CPE, + CPI	1,000
		3DWind34 - 180, +/- Cpe, + CPE, + CPI	1,000
		3DWind35 - 180, +/- Cpe, + CPE, - CPI	1,000
		3DWind36 - 180, +/- Cpe, + CPE, - CPI	1,000
		3DWind37 - 180, +/- Cpe, - CPE, + CPI	1,000
		3DWind38 - 180, +/- Cpe, - CPE, + CPI	1,000
		3DWind39 - 180, +/- Cpe, - CPE, - CPI	1,000
		3DWind40 - 180, +/- Cpe, - CPE, - CPI	1,000
		3DWind41 - 270, +/- Cpe, + CPE, + CPI	1,000
		3DWind42 - 270, +/- Cpe, + CPE, + CPI	1,000
		3DWind43 - 270, +/- Cpe, + CPE, - CPI	1,000
		3DWind44 - 270, +/- Cpe, + CPE, - CPI	1,000
		3DWind45 - 270, +/- Cpe, - CPE, + CPI	1,000
		3DWind46 - 270, +/- Cpe, - CPE, + CPI	1,000
		3DWind47 - 270, +/- Cpe, - CPE, - CPI	1,000
		3DWind48 - 270, +/- Cpe, - CPE, - CPI	1,000

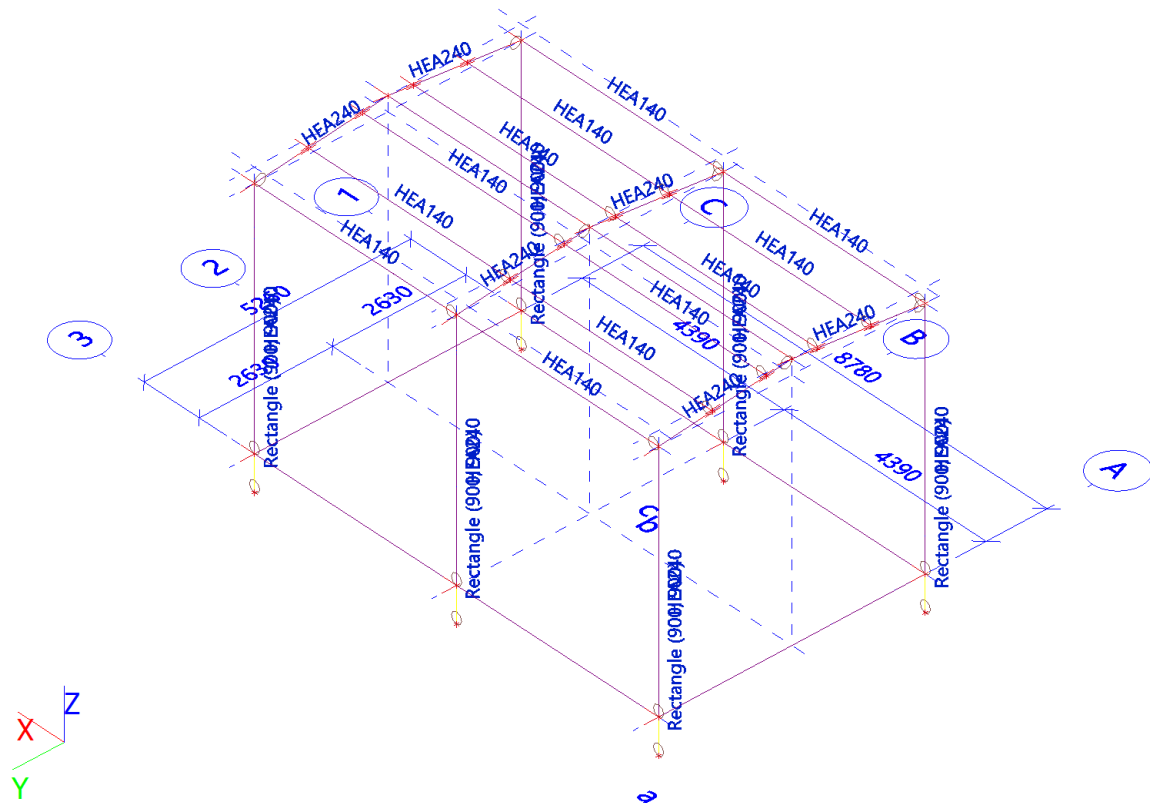
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2.6 USVOJENI ČELIČNI PROFILI



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GLAVNI PROJEKT – PROJEKT KONSTRUKCIJE

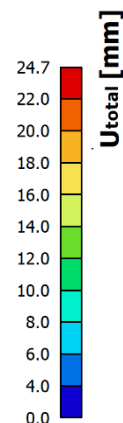
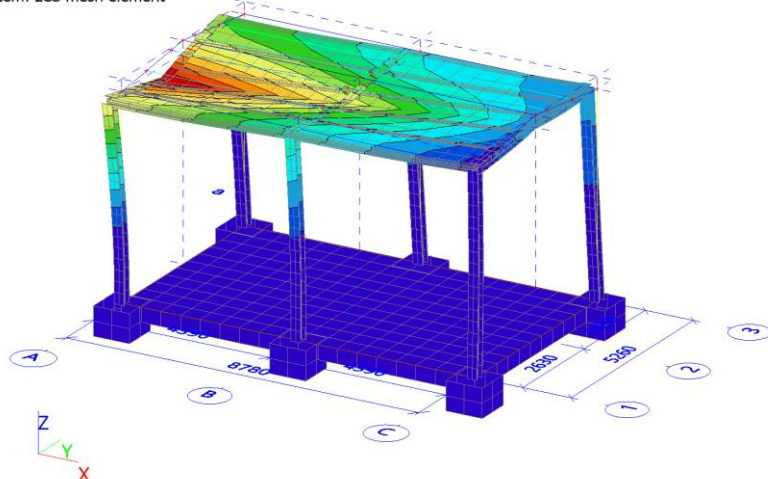
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2.7 KONTROLA DEFORMACIJE

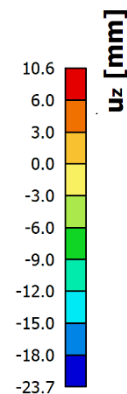
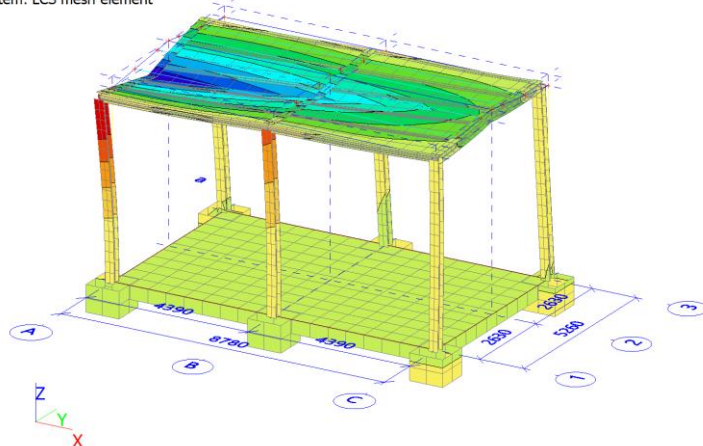
Deformacija konstrukcije

Values: U_{total}
Linear calculation
Combination: ULS-Set B (auto)
Selection: All
Location: In nodes avg. on macro
System: LCS mesh element



Maksimalni vertikalni pomak konstrukcije

Values: u_z
Linear calculation
Combination: ULS-Set B (auto)
Selection: All
Location: In nodes avg. on macro
System: LCS mesh element



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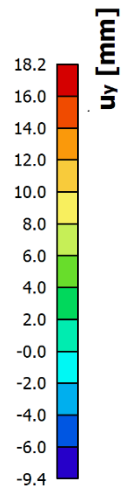
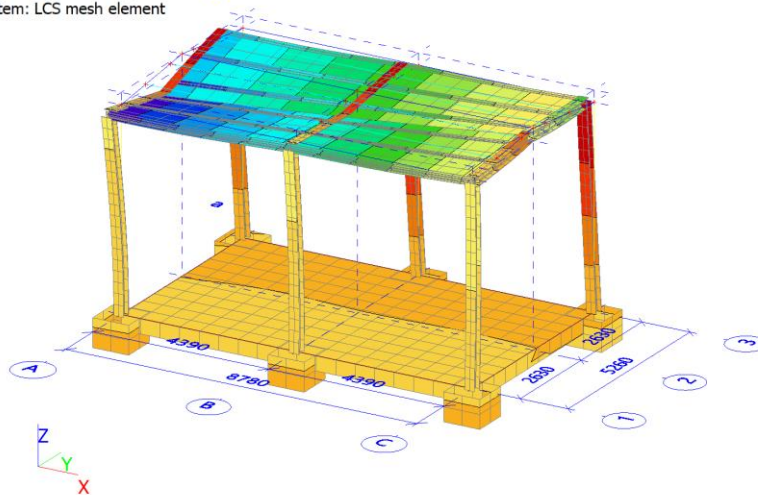
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Maksimalni horizontalni pomak konstrukcije

Values: u_y
Linear calculation
Combination: ULS-Set B (auto)
Selection: All
Location: In nodes avg. on macro
System: LCS mesh element



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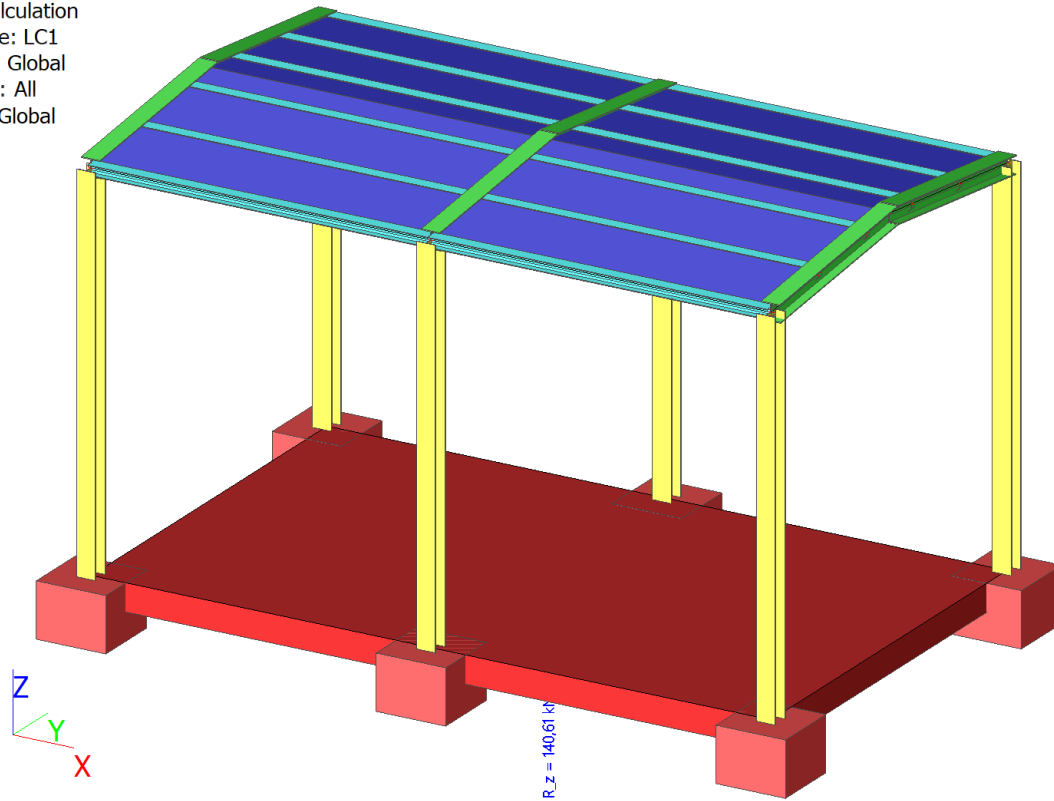
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2.8 REAKCIJE U OSLONCIMA (ANVELOPAMA)

Values: R_z
Linear calculation
Load case: LC1
Extreme: Global
Selection: All
System: Global



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GLAVNI PROJEKT – PROJEKT KONSTRUKCIJE

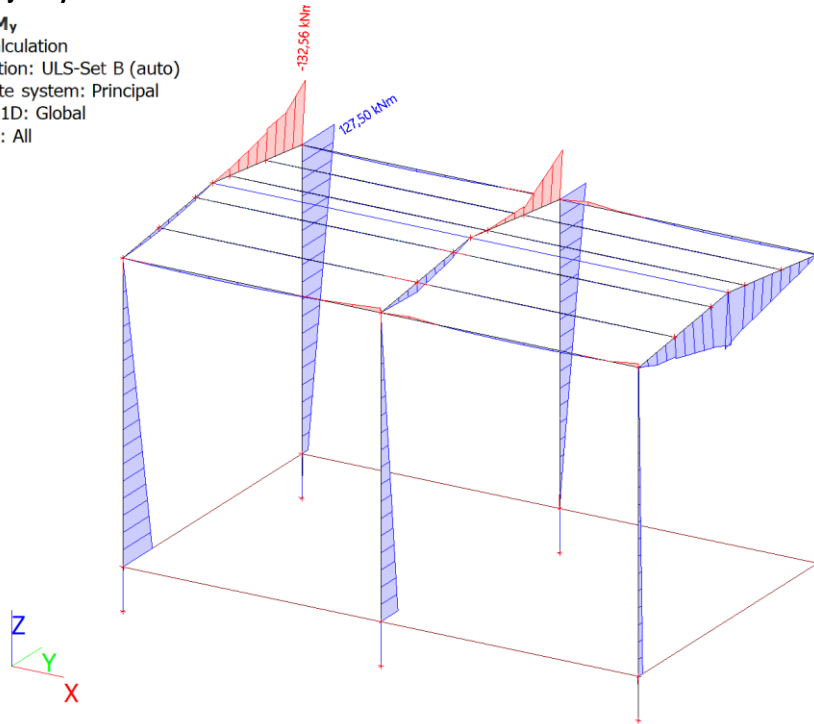
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Zagreb, srpanj 2023

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MAPA II
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2.9 UNUTARNJE SILE I MOMENTI SAVIJANJA - KARAKTERISTIČNI OKVIR

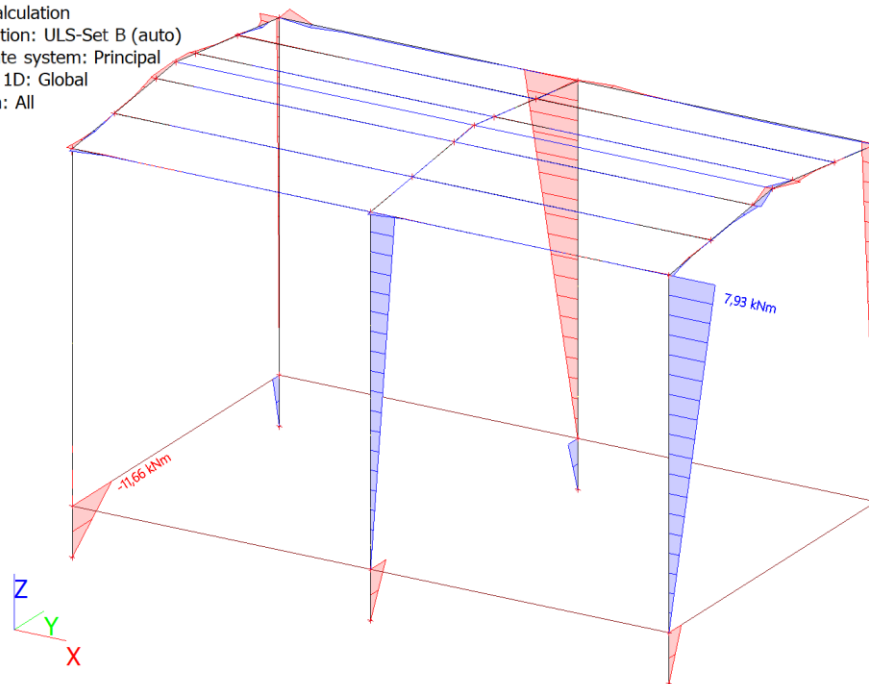
Moment savijanja M_y u karakterističnom okviru

Values: M_y
Linear calculation
Combination: ULS-Set B (auto)
Coordinate system: Principal
Extreme 1D: Global
Selection: All



Moment savijanja M_z u karakterističnom okviru

Values: M_z
Linear calculation
Combination: ULS-Set B (auto)
Coordinate system: Principal
Extreme 1D: Global
Selection: All



POMOĆNA GRAĐEVINA - SPREMIŠTE

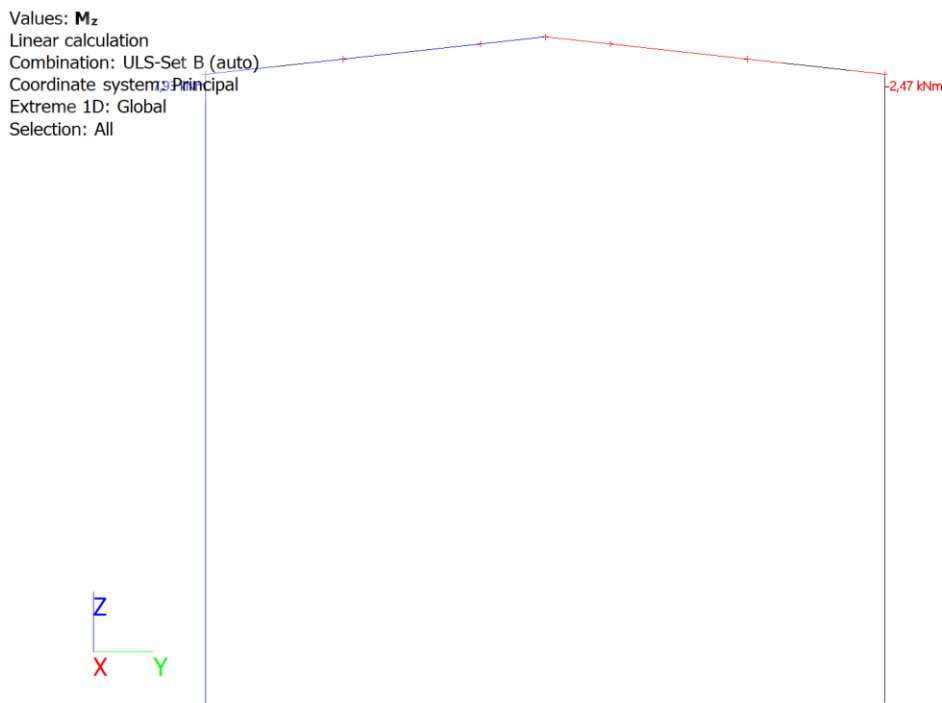
GLAVNI PROJEKT – PROJEKT KONSTRUKCIJE

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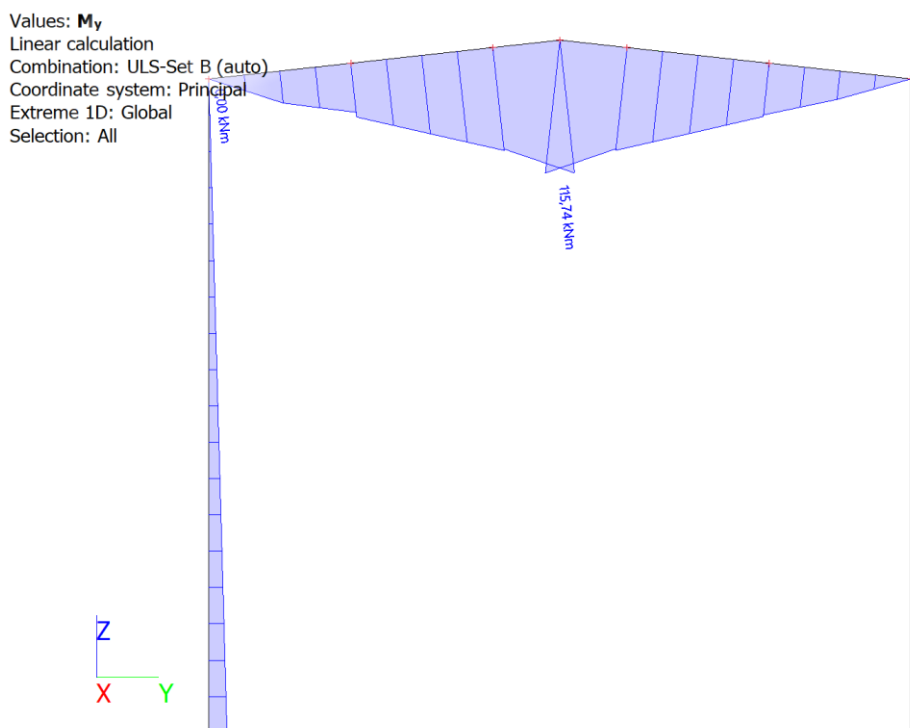
ZOP: ZTC - ST
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MAPA II
str.26/77

2.10 UNUTARNJE SILE I MOMENTI SAVIJANJA - ZABATNA STIJENA U OSI Y

Moment savijanja M_z u zabatnoj stijeni osi A



Moment savijanja M_y u zabatnoj stijeni osi A



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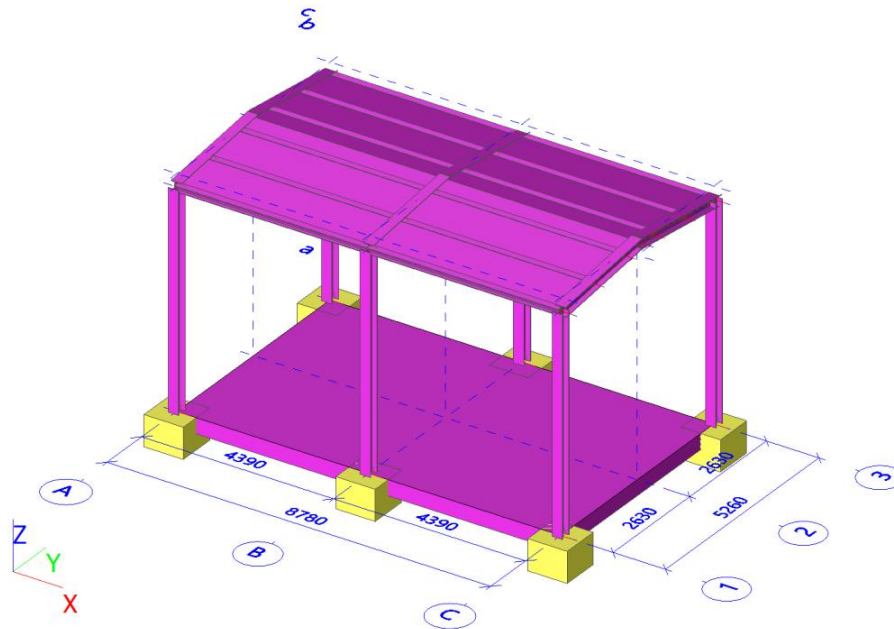
GLAVNI PROJEKT – PROJEKT KONSTRUKCIJE

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ZRAKOPLOVNO TEHNIČKI CENTAR d.d.
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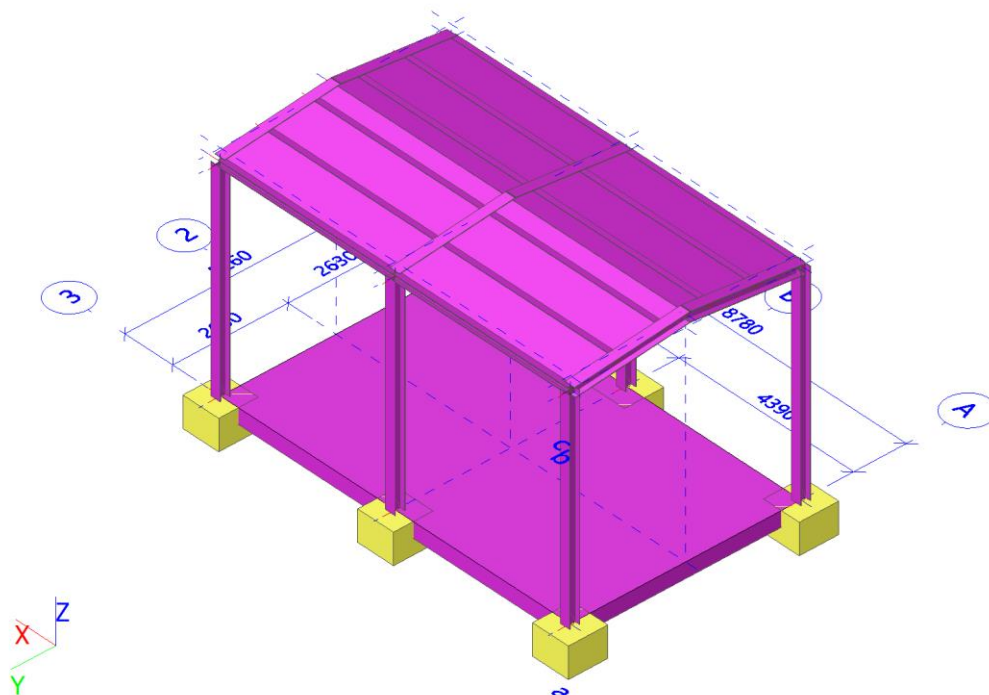
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MAPA II
str.27/77

2.11 DIMENZIONIRANJE ČELIKA

Izometrijski prikaz



Izometrijski prikaz



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Member	CS Name	Part	Sway y	Ly [m]	ky [-]	ly [m]	Lam y [-]	lyz [m]	LTB [m]
			Sway z	Lz [m]	kz [-]	lz [m]	Lam z [-]		
HEA 240	HEA 240	1	Yes	4,890	2,031	9,930	98,786	4,890	4,890
			No	4,890	0,992	4,851	80,774		
HEA 241	HEA 240	1	Yes	4,890	1,980	9,683	96,327	4,890	4,890
			No	4,890	0,992	4,851	80,769		
HEA 242	HEA 240	1	Yes	4,890	2,019	9,875	98,242	4,890	4,890
			No	4,890	0,796	3,894	64,835		
HEA 243	HEA 240	1	Yes	4,890	1,529	7,479	74,399	4,890	4,890
			No	4,890	0,797	3,898	64,904		
HEA 244	HEA 240	1	Yes	4,890	2,025	9,904	98,523	4,890	4,890
			No	4,890	0,835	4,081	67,949		
HEA 245	HEA 240	1	Yes	4,890	2,033	9,941	98,893	4,890	4,890
			No	4,890	0,836	4,087	68,049		
HEA 280	HEA 240	1	Yes	1,070	4,487	4,801	47,763	1,070	1,070
			No	1,070	0,808	0,865	14,405		
HEA 280	HEA 240	2	Yes	1,070	2,320	2,483	24,699	1,070	1,070
			No	1,070	0,982	1,051	17,503		
HEA 280	HEA 240	3	Yes	0,506	1,799	0,910	9,052	0,506	0,506
			No	0,506	0,976	0,494	8,224		
HEA 281	HEA 240	1	Yes	1,070	4,654	4,980	49,538	1,070	1,070
			No	1,070	0,916	0,980	16,323		
HEA 281	HEA 240	2	Yes	1,070	2,613	2,796	27,813	1,070	1,070
			No	1,070	0,971	1,039	17,300		
HEA 281	HEA 240	3	Yes	0,506	1,950	0,986	9,813	0,506	0,506
			No	0,506	0,981	0,496	8,266		
HEA 282	HEA 240	1	Yes	1,070	7,852	8,402	83,585	1,070	1,070
			No	1,070	0,799	0,855	14,236		
HEA 282	HEA 240	2	Yes	1,070	8,053	8,617	85,726	1,070	1,070
			No	1,070	0,919	0,984	16,381		
HEA 282	HEA 240	3	Yes	0,506	10,000	5,059	50,333	0,506	0,506
			No	0,506	0,986	0,499	8,310		
HEA 283	HEA 240	1	Yes	0,506	10,000	5,059	50,333	0,506	0,506
			No	0,506	0,976	0,494	8,219		
HEA 283	HEA 240	2	Yes	1,070	5,694	6,093	60,614	1,070	1,070
			No	1,070	0,897	0,960	15,989		
HEA 283	HEA 240	3	Yes	1,070	4,446	4,757	47,323	1,070	1,070
			No	1,070	0,798	0,854	14,214		
HEA 284	HEA 240	1	Yes	1,070	10,000	10,700	106,447	1,070	1,070
			No	1,070	0,778	0,832	13,854		
HEA 284	HEA 240	2	Yes	1,070	10,000	10,700	106,447	1,070	1,070
			No	1,070	0,900	0,963	16,034		
HEA 284	HEA 240	3	Yes	0,506	10,000	5,059	50,333	0,506	0,506
			No	0,506	0,867	0,439	7,307		
HEA 285	HEA 240	1	Yes	0,506	10,000	5,059	50,333	0,506	0,506
			No	0,506	0,853	0,432	7,190		
HEA 285	HEA 240	2	Yes	1,070	10,000	10,700	106,447	1,070	1,070
			No	1,070	0,918	0,982	16,359		
HEA 285	HEA 240	3	Yes	1,070	10,000	10,700	106,447	1,070	1,070
			No	1,070	0,686	0,734	12,220		
HEA 140	HEA 140	1	Yes	4,390	1,744	7,657	133,695	4,390	4,390
			No	4,390	0,574	2,521	71,626		
HEA 286	HEA 140	1	Yes	4,390	2,155	9,462	165,205	4,390	4,390
			No	4,390	0,540	2,369	67,302		
HEA 287	HEA 140	1	Yes	4,390	1,779	7,811	136,382	4,390	4,390
			No	4,390	0,580	2,544	72,283		
HEA 288	HEA 140	1	Yes	4,390	2,248	9,869	172,321	4,390	4,390
			No	4,390	0,638	2,799	79,520		
HEA 289	HEA 140	1	Yes	4,390	2,230	9,791	170,958	4,390	4,390
			No	4,390	0,602	2,642	75,063		
HEA 290	HEA 140	1	Yes	4,390	3,334	14,635	255,524	4,390	4,390
			No	4,390	0,626	2,748	78,086		
HEA 291	HEA 140	1	Yes	4,390	3,411	14,975	261,457	4,390	4,390
			No	4,390	0,636	2,791	79,308		
HEA 292	HEA 140	1	Yes	4,390	10,000	43,900	766,497	4,390	4,390

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Zagreb, srpanj 2023

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Member	CS Name	Part	Sway y	Ly [m]	ky [-]	ly [m]	Lam y [-]	lyz [m]	I LTB [m]
			Sway z	Lz [m]	kz [-]	lz [m]	Lam z [-]		
			No	4,390	0,881	3,868	109,900		
HEA 293	HEA 140	1	Yes	4,390	2,357	10,349	180,699	4,390	4,390
			No	4,390	0,611	2,683	76,229		
HEA 294	HEA 140	1	Yes	4,390	3,294	14,461	252,487	4,390	4,390
			No	4,390	0,642	2,817	80,026		
HEA 295	HEA 140	1	Yes	4,390	10,000	43,900	766,497	4,390	4,390
			No	4,390	0,945	4,150	117,902		
HEA 296	HEA 140	1	Yes	4,390	3,537	15,525	271,076	4,390	4,390
			No	4,390	0,655	2,873	81,636		

Linear calculation

Class: All ULS

Coordinate system: Principal

Extreme 1D: Cross-section

Selection: All

EN 1993-1-1 Code Check

National annex: Standard EN

Member B10	0,200 / 5,340 m	HEA240	S 235	All ULS	0,51 -
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Combination key

All ULS / 1.35*LC1 + 1.35*LC2 + 1.50*LC3 + 0.90*3DWind6

Partial safety factors

γ_{M0} for resistance of cross-sections	1,00
γ_{M1} for resistance to instability	1,00
γ_{M2} for resistance of net sections	1,25

Material

Yield strength	f_y	235,0	MPa
Ultimate strength	f_u	360,0	MPa
Fabrication		Rolled	

....:SECTION CHECK:....

The critical check is on position 0,200 m

Internal forces		Calculated	Unit
Normal force	N_{Ed}	-86,42	kN
Shear force	$V_{y,Ed}$	0,13	kN
Shear force	$V_{z,Ed}$	12,94	kN
Torsion	T_{Ed}	0,00	kNm
Bending moment	$M_{y,Ed}$	2,62	kNm
Bending moment	$M_{z,Ed}$	-0,01	kNm

Classification for cross-section design

Classification according to EN 1993-1-1 article 5.5.2

Classification of Internal and Outstand parts according to EN 1993-1-1 Table 5.2 Sheet 1 & 2

Id	Type	c [mm]	t [mm]	σ_1 [kN/m ²]	σ_2 [kN/m ²]	ψ [-]	k_σ [-]	α [-]	c/t [-]	Class 1 Limit [-]	Class 2 Limit [-]	Class 3 Limit [-]	Class
1	SO	95	12	7584,739	7626,380	1,0	0,4	1,0	7,9	9,0	10,0	13,8	1
3	SO	95	12	7563,099	7521,457	1,0	0,4	1,0	7,9	9,0	10,0	13,8	1
4	I	164	8	8483,287	14006,853	0,6		1,0	21,9	28,0	34,0	44,0	1
5	SO	95	12	14905,401	14863,759	1,0	0,4	1,0	7,9	9,0	10,0	13,8	1
7	SO	95	12	14927,041	14968,682	1,0	0,4	1,0	7,9	9,0	10,0	13,8	1

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Note: The Classification limits have been set according to Semi-Comp+.
The cross-section is classified as Class 1

Compression check

According to EN 1993-1-1 article 6.2.4 and formula (6.9)

Cross-section area	A	7,6800e-03	m ²
Compression resistance	N _{c,Rd}	1804,80	kN
Unity check		0,05	-

Bending moment check for M_y

According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

Plastic section modulus	W _{pl,y}	7,4583e-04	m ³
Plastic bending moment	M _{pl,y,Rd}	175,27	kNm
Unity check		0,01	-

Bending moment check for M_z

According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

Plastic section modulus	W _{pl,z}	3,5167e-04	m ³
Plastic bending moment	M _{pl,z,Rd}	82,64	kNm
Unity check		0,00	-

Shear check for V_y

According to EN 1993-1-1 article 6.2.6 and formula (6.17)

Shear correction factor	η	1,20	
Shear area	A _v	5,9737e-03	m ²
Plastic shear resistance for V _y	V _{pl,y,Rd}	810,50	kN
Unity check		0,00	-

Shear check for V_z

According to EN 1993-1-1 article 6.2.6 and formula (6.17)

Shear correction factor	η	1,20	
Shear area	A _v	2,5140e-03	m ²
Plastic shear resistance for V _z	V _{pl,z,Rd}	341,09	kN
Unity check		0,04	-

Combined bending, axial force and shear force check

According to EN 1993-1-1 article 6.2.9.1 and formula (6.41)

Plastic bending moment	M _{pl,y,Rd}	175,27	kNm
Exponent of bending ratio y	α	2,00	
Plastic bending moment	M _{pl,z,Rd}	82,64	kNm
Exponent of bending ratio z	β	1,00	

Unity check (6.41) = 0,00 + 0,00 = 0,00 -

Note: Since the shear forces are less than half the plastic shear resistances their effect on the moment resistances is neglected.

Note: Since the axial force satisfies both criteria (6.33) and (6.34) of EN 1993-1-1 article 6.2.9.1(4) its effect on the moment resistance about the y-y axis is neglected.

Note: Since the axial force satisfies criteria (6.35) of EN 1993-1-1 article 6.2.9.1(4) its effect on the moment resistance about the z-z axis is neglected.

The member satisfies the section check.

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....:STABILITY CHECK:....

Classification for member buckling design

Decisive position for stability classification: 5,340 m

Decisive utilisation factor η : 0,39

Classification according to EN 1993-1-1 article 5.5.2

Classification of Internal and Outstand parts according to EN 1993-1-1 Table 5.2 Sheet 1 & 2

Id	Type	c [mm]	t [mm]	σ_1 [kN/m ²]	σ_2 [kN/m ²]	Ψ [-]	k_σ [-]	α [-]	c/t [-]	Class 1 Limit [-]	Class 2 Limit [-]	Class 3 Limit [-]	Class 4 Limit [-]
1	SO	95	12	-86750,581	-86750,642								
3	SO	95	12	-86750,550	-86750,488								
4	I	164	8	-63284,521	79249,969	-0,8		0,6	21,9	54,0	63,6	101,1	1
5	SO	95	12	102716,029	102716,090	1,0	0,4	1,0	7,9	9,0	10,0	13,8	1
7	SO	95	12	102715,997	102715,936	1,0	0,4	1,0	7,9	9,0	10,0	13,8	1

Note: The Classification limits have been set according to Semi-Comp+.

The cross-section is classified as Class 1

Note: The decisive position for the stability classification is based on the utilisation factor η according to Semi-Comp+.

Flexural Buckling check

According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

Buckling parameters		yy	zz	
Sway type		sway	non-sway	
System length	L	5,340	1,647	m
Buckling factor	k	2,23	0,87	
Buckling length	l_{cr}	11,891	1,432	m
Critical Euler load	N_{cr}	1137,54	28000,77	kN
Slenderness	λ	118,29	23,84	
Relative slenderness	λ_{rel}	1,26	0,25	
Limit slenderness	$\lambda_{rel,0}$	0,20	0,20	
Buckling curve		b	c	
Imperfection	α	0,34	0,49	
Reduction factor	χ	0,45	0,97	
Buckling resistance	$N_{b,Rd}$	806,48	1755,36	kN

Flexural Buckling verification			
Cross-section area	A	7,6800e-03	m ²
Buckling resistance	$N_{b,Rd}$	806,48	kN
Unity check		0,11	-

Torsional(-Flexural) Buckling check

According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

Note: For this I-section the Torsional(-Flexural) buckling resistance is higher than the resistance for Flexural buckling. Therefore Torsional(-Flexural) buckling is not printed on the output.

Lateral Torsional Buckling check

According to EN 1993-1-1 article 6.3.2.1 & 6.3.2.3 and formula (6.54)

LTB parameters			
Method for LTB curve		Alternative case	
Plastic section modulus	$W_{pl,y}$	7,4583e-04	m ³
Elastic critical moment	M_{cr}	4074,48	kNm
Relative slenderness	$\lambda_{rel,LT}$	0,21	
Limit slenderness	$\lambda_{rel,LT,0}$	0,40	

Note: The slenderness or bending moment is such that Lateral Torsional Buckling effects may be ignored according to EN 1993-1-1 article 6.3.2.2(4).

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Mcr parameters			
LTB length	l_{LT}	1,647	m
Influence of load position		no influence	
Correction factor	k	1,00	
Correction factor	k_w	1,00	
LTB moment factor	C_1	1,66	
LTB moment factor	C_2	0,00	
LTB moment factor	C_3	1,00	
Shear centre distance	d_z	0	mm
Distance of load application	z_g	0	mm
Mono-symmetry constant	β_y	0	mm
Mono-symmetry constant	z_j	0	mm

Note: C parameters are determined according to ECCS 119 2006 / Galea 2002.

Bending and axial compression check

According to EN 1993-1-1 article 6.3.3 and formula (6.61),(6.62)

Bending and axial compression check parameters			
Interaction method		alternative method 1	
Cross-section area	A	7,6800e-03	m ²
Plastic section modulus	$W_{pl,y}$	7,4583e-04	m ³
Plastic section modulus	$W_{pl,z}$	3,5167e-04	m ³
Design compression force	N_{Ed}	86,42	kN
Design bending moment (maximum)	$M_{y,Ed}$	67,48	kNm
Design bending moment (maximum)	$M_{z,Ed}$	0,20	kNm
Characteristic compression resistance	N_{Rk}	1804,80	kN
Characteristic moment resistance	$M_{y,Rk}$	175,27	kNm
Characteristic moment resistance	$M_{z,Rk}$	82,64	kNm
Reduction factor	χ_y	0,45	
Reduction factor	χ_z	0,97	
Modified reduction factor	$\chi_{LT,mod}$	1,00	
Interaction factor	k_{yy}	1,04	
Interaction factor	k_{yz}	0,53	
Interaction factor	k_{zy}	0,59	
Interaction factor	k_{zz}	0,81	

Maximum moment $M_{y,Ed}$ is derived from beam B10 position 5,340 m.

Maximum moment $M_{z,Ed}$ is derived from beam B10 position 1,847 m.

Interaction method 1 parameters			
Critical Euler load	$N_{cr,y}$	1137,54	kN
Critical Euler load	$N_{cr,z}$	28000,77	kN
Elastic critical load	$N_{cr,T}$	20763,50	kN
Plastic section modulus	$W_{pl,y}$	7,4583e-04	m ³
Elastic section modulus	$W_{el,y}$	6,7500e-04	m ³
Plastic section modulus	$W_{pl,z}$	3,5167e-04	m ³
Elastic section modulus	$W_{el,z}$	2,3100e-04	m ³
Second moment of area	I_y	7,7600e-05	m ⁴
Second moment of area	I_z	2,7700e-05	m ⁴
Torsional constant	I_t	4,1600e-07	m ⁴
Method for equivalent moment factor $C_{my,0}$		Table A.2 Line 2 (General)	
Design bending moment (maximum)	$M_{y,Ed}$	67,48	kNm
Maximum relative deflection	δ_z	-7,7	mm
Equivalent moment factor	$C_{my,0}$	0,97	
Method for equivalent moment factor $C_{mz,0}$		Table A.2 Line 1 (Linear)	
Ratio of end moments	ψ_z	-0,06	
Equivalent moment factor	$C_{mz,0}$	0,78	
Factor	μ_y	0,96	
Factor	μ_z	1,00	
Factor	ϵ_y	8,88	
Factor	a_{LT}	0,99	
Critical moment for uniform bending	$M_{cr,0}$	2455,15	kNm
Relative slenderness	$\lambda_{rel,0}$	0,27	
Limit relative slenderness	$\lambda_{rel,0,lim}$	0,26	
Equivalent moment factor	C_{my}	0,99	

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Interaction method 1 parameters			
Equivalent moment factor	C_{mz}	0,78	
Equivalent moment factor	C_{mLT}	1,00	
Factor	b_{LT}	0,00	
Factor	c_{LT}	0,06	
Factor	d_{LT}	0,01	
Factor	e_{LT}	1,68	
Factor	w_y	1,10	
Factor	w_z	1,50	
Factor	n_{pl}	0,05	
Maximum relative slenderness	$\lambda_{rel,max}$	1,26	
Factor	C_{yy}	0,99	
Factor	C_{yz}	0,98	
Factor	C_{zy}	0,94	
Factor	C_{zz}	0,96	

Unity check (6.61) = $0,11 + 0,40 + 0,00 = 0,51$ -

Unity check (6.62) = $0,05 + 0,23 + 0,00 = 0,28$ -

Shear Buckling check

According to EN 1993-1-5 article 5 & 7.1 and formula (5.10) & (7.1)

Shear Buckling parameters			
Buckling field length	a	5,340	m
Web		unstiffened	
Web height	h_w	206	mm
Web thickness	t	8	mm
Material coefficient	ε	1,00	
Shear correction factor	η	1,20	

Shear Buckling verification			
Web slenderness	h_w/t	27,47	
Web slenderness limit		60,00	

Note: The web slenderness is such that Shear Buckling effects may be ignored according to EN 1993-1-5 article 5.1(2).

The member satisfies the stability check.

EN 1993-1-1 Code Check

National annex: Standard EN

Member B15	0,000 / 9,692 m	HEA300	S 235	All ULS	0,32 -
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Combination key	
All ULS / $1.35 \cdot LC1 + 1.35 \cdot LC2 + 1.50 \cdot LC3 + 0.90 \cdot 3DWind6$	

Partial safety factors			
γ_{M0} for resistance of cross-sections		1,00	
γ_{M1} for resistance to instability		1,00	
γ_{M2} for resistance of net sections		1,25	

Material			
Yield strength	f_y	235,0	MPa
Ultimate strength	f_u	360,0	MPa
Fabrication		Rolled	

....:SECTION CHECK:....

The critical check is on position 0,000 m

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Internal forces		Calculated	Unit
Normal force	N_{Ed}	-19,31	kN
Shear force	$V_{y,Ed}$	0,26	kN
Shear force	$V_{z,Ed}$	62,49	kN
Torsion	T_{Ed}	0,00	kNm
Bending moment	$M_{y,Ed}$	-44,70	kNm
Bending moment	$M_{z,Ed}$	0,00	kNm

Classification for cross-section design

Classification according to EN 1993-1-1 article 5.5.2

Classification of Internal and Outstand parts according to EN 1993-1-1 Table 5.2 Sheet 1 & 2

Id	Type	c [mm]	t [mm]	σ_1 [kN/m ²]	σ_2 [kN/m ²]	Ψ [-]	k_σ [-]	α [-]	c/t [-]	Class 1 Limit [-]	Class 2 Limit [-]	Class 3 Limit [-]	Class 4 Limit [-]
1	SO	119	14	35481,525	35481,529	1,0	0,4	1,0	8,5	9,0	10,0	13,8	1
3	SO	119	14	35481,524	35481,520	1,0	0,4	1,0	8,5	9,0	10,0	13,8	1
4	I	208	9	27162,479	-23730,507	-0,9		0,5	24,5	67,1	77,8	108,6	1
5	SO	119	14	-32049,554	-32049,557								
7	SO	119	14	-32049,552	-32049,548								

Note: The Classification limits have been set according to Semi-Comp+.
The cross-section is classified as Class 1

Compression check

According to EN 1993-1-1 article 6.2.4 and formula (6.9)

Cross-section area	A	1,1300e-02	m ²
Compression resistance	$N_{c,Rd}$	2655,50	kN
Unity check		0,01	-

Bending moment check for M_y

According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

Plastic section modulus	$W_{pl,y}$	1,3833e-03	m ³
Plastic bending moment	$M_{pl,y,Rd}$	325,08	kNm
Unity check		0,14	-

Shear check for V_y

According to EN 1993-1-1 article 6.2.6 and formula (6.17)

Shear correction factor	η	1,20	
Shear area	A_v	8,7017e-03	m ²
Plastic shear resistance for V_y	$V_{pl,y,Rd}$	1180,63	kN
Unity check		0,00	-

Shear check for V_z

According to EN 1993-1-1 article 6.2.6 and formula (6.17)

Shear correction factor	η	1,20	
Shear area	A_v	3,7750e-03	m ²
Plastic shear resistance for V_z	$V_{pl,z,Rd}$	512,18	kN
Unity check		0,12	-

Torsion check

According to EN 1993-1-1 article 6.2.7 and formula (6.23)

Index of fibre	Fibre	2	
Total torsional moment	T_{Ed}	0,0	MPa
Elastic shear resistance	T_{Rd}	135,7	MPa
Unity check		0,00	-

Note: The unity check for torsion is lower than the limit value of 0,05. Therefore torsion is considered as

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insignificant and is ignored in the combined checks.

Combined bending, axial force and shear force check

According to EN 1993-1-1 article 6.2.9.1 and formula (6.41)

Plastic bending moment	$M_{pl,y,Rd}$	325,08	kNm
Exponent of bending ratio y	α	2,00	
Plastic bending moment	$M_{pl,z,Rd}$	150,79	kNm
Exponent of bending ratio z	β	1,00	

Unity check (6.41) = $0,02 + 0,00 = 0,02$ -

Note: Since the shear forces are less than half the plastic shear resistances their effect on the moment resistances is neglected.

Note: Since the axial force satisfies both criteria (6.33) and (6.34) of EN 1993-1-1 article 6.2.9.1(4) its effect on the moment resistance about the y-y axis is neglected.

Note: Since the axial force satisfies criteria (6.35) of EN 1993-1-1 article 6.2.9.1(4) its effect on the moment resistance about the z-z axis is neglected.

The member satisfies the section check.

....:STABILITY CHECK:....

Classification for member buckling design

Decisive position for stability classification: 4,419 m

Decisive utilisation factor η : 0,31

Classification according to EN 1993-1-1 article 5.5.2

Classification of Internal and Outstand parts according to EN 1993-1-1 Table 5.2 Sheet 1 & 2

Id	Type	c [mm]	t [mm]	σ_1 [kN/m ²]	σ_2 [kN/m ²]	Ψ [-]	k_σ [-]	α [-]	c/t [-]	Class 1 Limit [-]	Class 2 Limit [-]	Class 3 Limit [-]	Class 4 Limit [-]
1	SO	119	14	-74290,588	-74156,453								
3	SO	119	14	-74361,185	-74495,320								
4	I	208	9	-55745,221	57924,734	-1,0		0,5	24,5	68,8	79,6	119,1	1
5	SO	119	14	76470,102	76335,967	1,0	0,4	1,0	8,5	9,0	10,0	13,8	1
7	SO	119	14	76540,699	76674,833	1,0	0,4	1,0	8,5	9,0	10,0	13,8	1

Note: The Classification limits have been set according to Semi-Comp+.

The cross-section is classified as Class 1

Note: The decisive position for the stability classification is based on the utilisation factor η according to Semi-Comp+.

Flexural Buckling check

According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

Buckling parameters		yy	zz	
Sway type		sway	non-sway	
System length	L	9,692	0,200	m
Buckling factor	k	1,34	1,00	
Buckling length	l_{cr}	13,022	0,200	m
Critical Euler load	N_{cr}	2236,82	3282978,81	kN
Slenderness	λ	102,33	2,67	
Relative slenderness	λ_{rel}	1,09	0,03	
Limit slenderness	$\lambda_{rel,0}$	0,20	0,20	

Note: The slenderness or compression force is such that Flexural Buckling effects may be ignored according to EN 1993-1-1 article 6.3.1.2(4).

Torsional(-Flexural) Buckling check

According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

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Note: For this I-section the Torsional(-Flexural) buckling resistance is higher than the resistance for Flexural buckling. Therefore Torsional(-Flexural) buckling is not printed on the output.

Lateral Torsional Buckling check

According to EN 1993-1-1 article 6.3.2.1 & 6.3.2.3 and formula (6.54)

LTB parameters			
Method for LTB curve		Alternative case	
Plastic section modulus	$W_{pl,y}$	1,3833e-03	m ³
Elastic critical moment	M_{cr}	523523,46	kNm
Relative slenderness	$\lambda_{rel,LT}$	0,02	
Limit slenderness	$\lambda_{rel,LT,0}$	0,40	

Note: The slenderness or bending moment is such that Lateral Torsional Buckling effects may be ignored according to EN 1993-1-1 article 6.3.2.2(4).

Mcr parameters			
LTB length	l_{LT}	0,200	m
Influence of load position		no influence	
Correction factor	k	1,00	
Correction factor	k_w	1,00	
LTB moment factor	C_1	1,16	
LTB moment factor	C_2	0,00	
LTB moment factor	C_3	1,00	
Shear centre distance	d_z	0	mm
Distance of load application	z_g	0	mm
Mono-symmetry constant	β_y	0	mm
Mono-symmetry constant	z_j	0	mm

Note: C parameters are determined according to ECCS 119 2006 / Galea 2002.

Bending and axial compression check

According to EN 1993-1-1 article 6.3.3 and formula (6.61),(6.62)

Bending and axial compression check parameters			
Interaction method		alternative method 1	
Cross-section area	A	1,1300e-02	m ²
Plastic section modulus	$W_{pl,y}$	1,3833e-03	m ³
Plastic section modulus	$W_{pl,z}$	6,4167e-04	m ³
Design compression force	N_{Ed}	19,31	kN
Design bending moment (maximum)	$M_{y,Ed}$	99,83	kNm
Design bending moment (maximum)	$M_{z,Ed}$	0,05	kNm
Characteristic compression resistance	N_{Rk}	2655,50	kN
Characteristic moment resistance	$M_{y,Rk}$	325,08	kNm
Characteristic moment resistance	$M_{z,Rk}$	150,79	kNm
Reduction factor	χ_y	1,00	
Reduction factor	χ_z	1,00	
Modified reduction factor	$\chi_{LT,mod}$	1,00	
Interaction factor	k_{yy}	1,01	
Interaction factor	k_{yz}	0,55	
Interaction factor	k_{zy}	0,52	
Interaction factor	k_{zz}	0,79	

Maximum moment $M_{y,Ed}$ is derived from beam B15 position 4,419 m.

Maximum moment $M_{z,Ed}$ is derived from beam B15 position 0,200 m.

Interaction method 1 parameters			
Critical Euler load	$N_{cr,y}$	2236,82	kN
Critical Euler load	$N_{cr,z}$	3282978,81	kN
Elastic critical load	$N_{cr,T}$	2857623,95	kN
Plastic section modulus	$W_{pl,y}$	1,3833e-03	m ³
Elastic section modulus	$W_{el,y}$	1,2600e-03	m ³
Plastic section modulus	$W_{pl,z}$	6,4167e-04	m ³
Elastic section modulus	$W_{el,z}$	4,2100e-04	m ³

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Interaction method 1 parameters			
Second moment of area	I_y	1,8300e-04	m ⁴
Second moment of area	I_z	6,3100e-05	m ⁴
Torsional constant	I_t	8,5200e-07	m ⁴
Method for equivalent moment factor $C_{my,0}$		Table A.2 Line 2 (General)	
Design bending moment (maximum)	$M_{y,Ed}$	99,83	kNm
Maximum relative deflection	δ_z	-23,0	mm
Equivalent moment factor	$C_{my,0}$	1,00	
Method for equivalent moment factor $C_{mz,0}$		Table A.2 Line 1 (Linear)	
Ratio of end moments	ψ_z	0,00	
Equivalent moment factor	$C_{mz,0}$	0,79	
Factor	μ_y	1,00	
Factor	μ_z	1,00	
Factor	ϵ_y	46,35	
Factor	a_{LT}	1,00	
Critical moment for uniform bending	$M_{cr,0}$	451090,13	kNm
Relative slenderness	$\lambda_{rel,0}$	0,03	
Limit relative slenderness	$\lambda_{rel,0,lim}$	0,22	
Equivalent moment factor	C_{my}	1,00	
Equivalent moment factor	C_{mz}	0,79	
Equivalent moment factor	C_{mLT}	1,00	
Factor	b_{LT}	0,00	
Factor	c_{LT}	0,00	
Factor	d_{LT}	0,00	
Factor	e_{LT}	0,14	
Factor	w_y	1,10	
Factor	w_z	1,50	
Factor	η_{pl}	0,01	
Maximum relative slenderness	$\lambda_{rel,max}$	1,09	
Factor	C_{yy}	1,00	
Factor	C_{yz}	1,00	
Factor	C_{zy}	0,99	
Factor	C_{zz}	1,00	

Unity check (6.61) = 0,01 + 0,31 + 0,00 = 0,32 -

Unity check (6.62) = 0,01 + 0,16 + 0,00 = 0,17 -

Shear Buckling check

According to EN 1993-1-5 article 5 & 7.1 and formula (5.10) & (7.1)

Shear Buckling parameters			
Buckling field length	a	9,692	m
Web		unstiffened	
Web height	h_w	262	mm
Web thickness	t	9	mm
Material coefficient	ϵ	1,00	
Shear correction factor	η	1,20	

Shear Buckling verification		
Web slenderness	h_w/t	30,82
Web slenderness limit		60,00

Note: The web slenderness is such that Shear Buckling effects may be ignored according to EN 1993-1-5 article 5.1(2).

The member satisfies the stability check.

EN 1993-1-1 Code Check

National annex: Standard EN

Member B29	5,577 / 5,577 m	CFRHS100X100X5	S 235	All ULS	0,06 -
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Note: EN 1993-1-3 article 1.1(3) specifies that this part does not apply to cold formed CHS and RHS sections. The default EN 1993-1-1 code check is executed instead of the EN 1993-1-3 code check.

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Combination key
All ULS / 1.35*LC1 + 1.35*LC2 + 0.75*LC3 + 1.50*3DWind10

Partial safety factors	
γ_{M0} for resistance of cross-sections	1,00
γ_{M1} for resistance to instability	1,00
γ_{M2} for resistance of net sections	1,25

Material			
Yield strength	f _y	235,0	MPa
Ultimate strength	f _u	360,0	MPa
Fabrication		Cold formed	

....:SECTION CHECK:....

The critical check is on position

Internal forces		Calculated	Unit
Normal force	N_{Ed}	-8,02	kN
Shear force	$V_{y,Ed}$	0,00	kN
Shear force	$V_{z,Ed}$	0,00	kN
Torsion	T_{Ed}	0,00	kNm
Bending moment	$M_{y,Ed}$	0,00	kNm
Bending moment	$M_{z,Ed}$	0,00	kNm

Classification for cross-section design

Classification according to EN 1993-1-1 article 5.5.2

Classification of Internal and Outstand parts according to EN 1993-1-1 Table 5.2 Sheet 1 & 2

Id	Type	c [mm]	t [mm]	σ_1 [kN/m ²]	σ_2 [kN/m ²]	Ψ [-]	k_σ [-]	α [-]	c/t [-]	Class 1 Limit [-]	Class 2 Limit [-]	Class 3 Limit [-]	Class
1	I	85	5	4368,067	4368,067	1,0		1,0	17,0	28,0	34,0	38,0	1
3	I	85	5	4368,067	4368,067	1,0		1,0	17,0	28,0	34,0	38,0	1
5	I	85	5	4368,067	4368,067	1,0		1,0	17,0	28,0	34,0	38,0	1
7	I	85	5	4368,067	4368,067	1,0		1,0	17,0	28,0	34,0	38,0	1

Note: The Classification limits have been set according to Semi-Comp+.
The cross-section is classified as Class 1

Compression check

According to EN 1993-1-1 article 6.2.4 and formula (6.9)

Cross-section area	A	1,8360e-03	m ²
Compression resistance	$N_{c,Rd}$	431,46	kN
Unity check		0,02	-

The member satisfies the section check.

....:STABILITY CHECK:....

Classification for member buckling design

Decisive position for stability classification: 5,577 m

Decisive utilisation factor η : 0,02

Classification according to EN 1993-1-1 article 5.5.2

Classification of Internal and Outstand parts according to EN 1993-1-1 Table 5.2 Sheet 1 & 2

Id	Type	c [mm]	t [mm]	σ_1 [kN/m ²]	σ_2 [kN/m ²]	Ψ [-]	k_σ [-]	α [-]	c/t [-]	Class 1 Limit [-]	Class 2 Limit [-]	Class 3 Limit [-]	Class
1	I	85	5	4368,067	4368,067	1,0		1,0	17,0	28,0	34,0	38,0	1
3	I	85	5	4368,067	4368,067	1,0		1,0	17,0	28,0	34,0	38,0	1

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Id	Type	c [mm]	t [mm]	σ_1 [kN/m ²]	σ_2 [kN/m ²]	Ψ [-]	k_σ [-]	α [-]	c/t [-]	Class 1 Limit [-]	Class 2 Limit [-]	Class 3 Limit [-]	Class
5	I	85	5	4368,067	4368,067	1,0		1,0	17,0	28,0	34,0	38,0	1
7	I	85	5	4368,067	4368,067	1,0		1,0	17,0	28,0	34,0	38,0	1

Note: The Classification limits have been set according to Semi-Comp+.
The cross-section is classified as Class 1

Note: The decisive position for the stability classification is based on the utilisation factor η according to Semi-Comp+.

Flexural Buckling check

According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

Buckling parameters		yy	zz	
Sway type		sway	non-sway	
System length	L	5,577	5,577	m
Buckling factor	k	1,00	1,00	
Buckling length	l_{cr}	5,577	5,577	m
Critical Euler load	N_{cr}	180,67	180,67	kN
Slenderness	λ	145,13	145,13	
Relative slenderness	λ_{rel}	1,55	1,55	
Limit slenderness	$\lambda_{rel,0}$	0,20	0,20	
Buckling curve		c	c	
Imperfection	α	0,49	0,49	
Reduction factor	χ	0,30	0,30	
Buckling resistance	$N_{b,Rd}$	129,56	129,56	kN

Flexural Buckling verification			
Cross-section area	A	1,8360e-03	m ²
Buckling resistance	$N_{b,Rd}$	129,56	kN
Unity check		0,06	-

Torsional(-Flexural) Buckling check

According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

Note: The cross-section concerns a RHS section which is not susceptible to Torsional(-Flexural) Buckling.

The member satisfies the stability check.

EN 1993-1-1 Code Check

National annex: Standard EN

Member B42	2,500 / 5,000 m	HEA140	S 235	All ULS	0,23 -
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Combination key	
All ULS / 1.35*LC1 + 1.35*LC2 + 1.50*LC3 + 0.90*3DWind6	

Partial safety factors	
γ_{M0} for resistance of cross-sections	1,00
γ_{M1} for resistance to instability	1,00
γ_{M2} for resistance of net sections	1,25

Material			
Yield strength	f_y	235,0	MPa
Ultimate strength	f_u	360,0	MPa
Fabrication		Rolled	

....:SECTION CHECK:....

The critical check is on position 2,500 m

Internal forces		Calculated	Unit
Normal force	N_{Ed}	-0,37	kN

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Internal forces		Calculated	Unit
Shear force	$V_{y,Ed}$	0,11	kN
Shear force	$V_{z,Ed}$	0,00	kN
Torsion	T_{Ed}	0,00	kNm
Bending moment	$M_{y,Ed}$	7,99	kNm
Bending moment	$M_{z,Ed}$	-0,26	kNm

Classification for cross-section design

Classification according to EN 1993-1-1 article 5.5.2

Classification of Internal and Outstand parts according to EN 1993-1-1 Table 5.2 Sheet 1 & 2

Id	Type	c [mm]	t [mm]	σ_1 [kN/m ²]	σ_2 [kN/m ²]	Ψ [-]	k_σ [-]	α [-]	c/t [-]	Class 1 Limit [-]	Class 2 Limit [-]	Class 3 Limit [-]	Class 4 Limit [-]
1	SO	55	9	-47003,736	-43260,204								
3	SO	55	9	-49002,544	-52746,075								
4	I	92	6	-35441,816	35674,603	-1,0		0,5	16,7	71,7	82,6	123,3	1
5	SO	55	9	47236,523	43492,992	0,9	0,5	1,0	6,5	9,0	10,0	14,2	1
7	SO	55	9	49235,331	52978,863	0,9	0,4	1,0	6,5	9,0	10,0	13,9	1

Note: The Classification limits have been set according to Semi-Comp+.
The cross-section is classified as Class 1

Compression check

According to EN 1993-1-1 article 6.2.4 and formula (6.9)

Cross-section area	A	3,1400e-03	m ²
Compression resistance	$N_{c,Rd}$	737,90	kN
Unity check		0,00	-

Bending moment check for M_y

According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

Plastic section modulus	$W_{pl,y}$	1,7333e-04	m ³
Plastic bending moment	$M_{pl,y,Rd}$	40,73	kNm
Unity check		0,20	-

Bending moment check for M_z

According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

Plastic section modulus	$W_{pl,z}$	8,5000e-05	m ³
Plastic bending moment	$M_{pl,z,Rd}$	19,98	kNm
Unity check		0,01	-

Shear check for V_y

According to EN 1993-1-1 article 6.2.6 and formula (6.17)

Shear correction factor	η	1,20	
Shear area	A_v	2,4763e-03	m ²
Plastic shear resistance for V_y	$V_{pl,y,Rd}$	335,97	kN
Unity check		0,00	-

Torsion check

According to EN 1993-1-1 article 6.2.7 and formula (6.23)

Index of fibre	Fibre	1	
Total torsional moment	T_{Ed}	0,0	MPa
Elastic shear resistance	T_{Rd}	135,7	MPa
Unity check		0,00	-

Note: The unity check for torsion is lower than the limit value of 0,05. Therefore torsion is considered as insignificant and is ignored in the combined checks.

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Combined bending, axial force and shear force check

According to EN 1993-1-1 article 6.2.9.1 and formula (6.41)

Plastic bending moment	$M_{pl,y,Rd}$	40,73	kNm
Exponent of bending ratio y	α	2,00	
Plastic bending moment	$M_{pl,z,Rd}$	19,98	kNm
Exponent of bending ratio z	β	1,00	

Unity check (6.41) = 0,04 + 0,01 = 0,05 -

Note: Since the shear forces are less than half the plastic shear resistances their effect on the moment resistances is neglected.

Note: Since the axial force satisfies both criteria (6.33) and (6.34) of EN 1993-1-1 article 6.2.9.1(4) its effect on the moment resistance about the y-y axis is neglected.

Note: Since the axial force satisfies criteria (6.35) of EN 1993-1-1 article 6.2.9.1(4) its effect on the moment resistance about the z-z axis is neglected.

The member satisfies the section check.

....:STABILITY CHECK:....

Classification for member buckling design

Decisive position for stability classification: 2,500 m

Decisive utilisation factor η : 0,20

Classification according to EN 1993-1-1 article 5.5.2

Classification of Internal and Outstand parts according to EN 1993-1-1 Table 5.2 Sheet 1 & 2

Id	Type	c [mm]	t [mm]	σ_1 [kN/m ²]	σ_2 [kN/m ²]	Ψ [-]	k_σ [-]	α [-]	c/t [-]	Class 1 Limit [-]	Class 2 Limit [-]	Class 3 Limit [-]	Class 4 Limit [-]
1	SO	55	9	-47003,736	-43260,204								
3	SO	55	9	-49002,544	-52746,075								
4	I	92	6	-35441,816	35674,603	-1,0		0,5	16,7	71,7	82,6	123,3	1
5	SO	55	9	47236,523	43492,992	0,9	0,5	1,0	6,5	9,0	10,0	14,2	1
7	SO	55	9	49235,331	52978,863	0,9	0,4	1,0	6,5	9,0	10,0	13,9	1

Note: The Classification limits have been set according to Semi-Comp+.

The cross-section is classified as Class 1

Note: The decisive position for the stability classification is based on the utilisation factor η according to Semi-Comp+.

Flexural Buckling check

According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

Buckling parameters		yy	zz	
Sway type		sway	non-sway	
System length	L	5,000	5,000	m
Buckling factor	k	1,00	0,52	
Buckling length	l_{cr}	5,000	2,583	m
Critical Euler load	N_{cr}	853,92	1208,70	kN
Slenderness	λ	87,30	73,38	
Relative slenderness	λ_{rel}	0,93	0,78	
Limit slenderness	$\lambda_{rel,0}$	0,20	0,20	

Note: The slenderness or compression force is such that Flexural Buckling effects may be ignored according to EN 1993-1-1 article 6.3.1.2(4).

Torsional(-Flexural) Buckling check

According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

Note: For this I-section the Torsional(-Flexural) buckling resistance is higher than the resistance for Flexural buckling. Therefore Torsional(-Flexural) buckling is not printed on the output.

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Lateral Torsional Buckling check

According to EN 1993-1-1 article 6.3.2.1 & 6.3.2.3 and formula (6.54)

LTB parameters			
Method for LTB curve		Alternative case	
Plastic section modulus	$W_{pl,y}$	1,7333e-04	m ³
Elastic critical moment	M_{cr}	56,58	kNm
Relative slenderness	$\lambda_{rel,LT}$	0,85	
Limit slenderness	$\lambda_{rel,LT,0}$	0,40	

Note: The slenderness or bending moment is such that Lateral Torsional Buckling effects may be ignored according to EN 1993-1-1 article 6.3.2.2(4).

Mcr parameters			
LTB length	l_{LT}	5,000	m
Influence of load position		no influence	
Correction factor	k	1,00	
Correction factor	k_w	1,00	
LTB moment factor	C_1	1,13	
LTB moment factor	C_2	0,45	
LTB moment factor	C_3	0,53	
Shear centre distance	d_z	0	mm
Distance of load application	z_g	0	mm
Mono-symmetry constant	β_y	0	mm
Mono-symmetry constant	z_j	0	mm

Note: C parameters are determined according to ECCS 119 2006 / Galea 2002.

Bending and axial compression check

According to EN 1993-1-1 article 6.3.3 and formula (6.61),(6.62)

Bending and axial compression check parameters			
Interaction method		alternative method 1	
Cross-section area	A	3,1400e-03	m ²
Plastic section modulus	$W_{pl,y}$	1,7333e-04	m ³
Plastic section modulus	$W_{pl,z}$	8,5000e-05	m ³
Design compression force	N_{Ed}	0,37	kN
Design bending moment (maximum)	$M_{y,Ed}$	7,99	kNm
Design bending moment (maximum)	$M_{z,Ed}$	0,81	kNm
Characteristic compression resistance	N_{Rk}	737,90	kN
Characteristic moment resistance	$M_{y,Rk}$	40,73	kNm
Characteristic moment resistance	$M_{z,Rk}$	19,98	kNm
Reduction factor	χ_y	1,00	
Reduction factor	χ_z	1,00	
Modified reduction factor	$\chi_{LT,mod}$	1,00	
Interaction factor	k_{yy}	1,00	
Interaction factor	k_{yz}	0,81	
Interaction factor	k_{zy}	0,52	
Interaction factor	k_{zz}	1,00	

Maximum moment $M_{y,Ed}$ is derived from beam B42 position 2,500 m.

Maximum moment $M_{z,Ed}$ is derived from beam B42 position 5,000 m.

Interaction method 1 parameters			
Critical Euler load	$N_{cr,y}$	853,92	kN
Critical Euler load	$N_{cr,z}$	1208,70	kN
Elastic critical load	$N_{cr,T}$	1729,41	kN
Plastic section modulus	$W_{pl,y}$	1,7333e-04	m ³
Elastic section modulus	$W_{el,y}$	1,5500e-04	m ³
Plastic section modulus	$W_{pl,z}$	8,5000e-05	m ³
Elastic section modulus	$W_{el,z}$	5,5600e-05	m ³
Second moment of area	I_y	1,0300e-05	m ⁴
Second moment of area	I_z	3,8900e-06	m ⁴
Torsional constant	I_t	8,1300e-08	m ⁴

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Interaction method 1 parameters			
Method for equivalent moment factor $C_{my,0}$		Table A.2 Line 4 (Line load)	
Equivalent moment factor	$C_{my,0}$	1,00	
Method for equivalent moment factor $C_{mz,0}$		Table A.2 Line 2 (General)	
Design bending moment (maximum)	$M_{z,Ed}$	0,81	kNm
Maximum relative deflection	δ_y	0,5	mm
Equivalent moment factor	$C_{mz,0}$	1,00	
Factor	μ_y	1,00	
Factor	μ_z	1,00	
Factor	ϵ_y	442,43	
Factor	a_{LT}	0,99	
Critical moment for uniform bending	$M_{cr,0}$	50,20	kNm
Relative slenderness	$\lambda_{rel,0}$	0,90	
Limit relative slenderness	$\lambda_{rel,0,lim}$	0,21	
Equivalent moment factor	C_{my}	1,00	
Equivalent moment factor	C_{mz}	1,00	
Equivalent moment factor	C_{mLT}	1,00	
Factor	b_{LT}	0,00	
Factor	c_{LT}	0,29	
Factor	d_{LT}	0,03	
Factor	e_{LT}	0,63	
Factor	w_y	1,12	
Factor	w_z	1,50	
Factor	n_{pl}	0,00	
Maximum relative slenderness	$\lambda_{rel,max}$	0,93	
Factor	C_{yy}	1,00	
Factor	C_{yz}	0,85	
Factor	C_{zy}	1,00	
Factor	C_{zz}	1,00	

Unity check (6.61) = $0,00 + 0,20 + 0,03 = 0,23$ -

Unity check (6.62) = $0,00 + 0,10 + 0,04 = 0,14$ -

The member satisfies the stability check.

EN 1993-1-1 Code Check

National annex: Standard EN

Member B89	20,000 / 25,000 m	UPE180	S 235	All ULS	0,64 -
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Combination key	
All ULS / $1.35 \cdot LC1 + 1.35 \cdot LC2 + 1.50 \cdot 3DWind9$	

Partial safety factors	
γ_{M0} for resistance of cross-sections	1,00
γ_{M1} for resistance to instability	1,00
γ_{M2} for resistance of net sections	1,25

Material			
Yield strength	f_y	235,0	MPa
Ultimate strength	f_u	360,0	MPa
Fabrication		Rolled	

....:SECTION CHECK:....

The critical check is on position 20,000 m

Internal forces		Calculated	Unit
Normal force	N_{Ed}	-5,25	kN
Shear force	$V_{y,Ed}$	-1,49	kN
Shear force	$V_{z,Ed}$	-2,49	kN
Torsion	T_{Ed}	0,00	kNm
Bending moment	$M_{y,Ed}$	1,85	kNm
Bending moment	$M_{z,Ed}$	1,76	kNm

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Classification for cross-section design

Classification according to EN 1993-1-1 article 5.5.2

Classification of Internal and Outstand parts according to EN 1993-1-1 Table 5.2 Sheet 1 & 2

Id	Type	c [mm]	t [mm]	σ_1 [kN/m ²]	σ_2 [kN/m ²]	Ψ [-]	k_σ [-]	α [-]	c/t [-]	Class 1 Limit [-]	Class 2 Limit [-]	Class 3 Limit [-]	Class
1	UO	57	11	-18251,806	52002,080	-0,4	0,7	0,7	5,5	12,2	13,5	17,0	1
3	I	135	6	-33917,556	-15480,079								
5	UO	57	11	4897,470	75151,357	0,1	0,6	1,0	5,5	9,0	10,0	15,7	1

Note: The Classification limits have been set according to Semi-Comp+.

The cross-section is classified as Class 1

Compression check

According to EN 1993-1-1 article 6.2.4 and formula (6.9)

Cross-section area	A	2,5100e-03	m ²
Compression resistance	N _{c,Rd}	589,85	kN
Unity check		0,01	-

Bending moment check for M_y

According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

Plastic section modulus	W _{pl,y}	1,7300e-04	m ³
Plastic bending moment	M _{pl,y,Rd}	40,66	kNm
Unity check		0,05	-

Bending moment check for M_z

According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

Plastic section modulus	W _{pl,z}	5,1300e-05	m ³
Plastic bending moment	M _{pl,z,Rd}	12,06	kNm
Unity check		0,15	-

Shear check for V_y

According to EN 1993-1-1 article 6.2.6 and formula (6.17)

Shear correction factor	η	1,20	
Shear area	A _v	1,5750e-03	m ²
Plastic shear resistance for V _y	V _{pl,y,Rd}	213,69	kN
Unity check		0,01	-

Shear check for V_z

According to EN 1993-1-1 article 6.2.6 and formula (6.17)

Shear correction factor	η	1,20	
Shear area	A _v	1,1188e-03	m ²
Plastic shear resistance for V _z	V _{pl,z,Rd}	151,79	kN
Unity check		0,02	-

Torsion check

According to EN 1993-1-1 article 6.2.7 and formula (6.23)

Index of fibre	Fibre	3	
Total torsional moment	T _{Ed}	0,0	MPa
Elastic shear resistance	T _{Rd}	135,7	MPa
Unity check		0,00	-

Note: The unity check for torsion is lower than the limit value of 0,05. Therefore torsion is considered as insignificant and is ignored in the combined checks.

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Combined bending, axial force and shear force check

According to EN 1993-1-1 article 6.2.1 and formula (6.2)

Plastic tension resistance	$N_{pl,Rd}$	589,85	kN
Plastic bending moment	$M_{pl,y,Rd}$	40,66	kNm
Plastic bending moment	$M_{pl,z,Rd}$	12,06	kNm

Unity check (6.2) = 0,01 + 0,05 + 0,15 = 0,20 -

Note: No specific interaction formulae according to EN 1993-1-1 article 6.2.9.1 apply.

Therefore the plastic linear summation according to EN 1993-1-1 article 6.2.1(7) is verified.

Note: Since the shear forces are less than half the plastic shear resistances their effect on the moment resistances is neglected.

The member satisfies the section check.

....:STABILITY CHECK:....

Classification for member buckling design

Decisive position for stability classification: 15,000 m

Decisive utilisation factor η : 0,25

Classification according to EN 1993-1-1 article 5.5.2

Classification of Internal and Outstand parts according to EN 1993-1-1 Table 5.2 Sheet 1 & 2

Id	Type	c [mm]	t [mm]	σ_1 [kN/m ²]	σ_2 [kN/m ²]	Ψ [-]	k_G [-]	α [-]	c/t [-]	Class 1 Limit [-]	Class 2 Limit [-]	Class 3 Limit [-]	Class
1	UO	57	11	-19849,401	81124,672	-0,2	0,6	0,8	5,5	11,2	12,4	16,6	1
3	I	135	6	-43967,130	-30002,916								
5	UO	57	11	-2316,555	98657,518	0,0	0,6	1,0	5,5	9,2	10,2	15,9	1

Note: The Classification limits have been set according to Semi-Comp+.

The cross-section is classified as Class 1

Note: The decisive position for the stability classification is based on the utilisation factor η according to Semi-Comp+.

Flexural Buckling check

According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

Buckling parameters		yy	zz	
Sway type		sway	non-sway	
System length	L	25,000	5,000	m
Buckling factor	k	1,70	0,88	
Buckling length	l_{cr}	42,625	4,411	m
Critical Euler load	N_{cr}	15,43	153,37	kN
Slenderness	λ	580,57	184,17	
Relative slenderness	λ_{rel}	6,18	1,96	
Limit slenderness	$\lambda_{rel,0}$	0,20	0,20	
Buckling curve		c	c	
Imperfection	α	0,49	0,49	
Reduction factor	χ	0,02	0,20	
Buckling resistance	$N_{b,Rd}$	14,31	119,68	kN

Flexural Buckling verification			
Cross-section area	A	2,5100e-03	m ²
Buckling resistance	$N_{b,Rd}$	14,31	kN
Unity check		0,37	-

Torsional(-Flexural) Buckling check

According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

Torsional buckling length	l_{cr}	5,000	m
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Elastic critical load	$N_{cr,T}$	716,68	kN
Elastic critical load	$N_{cr,TF}$	15,33	kN
Relative slenderness	$\lambda_{rel,T}$	6,20	
Limit slenderness	$\lambda_{rel,0}$	0,20	
Buckling curve	c		
Imperfection	α	0,49	
Reduction factor	χ	0,02	
Cross-section area	A	2,5100e-03	m ²
Buckling resistance	$N_{b,Rd}$	14,22	kN
Unity check		0,37	-

Lateral Torsional Buckling check

According to EN 1993-1-1 article 6.3.2.1 & 6.3.2.2 and formula (6.54)

LTB parameters			
Method for LTB curve		General case	
Plastic section modulus	$W_{pl,y}$	1,7300e-04	m ³
Elastic critical moment	M_{cr}	32,98	kNm
Relative slenderness	$\lambda_{rel,LT}$	1,11	
Relative slenderness	$\lambda_{rel,T}$	0,11	
Relative slenderness	$\lambda_{rel,EXTRA}$	1,22	
Limit slenderness	$\lambda_{rel,LT,0}$	0,20	
LTB curve	a		
Imperfection	α_{LT}	0,21	
Reduction factor	χ_{LT}	0,52	
Design buckling resistance	$M_{b,Rd}$	21,08	kNm
Unity check		0,09	-

Note: $\lambda_{rel,EXTRA}$ is determined according to "Design rule for lateral torsional buckling of channel sections, 2007".

Mcr parameters			
LTB length	l_{LT}	5,000	m
Influence of load position		no influence	
Correction factor	k	1,00	
Correction factor	k_w	1,00	
LTB moment factor	C_1	1,21	
LTB moment factor	C_2	0,72	
LTB moment factor	C_3	0,53	
Shear centre distance	d_z	0	mm
Distance of load application	z_g	0	mm
Mono-symmetry constant	β_y	0	mm
Mono-symmetry constant	z_j	0	mm

Note: C parameters are determined according to ECCS 119 2006 / Galea 2002.

Bending and axial compression check

According to EN 1993-1-1 article 6.3.3 and formula (6.61),(6.62)

Bending and axial compression check parameters			
Interaction method		alternative method 1	
Cross-section area	A	2,5100e-03	m ²
Plastic section modulus	$W_{pl,y}$	1,7300e-04	m ³
Plastic section modulus	$W_{pl,z}$	5,1300e-05	m ³
Design compression force	N_{Ed}	5,25	kN
Design bending moment (maximum)	$M_{y,Ed}$	-1,96	kNm
Design bending moment (maximum)	$M_{z,Ed}$	1,76	kNm
Characteristic compression resistance	N_{Rk}	589,85	kN
Characteristic moment resistance	$M_{y,Rk}$	40,66	kNm
Characteristic moment resistance	$M_{z,Rk}$	12,06	kNm
Reduction factor	χ_y	0,02	
Reduction factor	χ_z	0,02	
Reduction factor	χ_{LT}	0,52	
Interaction factor	k_{yy}	0,98	
Interaction factor	k_{yz}	0,68	

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Bending and axial compression check parameters			
Interaction factor	k_{zy}	1,00	
Interaction factor	k_{zz}	1,22	

Interaction method 1 parameters			
Critical Euler load	$N_{cr,y}$	15,43	kN
Critical Euler load	$N_{cr,z}$	153,37	kN
Elastic critical load	$N_{cr,T}$	716,68	kN
Plastic section modulus	$W_{pl,y}$	1,7300e-04	m ³
Elastic section modulus	$W_{el,y}$	1,5000e-04	m ³
Plastic section modulus	$W_{pl,z}$	5,1300e-05	m ³
Elastic section modulus	$W_{el,z}$	2,8600e-05	m ³
Second moment of area	I_y	1,3530e-05	m ⁴
Second moment of area	I_z	1,4400e-06	m ⁴
Torsional constant	I_t	6,9900e-08	m ⁴
Method for equivalent moment factor $C_{my,0}$		Table A.2 Line 2 (General)	
Design bending moment (maximum)	$M_{y,Ed}$	-1,96	kNm
Maximum relative deflection	δ_z	2,8	mm
Equivalent moment factor	$C_{my,0}$	0,68	
Method for equivalent moment factor $C_{mz,0}$		Table A.2 Line 2 (General)	
Design bending moment (maximum)	$M_{z,Ed}$	1,76	kNm
Maximum relative deflection	δ_y	4,2	mm
Equivalent moment factor	$C_{mz,0}$	0,98	
Factor	μ_y	0,67	
Factor	μ_z	0,97	
Factor	ϵ_y	6,25	
Factor	a_{LT}	0,99	
Critical moment for uniform bending	$M_{cr,0}$	27,29	kNm
Relative slenderness	$\lambda_{rel,0}$	1,22	
Limit relative slenderness	$\lambda_{rel,0,lim}$	0,22	
Equivalent moment factor	C_{my}	0,91	
Equivalent moment factor	C_{mz}	0,98	
Equivalent moment factor	C_{mLT}	1,00	
Factor	b_{LT}	0,01	
Factor	c_{LT}	0,08	
Factor	d_{LT}	0,00	
Factor	e_{LT}	0,01	
Factor	w_y	1,15	
Factor	w_z	1,50	
Factor	η_{pl}	0,01	
Maximum relative slenderness	$\lambda_{rel,max}$	6,18	
Factor	C_{yy}	0,93	
Factor	C_{yz}	0,67	
Factor	C_{zy}	0,71	
Factor	C_{zz}	0,81	

Unity check (6.61) = 0,37 + 0,09 + 0,10 = 0,56 -

Unity check (6.62) = 0,37 + 0,09 + 0,18 = 0,64 -

The member satisfies the stability check.

EN 1993-1-1 Code Check

National annex: Standard EN

Member B93	4,590 / 4,590 m	HEA200	S 235	All ULS	0,29 -
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Combination key	
All ULS / LC1 + LC2 + 1.50*3DWind13	

Partial safety factors	
γ_{M0} for resistance of cross-sections	1,00
γ_{M1} for resistance to instability	1,00
γ_{M2} for resistance of net sections	1,25

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Material			
Yield strength	f_y	235,0	MPa
Ultimate strength	f_u	360,0	MPa
Fabrication		Rolled	

....:SECTION CHECK:....

The critical check is on position 4,590 m

Internal forces		Calculated	Unit
Normal force	N_{Ed}	-6,14	kN
Shear force	$V_{y,Ed}$	16,69	kN
Shear force	$V_{z,Ed}$	1,48	kN
Torsion	T_{Ed}	0,00	kNm
Bending moment	$M_{y,Ed}$	0,00	kNm
Bending moment	$M_{z,Ed}$	14,06	kNm

Classification for cross-section design

Classification according to EN 1993-1-1 article 5.5.2

Classification of Internal and Outstand parts according to EN 1993-1-1 Table 5.2 Sheet 1 & 2

Id	Type	c [mm]	t [mm]	σ_1 [kN/m ²]	σ_2 [kN/m ²]	Ψ [-]	k_σ [-]	α [-]	c/t [-]	Class 1 Limit [-]	Class 2 Limit [-]	Class 3 Limit [-]	Class 4 Limit [-]
1	SO	79	10	-21224,881	-104108,375								
3	SO	79	10	23505,894	106389,388	0,2	0,5	1,0	7,9	9,0	10,0	15,2	1
4	I	134	7	1140,507	1140,507	1,0		1,0	20,6	28,0	34,0	38,0	1
5	SO	79	10	23505,894	106389,388	0,2	0,5	1,0	7,9	9,0	10,0	15,2	1
7	SO	79	10	-21224,881	-104108,375								

Note: The Classification limits have been set according to Semi-Comp+.
The cross-section is classified as Class 1

Compression check

According to EN 1993-1-1 article 6.2.4 and formula (6.9)

Cross-section area	A	5,3800e-03	m ²
Compression resistance	$N_{c,Rd}$	1264,30	kN
Unity check		0,00	-

Bending moment check for M_z

According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

Plastic section modulus	$W_{pl,z}$	2,0375e-04	m ³
Plastic bending moment	$M_{pl,z,Rd}$	47,88	kNm
Unity check		0,29	-

Shear check for V_y

According to EN 1993-1-1 article 6.2.6 and formula (6.17)

Shear correction factor	η	1,20	
Shear area	A_v	4,1592e-03	m ²
Plastic shear resistance for V_y	$V_{pl,y,Rd}$	564,32	kN
Unity check		0,03	-

Shear check for V_z

According to EN 1993-1-1 article 6.2.6 and formula (6.17)

Shear correction factor	η	1,20	
Shear area	A_v	1,8050e-03	m ²
Plastic shear resistance for V_z	$V_{pl,z,Rd}$	244,90	kN
Unity check		0,01	-

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Torsion check

According to EN 1993-1-1 article 6.2.7 and formula (6.23)

Index of fibre	Fibre	2	
Total torsional moment	T_{Ed}	0,0	MPa
Elastic shear resistance	T_{Rd}	135,7	MPa
Unity check		0,00	-

Note: The unity check for torsion is lower than the limit value of 0,05. Therefore torsion is considered as insignificant and is ignored in the combined checks.

Combined bending, axial force and shear force check

According to EN 1993-1-1 article 6.2.9.1 and formula (6.31)

Plastic bending moment	$M_{pl,z,Rd}$	47,88	kNm
Unity check		0,29	-

Note: Since the shear forces are less than half the plastic shear resistances their effect on the moment resistances is neglected.

Note: Since the axial force satisfies criteria (6.35) of EN 1993-1-1 article 6.2.9.1(4) its effect on the moment resistance about the z-z axis is neglected.

The member satisfies the section check.

....:STABILITY CHECK:....

Classification for member buckling design

Decisive position for stability classification: 4,590 m

Decisive utilisation factor η : 0,29

Classification according to EN 1993-1-1 article 5.5.2

Classification of Internal and Outstand parts according to EN 1993-1-1 Table 5.2 Sheet 1 & 2

Id	Type	c [mm]	t [mm]	σ_1 [kN/m ²]	σ_2 [kN/m ²]	Ψ [-]	k_σ [-]	α [-]	c/t [-]	Class 1 Limit [-]	Class 2 Limit [-]	Class 3 Limit [-]	Class 4 Limit [-]
1	SO	79	10	-21224,881	-104108,375								
3	SO	79	10	23505,894	106389,388	0,2	0,5	1,0	7,9	9,0	10,0	15,2	1
4	I	134	7	1140,507	1140,507	1,0		1,0	20,6	28,0	34,0	38,0	1
5	SO	79	10	23505,894	106389,388	0,2	0,5	1,0	7,9	9,0	10,0	15,2	1
7	SO	79	10	-21224,881	-104108,375								

Note: The Classification limits have been set according to Semi-Comp+.

The cross-section is classified as Class 1

Note: The decisive position for the stability classification is based on the utilisation factor η according to Semi-Comp+.

Flexural Buckling check

According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

Buckling parameters		yy	zz	
Sway type		sway	non-sway	
System length	L	4,590	0,450	m
Buckling factor	k	1,00	0,72	
Buckling length	l_{cr}	4,590	0,324	m
Critical Euler load	N_{cr}	3630,11	263831,46	kN
Slenderness	λ	55,42	6,50	
Relative slenderness	λ_{rel}	0,59	0,07	
Limit slenderness	$\lambda_{rel,0}$	0,20	0,20	

Note: The slenderness or compression force is such that Flexural Buckling effects may be ignored according to EN 1993-1-1 article 6.3.1.2(4).

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Torsional(-Flexural) Buckling check

According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

Note: For this I-section the Torsional(-Flexural) buckling resistance is higher than the resistance for Flexural buckling. Therefore Torsional(-Flexural) buckling is not printed on the output.

Bending and axial compression check

According to EN 1993-1-1 article 6.3.3 and formula (6.61),(6.62)

Bending and axial compression check parameters			
Interaction method		alternative method 1	
Cross-section area	A	5,3800e-03	m ²
Plastic section modulus	W _{pl,y}	4,2917e-04	m ³
Plastic section modulus	W _{pl,z}	2,0375e-04	m ³
Design compression force	N _{Ed}	6,14	kN
Design bending moment (maximum)	M _{y,Ed}	-0,97	kNm
Design bending moment (maximum)	M _{z,Ed}	14,06	kNm
Characteristic compression resistance	N _{Rk}	1264,30	kN
Characteristic moment resistance	M _{y,Rk}	100,85	kNm
Characteristic moment resistance	M _{z,Rk}	47,88	kNm
Reduction factor	χ _y	1,00	
Reduction factor	χ _z	1,00	
Modified reduction factor	χ _{LT,mod}	1,00	
Interaction factor	k _{yy}	1,00	
Interaction factor	k _{yz}	0,62	
Interaction factor	k _{zy}	0,52	
Interaction factor	k _{zz}	0,89	

Maximum moment M_{y,Ed} is derived from beam B93 position 2,827 m.

Maximum moment M_{z,Ed} is derived from beam B93 position 4,590 m.

Interaction method 1 parameters			
Critical Euler load	N _{cr,y}	3630,11	kN
Critical Euler load	N _{cr,z}	263831,46	kN
Elastic critical load	N _{cr,T}	120045,37	kN
Plastic section modulus	W _{pl,y}	4,2917e-04	m ³
Elastic section modulus	W _{el,y}	3,8900e-04	m ³
Plastic section modulus	W _{pl,z}	2,0375e-04	m ³
Elastic section modulus	W _{el,z}	1,3400e-04	m ³
Second moment of area	I _y	3,6900e-05	m ⁴
Second moment of area	I _z	1,3400e-05	m ⁴
Torsional constant	I _t	2,1000e-07	m ⁴
Method for equivalent moment factor C _{my,0}		Table A.2 Line 4 (Line load)	
Equivalent moment factor	C _{my,0}	1,00	
Method for equivalent moment factor C _{mz,0}		Table A.2 Line 1 (Linear)	
Ratio of end moments	ψ _z	0,47	
Equivalent moment factor	C _{mz,0}	0,89	
Factor	μ _y	1,00	
Factor	μ _z	1,00	
Factor	ε _y	2,19	
Factor	α _{LT}	0,99	
Critical moment for uniform bending	M _{cr,0}	12406,95	kNm
Relative slenderness	λ _{rel,0}	0,09	
Limit relative slenderness	λ _{rel,0,lim}	0,27	
Equivalent moment factor	C _{my}	1,00	
Equivalent moment factor	C _{mz}	0,89	
Equivalent moment factor	C _{mLT}	1,00	
Factor	b _{LT}	0,00	
Factor	c _{LT}	0,00	
Factor	d _{LT}	0,01	
Factor	e _{LT}	0,01	
Factor	w _y	1,10	
Factor	w _z	1,50	
Factor	η _{pl}	0,00	
Maximum relative slenderness	λ _{rel,max}	0,59	

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Interaction method 1 parameters			
Factor	C_{yy}	1,00	
Factor	C_{yz}	1,00	
Factor	C_{zy}	1,00	
Factor	C_{zz}	1,00	

Unity check (6.61) = $0,00 + 0,01 + 0,18 = 0,20$ -

Unity check (6.62) = $0,00 + 0,00 + 0,26 = 0,27$ -

Shear Buckling check

According to EN 1993-1-5 article 5 & 7.1 and formula (5.10) & (7.1)

Shear Buckling parameters			
Buckling field length	a	4,590	m
Web		unstiffened	
Web height	h_w	170	mm
Web thickness	t	7	mm
Material coefficient	ε	1,00	
Shear correction factor	η	1,20	

Shear Buckling verification		
Web slenderness	h_w/t	26,15
Web slenderness limit		60,00

Note: The web slenderness is such that Shear Buckling effects may be ignored according to EN 1993-1-5 article 5.1(2).

The member satisfies the stability check.

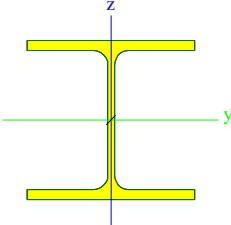
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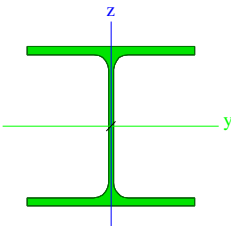
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ODABRANI ELEMENTI

HEA 140		
Type	HEA140	
Formcode	1 - I section	
Shape type	Thin-walled	
Item material	S 235	
Fabrication	rolled	
Flexural buckling y-y,	b	c
Flexural buckling z-z		
A [m ²]	3,1400e-03	
A _y [m ²], A _z [m ²]	2,2882e-03	7,8192e-04
I _y [m ⁴], I _z [m ⁴]	1,0300e-05	3,8900e-06
W _{ely} [m ³], W _{elz} [m ³]	1,5500e-04	5,5600e-05
W _{ply} [m ³], W _{plz} [m ³]	1,7333e-04	8,5000e-05
I _w [m ⁶], I _t [m ⁴]	1,5064e-08	8,1300e-08
d _y [mm], d _z [mm]	0	0
c _{yucs} [mm], c _{zucs} [mm]	70	66
α [deg]	0,00	
M _{ply+} [Nm], M _{ply-} [Nm]	40800,25	40800,25
M _{plz+} [Nm], M _{plz-} [Nm]	19943,24	19943,24
AL [m ² /m], AD [m ² /m]	7,9400e-01	7,9430e-01
β _y [mm], β _z [mm]	0	0
Picture		

HEA 240		
Type	HEA240	
Formcode	1 - I section	
Shape type	Thin-walled	
Item material	S 235	
Fabrication	rolled	
Flexural buckling y-y,	b	c
Flexural buckling z-z		
A [m ²]	7,6800e-03	
A _y [m ²], A _z [m ²]	5,5540e-03	1,8522e-03
I _y [m ⁴], I _z [m ⁴]	7,7600e-05	2,7700e-05
W _{ely} [m ³], W _{elz} [m ³]	6,7500e-04	2,3100e-04
W _{ply} [m ³], W _{plz} [m ³]	7,4583e-04	3,5167e-04
I _w [m ⁶], I _t [m ⁴]	3,2849e-07	4,1600e-07
d _y [mm], d _z [mm]	0	0
c _{yucs} [mm], c _{zucs} [mm]	120	115
α [deg]	0,00	
M _{ply+} [Nm], M _{ply-} [Nm]	175143,84	175143,84
M _{plz+} [Nm], M _{plz-} [Nm]	82666,47	82666,47
AL [m ² /m], AD [m ² /m]	1,3700e+00	1,3688e+00
β _y [mm], β _z [mm]	0	0
Picture		

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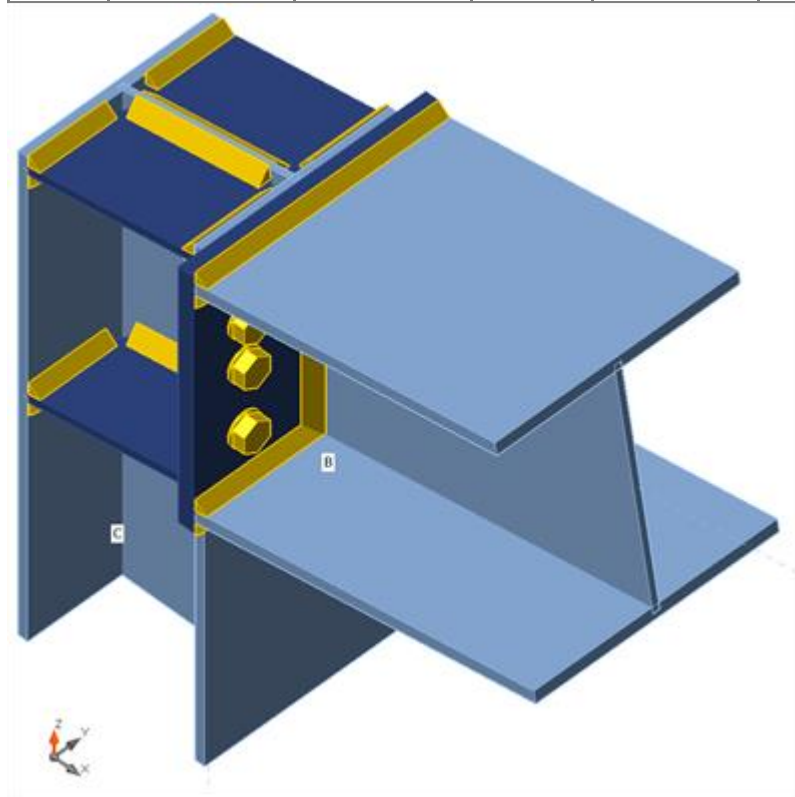
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2.12 DIMENZIONIRANJE PRIKLJUČAKA

PRIKLJUČAK STUPA I KROVNE KONSTRUKCIJE

Beams and columns

Name	Cross-section	β - Direction [°]	γ - Pitch [°]	α - Rotation [°]	Offset ex [mm]	Offset ey [mm]	Offset ez [mm]	Forces in
C	8 - HEA240	0,0	90,0	0,0	0	0	0	Node
B	9 – HEA280	0,0	-10,0	0,0	0	0	0	Node



Cross-sections

Name	Material
8 - HEA240	S 355
9 – HEA280	S 355

Bolts

Name	Bolt assembly	Diameter [mm]	f_u [MPa]	Gross area [mm ²]
M22 8.8	M22 8.8	22	800,0	380

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Load effects (equilibrium not required)

Name	Member	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
LE1	B	14,1	0,0	-70,0	0,0	55,0	0,0

Check

Summary

Name	Value	Status
Analysis	100,0%	OK
Plates	3,0 < 5,0%	OK
Bolts	86,2 < 100%	OK
Welds	98,1 < 100%	OK
Buckling	Not calculated	

Plates

Name	Thickness [mm]	Loads	σ_{Ed} [MPa]	ϵ_{Pl} [%]	σ_{CEd} [MPa]	Status
C-bfl 1	12,0	LE1	126,1	0,0	0,0	OK
C-tfl 1	12,0	LE1	329,0	3,0	171,2	OK
C-w 1	7,5	LE1	322,8	0,0	0,0	OK
B-bfl 1	14,0	LE1	249,7	0,0	0,0	OK
B-tfl 1	14,0	LE1	164,4	0,0	0,0	OK
B-w 1	8,5	LE1	190,1	0,0	0,0	OK
EP2	18,0	LE1	322,9	0,1	229,0	OK
STIFF2a	10,0	LE1	283,1	0,0	0,0	OK
STIFF2b	10,0	LE1	280,8	0,0	0,0	OK
STIFF2c	10,0	LE1	324,6	0,9	0,0	OK
STIFF2d	10,0	LE1	324,6	0,9	0,0	OK

Design data

Material	f_y [MPa]	ϵ_{lim} [%]
S 355	355,0	5,0

Symbol explanation

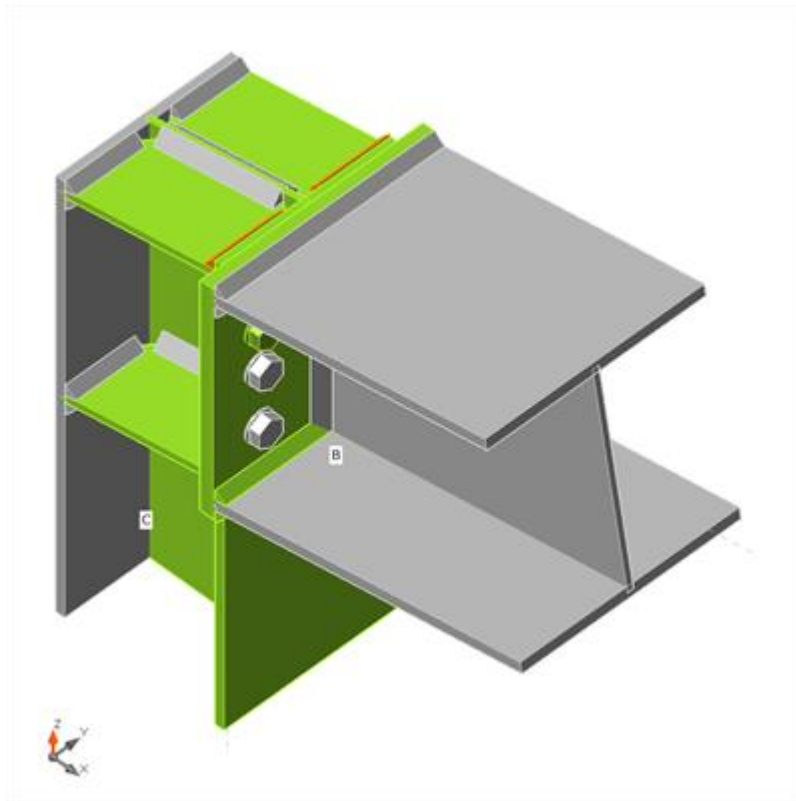
ϵ_{Pl}	Strain
σ_{Ed}	Eq. stress
σ_{CEd}	Contact stress
f_y	Yield strength
ϵ_{lim}	Limit of plastic strain

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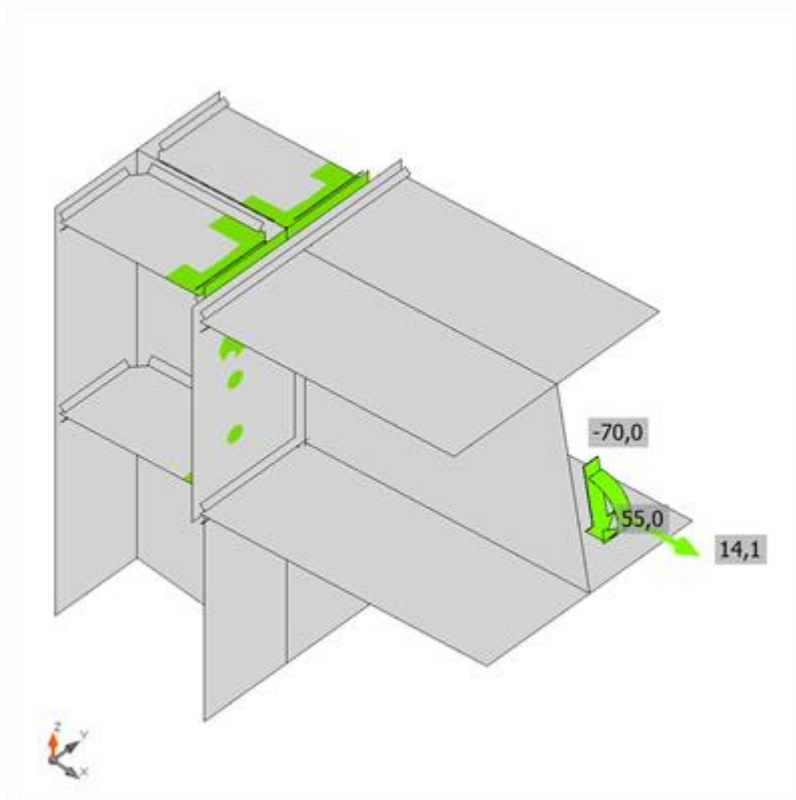
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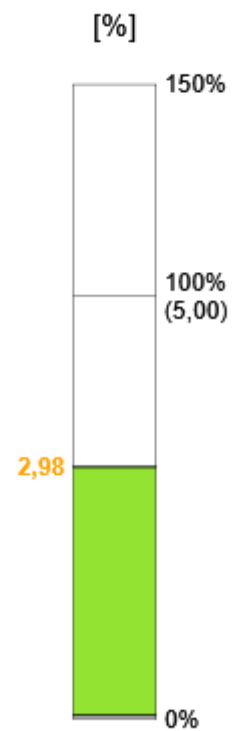
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Overall check, LE1



Strain check, LE1

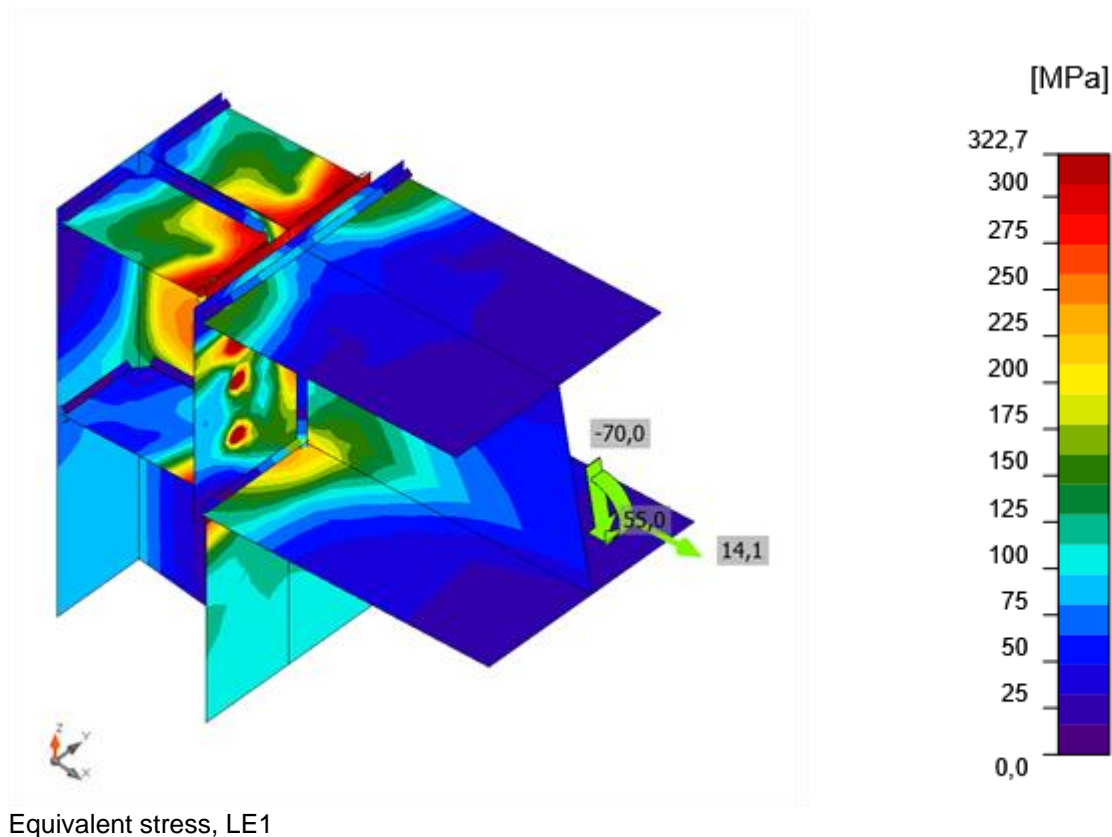


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Bolts

	Name	Loads	$F_{t,Ed}$ [kN]	V [kN]	$U_{t,t}$ [%]	$F_{b,Rd}$ [kN]	$U_{t,s}$ [%]	$U_{t,ts}$ [%]	Status
	B1	LE1	150,4	15,1	86,2	94,9	15,9	74,5	OK
	B2	LE1	150,4	15,1	86,2	94,9	15,9	74,5	OK
	B3	LE1	104,2	7,4	59,7	92,8	8,0	49,0	OK
	B4	LE1	103,9	7,5	59,6	93,1	8,0	49,0	OK
	B5	LE1	76,1	13,0	43,6	135,5	11,2	42,3	OK
	B6	LE1	76,6	12,9	43,9	135,5	11,1	42,5	OK

Design data

Name	$F_{t,Rd}$ [kN]	$B_{p,Rd}$ [kN]	$F_{v,Rd}$ [kN]
M22 8.8 - 1	174,5	318,0	116,4

Symbol explanation

- $F_{t,Rd}$ Bolt tension resistance EN 1993-1-8 tab. 3.4
- $F_{t,Ed}$ Tension force
- $B_{p,Rd}$ Punching shear resistance
- V Resultant of shear forces V_y , V_z in bolt
- $F_{v,Rd}$ Bolt shear resistance EN_1993-1-8 table 3.4
- $F_{b,Rd}$ Plate bearing resistance EN 1993-1-8 tab. 3.4

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Ut Utilization in tension
Us Utilization in shear

Welds (Plastic redistribution)

Item	Edge	Throat th. [mm]	Length [mm]	Loads	$\sigma_{w,Ed}$ [MPa]	ϵ_{Pl} [%]	σ_{\perp} [MPa]	τ_{\parallel} [MPa]	τ_{\perp} [MPa]	Ut [%]	Us [%]	Status
EP2	B-bfl 1	11,0	300	LE1	185,2	0,0	-43,1	-0,6	104,0	42,5	16,4	OK
		11,0	300	LE1	273,8	0,0	161,4	-0,2	127,7	62,9	23,1	OK
EP2	B-tfl 1	11,0	300	LE1	91,3	0,0	-11,8	-52,3	0,6	21,0	15,4	OK
		11,0	300	LE1	108,4	0,0	25,8	57,4	-19,9	24,9	17,6	OK
EP2	B-w 1	11,0	280	LE1	104,2	0,0	49,9	-17,4	49,8	23,9	14,0	OK
		11,0	280	LE1	105,2	0,0	50,5	17,0	-50,5	24,2	14,0	OK
C-bfl 1	STIFF2a	11,0	95	LE1	18,8	0,0	4,2	-10,6	0,8	4,3	3,2	OK
		11,0	95	LE1	32,1	0,0	-9,6	17,2	3,9	7,4	4,1	OK
C-w 1	STIFF2a	11,0	165	LE1	46,7	0,0	34,0	12,9	13,2	10,7	6,7	OK
		11,0	165	LE1	31,3	0,0	-13,6	-14,3	7,6	7,2	5,7	OK
C-tfl 1	STIFF2a	11,0	95	LE1	217,5	0,0	-53,9	-56,1	107,9	49,9	29,2	OK
		11,0	95	LE1	116,3	0,0	19,5	-66,2	0,0	26,7	18,7	OK
C-bfl 1	STIFF2b	11,0	95	LE1	32,7	0,0	-9,5	-17,7	-3,7	7,5	4,2	OK
		11,0	95	LE1	19,1	0,0	4,2	10,7	-0,8	4,4	3,2	OK
C-w 1	STIFF2b	11,0	165	LE1	31,5	0,0	-13,9	14,5	-7,6	7,2	5,7	OK
		11,0	165	LE1	47,3	0,0	34,5	-12,2	-14,1	10,9	6,7	OK
C-tfl 1	STIFF2b	11,0	95	LE1	117,1	0,0	19,5	66,7	1,0	26,9	18,7	OK
		11,0	95	LE1	212,5	0,0	-52,8	51,6	107,1	48,8	29,4	OK
C-bfl 1	STIFF2c	11,0	95	LE1	25,7	0,0	-9,2	-7,1	-11,9	5,9	5,2	OK
		11,0	95	LE1	34,1	0,0	-1,4	-19,2	4,3	7,8	5,9	OK
C-w 1	STIFF2c	11,0	165	LE1	89,1	0,0	-67,2	-25,4	-22,3	20,5	8,7	OK
		11,0	165	LE1	64,6	0,0	58,4	8,1	-13,6	16,6	9,7	OK
C-tfl 1	STIFF2c	11,0	95	LE1	427,4	0,3	40,4	245,6	4,3	98,1	81,2	OK
		11,0	95	LE1	427,1	0,1	-29,7	245,9	-5,1	98,1	72,9	OK
C-bfl 1	STIFF2d	11,0	95	LE1	34,1	0,0	-1,5	19,2	-4,3	7,8	5,9	OK
		11,0	95	LE1	25,4	0,0	-9,0	7,1	11,8	5,8	5,2	OK
C-w 1	STIFF2d	11,0	165	LE1	64,9	0,0	58,5	-8,3	13,9	16,6	9,7	OK
		11,0	165	LE1	89,2	0,0	-67,2	25,1	22,7	20,5	8,8	OK
C-tfl 1	STIFF2d	11,0	95	LE1	427,1	0,2	-29,0	245,9	6,2	98,1	72,8	OK

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		▲11,0▲	95	LE1	427,4	0,3	42,3	- 245,5	-4,8	98,1	81,1	OK
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Design data

	β_w [-]	$\sigma_{w,Rd}$ [MPa]	0.9σ [MPa]
S 355	0,90	435,6	352,8

Symbol explanation

ϵ_{PI}	Strain
$\sigma_{w,Ed}$	Equivalent stress
$\sigma_{w,Rd}$	Equivalent stress resistance
σ_{\perp}	Perpendicular stress
$\tau_{ }$	Shear stress parallel to weld axis
τ_{\perp}	Shear stress perpendicular to weld axis
0.9σ	Perpendicular stress resistance - $0.9 \cdot f_u / \gamma_{M2}$
β_w	Corelation factor EN 1993-1-8 tab. 4.1
U_t	Utilization
U_{tc}	Weld capacity utilization

Buckling

Buckling analysis was not calculated.

Code settings

Item	Value	Unit	Reference
γ_{M0}	1,10	-	EN 1993-1-1: 6.1
γ_{M1}	1,10	-	EN 1993-1-1: 6.1
γ_{M2}	1,25	-	EN 1993-1-1: 6.1
γ_{M3}	1,25	-	EN 1993-1-8: 2.2
γ_C	1,50	-	EN 1992-1-1: 2.4.2.4
γ_{Inst}	1,20	-	EN 1992-4: Table 4.1
Joint coefficient β_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
Weld stress evaluation	Plastic redistribution		
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

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Use calculated α_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

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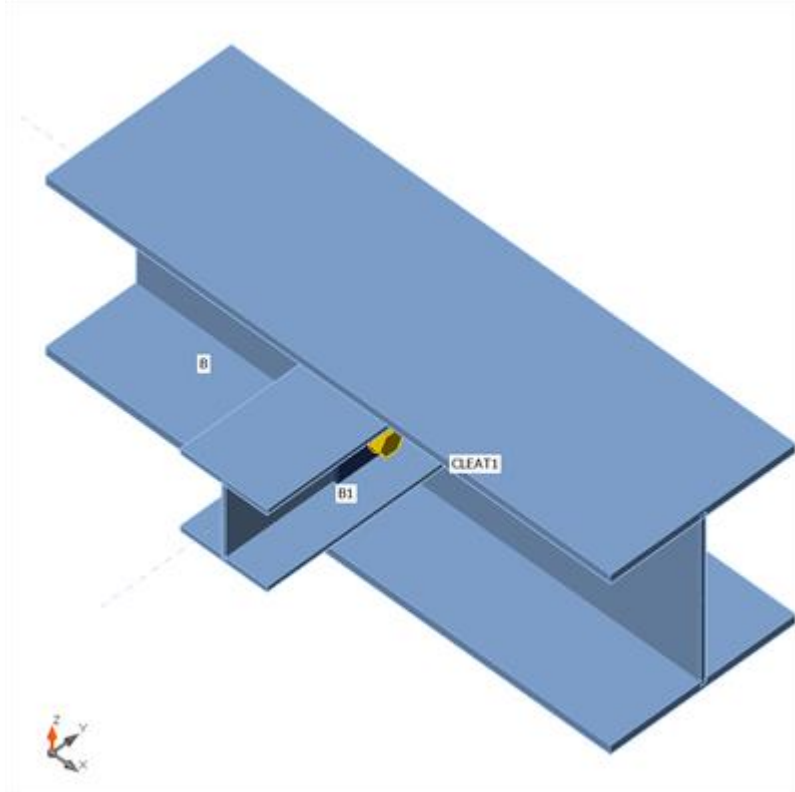
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PRIKLJUČAK KROVNE KONSTRUKCIJE I SEKUNDAARNE KONSTRUKCIJE

Beams and columns

Name	Cross-section	β – Direction [°]	γ - Pitch [°]	α - Rotation [°]	Offset ex [mm]	Offset ey [mm]	Offset ez [mm]	Forces in	X [mm]
B	2 - CON1(HEA280)	0,0	0,0	0,0	0	0	0	Node	0
B1	5 - HEA140	-90,0	0,0	0,0	0	0	30	Bolts	74



Cross-sections

Name	Material
2 - CON1(HEA280)	S 355
5 - HEA140	S 355
4 - T(IPE300)	S 355

Bolts

Name	Bolt assembly	Diameter [mm]	f_u [MPa]	Gross area [mm ²]
M22 8.8	M22 8.8	22	800,0	380

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Load effects (equilibrium not required)

Name	Member	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
LE1	B1	2,2	0,0	-80,0	0,0	0,0	0,0

Check

Summary

Name	Value	Status
Analysis	100,0%	OK
Plates	0,3 < 5,0%	OK
Bolts	74,7 < 100%	OK
Welds	25,2 < 100%	OK
Buckling	Not calculated	

Plates

Name	Thickness [mm]	Loads	σ_{Ed} [MPa]	ϵ_{Pl} [%]	σ_{CEd} [MPa]	Status
B-bfl 1	14,0	LE1	60,4	0,0	0,0	OK
B-tfl 1	14,0	LE1	64,1	0,0	0,0	OK
B-w 1	8,5	LE1	297,6	0,0	62,8	OK
B1-bfl 1	8,5	LE1	138,3	0,0	0,0	OK
B1-tfl 1	8,5	LE1	134,0	0,0	0,0	OK
B1-w 1	5,5	LE1	323,0	0,1	35,0	OK
CLEAT1-tfl 1	10,7	LE1	322,8	0,0	114,8	OK
CLEAT1-w 1	7,1	LE1	323,3	0,3	114,8	OK
STIFF1	8,0	LE1	116,7	0,0	0,0	OK

Design data

Material	f_y [MPa]	ϵ_{lim} [%]
S 355	355,0	5,0

Symbol explanation

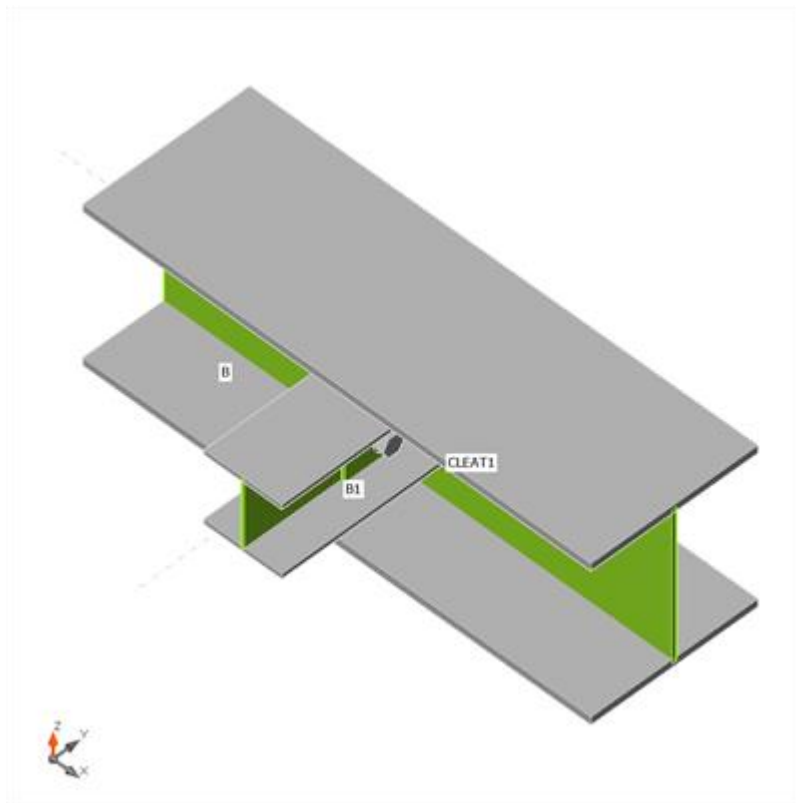
ϵ_{Pl}	Strain
σ_{Ed}	Eq. stress
σ_{CEd}	Contact stress
f_y	Yield strength
ϵ_{lim}	Limit of plastic strain

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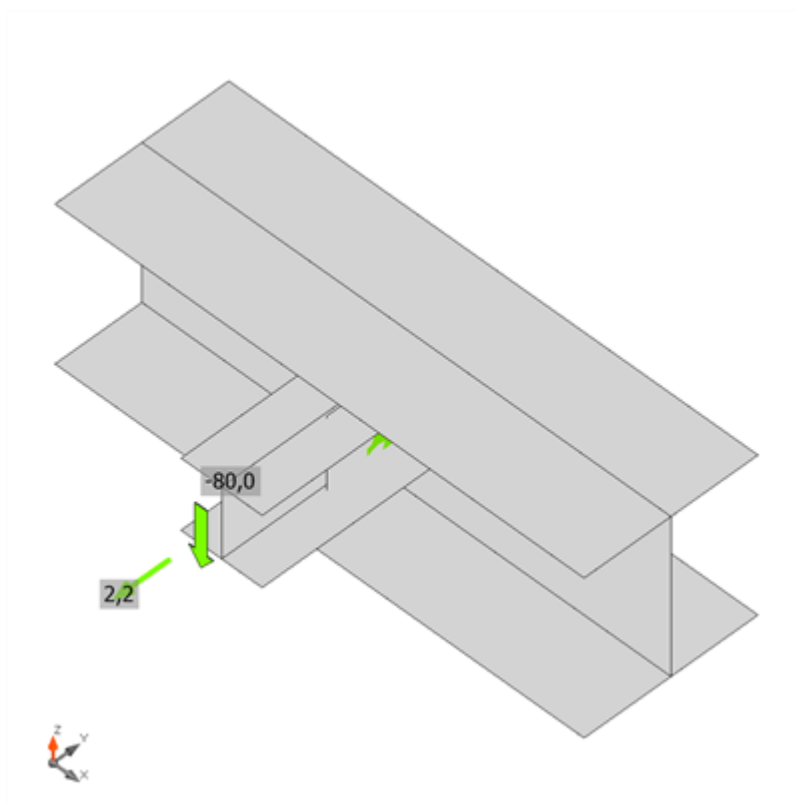
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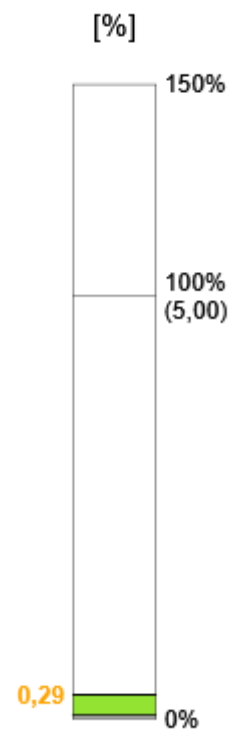
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Overall check, LE1



Strain check, LE1

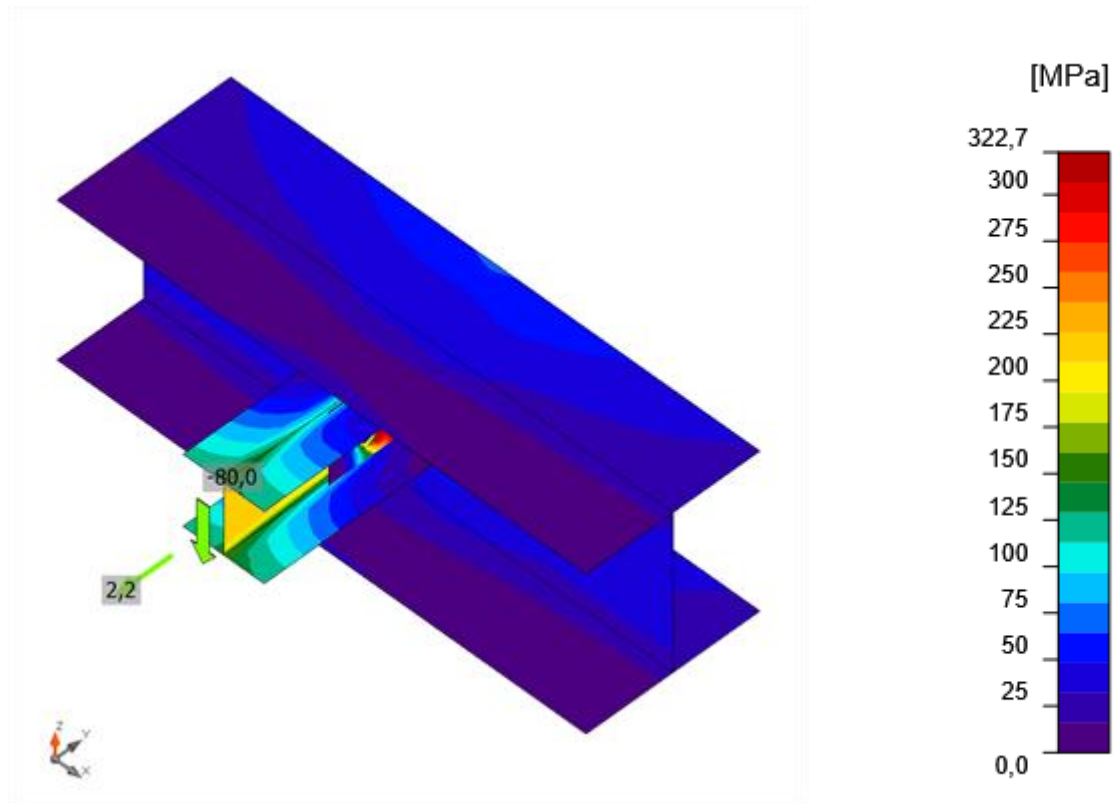


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Equivalent stress, LE1

Bolts

	Name	Grade	Loads	$F_{t,Ed}$ [kN]	V [kN]	U_{t1} [%]	$F_{b,Rd}$ [kN]	U_{ts} [%]	U_{ts1} [%]	Status
	B1	M22 8.8 - 1	LE1	22,9	39,7	15,7	53,1	74,7	43,5	OK
	B2	M22 8.8 - 1	LE1	5,4	40,3	3,7	69,2	58,3	36,9	OK
	B3	M22 8.8 - 2	LE1	53,3	17,5	30,5	101,9	17,2	36,8	OK
	B4	M22 8.8 - 2	LE1	5,7	18,1	3,3	128,3	15,5	17,9	OK
	B5	M22 8.8 - 2	LE1	60,2	21,7	34,5	101,9	21,3	43,3	OK
	B6	M22 8.8 - 2	LE1	5,2	23,0	3,0	128,3	19,8	21,9	OK

Design data

Name	$F_{t,Rd}$ [kN]	$B_{p,Rd}$ [kN]	$F_{v,Rd}$ [kN]
M22 8.8 - 1	174,5	145,7	116,4
M22 8.8 - 2	174,5	225,2	116,4

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Symbol explanation

$F_{t,Rd}$	Bolt tension resistance EN 1993-1-8 tab. 3.4
$F_{t,Ed}$	Tension force
$B_{p,Rd}$	Punching shear resistance
V	Resultant of shear forces V_y , V_z in bolt
$F_{v,Rd}$	Bolt shear resistance EN 1993-1-8 table 3.4
$F_{b,Rd}$	Plate bearing resistance EN 1993-1-8 tab. 3.4
U_t	Utilization in tension
U_s	Utilization in shear

Welds (Plastic redistribution)

Item	Edge	Throat th. [mm]	Length [mm]	Loads	$\sigma_{w,Ed}$ [MPa]	ϵ_{Pl} [%]	σ_{\perp} [MPa]	τ_{\parallel} [MPa]	τ_{\perp} [MPa]	U_t [%]	U_c [%]	Status
B-bfl 1	STIFF1	▲10,0▲	119	LE1	15,0	0,0	1,6	8,5	1,5	3,4	3,2	OK
		▲10,0▲	119	LE1	15,6	0,0	-3,5	-8,3	2,7	3,6	3,3	OK
B-w 1	STIFF1	▲10,0▲	208	LE1	109,8	0,0	-56,2	20,1	-50,6	25,2	12,2	OK
		▲10,0▲	208	LE1	103,7	0,0	-46,9	-10,1	52,5	23,8	11,1	OK
B-tfl 1	STIFF1	▲10,0▲	119	LE1	19,9	0,0	1,9	11,2	2,1	4,6	3,2	OK
		▲10,0▲	119	LE1	21,3	0,0	3,1	-11,8	-2,9	4,9	3,4	OK

Design data

	β_w [-]	$\sigma_{w,Rd}$ [MPa]	0.9σ [MPa]
S 355	0,90	435,6	352,8

Symbol explanation

ϵ_{Pl}	Strain
$\sigma_{w,Ed}$	Equivalent stress
$\sigma_{w,Rd}$	Equivalent stress resistance
σ_{\perp}	Perpendicular stress
τ_{\parallel}	Shear stress parallel to weld axis
τ_{\perp}	Shear stress perpendicular to weld axis
0.9σ	Perpendicular stress resistance - $0.9 \cdot f_u / \gamma_{M2}$
β_w	Corelation factor EN 1993-1-8 tab. 4.1
U_t	Utilization
U_c	Weld capacity utilization

Buckling

Buckling analysis was not calculated.

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Code settings

Item	Value	Unit	Reference
γ_{M0}	1,10	-	EN 1993-1-1: 6.1
γ_{M1}	1,10	-	EN 1993-1-1: 6.1
γ_{M2}	1,25	-	EN 1993-1-1: 6.1
γ_{M3}	1,25	-	EN 1993-1-8: 2.2
γ_C	1,50	-	EN 1992-1-1: 2.4.2.4
γ_{Inst}	1,20	-	EN 1992-4: Table 4.1
Joint coefficient β_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
Weld stress evaluation	Plastic redistribution		
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 ϕ_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

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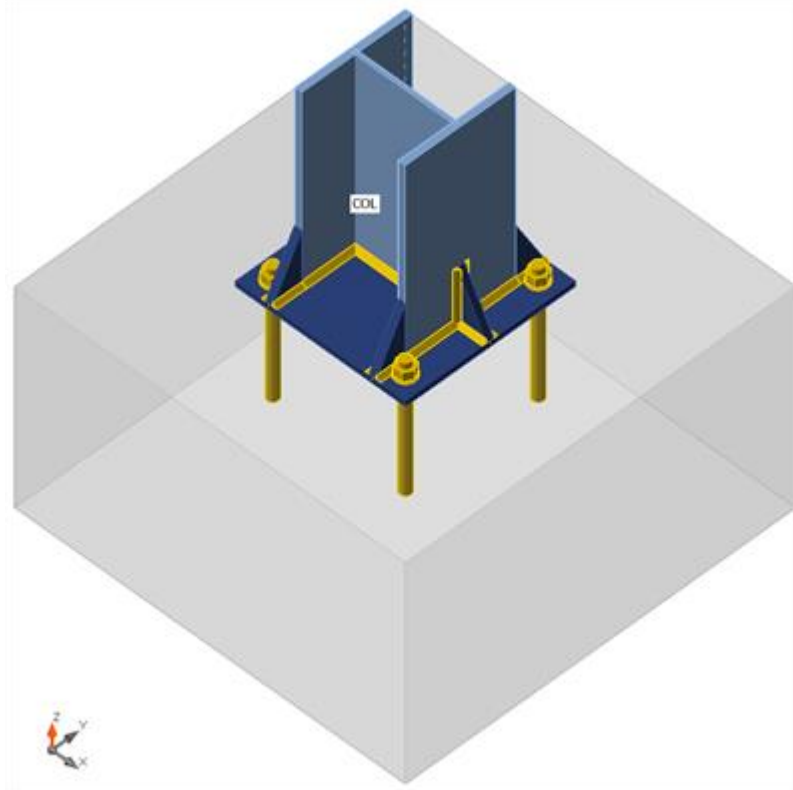
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PRIKLJUČAK STUPA, STABILIZACIJA TEMELJA

Beams and columns

Name	Cross-section	β – Direction [°]	γ - Pitch [°]	α - Rotation [°]	Offset ex [mm]	Offset ey [mm]	Offset ez [mm]	Forces in
COL	1 - CON1(HEA240)	0,0	-90,0	0,0	0	0	0	Node



Cross-sections

Name	Material
1 - CON1(HEA240)	S 355

Anchors

Name	Bolt assembly	Diameter [mm]	f_u [MPa]	Gross area [mm ²]
M30 10.9	M30 10.9	30	1000,0	707

Load effects (equilibrium not required)

Name	Member	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
LE1	COL	-400,0	0,0	0,0	0,0	70,0	8,0
LE2	COL	84,0	0,0	0,0	0,0	0,0	0,0

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Foundation block

Item	Value	Unit
CB 1		
Dimensions	1060 x 1060	mm
Depth	600	mm
Anchor	M30 10.9	
Anchoring length	300	mm
Shear force transfer	Friction	

Check

Summary

Name	Value	Status
Analysis	100,0%	OK
Plates	0,0 < 5,0%	OK
Anchors	57,5 < 100%	OK
Welds	29,1 < 100%	OK
Concrete block	29,9 < 100%	OK
Shear	0,0 < 100%	OK
Buckling	Not calculated	

Plates

Name	Thickness [mm]	Loads	σ_{Ed} [MPa]	ϵ_{PI} [%]	σ_{CEd} [MPa]	Status
COL-bfl 1	19,0	LE1	99,5	0,0	0,0	OK
COL-tfl 1	19,0	LE1	53,1	0,0	0,0	OK
COL-w 1	11,0	LE1	62,4	0,0	0,0	OK
BP1	16,0	LE1	118,4	0,0	0,0	OK
WID1a	20,0	LE1	85,8	0,0	0,0	OK
WID1b	20,0	LE1	121,8	0,0	0,0	OK
WID1c	20,0	LE1	77,8	0,0	0,0	OK
WID1d	20,0	LE2	57,2	0,0	0,0	OK
WID1e	20,0	LE1	16,9	0,0	0,0	OK
WID1f	20,0	LE1	84,7	0,0	0,0	OK

Design data

Material	f_y [MPa]	ϵ_{lim} [%]
S 355	355,0	5,0

Symbol explanation

ϵ_{PI}	Strain
σ_{Ed}	Eq. stress
σ_{CEd}	Contact stress
f_y	Yield strength

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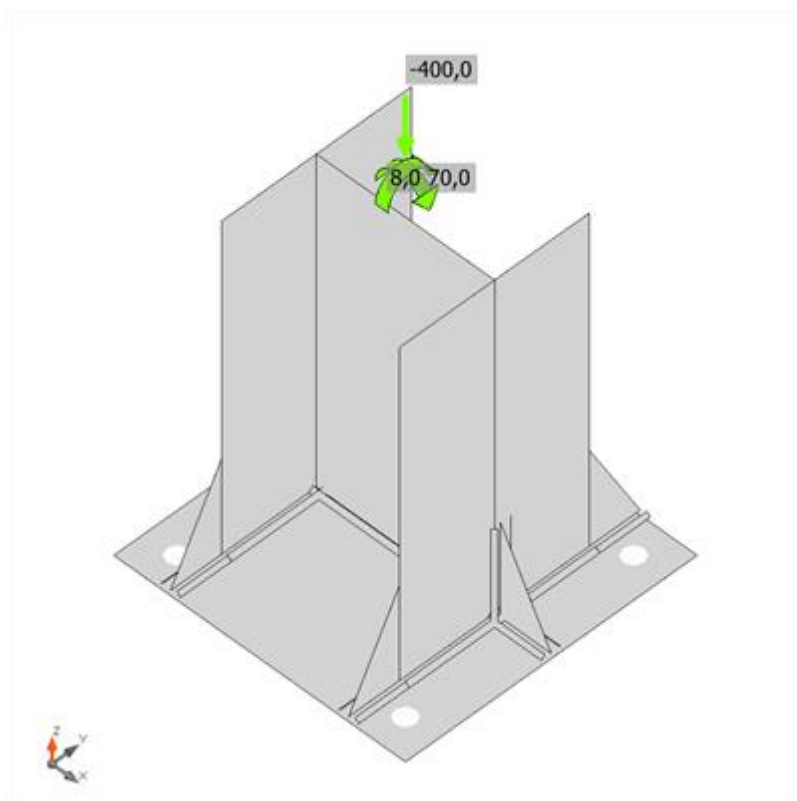
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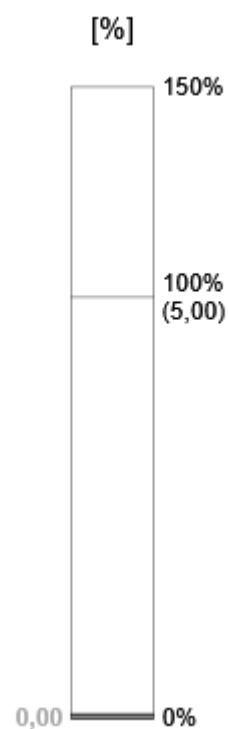
ϵ_{lim} Limit of plastic strain



Overall check, LE1



Strain check, LE1

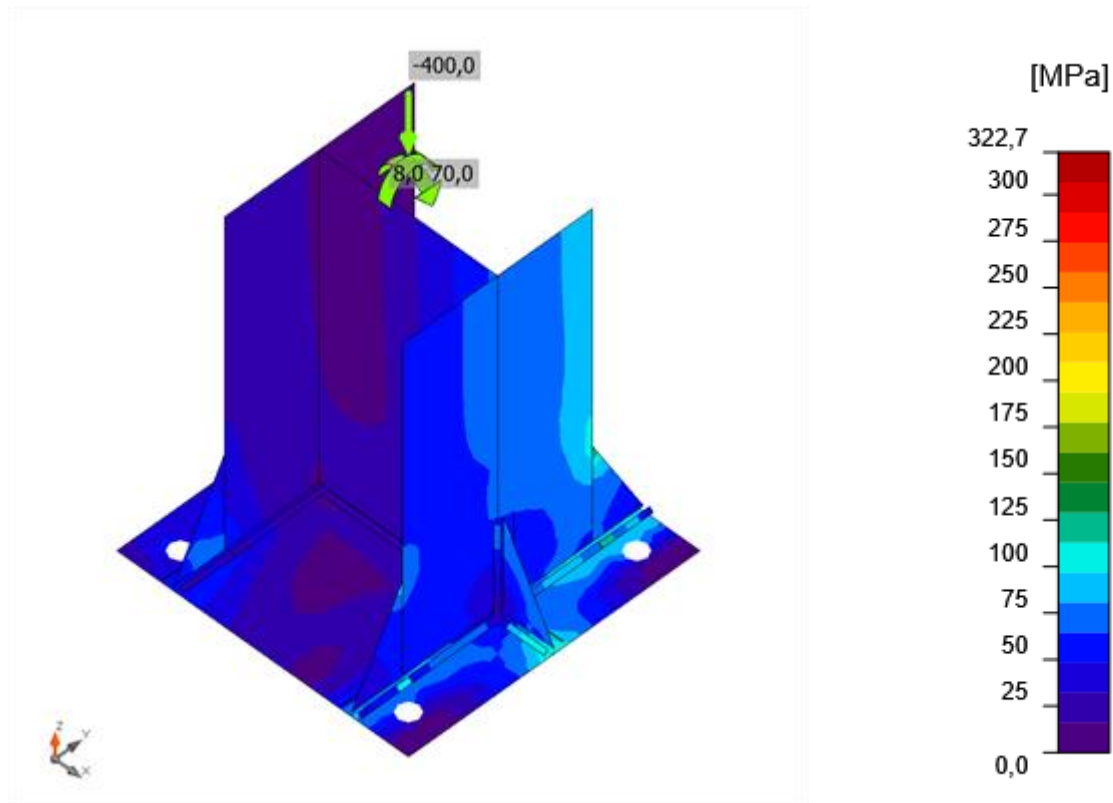


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Equivalent stress, LE1

Anchors

Shape	Item	Loads	N_{Ed} [kN]	V_{Ed} [kN]	$N_{Rd,c}$ [kN]	$V_{Rd,cp}$ [kN]	U_{t_t} [%]	U_{t_s} [%]	$U_{t_{ts}}$ [%]	Status
	A1	LE2	25,1	0,0	174,6	419,2	57,5	0,0	43,6	OK
	A2	LE2	25,1	0,0	174,6	419,2	57,5	0,0	43,6	OK
	A3	LE2	25,1	0,0	174,6	419,2	57,5	0,0	43,6	OK
	A4	LE2	25,1	0,0	174,6	419,2	57,5	0,0	43,6	OK

Design data

Grade	$N_{Rd,s}$ [kN]	$V_{Rd,s}$ [kN]
M30 10.9 - 1	340,6	187,0

Symbol explanation

N_{Ed}	Tension force
V_{Ed}	Resultant of shear forces V_y , V_z in bolt
$N_{Rd,c}$	Design resistance in case of concrete cone failure under tension load - EN1992-4 - Cl. 7.2.1.4
$V_{Rd,cp}$	Design resistance in case of concrete pryout failure - EN1992-4 - Cl. 7.2.2.4
U_{t_t}	Utilization in tension
U_{t_s}	Utilization in shear

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Ut_{ts} Utilization in tension and shear
N_{Rd,s} Design tensile resistance of a fastener in case of steel failure - EN1992-4 - Cl. 7.2.1.3
V_{Rd,s} Design shear resistance in case of steel failure - EN1992-4 - Cl.7.2.2.3.1

Welds (Plastic redistribution)

Item	Edge	Throat th. [mm]	Length [mm]	Loads	$\sigma_{w,Ed}$ [MPa]	ϵ_{Pl} [%]	σ_{\perp} [MPa]	τ_{\parallel} [MPa]	τ_{\perp} [MPa]	Ut [%]	Ut _c [%]	Status
COL-bfl 1	WID1a	8,0	150	LE1								OK
COL-bfl 1	WID1b	8,0	150	LE1								OK
COL-tfl 1	WID1c	8,0	150	LE1								OK
COL-tfl 1	WID1d	8,0	150	LE1								OK
BP1	COL-bfl 1	▲9,0▲	300	LE1	69,3	0,0	-31,6	-1,0	-35,6	15,9	12,5	OK
		▲9,0▲	300	LE1	81,4	0,0	-42,8	9,2	38,9	18,7	14,8	OK
BP1	COL-tfl 1	▲9,0▲	300	LE1	61,6	0,0	14,1	-33,1	10,4	14,2	6,2	OK
		▲9,0▲	300	LE1	32,5	0,0	1,5	-18,4	-3,6	7,5	4,8	OK
BP1	COL-w 1	▲9,0▲	281	LE1	37,6	0,0	-17,2	10,0	-16,5	8,6	5,1	OK
		▲9,0▲	281	LE1	37,5	0,0	-16,3	-9,7	16,9	8,6	5,5	OK
BP1	WID1a	▲8,0▲	80	LE1	85,7	0,0	-33,6	19,7	-41,1	19,7	13,3	OK
		▲8,0▲	80	LE1	99,6	0,0	-53,1	-16,9	45,6	22,9	14,8	OK
BP1	WID1b	▲8,0▲	80	LE1	126,5	0,0	-67,5	20,8	-58,2	29,1	19,8	OK
		▲8,0▲	80	LE1	108,9	0,0	-43,4	-23,5	52,7	25,0	17,8	OK
BP1	WID1c	▲8,0▲	80	LE1	77,5	0,0	33,9	-31,0	25,7	17,8	13,5	OK
		▲8,0▲	80	LE1	35,4	0,0	5,3	-16,7	-11,4	8,1	5,5	OK
BP1	WID1d	▲8,0▲	80	LE2	24,4	0,0	2,2	11,7	7,8	5,6	3,7	OK
		▲8,0▲	80	LE2	55,6	0,0	23,8	22,6	-18,2	12,8	9,6	OK
BP1	WID1e	▲8,0▲	80	LE2	10,3	0,0	2,9	-4,9	2,9	2,4	1,5	OK
		▲8,0▲	80	LE1	15,5	0,0	7,0	7,3	-3,3	3,5	2,2	OK
COL-tfl 1	WID1e	▲8,0▲	150	LE1	18,1	0,0	3,1	10,0	2,5	4,2	1,7	OK
		▲8,0▲	150	LE1	11,6	0,0	1,9	-6,1	-2,5	2,7	1,8	OK
BP1	WID1f	▲8,0▲	80	LE1	111,6	0,0	-40,5	43,0	-41,9	25,6	19,4	OK
		▲8,0▲	80	LE1	113,7	0,0	-42,7	-44,7	41,2	26,1	19,9	OK
COL-bfl 1	WID1f	▲8,0▲	150	LE1	75,4	0,0	-9,1	-42,1	-9,7	17,3	11,4	OK
		▲8,0▲	150	LE1	77,3	0,0	-17,6	39,8	17,5	17,8	11,7	OK

Design data

	β_w [-]	$\sigma_{w,Rd}$ [MPa]	0.9σ [MPa]
S 355	0,90	435,6	352,8

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Symbol explanation

ϵ_{Pl}	Strain
$\sigma_{w,Ed}$	Equivalent stress
$\sigma_{w,Rd}$	Equivalent stress resistance
σ_{\perp}	Perpendicular stress
$\tau_{ }$	Shear stress parallel to weld axis
τ_{\perp}	Shear stress perpendicular to weld axis
0.9σ	Perpendicular stress resistance - $0.9 \cdot f_u / \gamma_{M2}$
β_w	Corelation factor EN 1993-1-8 tab. 4.1
U_t	Utilization
U_{tc}	Weld capacity utilization

Concrete block

Item	Loads	c [mm]	A_{eff} [mm ²]	σ [MPa]	k_j [-]	F_{jd} [MPa]	U_t [%]	Status
CB 1	LE1	29	45329	10,0	3,00	33,5	29,9	OK

Symbol explanation

c	Bearing width
A_{eff}	Effective area
σ	Average stress in concrete
k_j	Concentration factor
F_{jd}	The ultimate bearing strength of the concrete block
U_t	Utilization

Shear in contact plane

Name	Loads	V_y [kN]	V_z [kN]	$V_{Rd,y}$ [kN]	$V_{Rd,z}$ [kN]	$V_{c,Rd}$ [kN]	U_t [%]	Status
BP1	LE1	0,0	0,0	113,5	113,5	0,0	0,0	OK

Symbol explanation

V_y	Shear force in base plate V_y
V_z	Shear force in base plate V_z
$V_{Rd,y}$	Shear resistance
$V_{Rd,z}$	Shear resistance
$V_{c,Rd}$	Concrete bearing resistance
U_t	Utilization

Buckling

Buckling analysis was not calculated.

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Code settings

Item	Value	Unit	Reference
γ_{M0}	1,10	-	EN 1993-1-1: 6.1
γ_{M1}	1,10	-	EN 1993-1-1: 6.1
γ_{M2}	1,25	-	EN 1993-1-1: 6.1
γ_{M3}	1,25	-	EN 1993-1-8: 2.2
γ_C	1,50	-	EN 1992-1-1: 2.4.2.4
γ_{Inst}	1,20	-	EN 1992-4: Table 4.1
Joint coefficient β_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
Weld stress evaluation	Plastic redistribution		
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 ϕ_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

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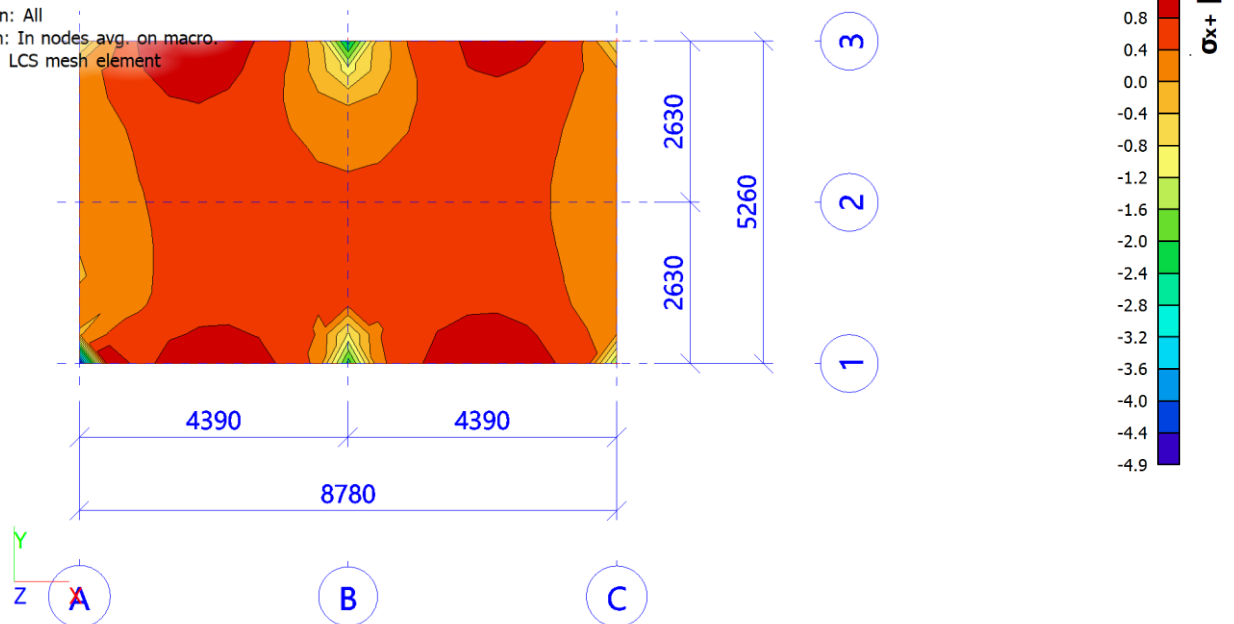
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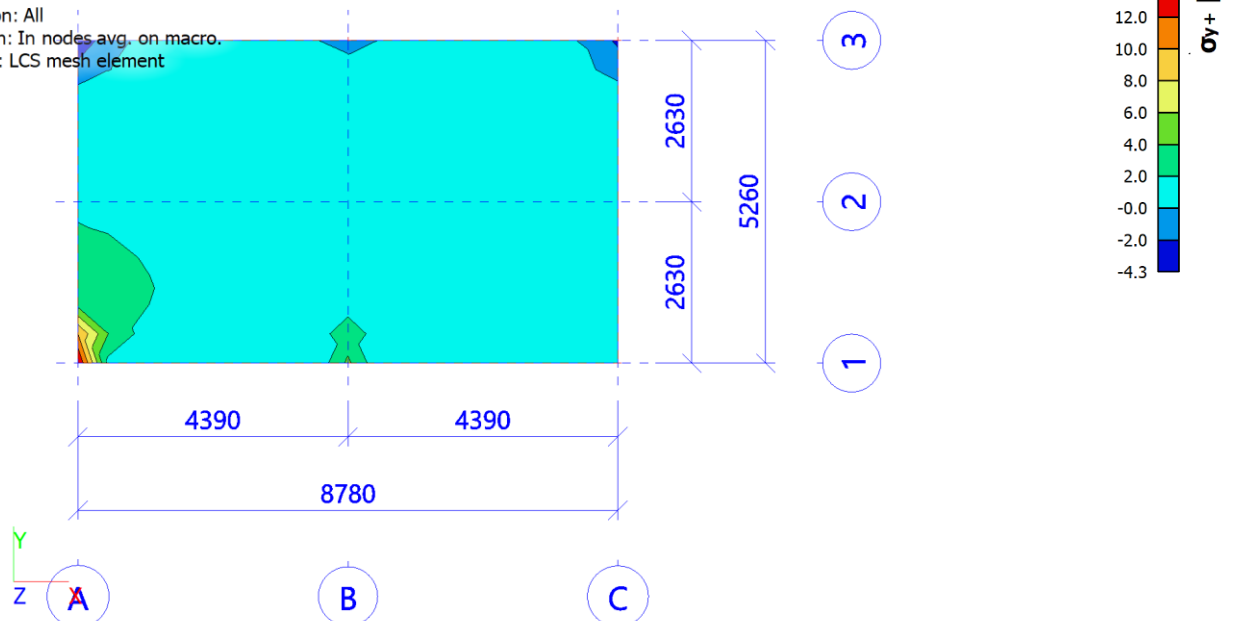
2.13 PODNA PLOČA POMOĆNA (SPREMIŠTE) , d = 35 cm, C25/30, B500B

KONTROLA NAPREZANJA PLOČE

Values: σ_{x+}
Linear calculation
Combination: ULS-Set B (auto)
Extreme: Global
Selection: All
Location: In nodes avg. on macro.
System: LCS mesh element



Values: σ_{y+}
Linear calculation
Combination: ULS-Set B (auto)
Extreme: Global
Selection: All
Location: In nodes avg. on macro.
System: LCS mesh element



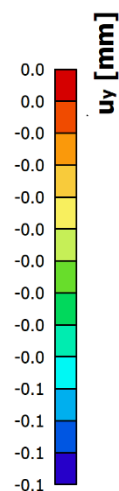
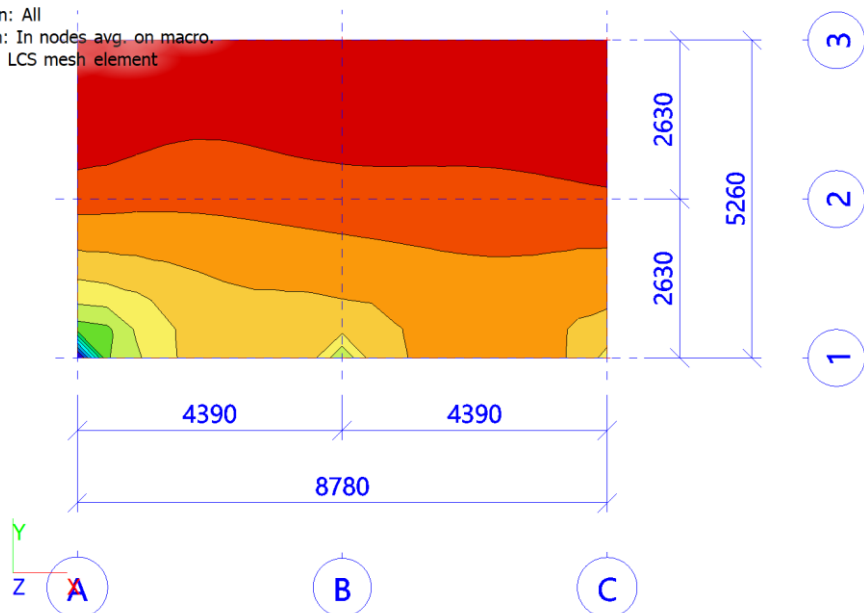
POMOĆNA GRAĐEVINA - SPREMIŠTE

GLAVNI PROJEKT – PROJEKT KONSTRUKCIJE

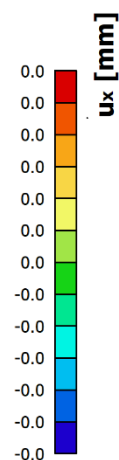
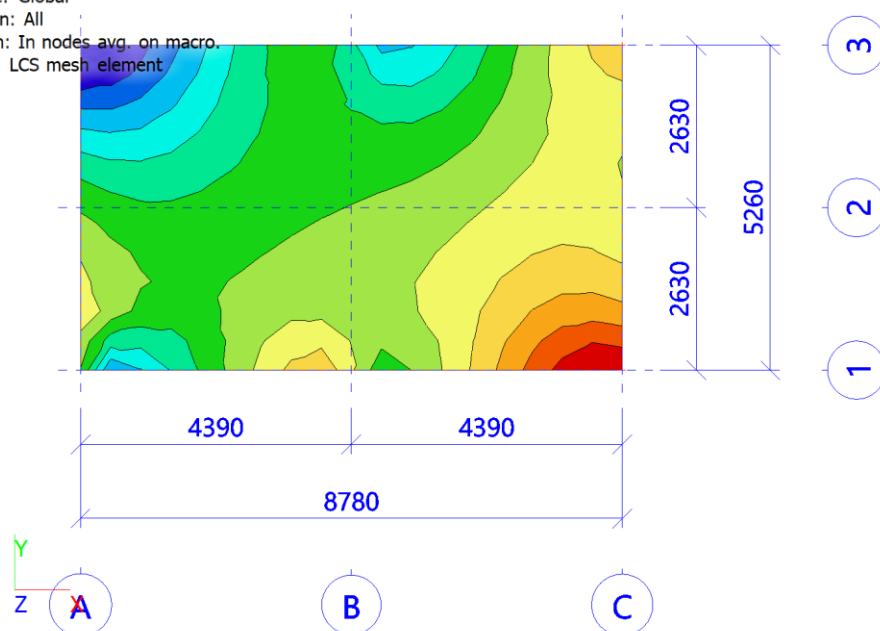
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Values: u_y
Linear calculation
Combination: ULS-Set B (auto)
Extreme: Global
Selection: All
Location: In nodes avg. on macro.
System: LCS mesh element



Values: u_x
Linear calculation
Combination: ULS-Set B (auto)
Extreme: Global
Selection: All
Location: In nodes avg. on macro.
System: LCS mesh element



POMOĆNA GRAĐEVINA - SPREMIŠTE

GLAVNI PROJEKT – PROJEKT KONSTRUKCIJE

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MINIMALNA I MAKSIMALNA ARMATURA PODNE PLOČE

Za visinu presjeka $h=35$ cm, C25/30, B500B

Visina presjeka:	$h=35$ cm
Zaštitni sloj betona:	$c=3,50$ cm (4 cm dolje i 2,5 cm gore)
Udaljenost do težišta armature:	$d_1=c+\phi_u/2=3,5+0,7/2=3,85$ cm
Statička visina presjeka	$d=h-d_1=35-3,85=31,15$ cm
Efektivna širina ploče	$b=100$ cm

Minimalna površina armature: (prema EN 1992-1-1, t.9.3.1.1)

Uvjet: $A_{s,min}=0,0013 \cdot b \cdot d=0,0013 \cdot 100 \cdot 11,15=1,45$ cm²

Uvjet: $A_{s,min}=0,26 \cdot b \cdot d \cdot (f_{ctm}/f_{yk})=0,26 \cdot 100 \cdot 11,15 \cdot (2,6/500)=1,51$ cm²

Mjerodavno: $A_{s,min}=1,51$ cm²

Maksimalna površina armature: (prema EN 1992-1-1, t.9.3.1.1)

Uvjet: $A_{s,max}=0,022 \cdot b \cdot d=0,022 \cdot 100 \cdot 11,15=24,53$ cm²

Uvjet: $A_{s,max}=0,04 \cdot b \cdot d=0,04 \cdot 100 \cdot 11,15=44,60$ cm²

Mjerodavno: $A_{s,max}=24,53$ cm²

Odabrana armatura mora se nalaziti u području između minimalne i maksimalne armature:

$A_{s,min} \leq A_s \leq A_{s,max}$

ODABRANA ARMATURA PODNE PLOČE:

Osnovna armatura:

- donja zona: mreža Q257 (2,57 cm²/m)

- gornja zona: mreža Q257 (2,57 cm²/m)

Pretpostavljena je nosivost tla 150 kN/m².

Stišljivost tla od 40 Mpa potrebno je provjeriti i upisati u građevinski dnevnik.

Ovlašteni geotehničar ili nadzor treba prije izvođenja provjeriti da li pretpostavljena nosivost tla odgovara stvarnoj na lokaciji.

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3 ISKAZ PROCJENJENIH TROŠKOVA GRADNJE

Temeljem pravilnika o obveznom sadržaju i opremanju projekata građevina (N.N. 118/19 i 65/20) dana je projektantska procjena gradnje. Troškovi su izračunati na temelju dobivenih količina materijala i projektantske

procjene jedinične cijene i mogu odstupati od tržišne cijene.

Troškovi gradnje konstrukcije objekta se procjenjuju na: 195.000,00 EUR + PDV (1.469.130,00 KN + PDV)

Zagreb, srpanj 2023.

Projektant: Miroslav Kopčinović dipl.ing.građ.

