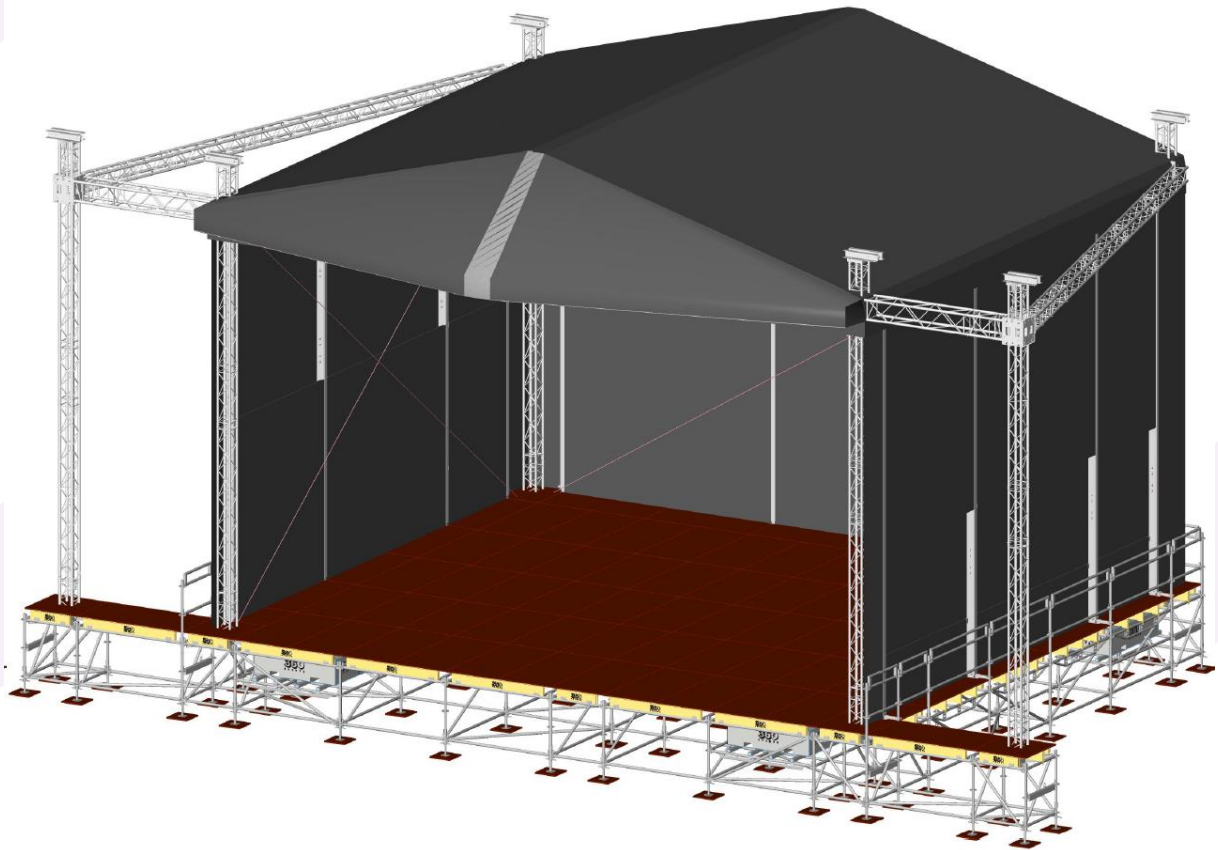


PODIUM – BOEK

MPT-L

Eekels Verhuur 112023-17



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Voorwoord

Opdrachtgevers en organisatoren, alsmede gemeentelijke diensten hebben behoefte aan handvatten voor de beoordeling van kwaliteit en specificaties van overdekte podia die tijdelijk geplaatst worden. Met als doel het inzichtelijk krijgen van waar gehuurde overdekte podia aan moeten voldoen op gebied van onder meer brandveiligheid- en constructieve veiligheid. Een van de is om een podiumboek op te stellen waarin deze zaken overzichtelijk en begrijpelijk worden weergegeven, dit op een vergelijkbare manier hoe een tentboek wordt samengesteld.

In het veld worden diverse termen gebruikt voor het overdekken van een podium; kap, dak, stage, overkapping. In essentie betreft het in dit bouwboek een podium wat voorzien is van een constructie welke zorgdraagt voor (gedeeltelijke) beschutting van de elementen.

In de bijlagen komen zaken aan de orde als tekeningen, kwaliteitsverklaringen, constructieve berekenen en andere informatie welke verder relevant is.

In de normen welke gaan over de overdekte podia worden kwaliteitsverklaringen, constructieve berekeningen en andere relevante stukken genoemd. Hierin staat gesteld dat deze stukken niet in de Nederlandse taal opgesteld hoeven te zijn, eventuele aanvullende toelichtingen en handleidingen wel. Het voorwoord en handleidingen die minimaal in het podium-boek moeten staan worden gezien als toelichting. Andere zaken dan de toelichting(en) in het podium-boek mogen in het Duits, Frans of Engels aangeleverd worden.

Het gebruik van het overdekte podium is geen onderwerp van het podium-boek.

Binnen het NEN lopen nog een aantal andere trajecten die te maken hebben met evenementen, allemaal beginnende met: 8020-

Een aantal, al dan niet Europese, algemeen gehanteerde normen en richtlijnen die te maken hebben met overdekte podia welke tijdelijk geplaatst worden zijn o.a.:

- NPR 8020-50 Evenementen – Podiumconstructies – Verantwoordelijkheden
- NPR 8020-51 Evenementen – Podiumconstructies – Belastingen en constructieve uitgangspunten
- NEN-EN 13814 Machines en constructies op kermisterreinen en amusementsparken – Veiligheid
- NEN-EN 1990 Grondslagen van het constructief ontwerp
- NEN-EN 1991 Belastingen op constructies
- NEN-EN 1993 Staalconstructies

Bovenstaande normen- en richtlijnen refereren o.a. aan de Eurocodes NEN-EN 1991-1-4/NB;

Deel 1: Belastingen op constructies

Deel 1-4: Algemene belastingen – Windbelasting.

Een tijdelijk geplaatst overdekt podium is in beginsel geen bouwwerk in de zin van het bouwbesluit. Hieruit voortvloeiende kan er daarom niet automatisch naar het bouwbesluit of andere zaken worden gekeken als het gaat om beoordeling van een tijdelijk geplaatst overdekt podium. Hier moeten dus ook de eerder genoemde normen- en richtlijnen naast gehouden worden.

Keuringsrapporten voor zeil, bijvoorbeeld bepaald volgens B1 of M1, zijn doorgaans voorzien van een geldigheidsdatum. Deze datum heeft alleen betrekking op het productieproces van het zeil en niet op het product. Het zegt niets over het (brand)verloop van de kwaliteit van het materiaal. Zeil dat voldoet aan de gestelde eisen blijft zelfdovend. Dit gegeven is mede onderschreven door het LNB, cluster brandveilig gebruik.

Overdekte podia zijn onder te verdelen in:

- (gedeeltelijk) met zijwanden van harde panelen of zeil
- zonder zijwanden
- voorzien van meer bouwlagen

Het gebruik van dit podium-boek is slechts voorbehouden aan Eekels Verhuur B.V..

Hallenstraat 20

P.O. Box 175

5530 AB Bladel

T: +31 0 73 6136867

E: info@eekelsverhuur.nl

I: www.eekelsverhuur.nl

NOODNUMMER: +31 0 467 870 112

1. Algemene informatie

In dit hoofdstuk worden alle gegevens van de fabrikant en algemene gegevens overdekte podia indien deze buiten Europa is geproduceerd, tevens naam van importeur.

1.1 Algemene gegevens fabrikant(en);

Zeil	POLYMAR – FR COLOR 700
Constructie	Prolyte H30D – H40V – H30V – S36R
Type zeil	PVC; artikel 8509 5240

1.2 Algemene gegevens;

Naam	MPT-L
Type	MPT-roof 12x10
Configuratie(s)	13,5x11,4 meter

2 Gegevens verhuurder of leverancier

Hieronder wordt alle huidige en relevante informatie weergegeven van de verhuurder/leverancier.

Rechtsvorm	Besloten Vennootschap
Handelsnaam	Eekels Verhuur B.V.
Bezoekadres	Hallenstraat 20 5531 AB BLADEL
Postadres	P.O. Box 175 5530 AD BLADEL
Telefoonnummer	0031 73 6136867
Website	www.eekelsverhuur.nl
Mailadres	info@eekelsverhuur.nl
K.v.K. nummer	84151722
Omzetbelasting nummer	NL863114192B01
Bank	Rabobank de Kempen
IBAN Rekening nummer	NL43RABO0374476608
BIC	RABONL2U

3 Algemene technische gegevens van de overdekte podia

Waar dient de huurder ten alle tijden rekening mee te houden bij de ingebruikname van het overdekte podium.

3.1 Algemeen

- Geen sneeuw- en/of hagelbelasting gerekend
- Podiumvloer is geschikt voor een belasting tot 750 kg/m²
- Obstakels moeten ten minste 0,5 meter van het doek verwijderd zijn (zowel binnen als buiten).

3.2 Bijzonderheden

Voor de berekeningen is aangehouden:

- Onbebouwde omgeving;
- Tekeningen volgens het bouwboek;
- Toetsing volgens NEN-EN 13814;
- Afmeting van de constructie: 13x11 meer

4 Basis instandhouding- en ontruimingsprotocol

Er zijn zaken welke in basis ten alle tijden van toepassing zijn bij een overdekt podium.

- De constructie van de overdekte podia mogen na oplevering nooit zo worden aangetast dat de constructieve veiligheid in het geding komt.
- Organisator moet grondankers, ballast, windverbanden, spanbanden, palen, wandpanelen, zeilen of andere zaken na losmaken voor welk doel dan ook direct weer terugplaatsen/vastmaken.
- Bij het verlaten van het terrein en/of afsluiten van dagelijkse werkzaamheden en/of na afloop van het evenement moet organisator waar mogelijk de toegang tot het overdekte podia sluiten of niet toegankelijk maken.
- Het overdekte podia moet(en) te allen tijde door organisator sneeuw- en of hagelvrij gehouden worden.
- Cumulatie van water, z.g. waterzakken, moeten door organisator direct verwijderd worden, indien dit niet lukt moet verhuurder meteen verwittigd worden.
- Eventuele loskomende grondverankering of verschuivende ballast moet door organisator direct gemeld worden aan verhuurder.
- Voor opgave gemiddelde wind in Bft. en windstoten. (piekwind) in relatie tot de grenswaarden, het sluiten of buiten gebruik stellen van het overdekte podium zie windtabel(len) elders in dit stuk. Daarbij dienen de beheersmaatregelen uit bijlage 4 in acht genomen te worden.
- Equipotentiaalverbinding. Al het blootliggende metaalwerk binnen een structuur dat in contact zou kunnen komen met een bron van elektrische stroom moet op adequate wijze geaard zijn. Er moet rekening worden gehouden met de mate van blootstelling en het risico op blikseminslag en, waar van toepassing, moet de constructie voldoende worden beschermd. Advies over verlichtingsniveaus voor normaal en noodgebruik valt buiten het toepassingsgebied van deze norm en is elders beschikbaar.
- Blikseminslag in de constructie die voldoet aan gestelde (brandveiligheidseisen levert geen schade op aan de overdekte podia).
- Bij acute dreiging van zwaar onweer gepaard gaande met z.g. valwind en/of hagel moet het overdekte podium en directe omgeving ontruimd-, en indien mogelijk gesloten worden. Het overdekte podium is hierin van ondergeschikt belang.
- Organisator moet het lokale weer tijdens het evenement adequaat bewaken en actie ondernemen waar eigen organisatieprotocollen of overdekte podiumspecificaties dit aangeven.

5 Verklaring weeromstandigheden

Met welke weersomstandigheden dient de huurder rekening te houden.

- Een constructie wordt berekend op een stuwdruk (de windbelasting per m²). De stuwdruk ontstaat door de windsnelheid. De windsnelheid is opgebouwd uit een stationair deel en een turbulent deel. Hierdoor ontstaan er pieken in de windsnelheid.
- Windsnelheid wordt standaard gemeten op 10 meter hoogte in het vrije veld, zonder obstakels. Er kan gesproken worden over een piekwindsnelheid, een 10-minuten gemiddelde windsnelheid of een uurgemiddelde windsnelheid. Hoe langer de tijd is, hoe lager het gemiddelde.
- De in de berekeningen gehanteerde beaufort-windschaal wordt in Nederland weergegeven in een 10-minuten **gemiddelde windsnelheid** op 10 meter hoogte in het vrije veld.
- **De stuwdruk waarop een overkapping berekend is, is bepalend voor de sterkte van de overkapping. Het gaat er dus om dat op de juiste manier wordt vastgesteld welke windsnelheid moet worden aangehouden om te kunnen bepalen of de stuwdruk overschreden wordt.**
- Als er niet op locatie gemeten wordt, moet gebruik worden gemaakt van de dichtstbijzijnde meteostation en moet de 10-minuten-gemiddelde windsnelheid op 10 meter hoogte worden opgevraagd. Als de grens-10 minutengemiddelde snelheid wordt bereikt, is de grens-stuwdruk bereikt. De opgegeven waarden gelden voor onbebouwd terrein (buiten de bebouwde kom) en niet voor het strand.
- Onderscheid tussen gemiddelde- en piekwindsnelheid in acht nemen.

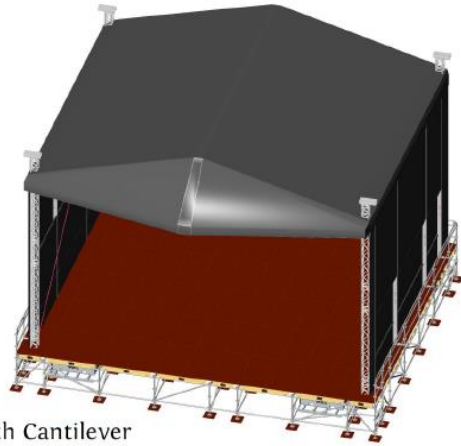
De windkracht volgens de Schaal van Beaufort (bron: KNMI). De schaal van Beaufort wordt gebruikt voor de gemiddelde windsnelheid, over minstens 10 minuten gemeten, niet voor de snelheid van rukwinden/windstoten (piekwind).

Kracht	Benaming van KNMI	Benaming in Zeevaart	Snelheid in km/h*	Snelheid in m/s*	Snelheid in knopen
0	Stil	Windstil	0-1	0-0,2	0-1
1	Zwak	Flauw en stil	1-5	0,3-1,5	1-3
2	Zwak	Flauwe koelte	6-11	1,6-3,3	4-6
3	Matig	Lichte koelte	12-19	3,4-5,4	7-10
4	Matig	Matige koelte	20-28	5,5-7,9	11-16
5	Vrij krachtig	Frisse bries	29-38	8,0-10,7	17-21
6	Vrij krachtig	Stijve bries	39-49	10,8-13,8	22-27
7	Hard	Harde wind	50-61	13,9-17,1	28-33
8	Stormachtig		62-74	17,2-20,7	34-40
9	Storm		75-88	20,8-24,4	41-47
10	Zware storm		89-102	24,5-28,4	48-55
11	Zeer zware storm / orkaanachtig		103-117	28,5-32,6	56-63
12	Orkaan		>117	>32,7	>63

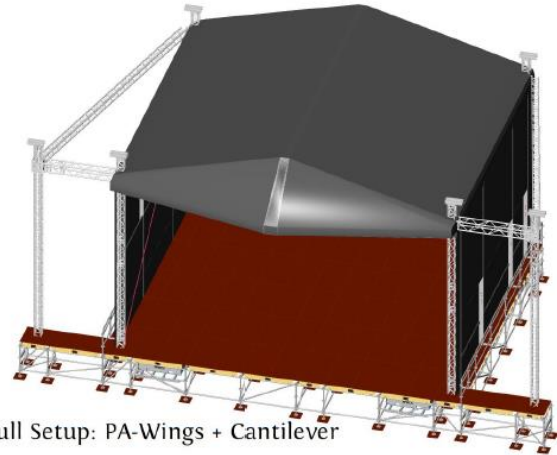
De Nederlandse weerstations onder andere vinden op: www.meteovista.nl, www.knmi.nl, www.meteoconsult.nl en www.meteostation.nl.

Organisator kan ook bij onder andere Meteovista en Meteoconsult gedurende de duur van het evenement een weerbewakingscontract aangaan om nog beter op de hoogte te zijn van de lokale weersomstandigheden.

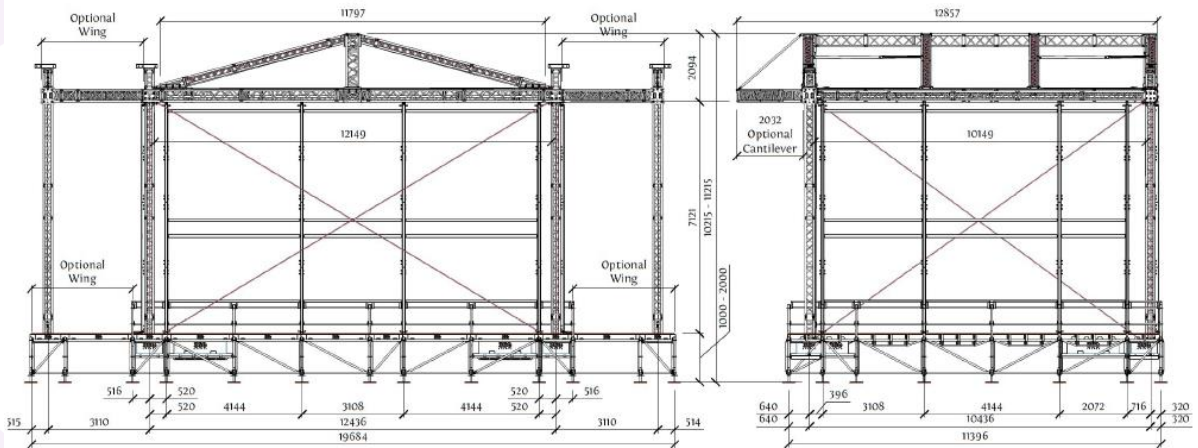
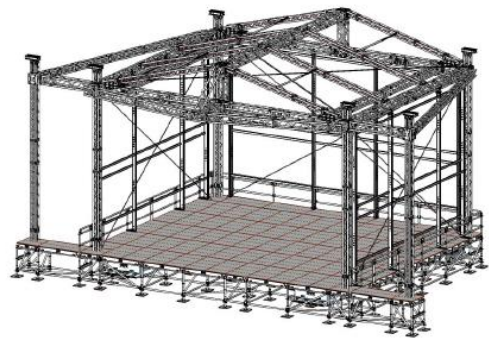
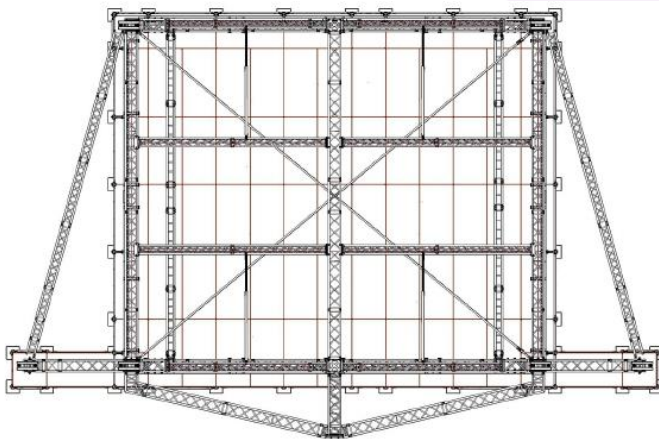
6 Bijlage I: Tekening(en)



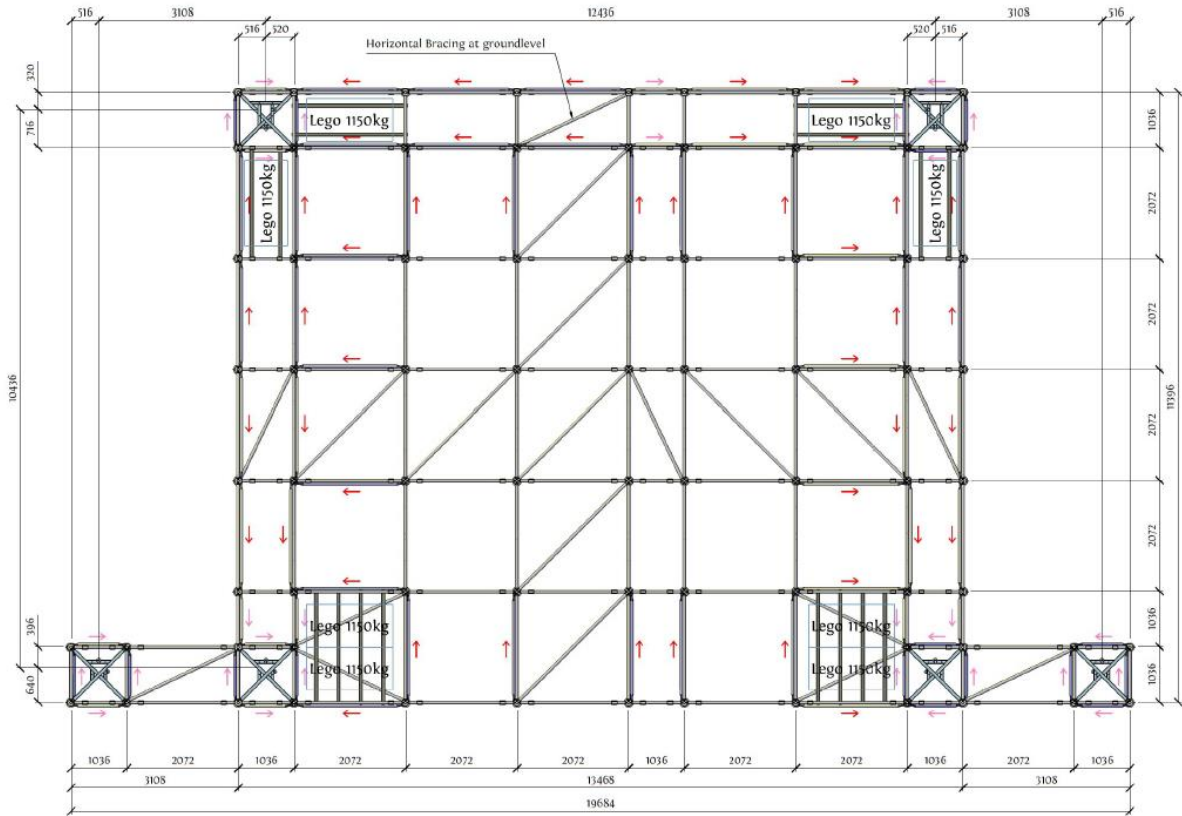
Setup with Cantilever



Full Setup: PA-Wings + Cantilever



7 Bijlage II: Ballastplan

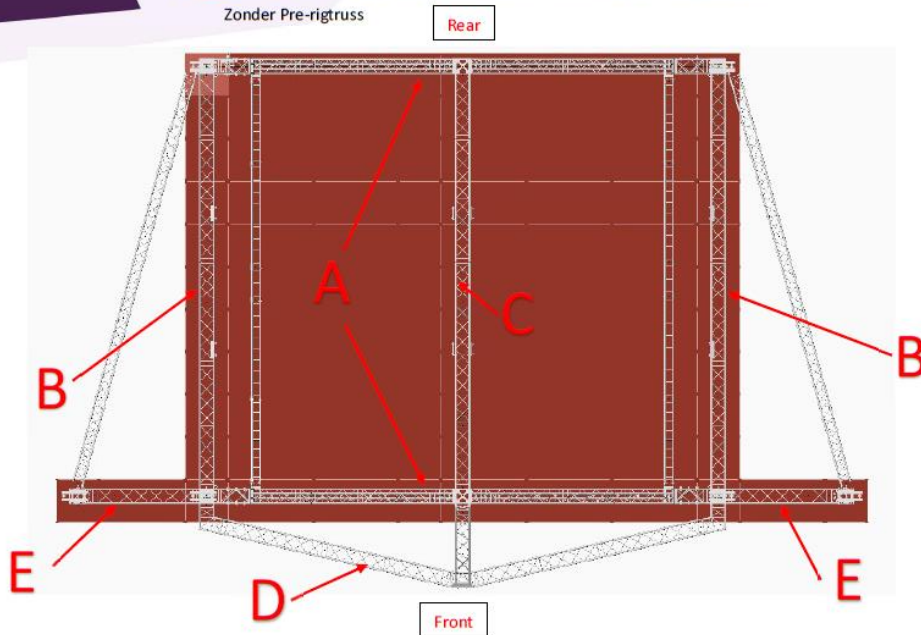


8 Bijlage III: Riggingscapaciteit



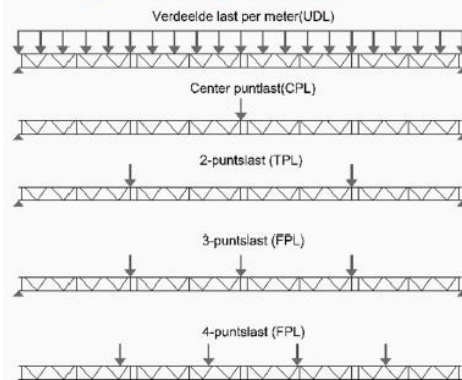
Riggingscapaciteit MPT met Luifel

Zonder Pre-rigtruss



Naam	Waarde	Maximale Gebruiksbelasting per punt				
		A(Front/Back)	B (Side)	C (Ridge)	D(luifel)	E (Wing)
1. Verdeelde last per meter (UDL)	kg/m	100	100	100	25	-
2. Center puntlast (CPL)	kg	700	600	600	200	1000
3. 2-puntslast (TPL)	kg	500	400	400	150	500
4. 3-puntslast(FPL)	kg	300	300	300	100	-
5. 4-puntslast (Zie Figuur 2)	kg	250	250	250	75	-

Let op: Bij Dynamische lasten dient een extra veiligheidsfactor gehanteerd te worden in overleg met constructeur Eekels verhuur!



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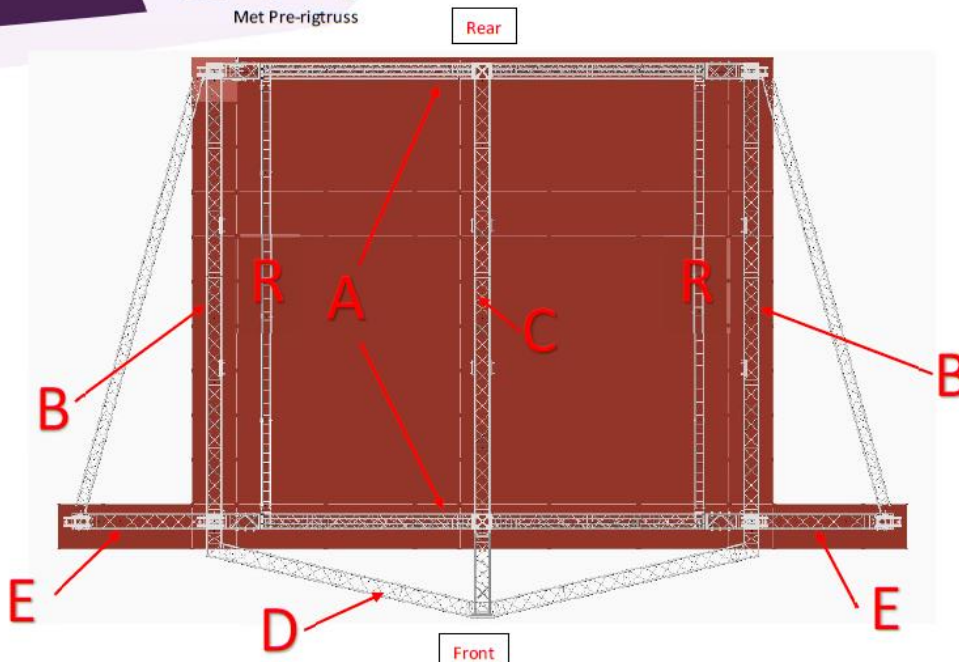


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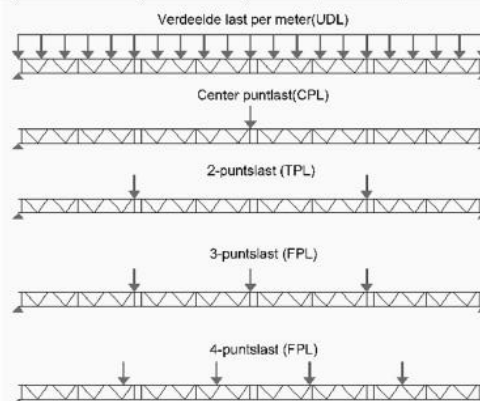
Riggingcapaciteit MPT met Luifel

Met Pre-rigtruss



Naam	Waarde	Maximale Gebruiksbelasting per punt					
		A(Front/Back)	B (Side)	C (Ridge)	D(luifel)	E(Wing)	R(pre-rig)
1. Verdeelde last per meter (UDL)	kg/m	0	100	100	25	-	200
2. Center puntlast (CPL)	kg	0	600	600	200	1000	900
3. 2-puntslast (TPL)	kg	0	400	400	150	500	600
4. 3-puntslast(FPL)	kg	0	300	300	100	-	450
5. 4-puntslast (Zie Figuur 2)	kg	0	250	250	75	-	350

Let op: Bij Dynamische lasten dient een extra veiligheidsfactor gehanteerd te worden in overleg met constructeur Eekels verhuur!



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9 Bijlage IV: Beheersmaatregelen (WMP; Wind Management Plan)

In dit Beheersplan wordt kort omschreven welke stappen bij welke windsnelheid gezet dienen te worden. De waarde waarbij deze stappen gezet dienen te worden verschillen per windgebied.

Hieronder een opsomming van de 10-minuten gemiddelde windsnelheid per locatie (omschreven in de NEN-EN 1991-1-4:2005)

In de bovenstaande hoofdstukken is uitgelegd hoe de berekening is opgebouwd. Conform de Geldende normen dient dan het onderstaande Beheersingsplan toegepast te worden.

1. Zij- en achterzeilen dienen verwijderd te zijn bij het bereiken van onderstaande waarde;

Gebied	10 minuten gemiddelde windsnelheid (m/s)	Beaufort (Bft)	Piekwindsnelheid (m/s)	Stuwdruk (kN/m ²)
Kust	11,3 m/s	6	20 m/s	0.20 kN/m ²
Onbebouwd	14,9m/s	7	20 m/s	0.20 kN/m ²
Bebouwd	15,9 m/s	7	20 m/s	0.20 kN/m ²

2. Het podium dient UIT-SERVICE (out-service) gesteld te zijn bij het bereiken van onderstaande waarde;
- Tevens dient de directe omgeving ontruimd te zijn

Gebied	10 minuten gemiddelde windsnelheid (m/s)	Beaufort (Bft)	Piekwindsnelheid (m/s)	Stuwdruk (kN/m ²)
Kust	15,9	7	31m/s	0.4375 kN/m ²
Onbebouwd	20,1	8	31m/s	0.4375 kN/m ²
Bebouwd	22,8	9	31m/s	0.4375 kN/m ²

3. Bij acute dreiging van zwaar onweer gepaard gaande met z.g. valwind en/of hagel moet de constructie en directe omgeving ontruimd-, en indien mogelijk, gesloten worden. De overkapping is hierin van ondergeschikt belang.

NOTE; de 10-minuten gemiddelde windsnelheid wordt alleen weergegeven als referentie windsnelheid. Acties omtrent de constructie dienen ondernomen te worden aan de hand van de piekwindsnelheid.

Bij vragen of twijfel over dit plan kunt u altijd contact opnemen met Eekels Verhuur B.V.

10 Bijlage V: Zeilcertificaat



Technisches Datenblatt Nr.: **1017.14**
 Produkt: **POLYMAR®** FR COLOR 700
 Artikel Nr.: **8509 5240**

Beschichtung und Ausrüstung			
Beschichtungsart	PVC		
Ausrüstung	beidseitig mit Acryllack, mikrobiozid, UV-geschützt		
Brennverhalten	BS 7837, D.M. 26.06.84 (UNI 9177): CL 2, DIN 4102: B1, NFP 92507: M2, GOST: G1, NFPA 701 Test 2, EN 13501-1: B-s2-d0		
zu Brennverhalten	stets die Aktualität der FR-Zulassung, sowie länderspezifische Gültigkeit prüfen		
Gesamtgewicht	680 g/m ²	DIN EN ISO 2286-2	
Reißkraft Kette/Schuss	3000 / 3000 N/50 mm	DIN EN ISO 1421/V1	
Weiterreißfestigkeit Kette/Schuss	300 / 300 N	DIN 53363	
Hafffestigkeit	20 N/cm	PA 09.03 (item)	
Kältebeständigkeit.	-40 °C	DIN EN 1876-1	
Wärmebeständigkeit	+70 °C	PA 07.04 (item)	
Lichtechtheit	>6 Note, Value	DIN EN ISO 105 B02	
Knickfestigkeit	keine Risse	100000 x	DIN 53359 A
Trägergewebe			
Material	PES	DIN EN ISO 2076	
Fadenstärke	1100 dtex	DIN EN ISO 2060	
Bindung	L 1/1	ISO 3572	

Bei den technischen Daten handelt es sich um ca. Werte, die auf Basis von ermittelten Durchschnittswerten erstellt wurden. Aus fertigungstechnischen Gründen sind Abweichungen bis zu -5% möglich. Diese technischen Angaben entsprechen dem heutigen Stand der Kenntnisse und sollen über unsere Produkte ohne Rechtsverbindlichkeit informieren. Diese Daten gelten für neue Ware. Einsatzvorschläge entbinden den Käufer nicht, selbst zu prüfen, ob das Material für den von ihm gewünschten Einsatz geeignet ist.

11 Bijlage VI: Berekening


STRUCTURAL ANALYSIS

PROJECT-NO.:	22012
PROJECT:	STAGEROOF MPT-ROOF 12x10m
CUSTOMER:	

PREPARED:  DIPL.-ING. OLIVER SPORYS	DATE/DATUM: 15.03.2022 PAGES/SEITEN: 1 – 199
THE STRUCTURAL ANALYSIS IS ONLY PREPARED FOR THE AFOREMENTIONED CUSTOMER. IF THIS CALCULATION SHOULD BE PASSED TO A THIRD PARTY A PERMISSION OF THE ORIGINATOR IS NEEDED. ANY PUBLICATION OF THIS REPORT IS NOT ALLOWED.	

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PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

1 PREAMBLE

1.1 APPLICABLE STANDARDS

DIN EN 1990 / Eurocode 0
Grundlagen der Tragwerkplanung
Basis of structural design

DIN EN 1991 / Eurocode 1
Einwirkungen auf Tragwerke
Actions on structures

DIN EN 1992 / Eurocode 2
Bemessung und Konstruktion von Stahlbeton und Spannbetontragwerken
Design of concrete structures

DIN EN 1993 / Eurocode 3
Bemessung und Konstruktion von Stahlbauten
Design of steel structures

DIN EN 1993 / Eurocode 5
Bemessung und Konstruktion von Holzbauten
Design of timber structures

DIN EN 1997 / Eurocode 7
Entwurf, Berechnung und Bemessung in der Geotechnik
Geotechnical design

DIN EN 1999 / Eurocode 9
Bemessung und Konstruktion von Aluminiumtragwerken
Design of aluminium structures

DIN EN 13782
Fliegende Bauten – Zelte - Sicherheit
Temporary structures – Tents - Safety

DIN EN 13814
Fliegende Bauten und Anlagen für Veranstaltungsplätze und Vergnügungsparks
Fairground and amusement park machinery and structures - safety

DIN EN 12385-4
Drahtseile aus Stahldraht/ Steel wire ropes

Or equivalent national versions of the aforementioned standards.
(e.g. NEN EN 1990)

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

1.2 SUPPORTING DOCUMENTS

Technical data of the used truss systems

Separate structural reports have been made by the Engineering office Krasenbrink+ Bastians for determining permissibly loads and resisting internal forces of Prolyte truss systems.

Technical data of the used scaffolding system Layher-Allround. (K2000+ or LW)

1.3 CONSTRUCTION ELEMENTS

Roof girders:	Prolyte H30D Alloy: EN AW-6082 T6 (AlMgSi1 F31)
Main girders:	Prolyte H40V Alloy: EN AW-6082 T6 (AlMgSi1 F31)
Columns:	Prolyte H30V Alloy: EN AW-6082 T6 (AlMgSi1 F31)
Rigging truss:	Prolyte S36R Alloy: EN AW-6082 T6 (AlMgSi1 F31)
Compression members:	Tube 48 x 3 Alloy: EN AW-6082 T6 (AlMgSi1 F31)
Keder:	170x88x3 Alloy: EN AW-6082 T6 (AlMgSi1 F31)
Podium:	LAYHER Allround scaffolding system (K2000+ or LW) Steel: S235 JR(H)
Guy wires:	Ø8 / 10mm, e.g. wire class 6 x 7, 1770 N/mm ² with steel inlay

The specifications of the steel cables are only examples. Equal constructions are possible.

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

1.4 GENERAL PRELIMINARY REMARKS

This structural analysis covers a stage roof structure for 360 Events. The roof will be assembled in the size of 13,50 x 11,40 m and it is built on a podium of Layher Allround scaffolding system. Including a 1,0m podium the total height of the stage is max. 10,50 m. Including a 2m podium the total height of the stage is max. 11,50m

Additionally and optionally side wings with a width of 3,10m can be build next to each front side. The Layher podium will then be extended in the front.

Also additionally and optionally a cantilever roof can be attached on the front side with a depth of approx. 2,0m.

The stage roof is considered to be a temporary demountable structure and not a permanent building.

The whole structural-framework of the roof consists of aluminium trusses H40V that are made by the company Prolyte. The towers are made out of Prolyte H30V.

The roof area, rear and side walls are closed with canopies. The wall canopies are fixed in keder profiles 170x88x3 mm and are attached with special adapters to the trusses.

The structure is stiffened by means of guy wires in roof, rear wall and side walls. Guy wires need to be adequately tensioned before use.

The roof is always build up with ballast loads. (see chapt. 1.9)

Optionally an additional rigging truss (S36R) can be mounted. For that case special load setups are given in chapter 1.8.

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
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1.5 TERMS OF USE

WIND MANAGEMENT

LOAD CASE " IN SERVICE"

The construction is calculated to withstand peak gust wind speed up to **20 m/s**. Above peak gust wind speed of 20 m/s measured in a height of 10m the rear and side wall canopies must be removed from the structure as well as the PA-load in the optional wings. If the peak gust wind speed is measured in a height less than 10m all aforementioned canopies and PA must be removed at peak gust wind speed of **18 m/s**.

The wind speed has to be measured at the top of the structure in an unobstructed surrounding area.

LOAD CASE " OUT OF SERVICE"

The construction with removed rear and side wall canopies and PA-load is calculated according to DIN EN 13814. It is calculated with a wind pressure of 0,625 kN/m².

SNOWLOAD

Snow loads are not taken into account.

The set up of the structure shall only be made in appropriate weather conditions or the roof shall be kept free of snow (e.g. heating).

PAYLOADS

Payloads may be inserted in the construction. (see chapt. 1.8)

BALLAST

To secure the construction against overturning, sliding and lifting there has to be ballast positioned on the construction.

The necessary ballast is shown in chapter 1.9.

The ballast will be placed force-fitted on the bottom level of the Layher Podium without the usage of Layher Base Collars or it must be placed on a separate level +0,50m.

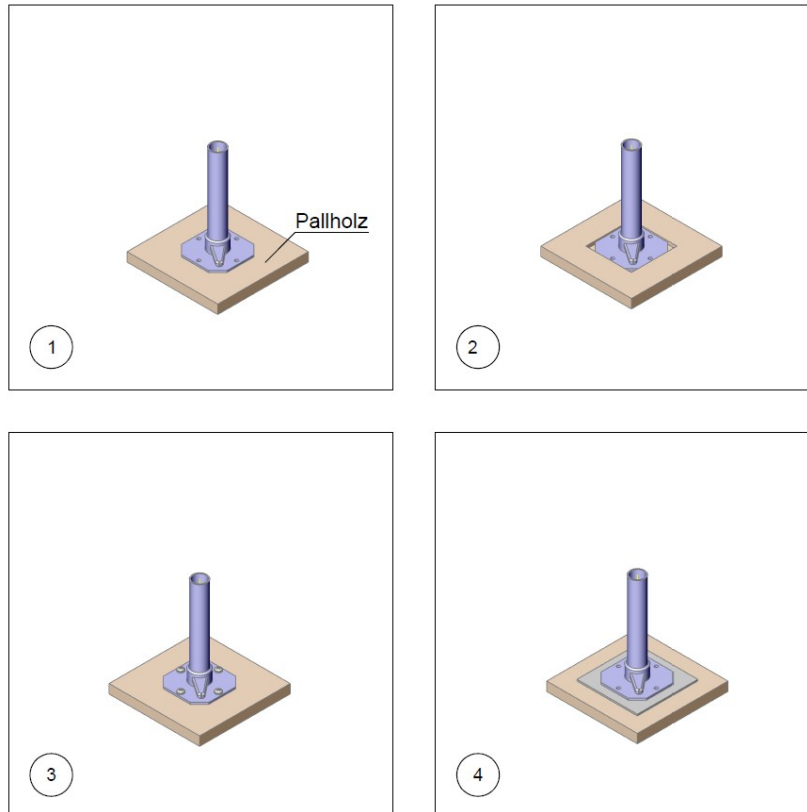
PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
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TIMBER SPREADER

drivable surface: timber spreader 400x400x30mm

In the case of softened soil there have to be chosen appropriate timber spreaders. (Proof in individual case)

Possible execution according to the required friction coefficient:




friction coefficient μ

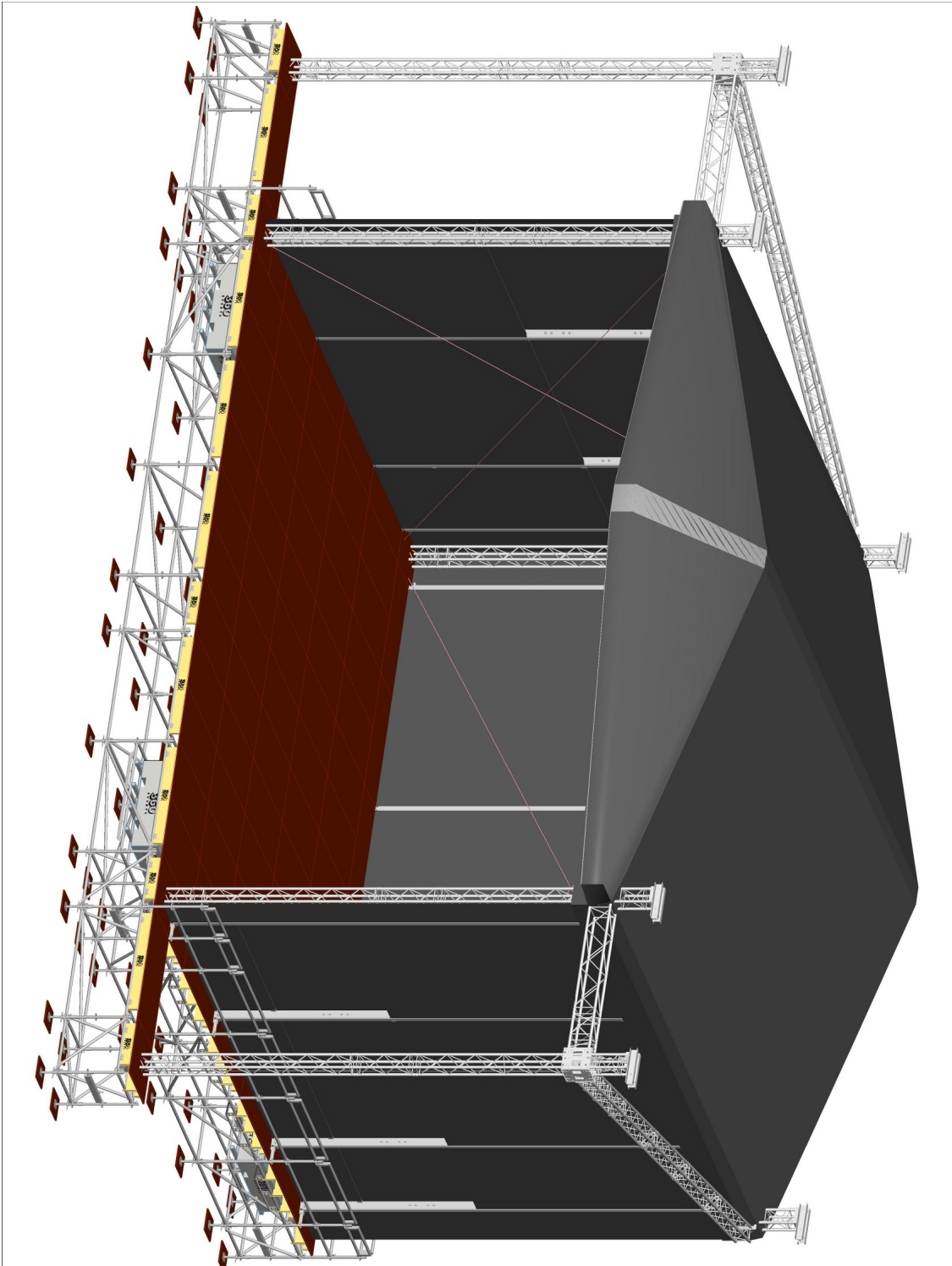
- 1: Spindle on timber spreader $\mu = 0,40$
- 2: Spindle on timber spreader, embedded $\mu = 0,60$
- 3: Spindle on timber spreader, screwed $\mu = 0,60$
- 4: Spindle on rubber mat $\mu = 0,60$

The timber spreader is laying on asphalt, concrete, paving, sand, gravel

Attention: if there is one timber spreader mounted on one another, they have to be screwed when a friction coefficient of 0,6 is required.

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
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1.6 DRAWINGS

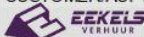


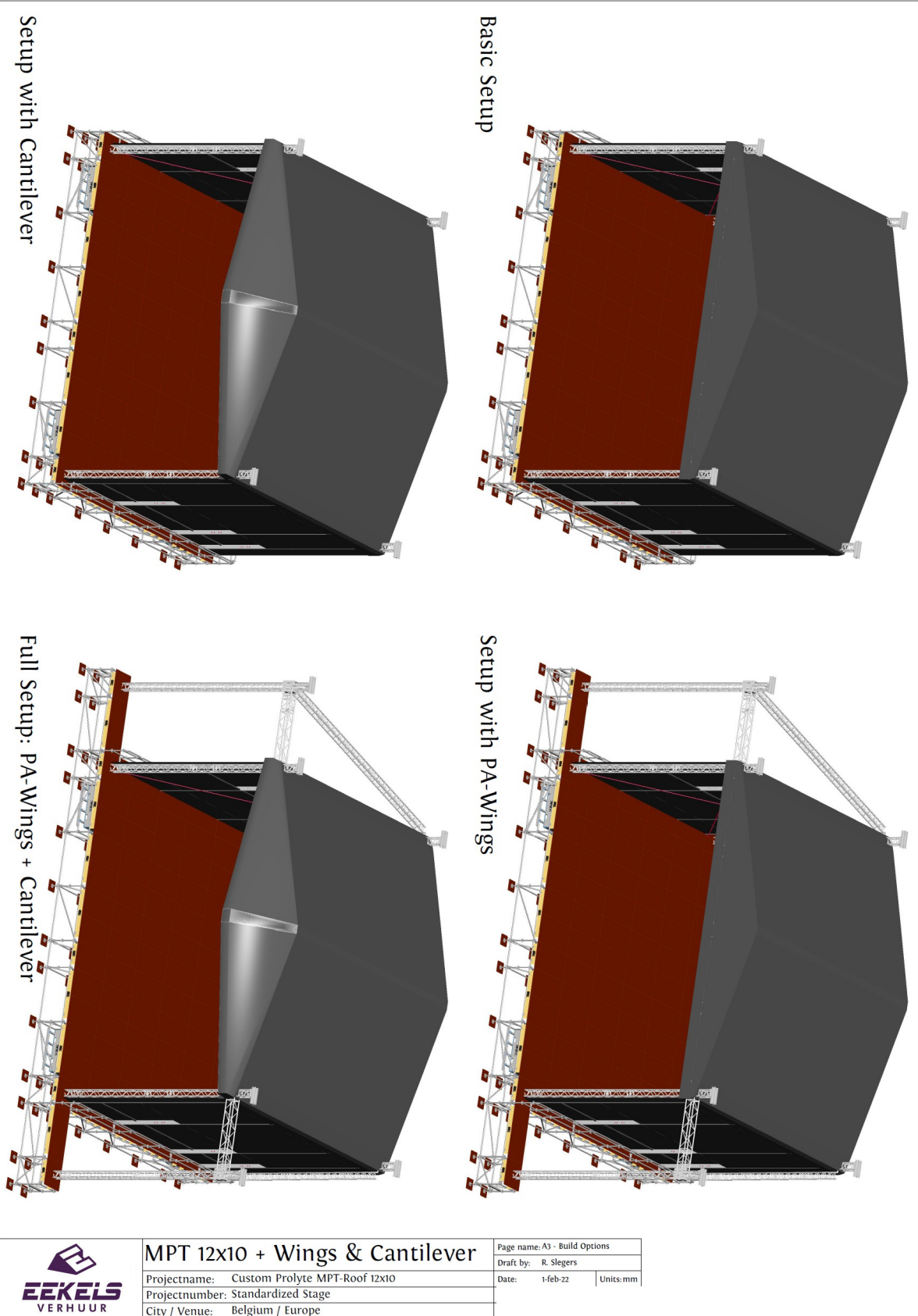
MPT 12x10 + Wings & Cantilever


Projectname: Custom Prolyte MPT-Roof 12x10
 Projectnumber: Standardized Stage
 City / Venue: Belgium / Europe

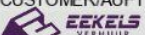
Page name: A3 - 3D View	
Draft by: R. Slegers	
Date: 1-feb-22	Units: mm

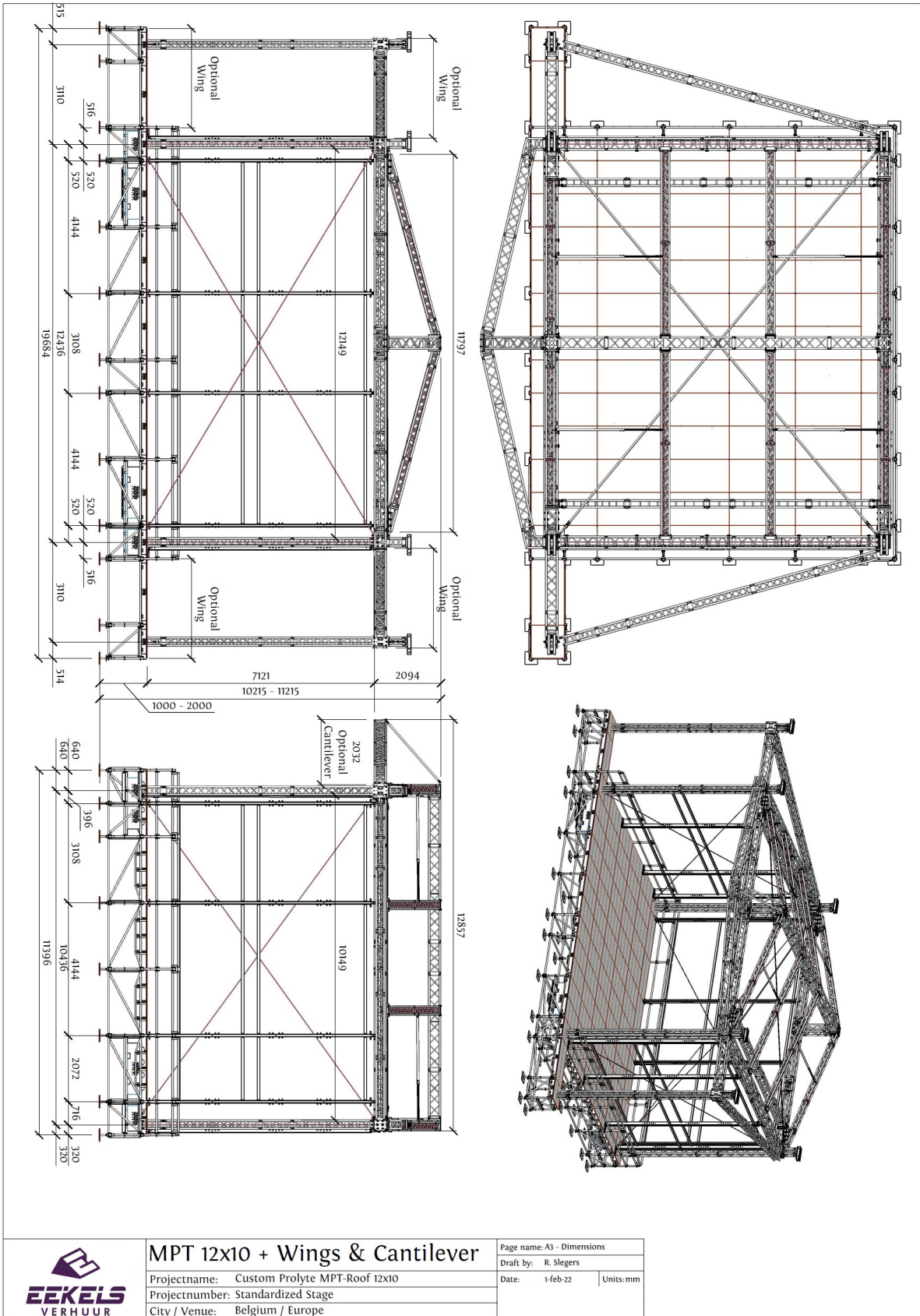
Drawn here with a 1m-Podium


PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022



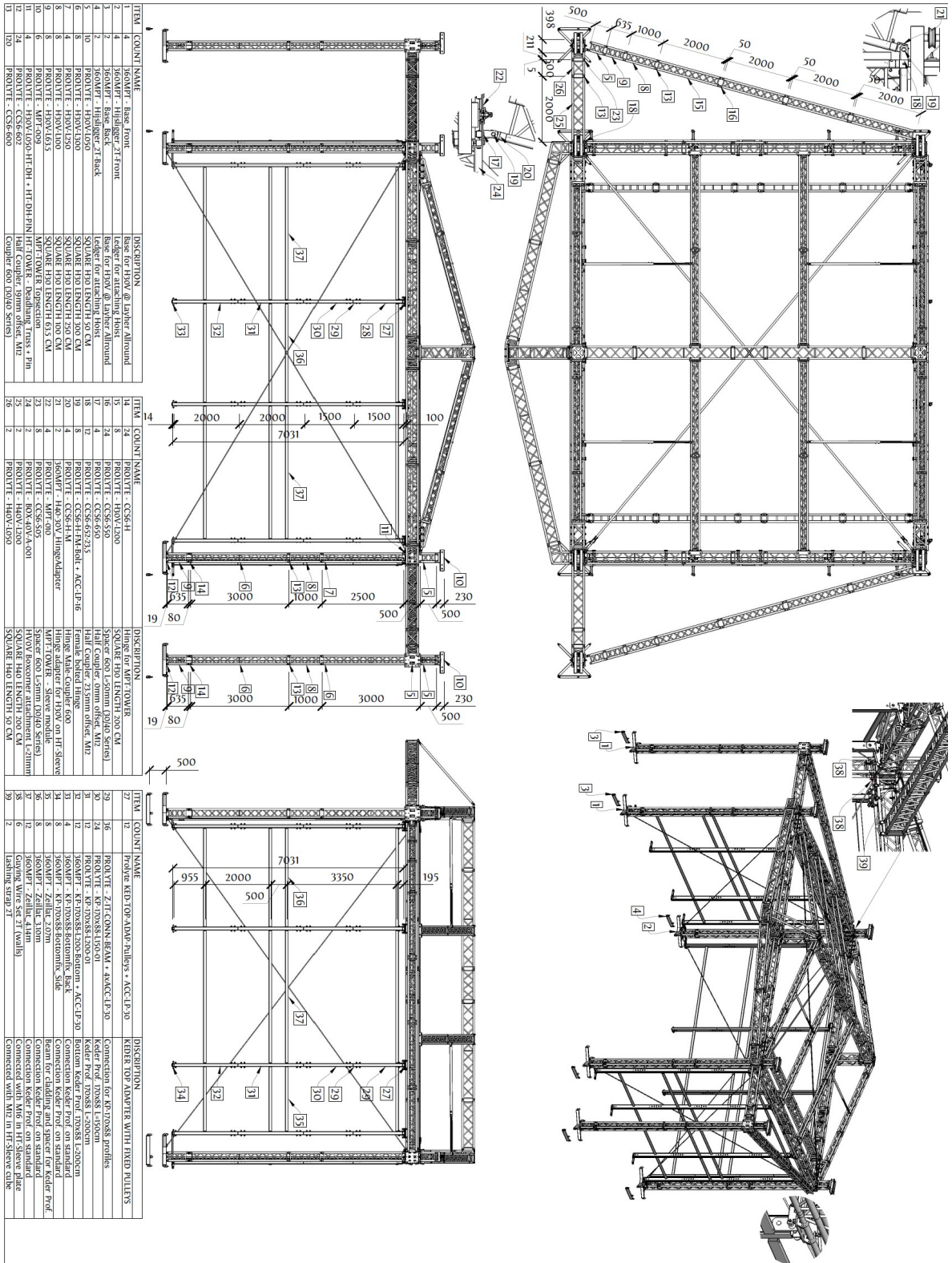
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	Projectname: Custom Prolyte MPT-Roof 12x10		Draft by: R. Slegers		
	Projectnumber: Standardized Stage		Date: 1-feb-22	Units: mm	
	City / Venue: Belgium / Europe				

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022



	MPT 12x10 + Wings & Cantilever		Page name: A3 - Dimensions		
	Projectname: Custom Prolite MPT-Roof 12x10		Draft by: R. Slegers		
	Projectnumber: Standardized Stage		Date: 1-feb-22	Units: mm	
	City / Venue: Belgium / Europe				

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022



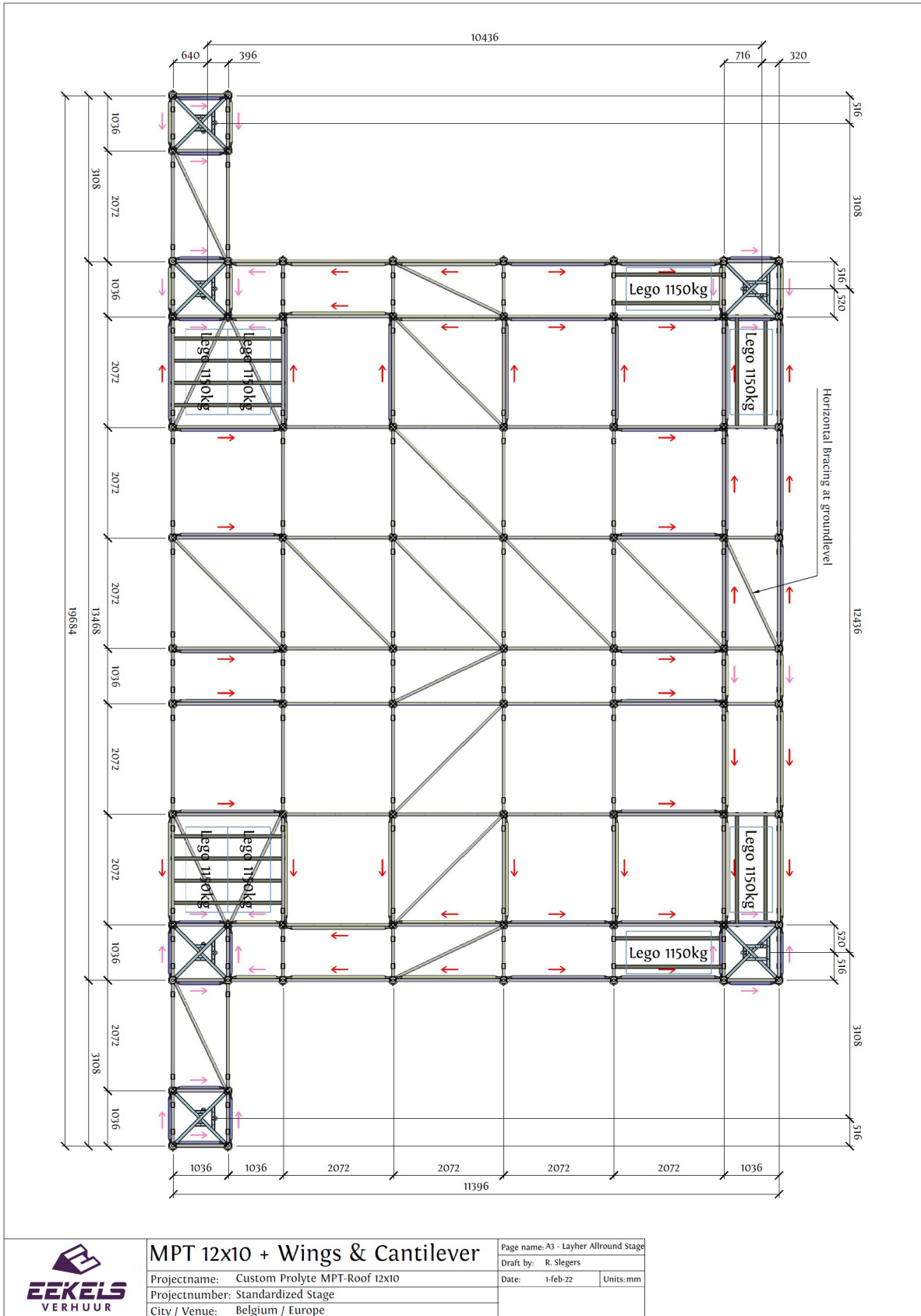
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1	1	PROLYTE - Base Front	LEADER FOR ATTACHING HOSE
2	4	PROLYTE - Base Back	LEADER FOR ATTACHING HOSE
3	2	PROLYTE - Base Back	Base for HVOV on Hanger Aligned
4	2	PROLYTE - HSHSinger 21 Back	LEADER FOR ATTACHING HOSE
5	20	PROLYTE - HVOV L200	SQUARE H90 LENGTH 200 CM
6	8	PROLYTE - HVOV L250	SQUARE H90 LENGTH 250 CM
7	8	PROLYTE - HVOV L300	SQUARE H90 LENGTH 300 CM
8	8	PROLYTE - HVOV L350	SQUARE H90 LENGTH 350 CM
9	8	PROLYTE - HVOV L400	SQUARE H90 LENGTH 400 CM
10	8	PROLYTE - HVOV L450	SQUARE H90 LENGTH 450 CM
11	4	PROLYTE - HVOV L500	SQUARE H90 LENGTH 500 CM
12	4	PROLYTE - HVOV L550	SQUARE H90 LENGTH 550 CM
13	24	PROLYTE - CCS6-600	Half Coupler - 90mm offset M12 (Coupler 600 (90/40 Series))


ITEM	COUNT	NAME	DESCRIPTION
14	8	PROLYTE - HVOV L200	SQUARE H90 LENGTH 200 CM
15	8	PROLYTE - HVOV L250	SQUARE H90 LENGTH 250 CM
16	24	PROLYTE - CCS6-600	Spacer 600 L-90mm (90/40 Series)
17	4	PROLYTE - CCS6-600	Half Coupler - 90mm offset M12
18	8	PROLYTE - CCS6-600	Female Bolted L-90mm offset M12
19	8	PROLYTE - CCS6-600	Female Bolted L-90mm offset M12
20	4	PROLYTE - CCS6-600	Half Coupler - 90mm offset M12
21	2	PROLYTE - HVOV L200	Hinge Adapter for HVOV on HT Slieve
22	2	PROLYTE - HVOV L200	Hinge Adapter for HVOV on HT Slieve
23	2	PROLYTE - HVOV L200	Hinge Adapter for HVOV on HT Slieve
24	2	PROLYTE - HVOV L200	Hinge Adapter for HVOV on HT Slieve
25	2	PROLYTE - HVOV L200	Hinge Adapter for HVOV on HT Slieve
26	2	PROLYTE - HVOV L200	SQUARE H90 LENGTH 200 CM

ITEM	COUNT	NAME	DESCRIPTION
27	16	PROLYTE - HVOV L200	SQUARE H90 LENGTH 200 CM
28	16	PROLYTE - HVOV L250	SQUARE H90 LENGTH 250 CM
29	56	PROLYTE - Z-FIT-CONN-BEAM - AKCC-CL-30	KEPER FOR TRUSS L-150x50
30	24	PROLYTE - KP-TRUSS-150x50	KEPER FOR TRUSS L-150x50
31	12	PROLYTE - KP-TRUSS-150x50	KEPER FOR TRUSS L-150x50
32	12	PROLYTE - KP-TRUSS-150x50	KEPER FOR TRUSS L-150x50
33	4	PROLYTE - KP-TRUSS-150x50	KEPER FOR TRUSS L-150x50
34	8	PROLYTE - KP-TRUSS-150x50	KEPER FOR TRUSS L-150x50
35	8	PROLYTE - Z-FIT-CONN-BEAM - AKCC-CL-30	KEPER FOR TRUSS L-150x50
36	8	PROLYTE - Z-FIT-CONN-BEAM - AKCC-CL-30	KEPER FOR TRUSS L-150x50
37	12	PROLYTE - Z-FIT-CONN-BEAM - AKCC-CL-30	KEPER FOR TRUSS L-150x50
38	6	PROLYTE - Z-FIT-CONN-BEAM - AKCC-CL-30	KEPER FOR TRUSS L-150x50
39	2	PROLYTE - Z-FIT-CONN-BEAM - AKCC-CL-30	KEPER FOR TRUSS L-150x50

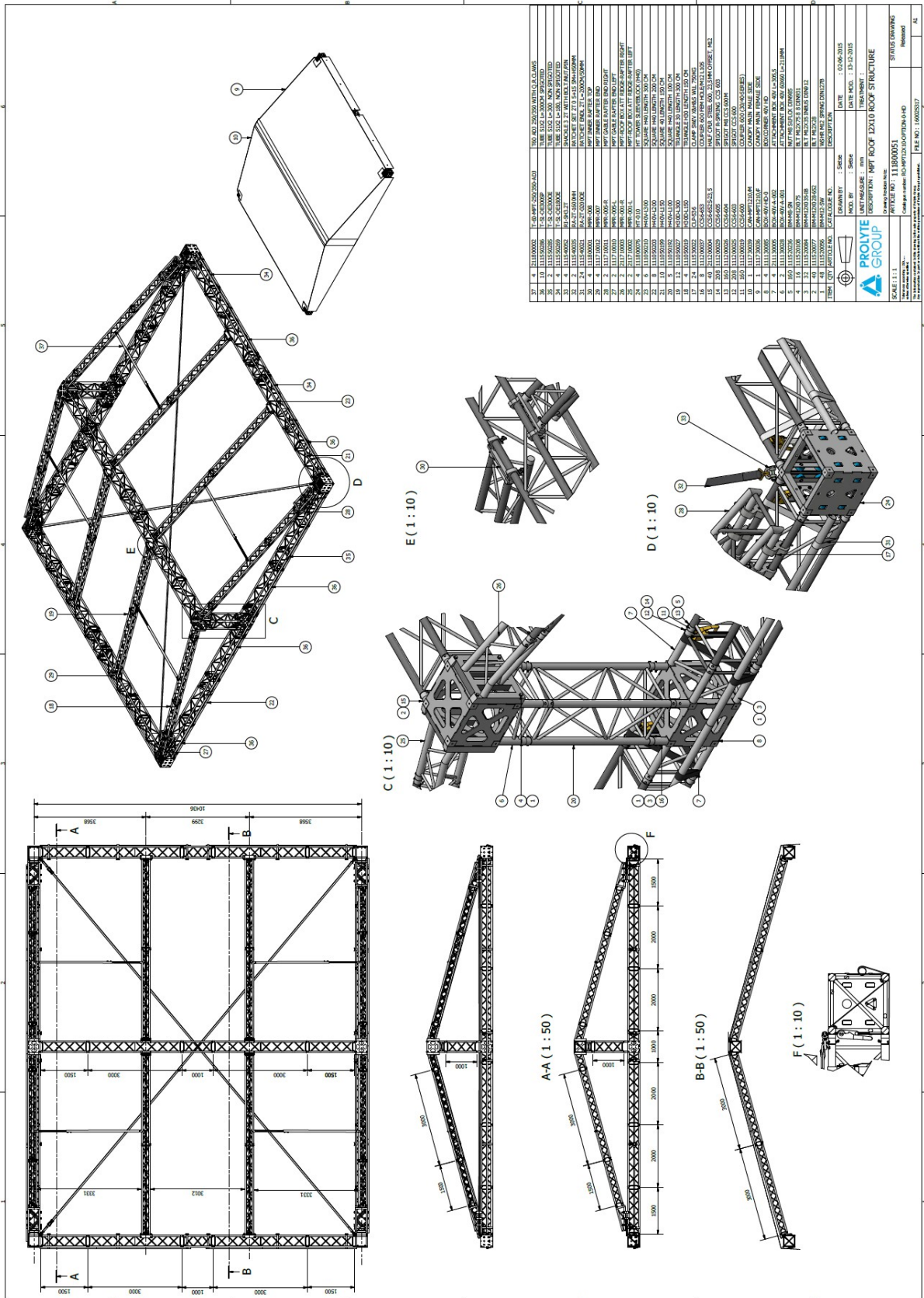
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	Projectname: Custom Prolyte MPT-Roof 12x10	Draft by: R. Slegers
	Projectnumber: Standardized Stage	Date: 11-mrt-22
	City / Venue: Belgium / Europe	Units: mm

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022



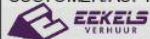
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	Projectname: Custom Prolyte MPT-Roof 12x10		Draft by: R. Slegers	
	Projectnumber: Standardized Stage		Date: 1-feb-22 Units:mm	
	City / Venue: Belgium / Europe			

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022



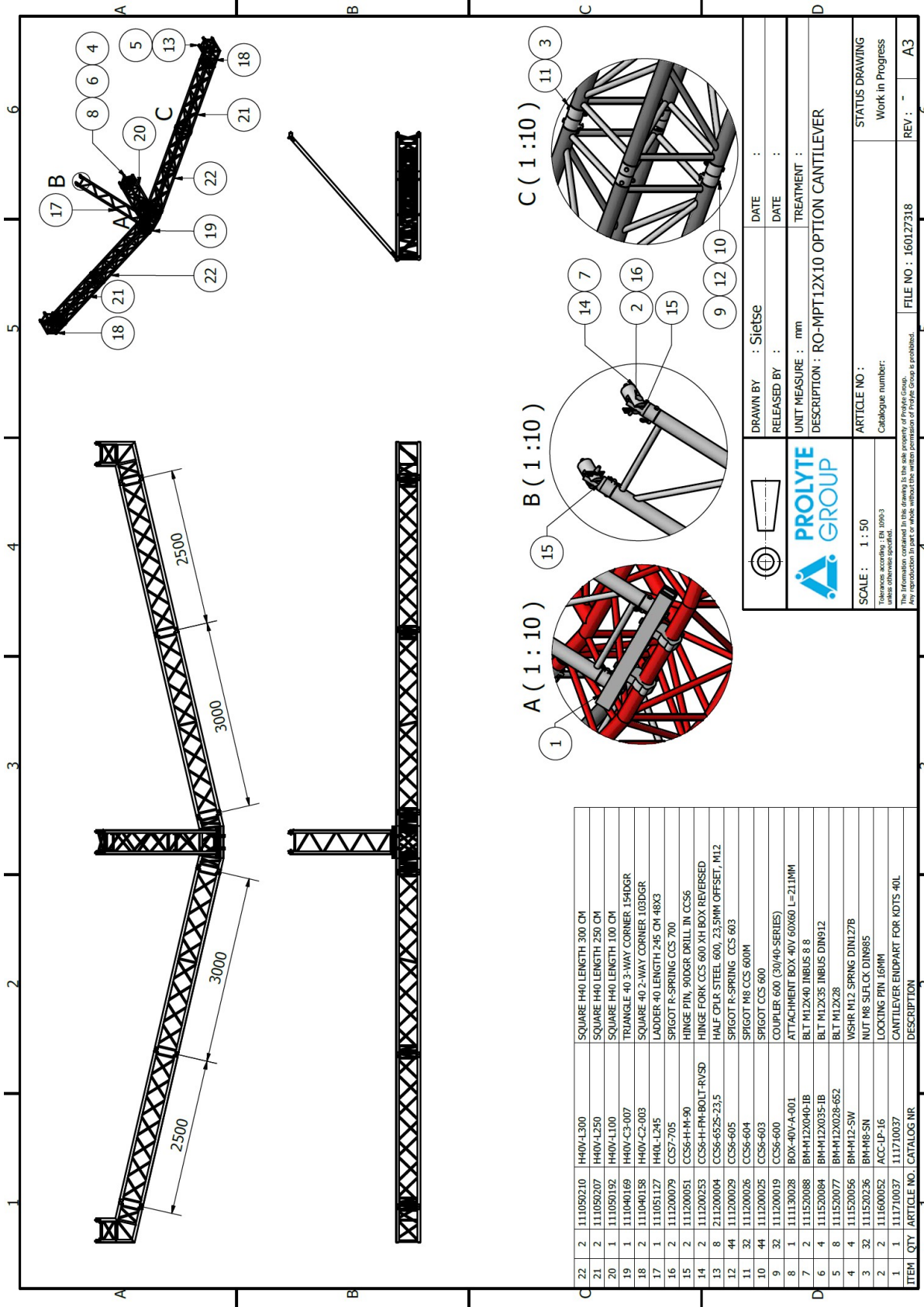
PROJECT:
MPT-ROOF 12x10m

CUSTOMER/AUFTRAGGEBER:



PROJECT-NO.:
22012

DATE/DATUM:
15.03.2022



PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

DRAWN BY : Sietse DATE :

 RELEASED BY : DATE :

 UNIT MEASURE : mm TREATMENT :

 DESCRIPTION : RO-MPT12X10 OPTION CANTILEVER

 ARTICLE NO :

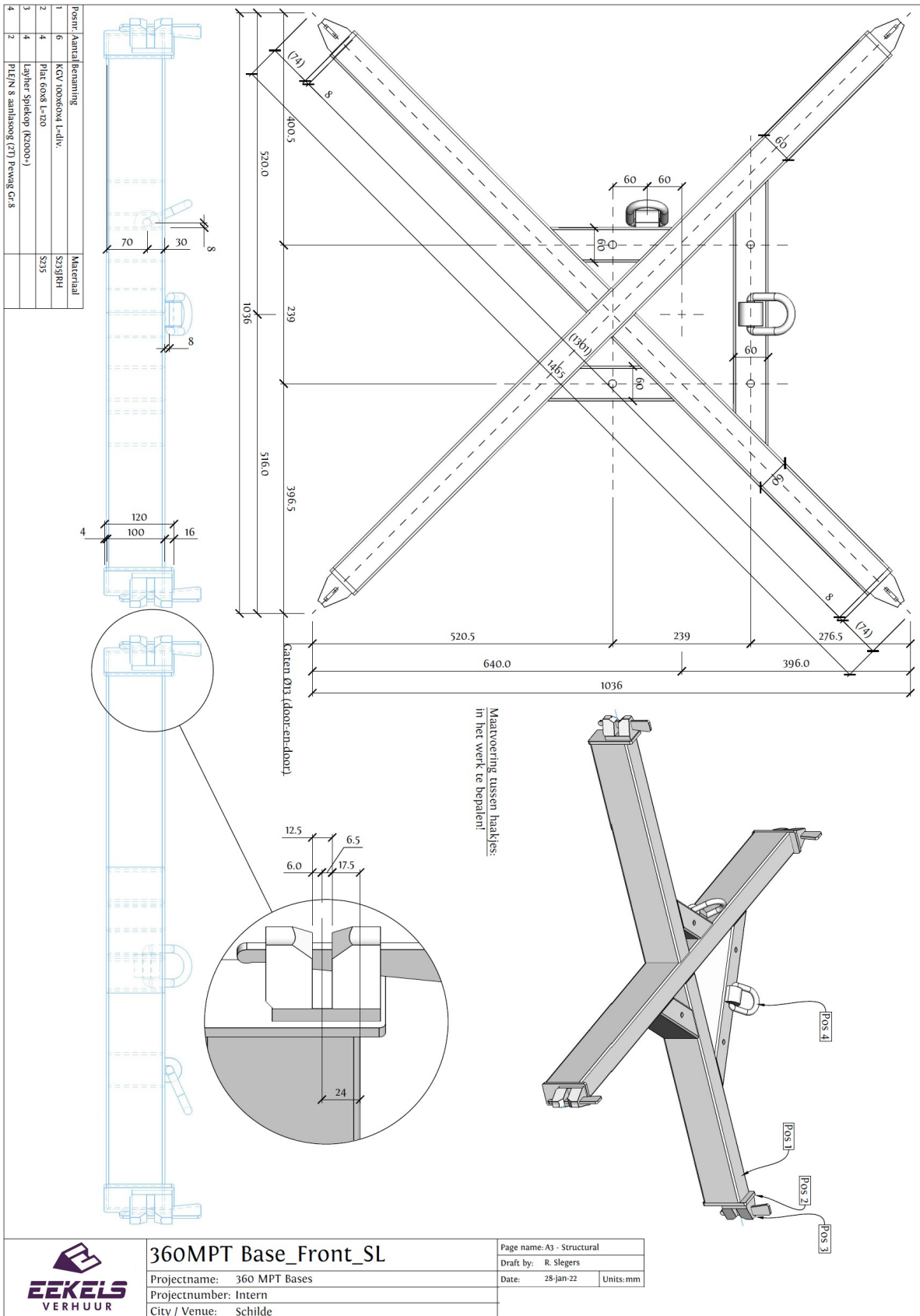
 Catalogue number:

 SCALE : 1 : 50

 STATUS DRAWING

 Work in Progress

 FILE NO : 160127318 REV : 6

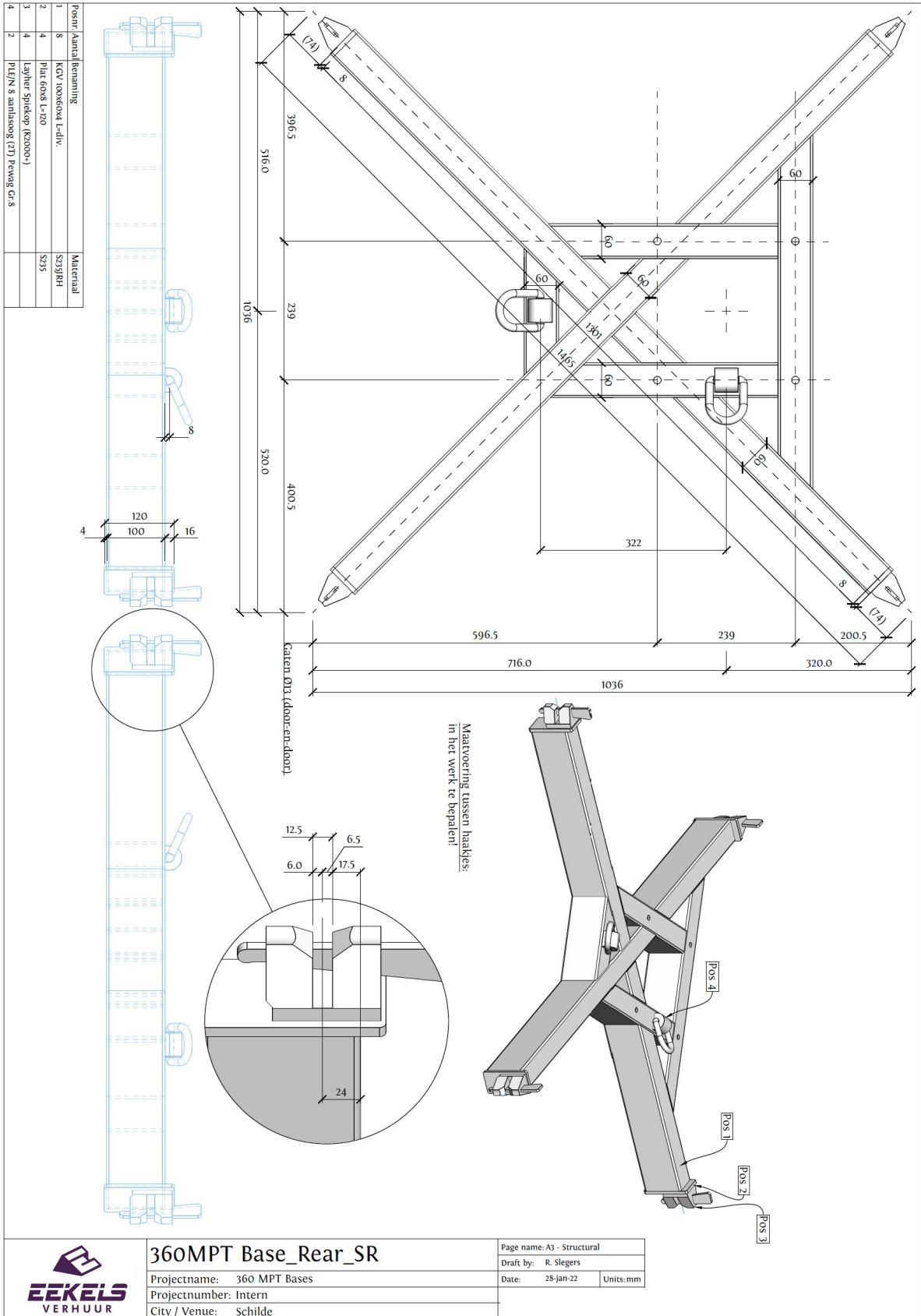



360MPT Base_Front_SL

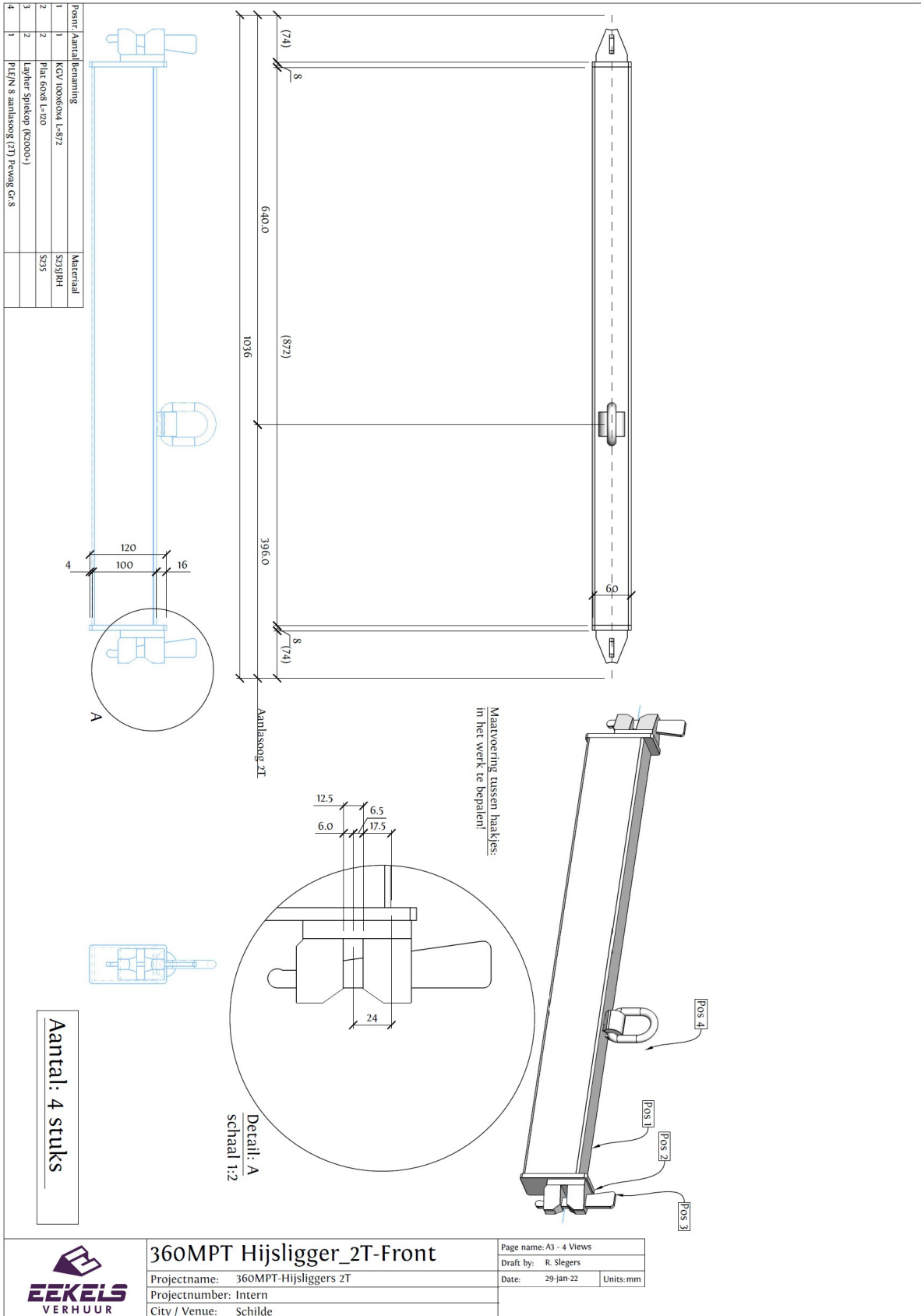
Projectname: 360 MPT Bases
 Projectnumber: Intern
 City / Venue: Schilde

Page name: A3 - Structural
 Draft by: R. Slegers
 Date: 28-jan-22 Units: mm

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

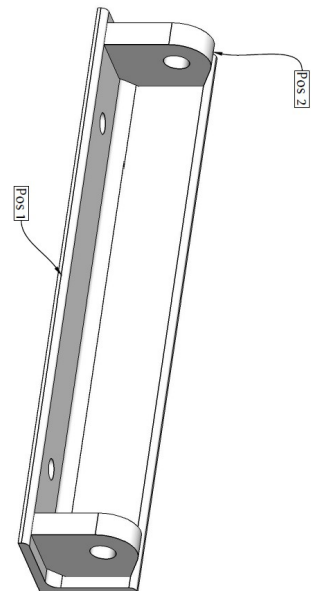
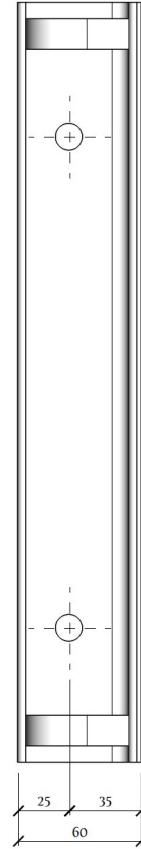
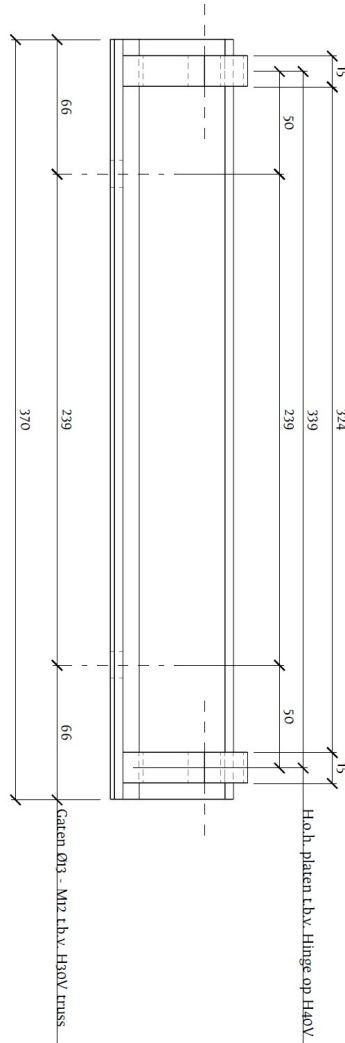


PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022



PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Posnr.	Aantal	Benaming	Material
1	1	MGW Looxoxos L-370	S23JR
2	2	MGW Plaat Øx50 d=15	S23JR



Aantal: 2 stuks



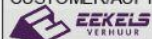
360MPT H40-30V_HingeAdapter

Projectname: 360MPT-Truss Adapters
 Projectnumber: Intern
 City / Venue: Schilde

Page name: A3 - 4 Views
 Draft by: R. Slegers
 Date: 29-jan-22 Units:mm

PROJECT:
MPT-ROOF 12x10m

CUSTOMER/AUFTRAGGEBER:



PROJECT-NO.:
22012

DATE/DATUM:
15.03.2022

1.7 LOADING ASSUMPTION

General:

Before erection, use and disassembling of the roof, weather reports should be gathered

1.7.1 WINDLOADS

load assumption according to DIN EN 13814

Table 1 — Wind pressure values for amusement devices

Height of the structure	Pressure $q_{eq} = q_{ref} \times ce(ze) \times c_d$ (kN/m ²) for reference wind speed	
	$v_{ref} \leq 15$ m/s (in service)	$v_{ref,0} \leq 28$ m/s (out of service)
0 ≤ 8 m	0,20	0,35
8 ≤ 20 m	0,30	0,50
20 ≤ 35 m	0,35	0,90
35 ≤ 50 m	0,40	1,00

Load case „in service“:

$h = 0 \leq 8m: q = 0,20 \text{ kN/m}^2$

$h = 8 \leq 20m: q = 0,30 \text{ kN/m}^2$

Load case „out of service“:

Column 3 of table 1 - DIN EN 13814:

The factor $c_{tem} = 0,80$ according to DIN EN 13814 is recalculated, therefore there aren't planned any additional reinforcements .

$h = 0 \leq 8 \text{ m}: q_p = 0,35 / 0,8 = 0,440 \text{ kN/m}^2$

$h = 8 \leq 20 \text{ m}: q_p = 0,50 / 0,8 = 0,625 \text{ kN/m}^2$

Valid for areas with $v_{b,0} = 28\text{m/s}$ / category III

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

BEAUFORT SCALE				
BEAUFORT NUMBER [BEAUFORT]	WIND SPEED [m/s]	WIND PRESSURE Q [kN/m ²]	DESCRIPTION	EFFECTS FROM WIND
0	0-0.2	≈ 0	Calm	Calm. Smoke rises vertically.
1	0.3-1.5	≤ 0.001	Very light	Direction of wind shown by smoke drift but not by wind vanes.
2	1.6-3.3	≤ 0.007	Light breeze	Wind felt on face. Leaves rustle. Ordinary wind vane moved by wind.
3	3.4-5.4	≤ 0.02	Gentle breeze	Leaves and smaller twigs in constant motion, wind extends light flag.
4	5.5-7.9	≤ 0.04	Moderate breeze	Dust and loose paper raised. Small branches begin to move.
5	8.0-10.7	≤ 0.07	Fresh breeze	Small trees in leaves start to sway.
6	10.8-13.8	≤ 0.12	Strong breeze	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult.
7	13.9-17.1	≤ 0.18	Near gale	Whole trees in motion. Inconvenient to walk against wind.
8	17.2-20.7	≤ 0.27	Gale	Twigs break from trees. Difficult to walk.
9	20.8-24.4	≤ 0.37	Strong gale	Slight structural damage. Chimney pots and slates removed.
10	24.5-28.4	≤ 0.50	Storm	Trees uprooted. Considerable structural damage.
11	28.5-32.6	≤ 0.67	Violent storm	Widespread structural damage. (seldomly in inland)
12	32.7-36.9	≤ 0.85	Hurricane	Massive and widespread structural damage.

$V [m/s] = v[km/h] / 3.6$

$q[kN/m^2] = V^2 / 1600$

Note:

Beaufort scale is based on average wind speed. Measures at the structure shall be executed according gust wind speed.

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1.7.2 MEMBRANE TENSION

By applying a dynamic loading $q = 0.50 \text{ KN/m}^2$ with its aerodynamic coefficient $c_{pe} = 0.40$ and regarding a span of $l = 5.00 \text{ m}$ a resulting membrane tension of $Z = 0.80 \text{ kN/m}$ is derived.

$$Z = (Z_y^2 + Z_z^2)^{1/2} = 0.80 \text{ kN/m}$$

$$\text{with } Z_z = 0.5 * 0.4 * 5.0 / 2 = 0.50 \text{ kN/m}$$


$$Z_y = (Z^2 - Z_z^2)^{1/2} = (0.80^2 - 0.50^2)^{1/2} = 0.624$$

$$Z_y / Z_z = 0.624 / 0.50 = 1.25 = 1 / 0.8$$

1.7.3 SNOW LOADING

Snow loads are not taken into account.

Building up of the structure shall only be made in appropriate weather conditions or the roof shall be kept free from snow.

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

1.8 PERMISSIBLE PAYLOADS

On following pages allowable pay loads of the structure and different possible configurations for equipment such as illumination(spots) and sounding are displayed. If the preparing loading configuration differ from these set up`s, please inform Prolyte or the Engineering office Krasenbrink+Bastians.

Loads up to 100 kg can be fastened at any position of the chord. Loads more than 100 kg have to be positioned at the node or adequate proofs have to be carried out. Loads shall be equally distributed over the trusses main chords.

All given values are static loads. To consider dynamic affecting the loads have to be decreased with a factor of minimum 1,2.

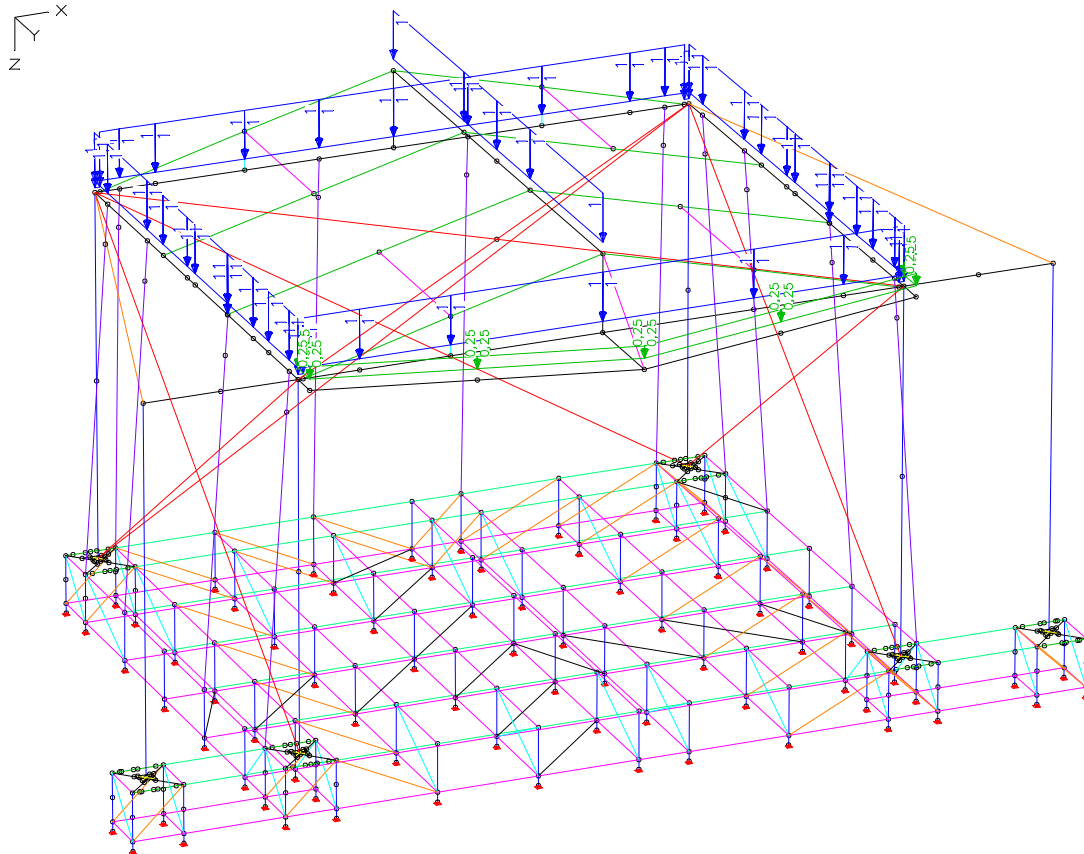
Optionally an additional rigging truss (S36R) can be mounted. For that case special load setups are given on page 29-34.

For all loading scenarios the PA-load can always be combined with.

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
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Types of Loading:

Distributed Load [kN/m]




LC 4: Load, Distributed Load

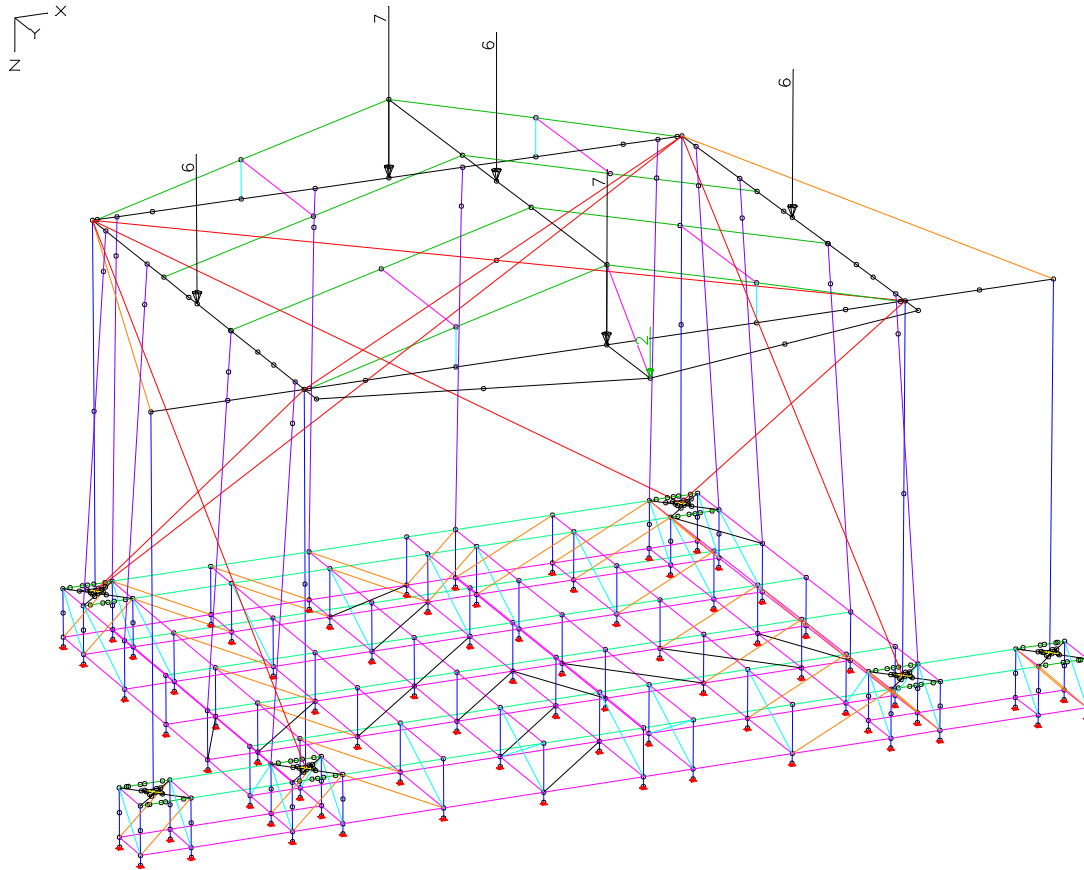
$1,00 \text{ kN/m} = 100 \text{ kg/m}$

$0,25 \text{ kN/m} = 25 \text{ kg/m}$

In case of building up the roof without the front cantilever, all loads from this cantilever truss can be added to the loads of the front truss. (load case specific)

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Center Point Load [kN]



LC 5: Load, Center Point Load

7,0 kN = 700 kg

6,0 kN = 600 kg

2,0 kN = 200 kg

PROJECT:
MPT-ROOF 12x10m

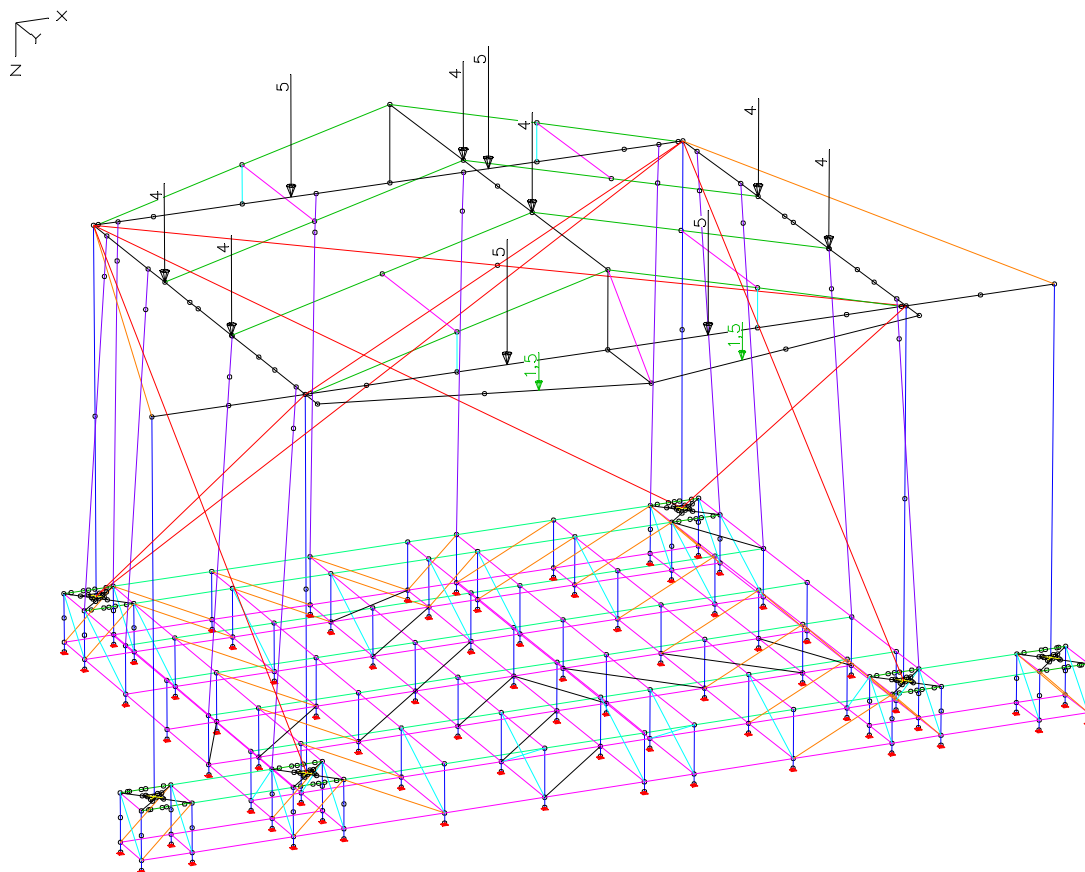
CUSTOMER/AUFTRAGGEBER:



PROJECT-NO.:
22012

DATE/DATUM:
15.03.2022

Third Point Load [kN]




LC 6: Load, Third Point Load

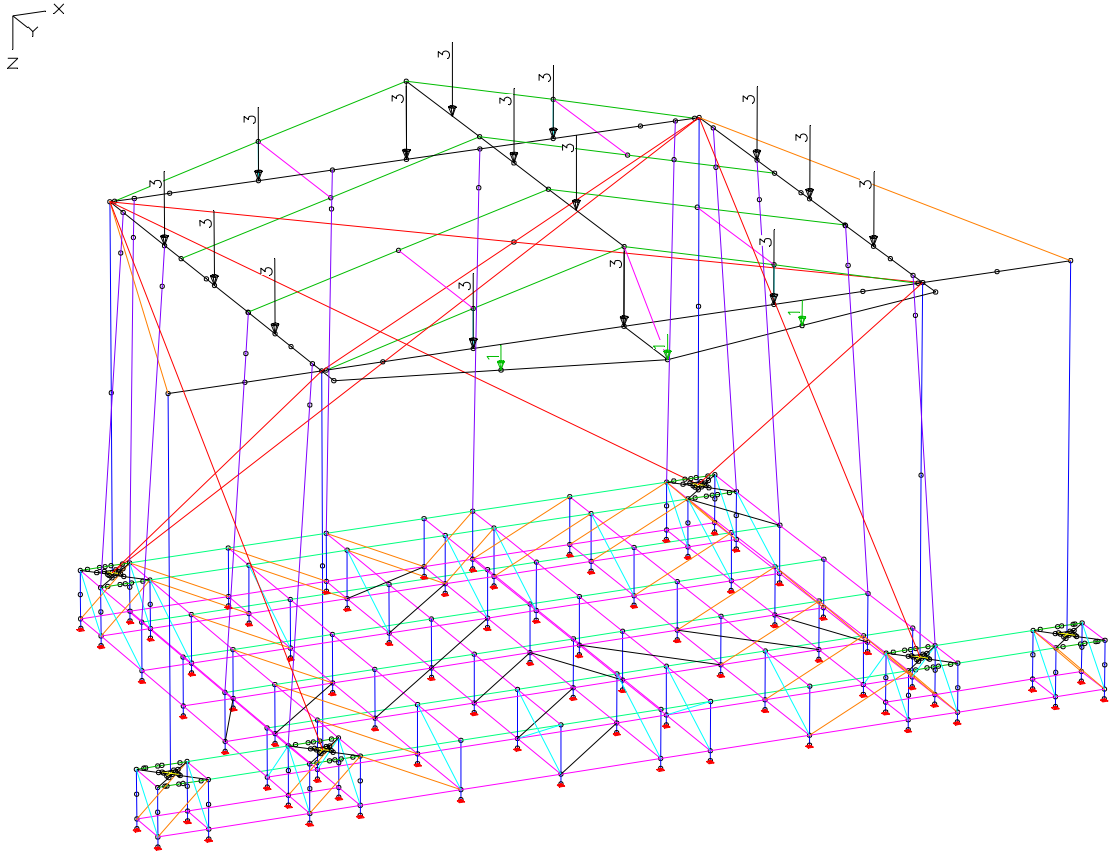
5,0 kN = 500 kg

4,0 kN = 400 kg

1,5 kN = 150 kg

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
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Fourth Point Load [kN]



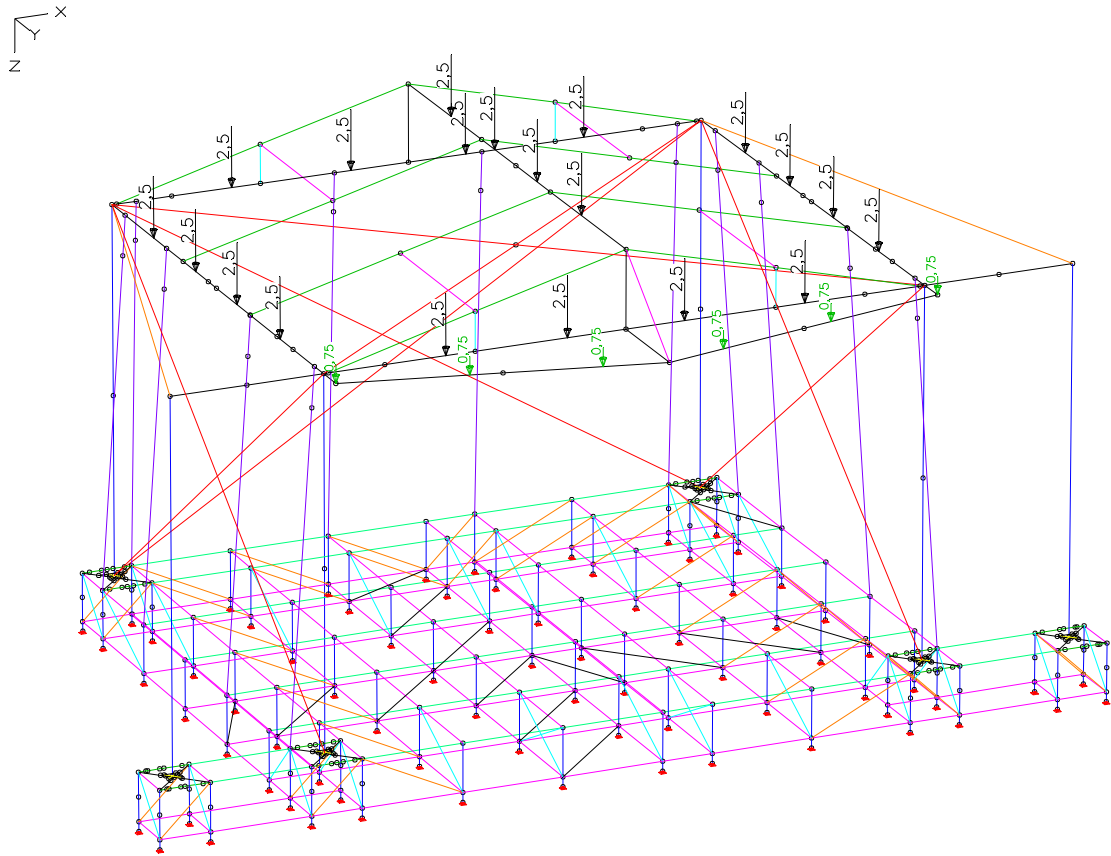
LC 7: Load, Fourth Point Load

3,0 kN = 300 kg

1,0 kN = 100 kg

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022


Fifth Point Load [kN]



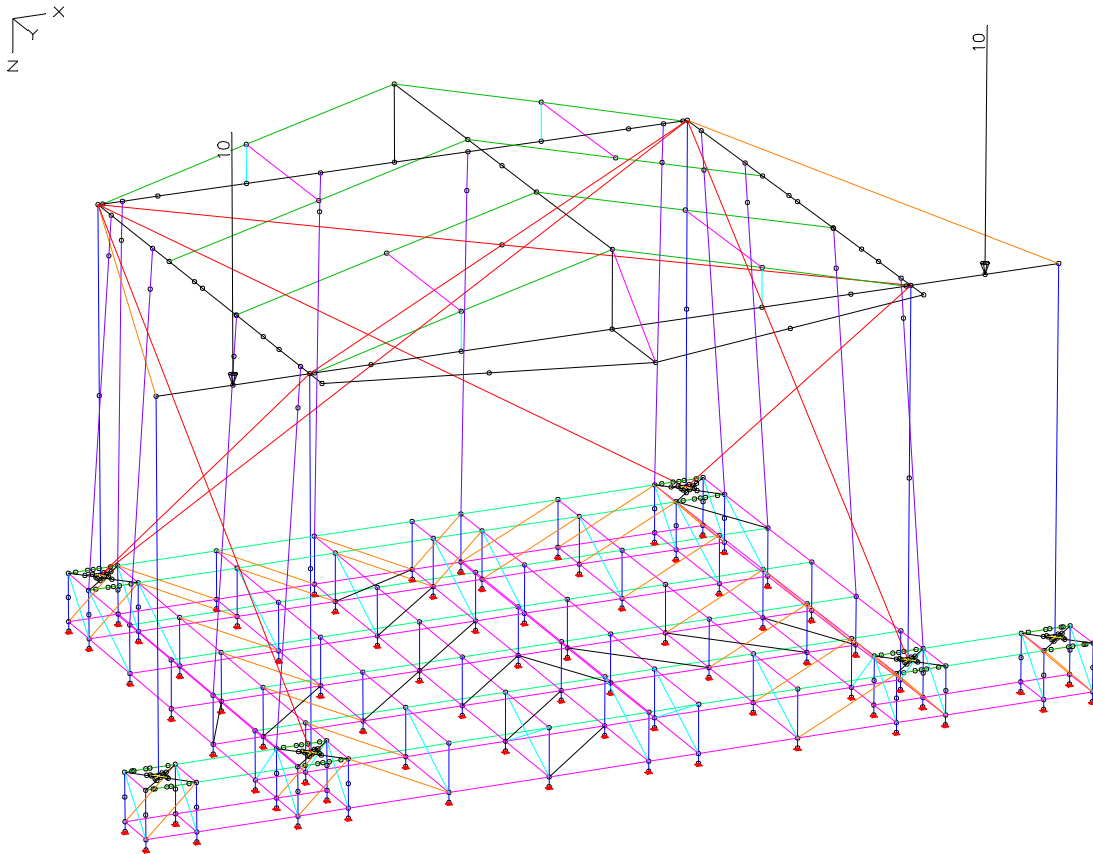
LC 8: Load, Fifth Point Load

2,5 kN = 250 kg

0,75 kN = 75 kg

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

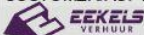
PA Load [kN]



LC 9: Load, PA-Load

10 kN = 1000 kg (can also be 2 x 500 kg with a distance)

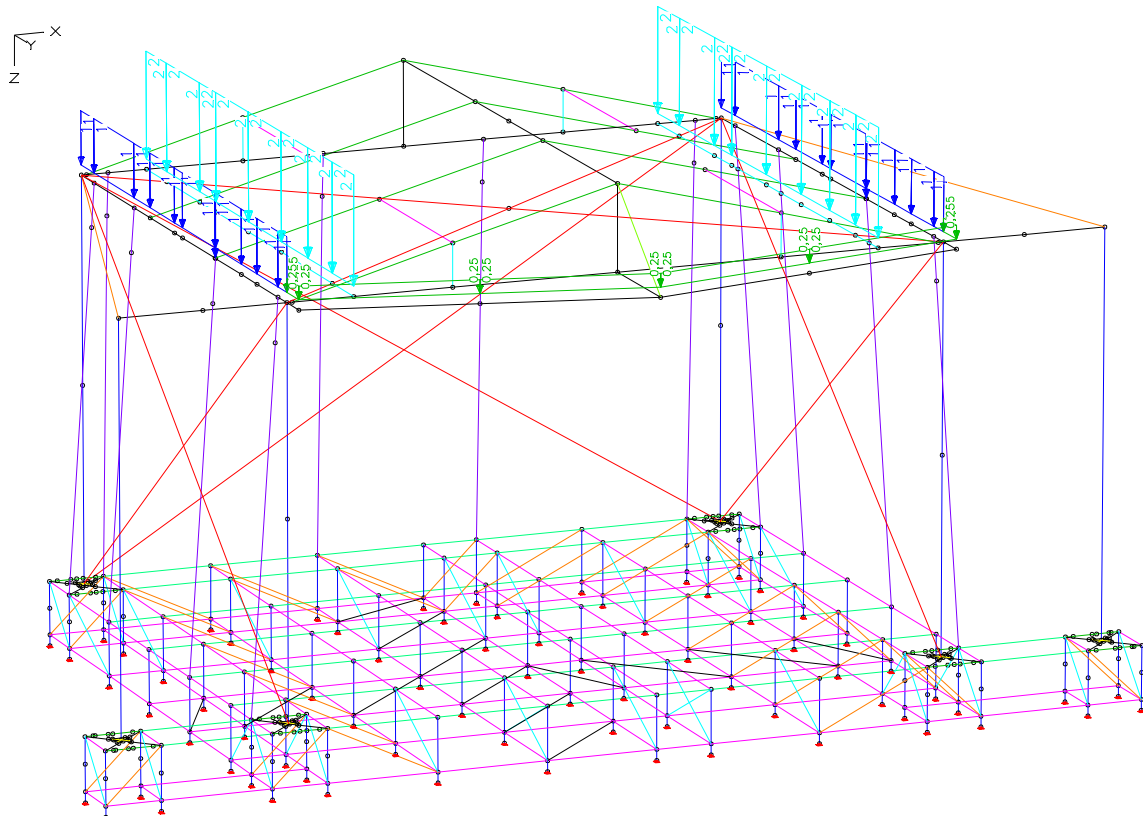
(wind exposed surface < 5m²)

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Load setup using rigging truss

In case of using the rigging truss (S36R) spanning from front to rear gable loads on the gables itself and on the ridge are not allowed.

distributed load [kN/m]




LC 4: Load, Distributed Load

1,00 kN/m = 100 kg/m

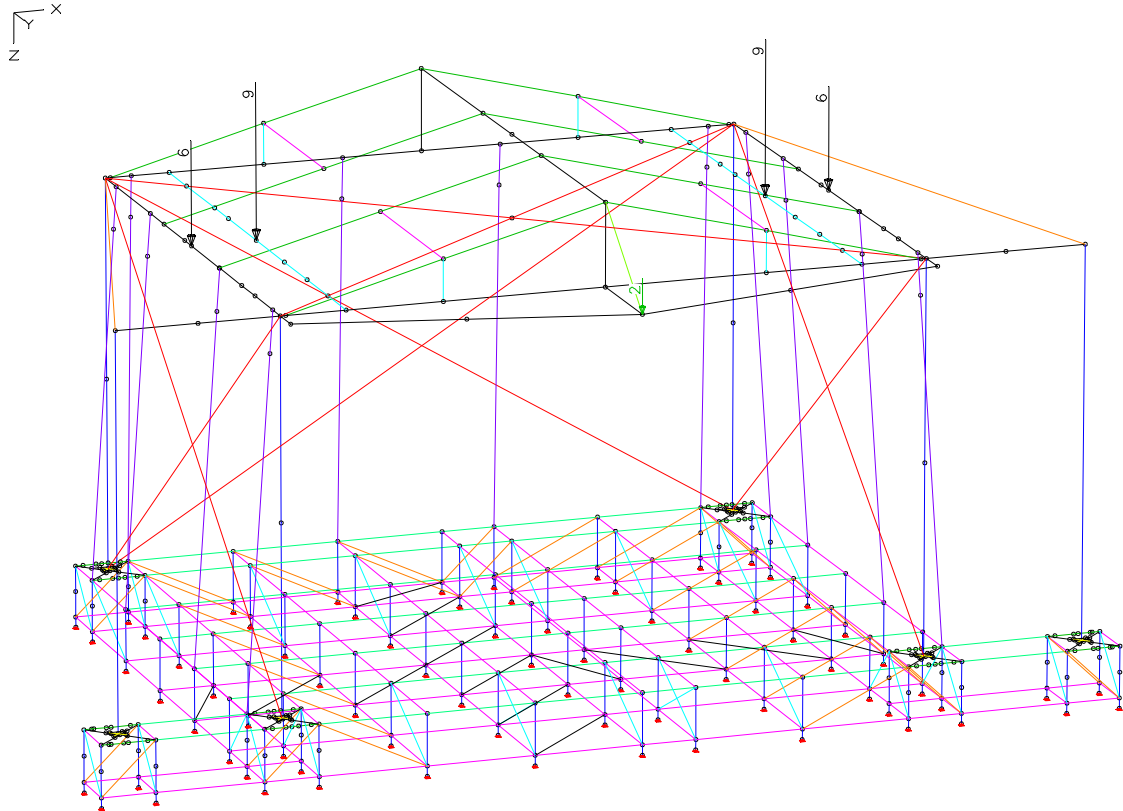
2,00 kN/m = 200 kg/m

0,25 kN/m = 25 kg/m

In case of building up the roof without the front cantilever, all loads from this cantilever truss can be added to the loads of the front truss. (load case specific)

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Center Point Load [kN]




LC 5: Load, Center Point Load

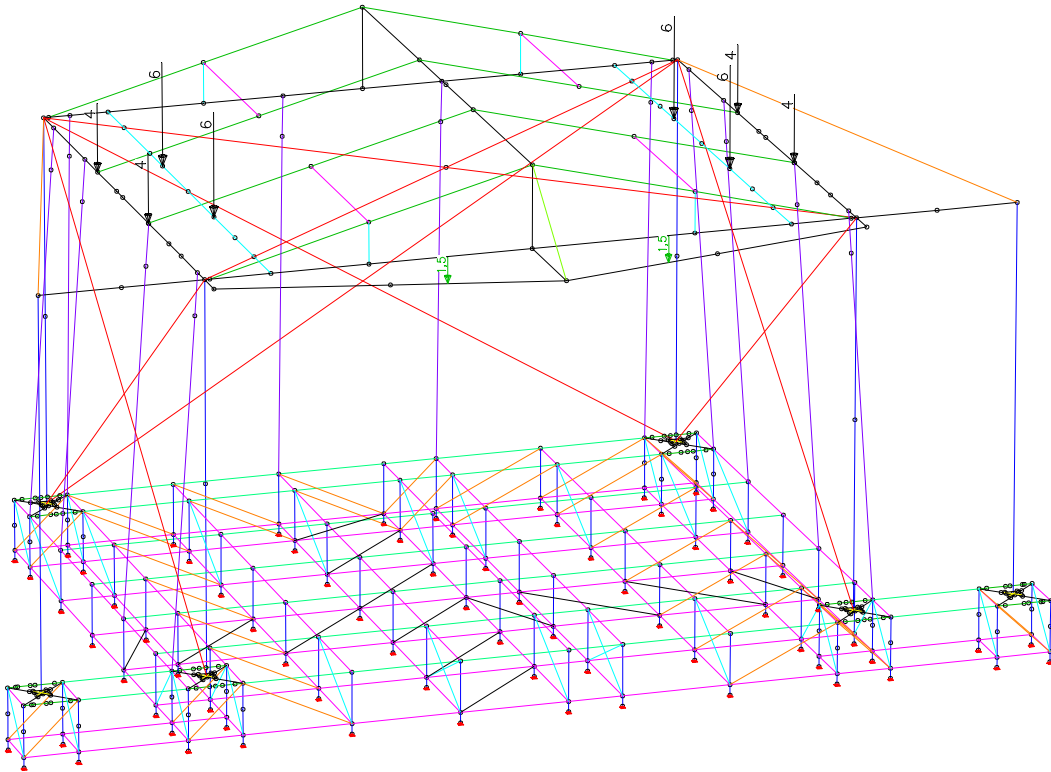
6,0 kN = 600 kg

9,0 kN = 900 kg

2,0 kN = 200 kg

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Third Point Load [kN]



LC 6: Load, Third Point Load

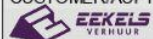
4,0 kN = 400 kg

6,0 kN = 600 kg

1,5 kN = 150 kg

PROJECT:
MPT-ROOF 12x10m

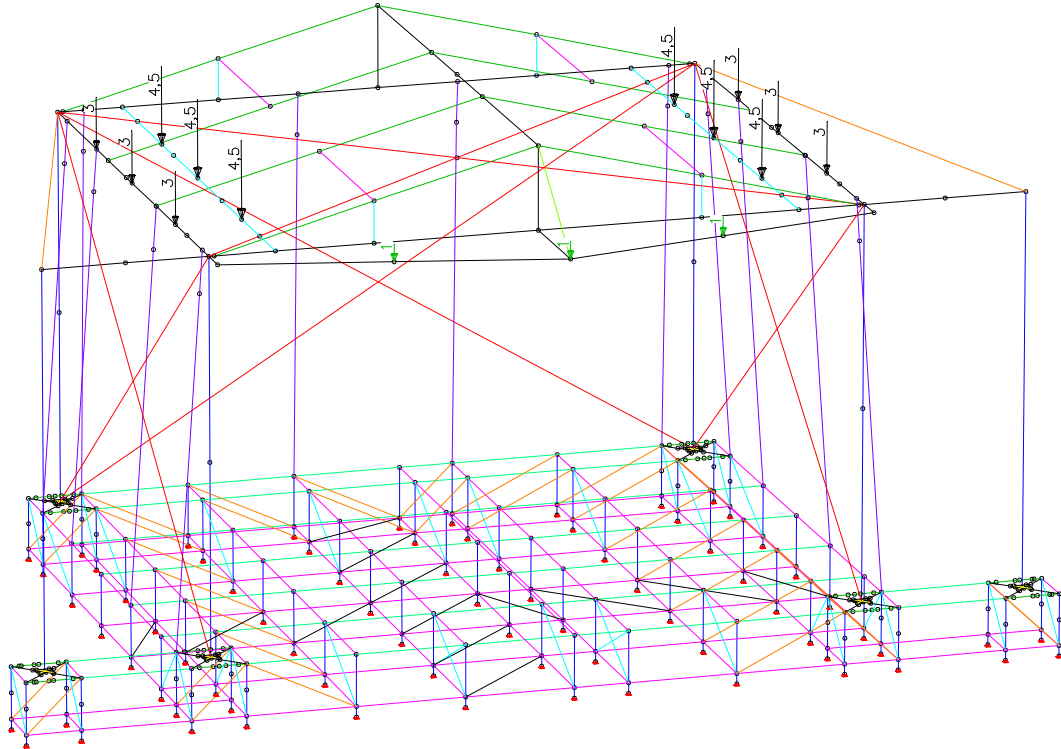
CUSTOMER/AUFTRAGGEBER:



PROJECT-NO.:
22012

DATE/DATUM:
15.03.2022

Fourth Point Load [kN]



LC 7: Load, Fourth Point Load

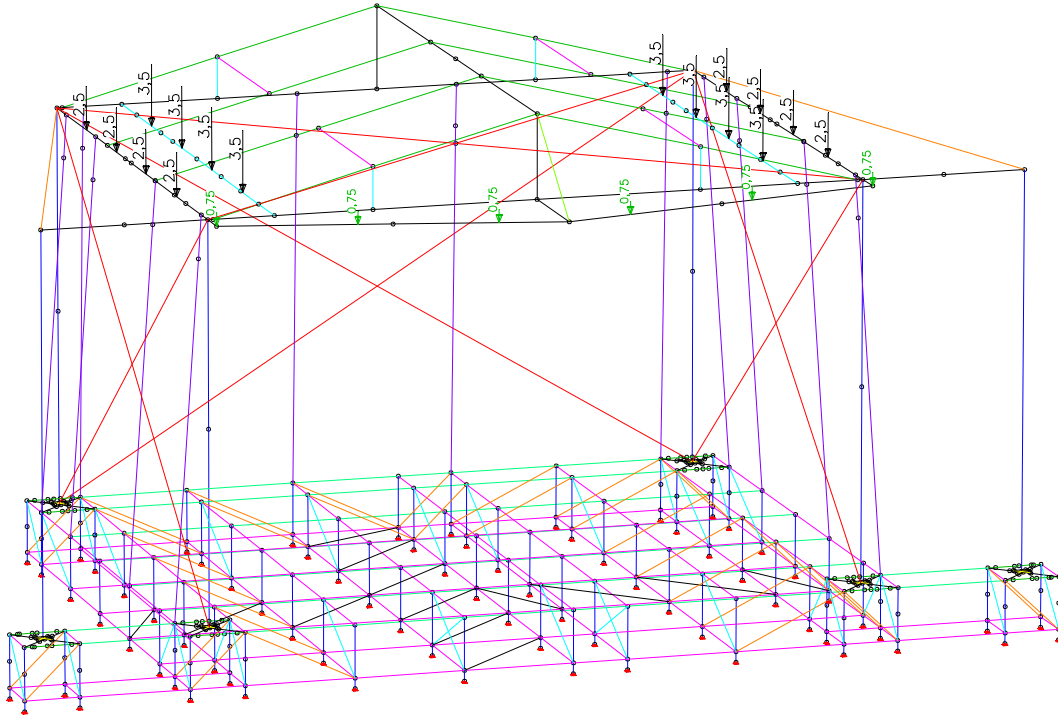
3,0 kN = 300 kg

4,5 kN = 450 kg

1,0 kN = 100 kg

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Fifth Point Load [kN]



LC 8: Load, Fifth Point Load

2,5 kN = 250 kg

3,5 kN = 350 kg

0,75 kN = 75 kg

PROJECT:
MPT-ROOF 12x10m

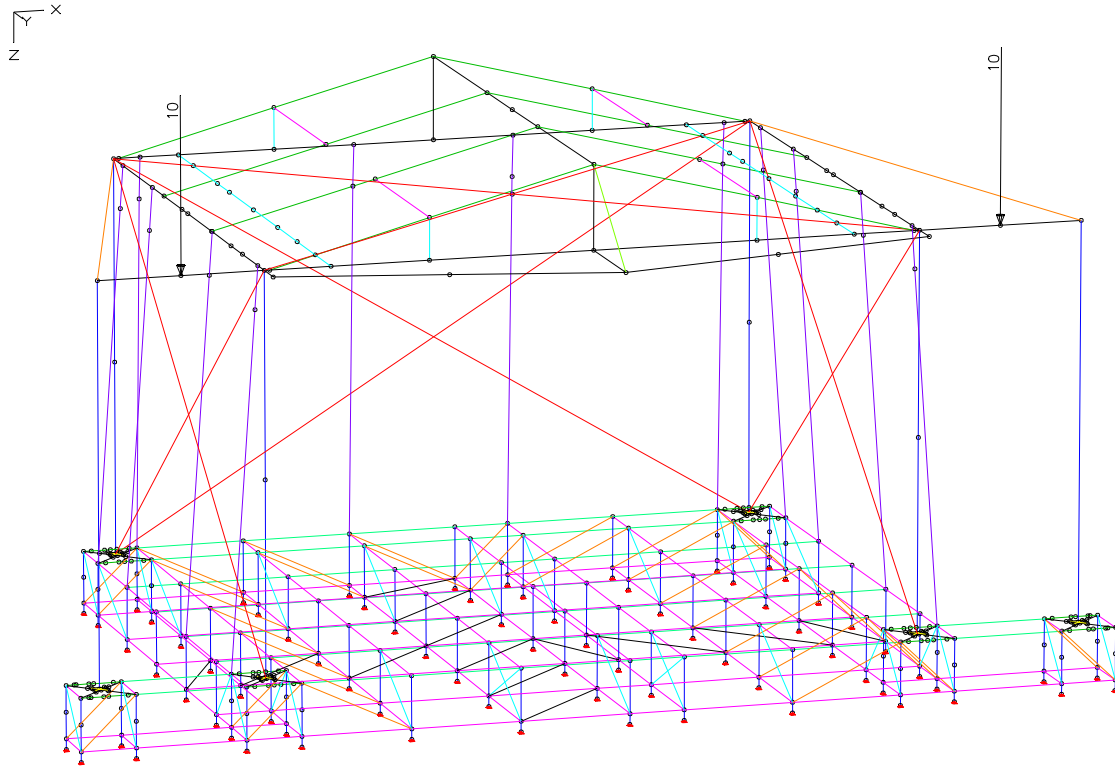
CUSTOMER/AUFTRAGGEBER:



PROJECT-NO.:
22012

DATE/DATUM:
15.03.2022

PA Load [kN]



LC 9: Load, PA-Load

10 kN = 1000 kg (can also be 2 x 500 kg with a distance)

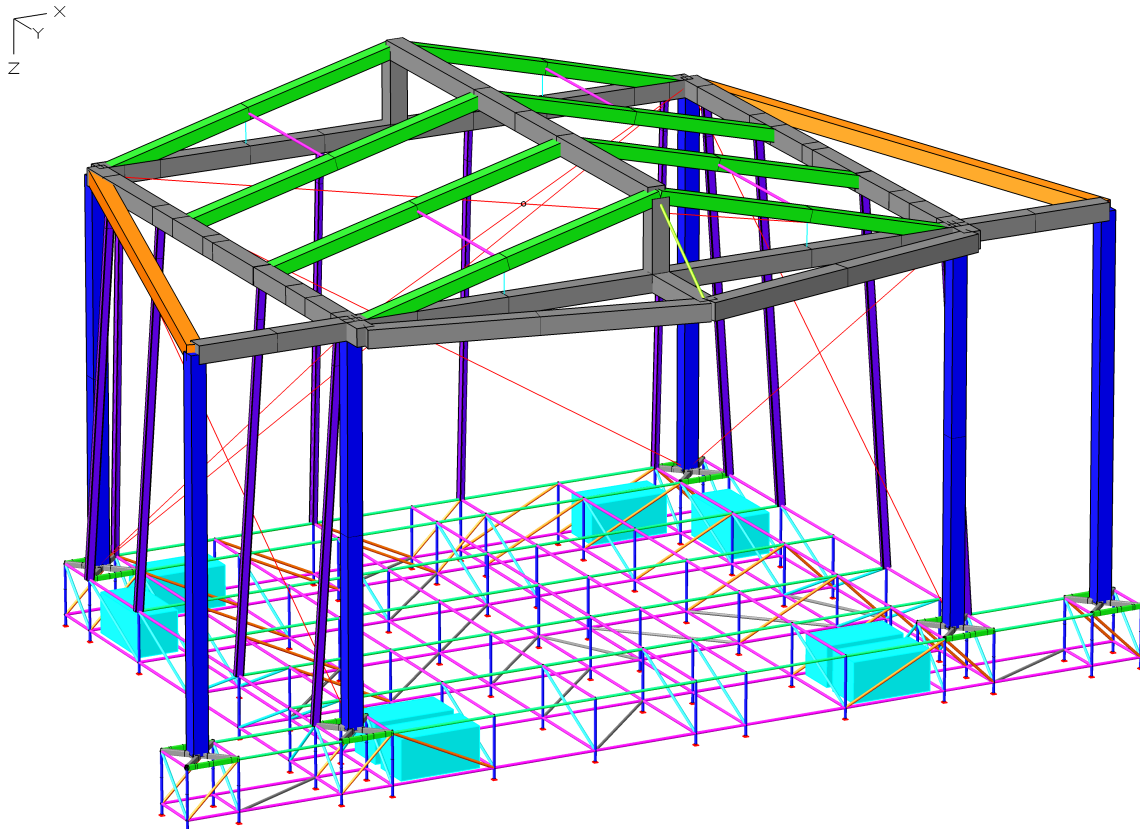
(wind exposed surface < 5m²)

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

1.9 NECESSARY BALLAST LOADS

Ballast Overview

friction coefficient $\mu = 0,60$

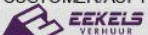


The ballast is displayed schematically as preferred by the customer.

light blue block: at least 1150 kg for $h \leq 1,0\text{m}$ podium
 at least 1450 kg for $1,0\text{m} > h \leq 2,0\text{m}$ podium

The ballast constructively remains the same also for the build up without the side wings.

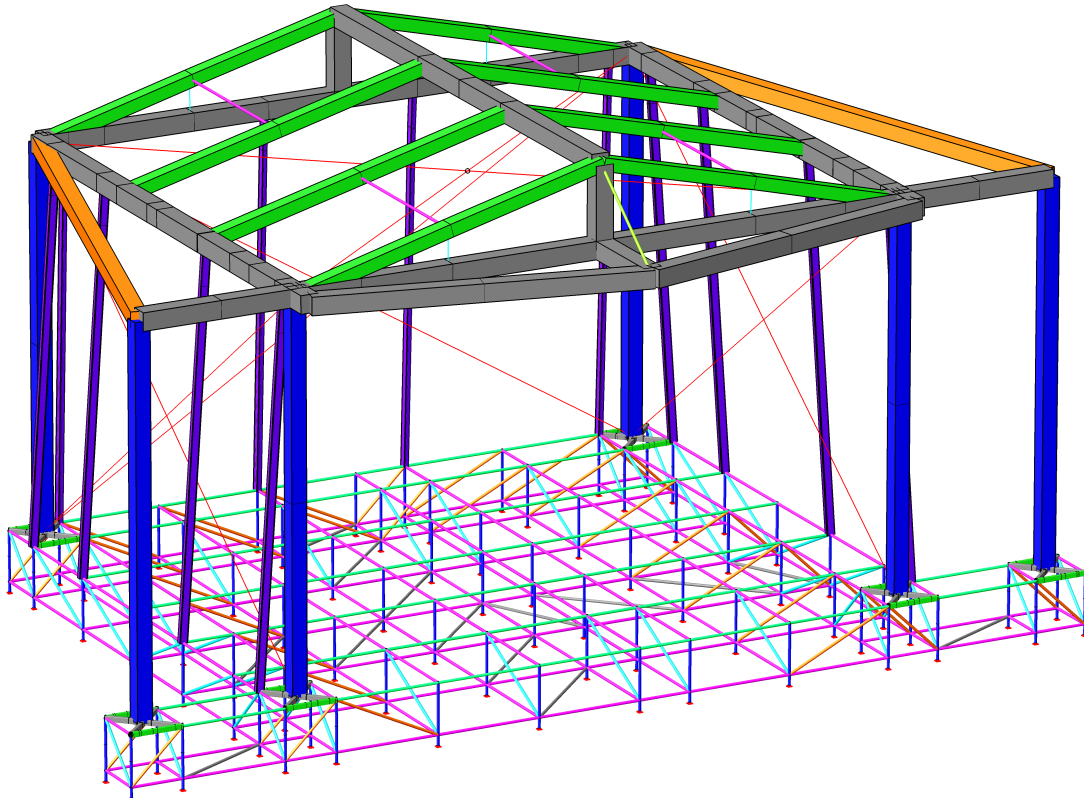
The ballast will be placed force-fitted on the bottom level of the Layher Podium without the usage of Layher Base Collars or it must be placed on a separate level +0,50m.

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

STRUCTURAL CALCULATION


2 STATICAL SYSTEM

Isometric:

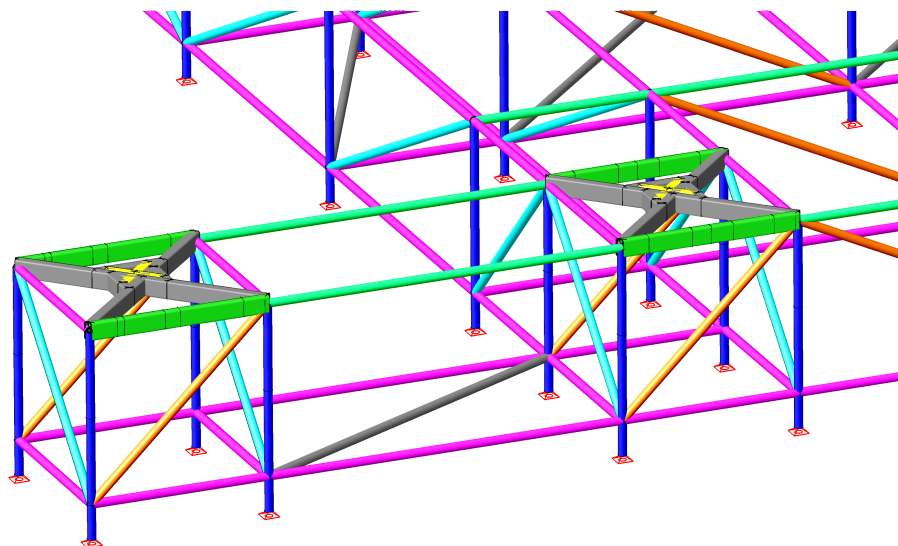
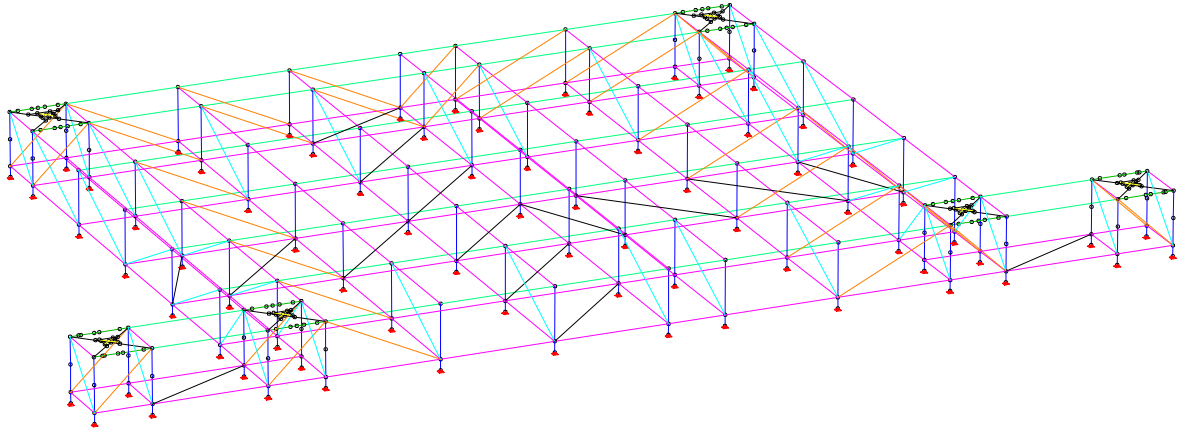


The trusses are shown in a simplified view.

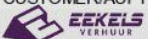
grey:	PROLYTE H40V
blue, orange:	PROLYTE H30V
green:	PROLYTE H30D
pink:	pipe Ø48x3
light green:	ladder truss PROLYTE H30L
dark violett	Keder 170x88x3m (EN AW 6082 T6)
red:	guy wires

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

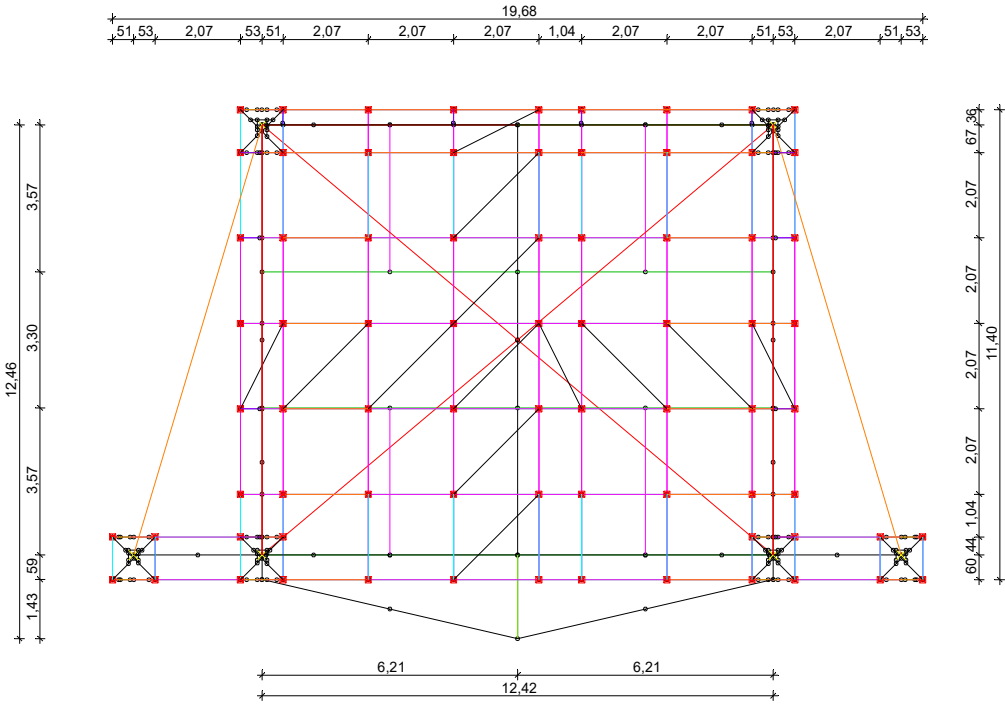
Layher:



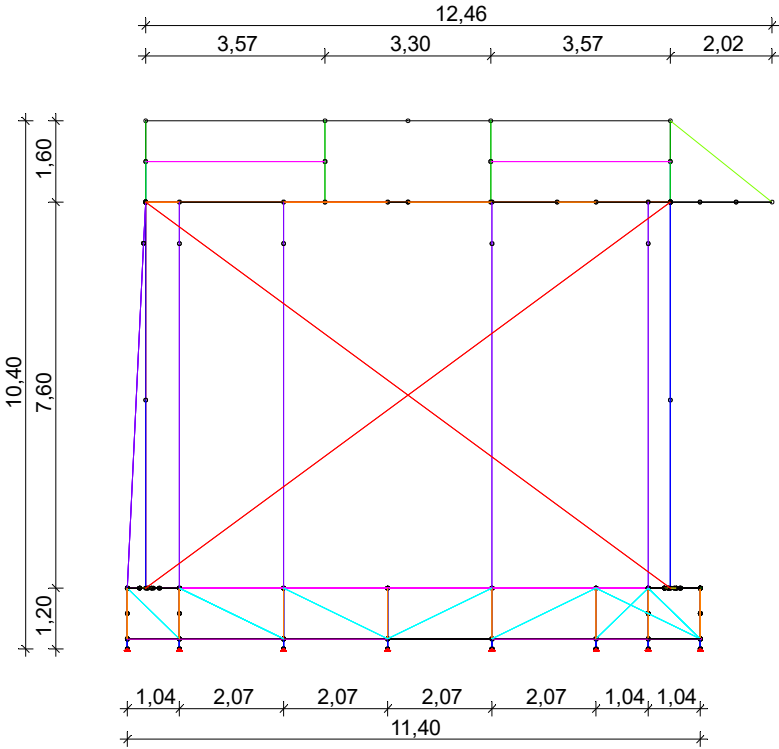
Ledger (light green)	Ø48,3x3,2mm	(S235 JR)
Podium beam (pink)	Layher O-ledgers bridging or LW	
Bottom beam (pink)	Ø48,3x3,2mm	(S235 JR)
Column (blue)	Ø48,3x3,2mm	(S235 JR R _h = 320 N/mm ²)
Diagonal (orange, light blue, grey)	Ø48,3x3,2mm	(S235 JR)
Base ledger (black)	RHS 100x60x4mm	(S235 JR)

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

top view roof/ podium:

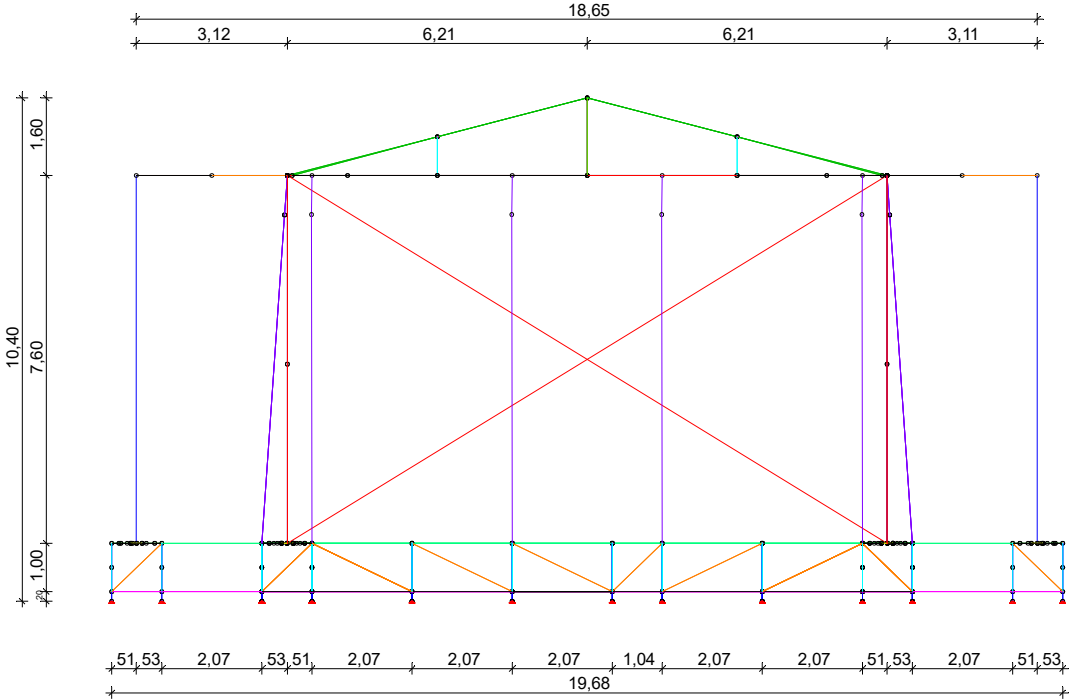


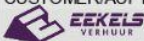
side view:



PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

front view:



PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

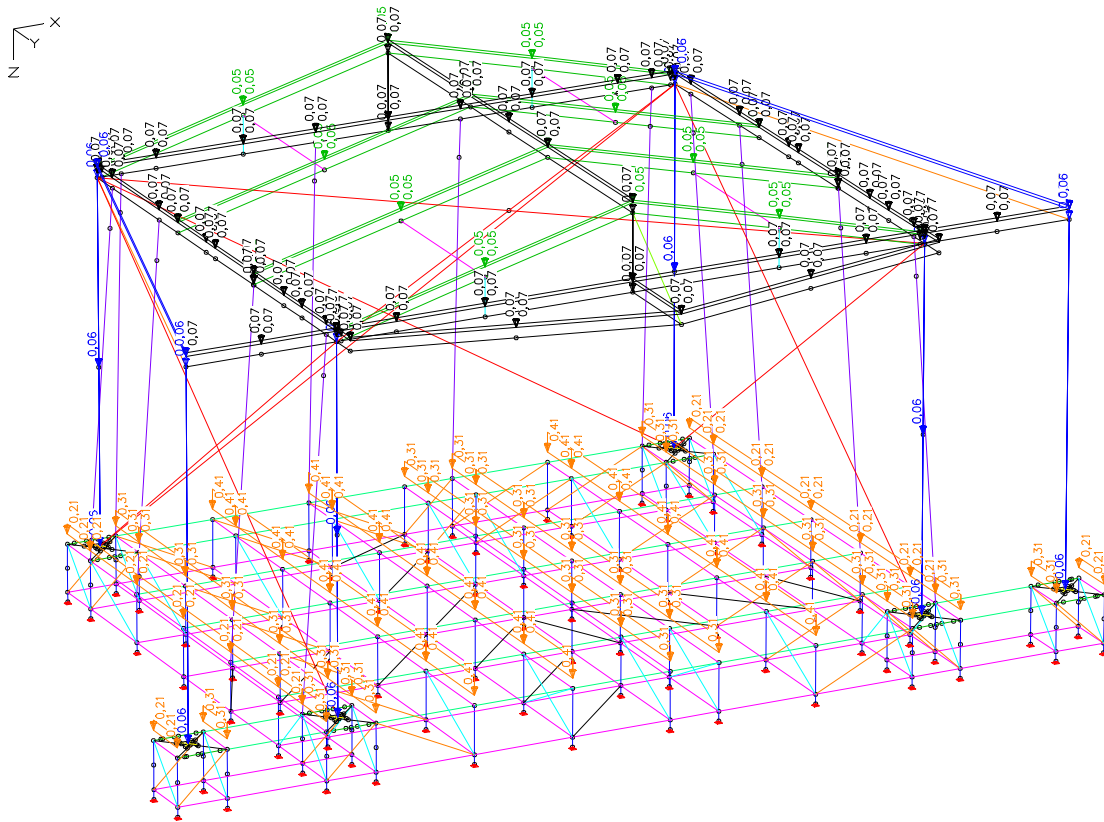
3 LOADING

Load case1: dead weight


H30D: 0,05 kN/m (green)
 H30V: 0,06 kN/m (blue)
 H40V: 0,07 kN/m (grey)

Podium decks $g = 0,20 \text{ kN/m}^2$:
 $0,20 \times 2,072 = 0,41 \text{ kN/m}$
 $0,20 \times (2,072+1,036)/2 = 0,311 \text{ kN/m}$
 $0,20 \times 2,072/2 = 0,21 \text{ kN/m}$

Layher tubes and other components are considered via specific weight and cross section by the software Infograph

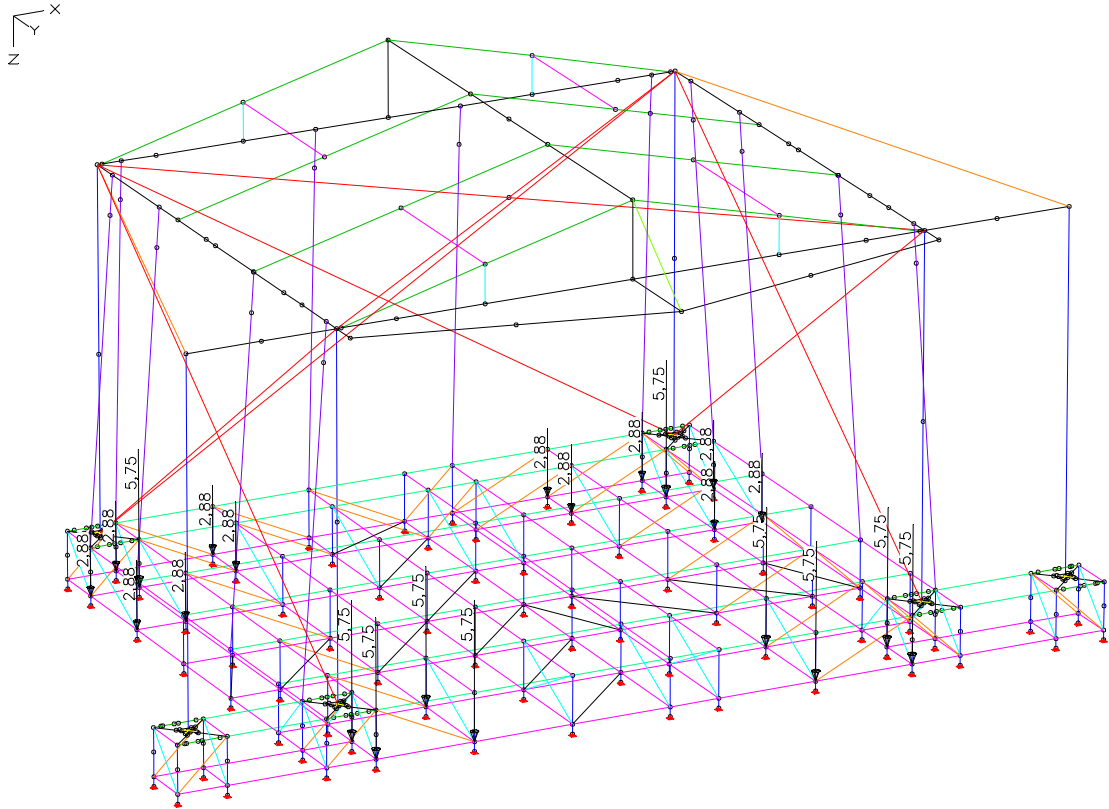


LC 1: Load, deadweight

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Load case 2: Ballast

1150 kg = 4 x 2,875 kN (at least)
2300 kg = 4 x 5,75 kN

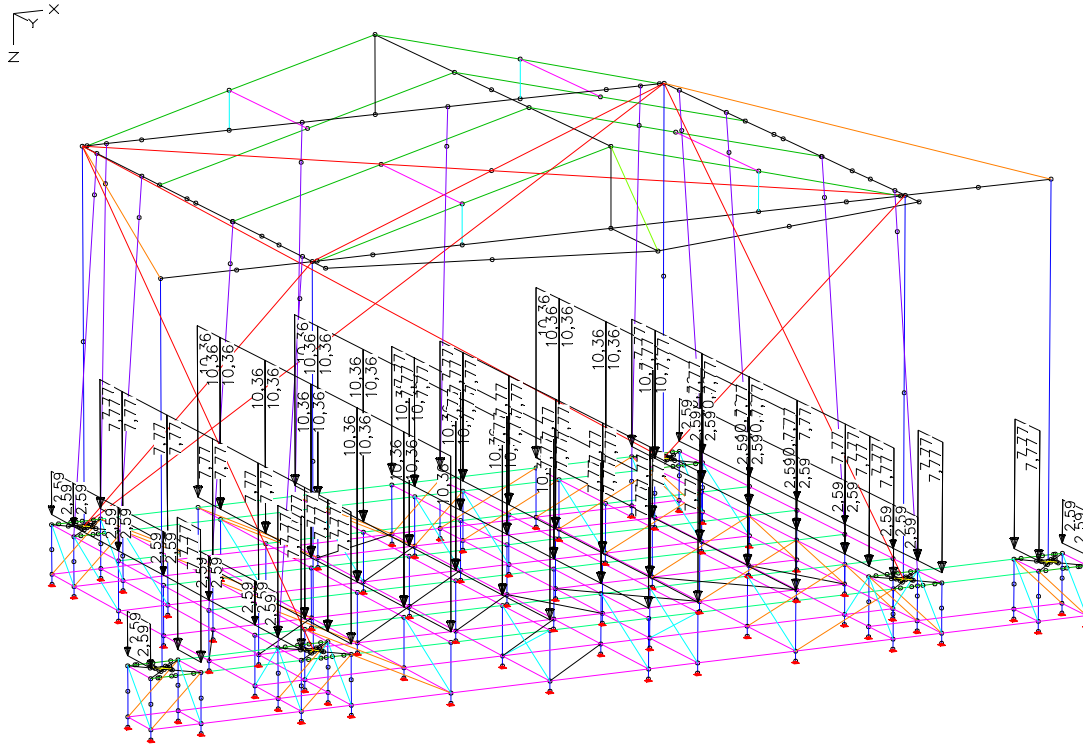


LC 2: Load, Ballast


PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Load case 3: Payload podium

$$\begin{aligned}
 500 \text{ kg/m}^2 & \quad 5,0 \times (2,072+1,036) / 2 & = 7,77 \text{ kN/m} \\
 & \quad 5,0 \times 2,072 & = 10,36 \text{ kN/m} \\
 & \quad 5,0 \times 1,036 / 2 & = 2,59 \text{ kN/m}
 \end{aligned}$$

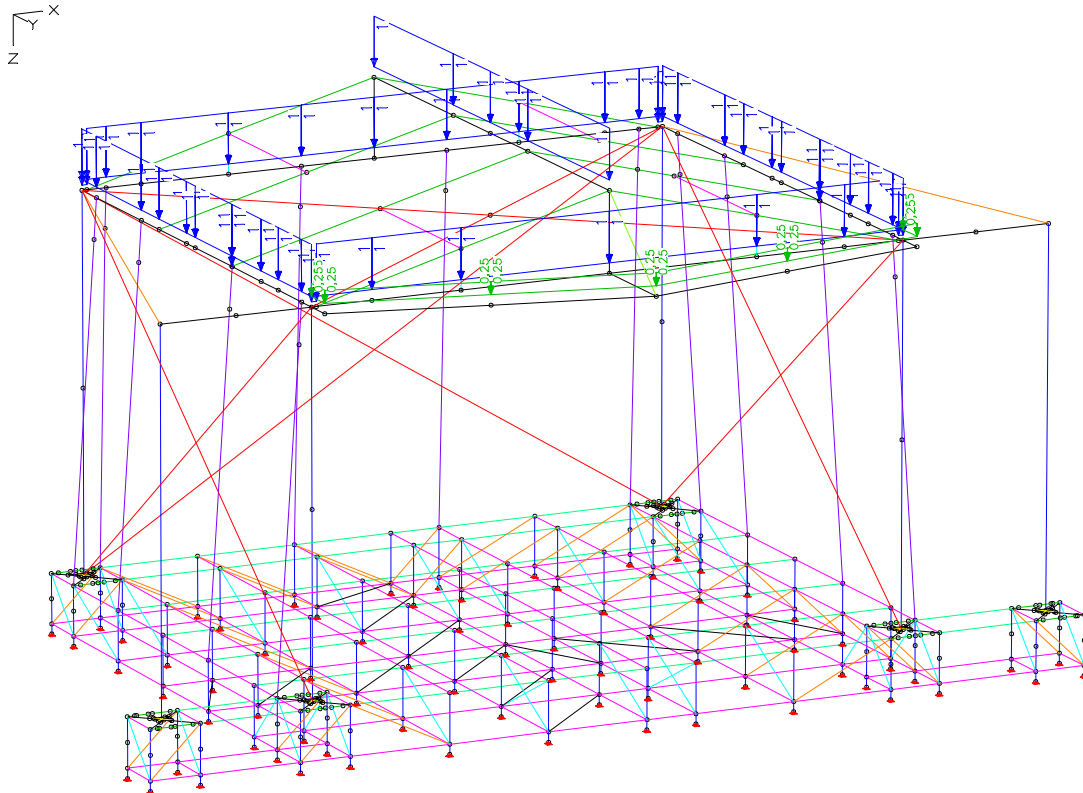


LC 3: Load, payload podium


PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Load case 4: Distributed Load

see chpt. 1.8

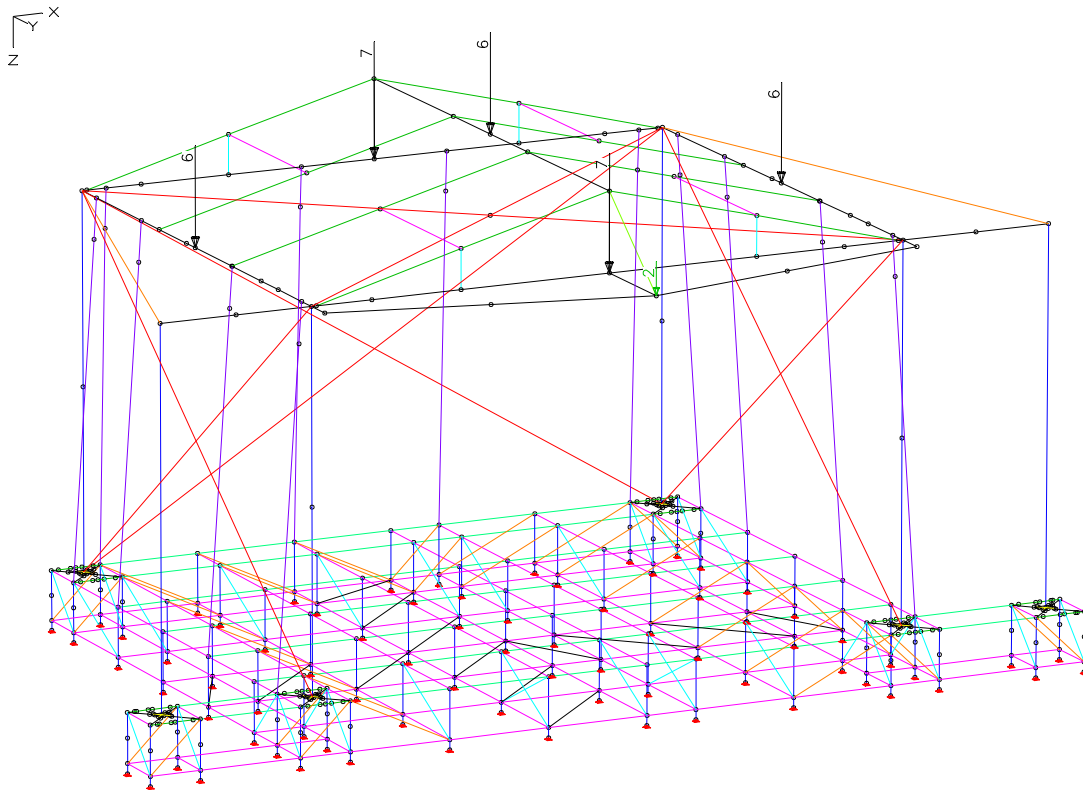


LC 4: Load, Distributed Load


PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Load case 5: Center Point Load

see chpt. 1.8

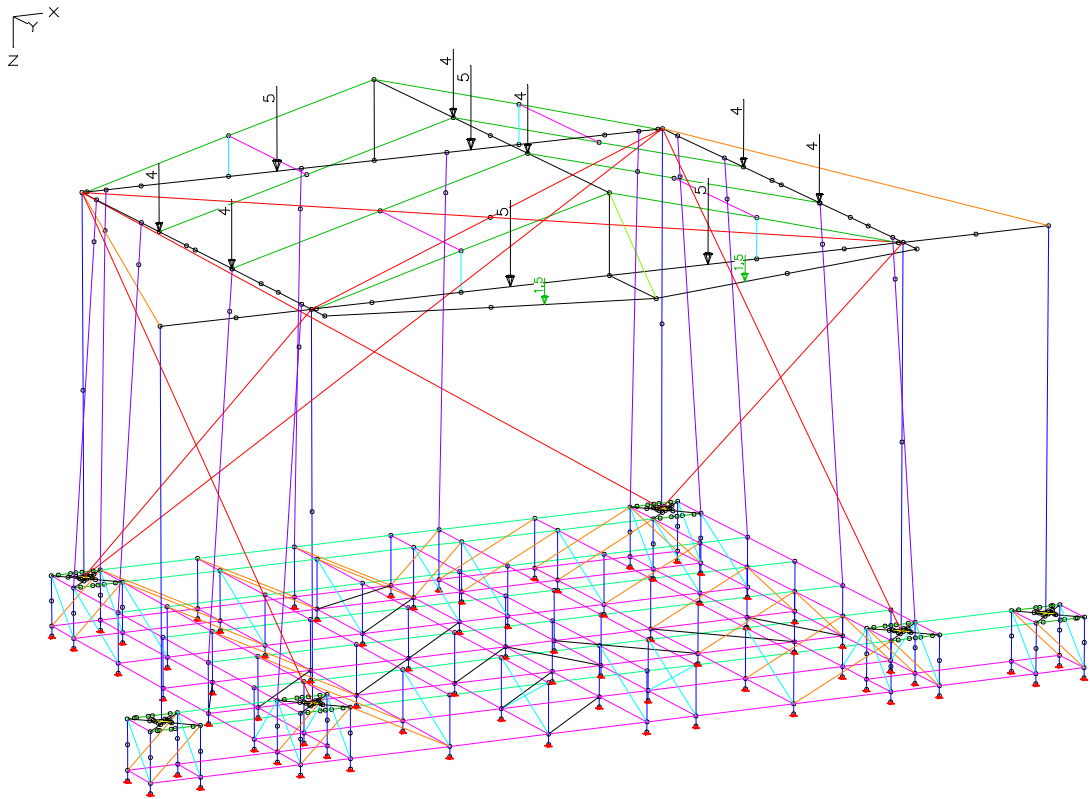


LC 5: Load, Center Point Load

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Load case 6: Third Point Load

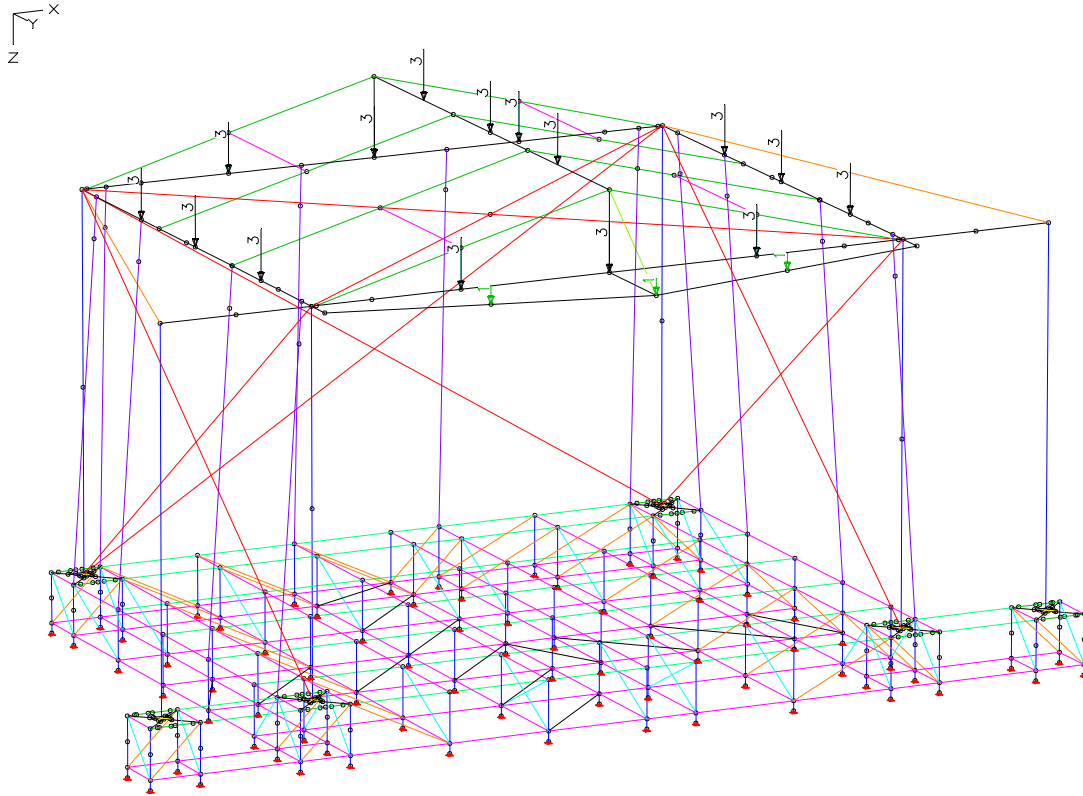
see chpt. 1.8




LC 6: Load, Third Point Load

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Load case 7: Fourth Point Load
see chpt. 1.8

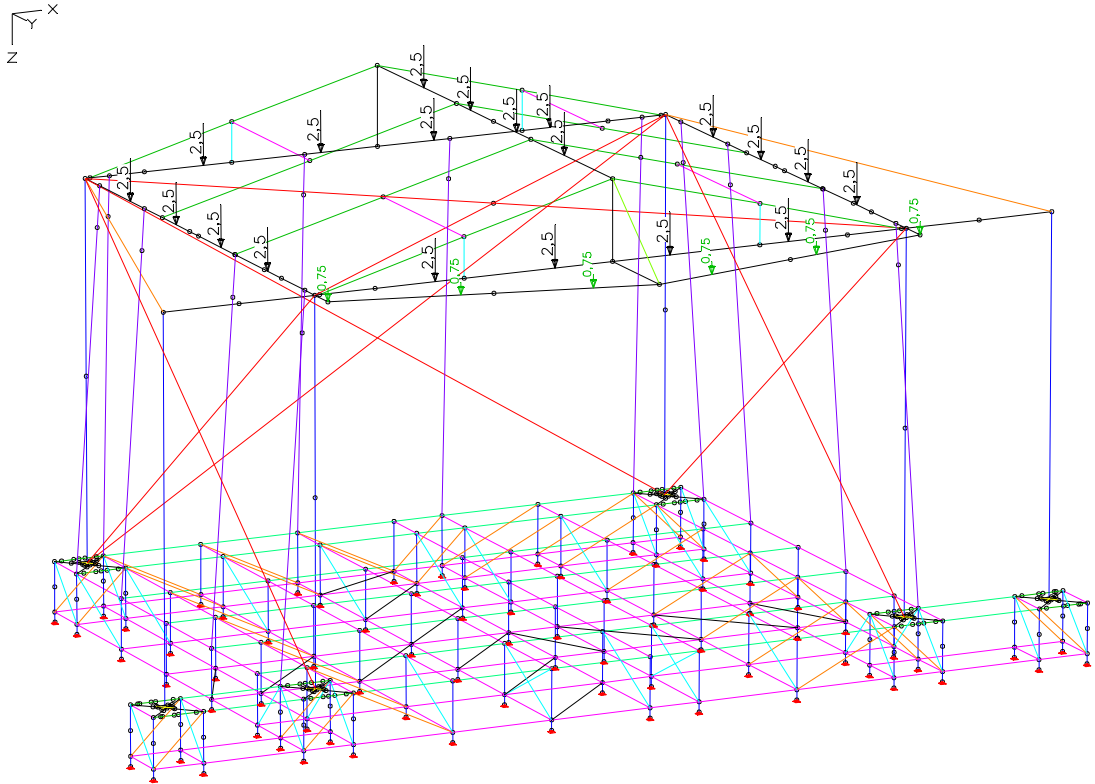


LC 7: Load, Fourth Point Load


PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Load case 8: Fifth Point Load

see chpt. 1.8

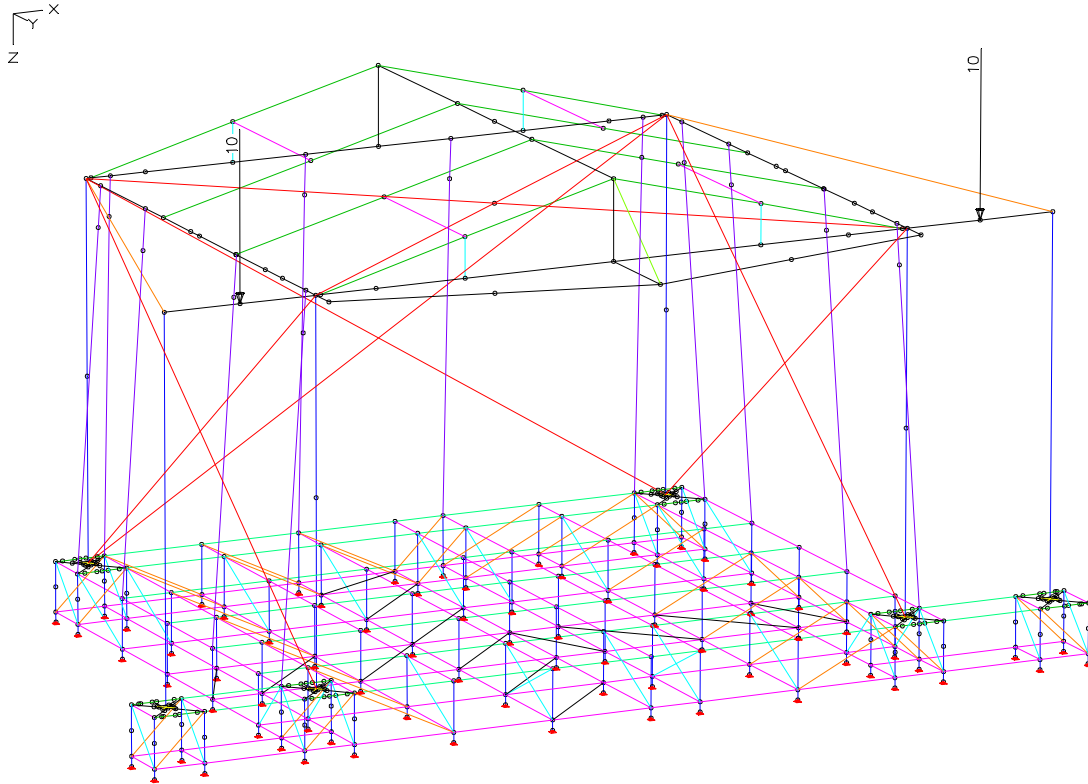


LC 8: Load, Fifth Point Load

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Load case 9: PA-load

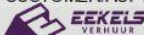
see chpt. 1.8



LC 9: Load, PA-Load

wind exposed surface <math>< 5\text{m}^2</math>

(can also be 2 x 500 kg with a distance)

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

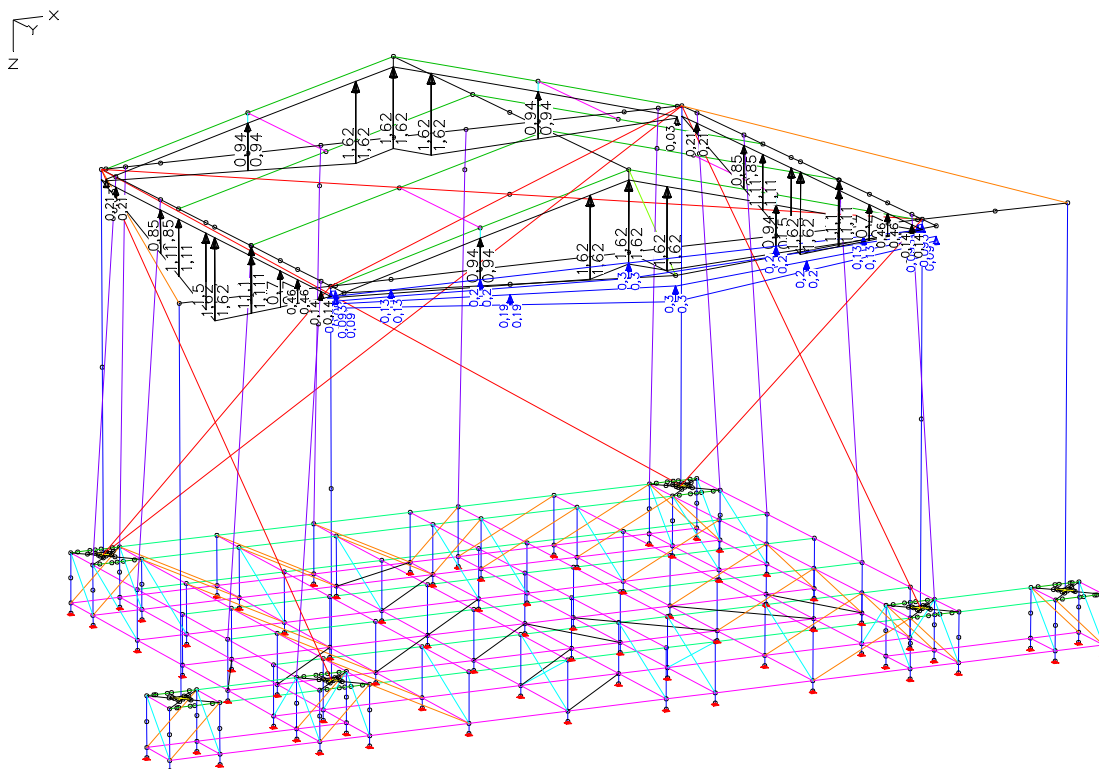
Load case 10: Wind Roof

$$q_b = 0.30 \text{ kN/m} \quad c_{pe} = 1.00$$

$$w_1 = 0,30 \times 1,0 \times 5,40 = 1,62 \text{ kN/m}$$

$$w_2 = 0,30 \times 1,0 \times 0,60/2 = 0,09 \text{ kN/m}$$

$$w_3 = 0,30 \times 1,0 \times 2,0/2 = 0,30 \text{ kN/m}$$

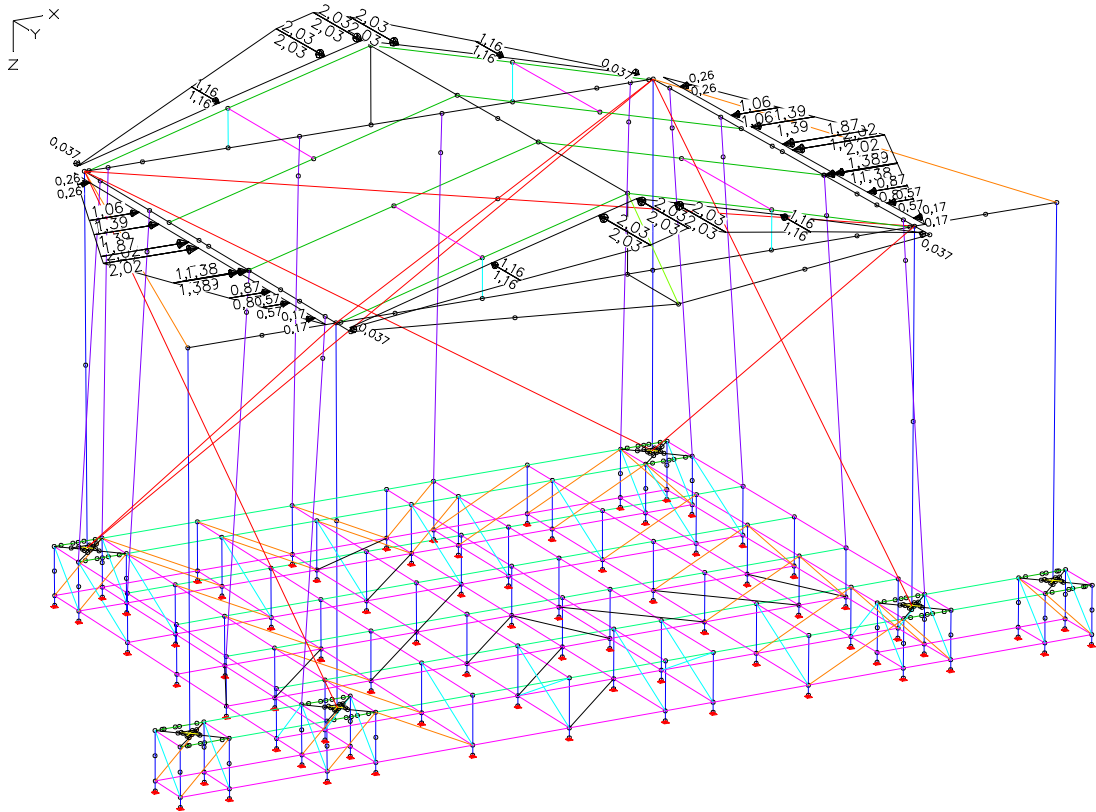


LC 10: Load, Wind Roof


PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

load case 11: Membrane-tension Roof

$z_1 = 1,62 / 0,8 = 2,10 \text{ kN/m}$



LC 11: Load, Membrane-tension Roof

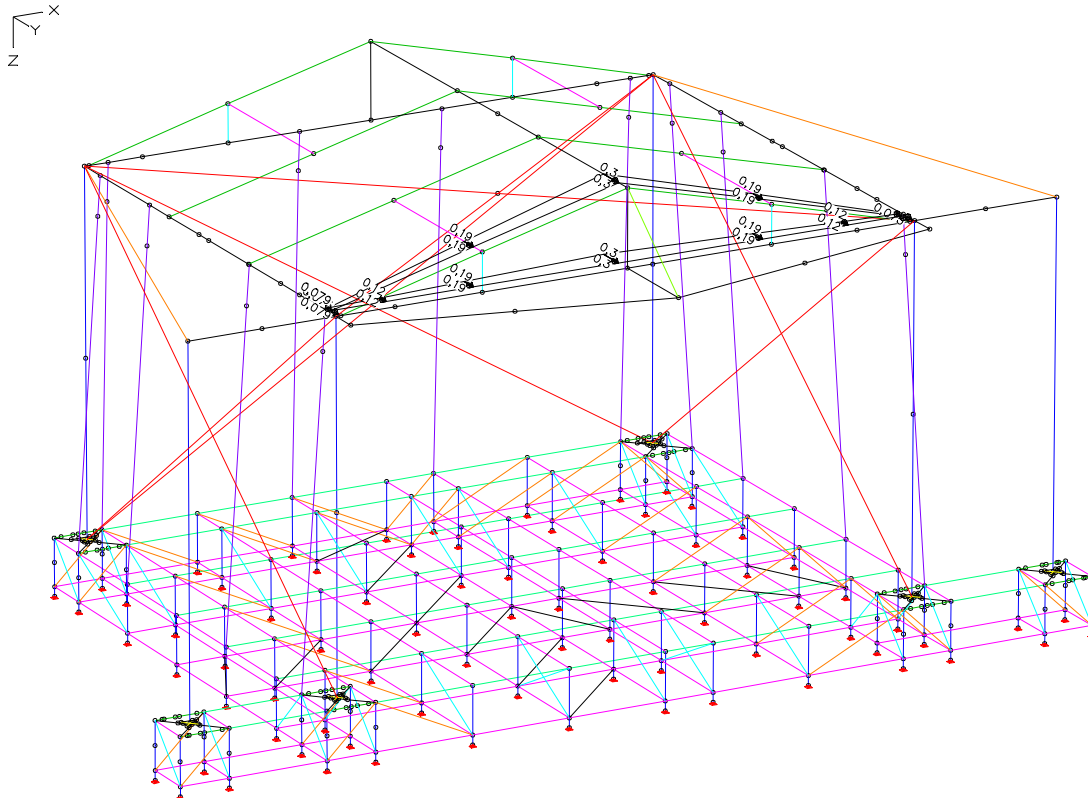
PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Load case 12: Wind Gable Front


$$q = 0,30 \text{ kN/m}^2 \quad c_{pe} = 1.00$$

$$w_1 = 0,30 \times 0,50/2 = 0,075 \text{ kN/m}$$

$$w_2 = 0,30 \times 2,0/2 = 0,300 \text{ kN/m}$$

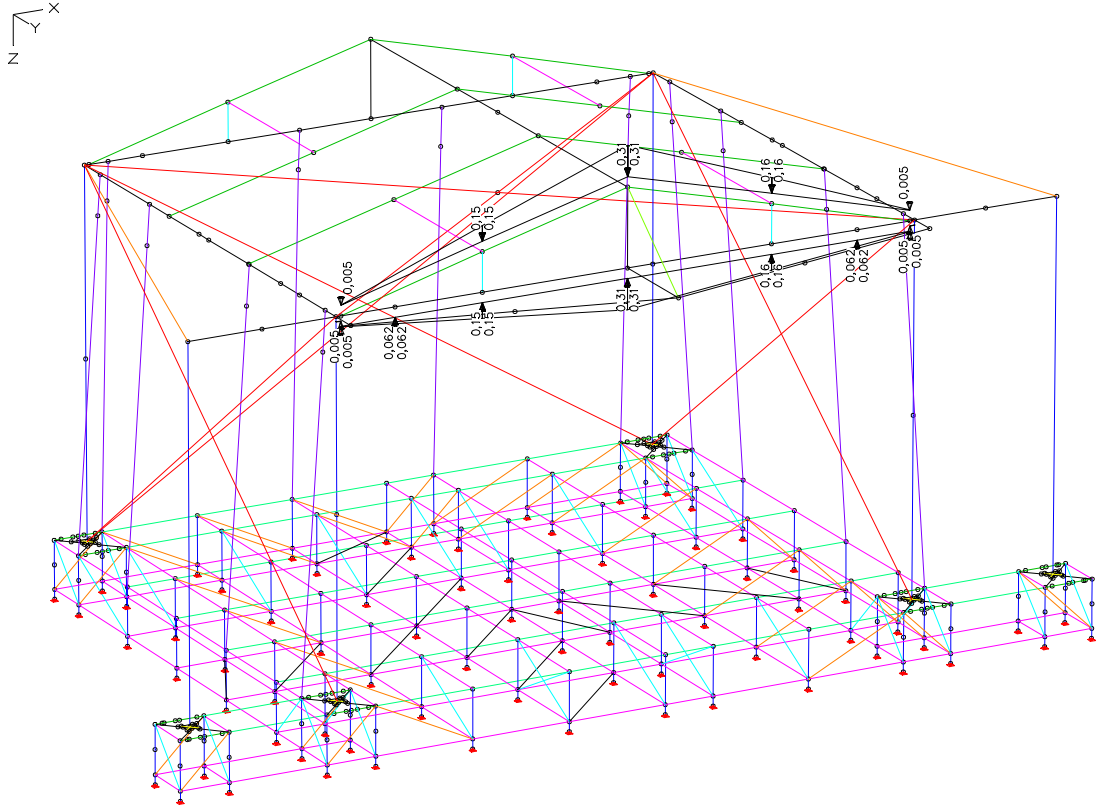


LC 12: Load, Wind Gable Front


PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Load case 13: Membrane-tension Gable Front

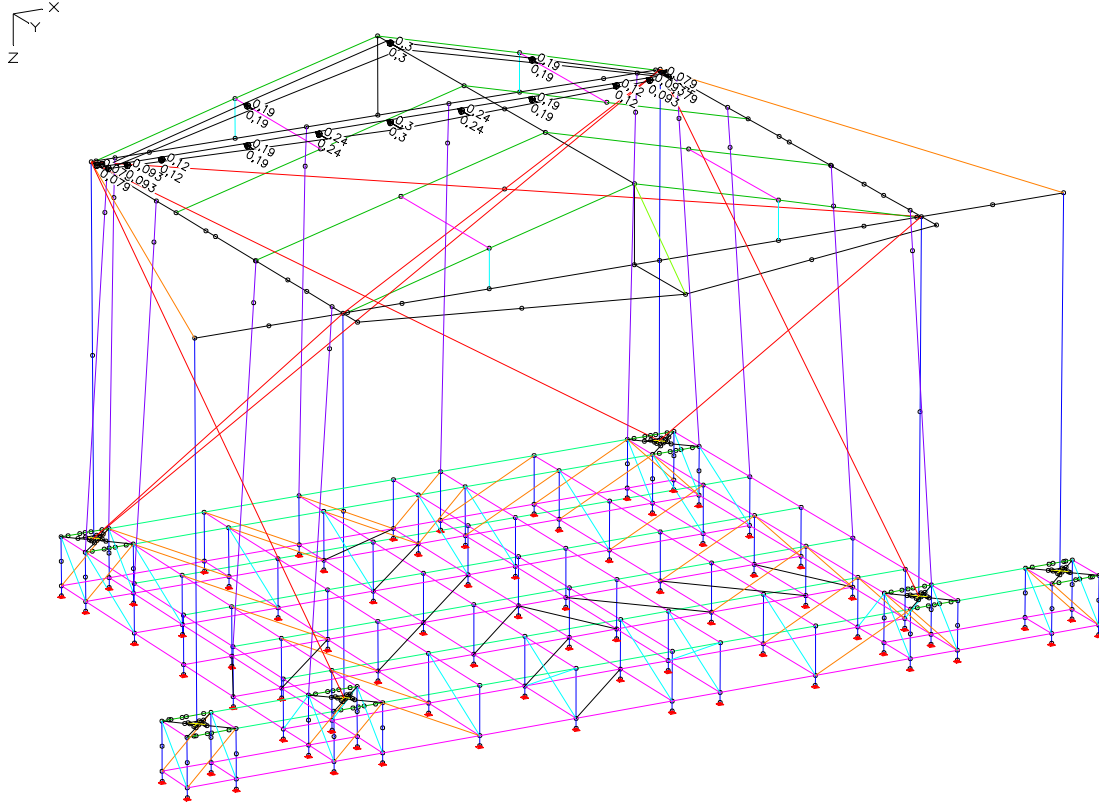
$$z_1 = 0,30 \times 1,65/2/0,8 = 0,31 \text{ kN/m}$$



LC 13: Load, Membrane-tension Gable front

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Load case 14: Wind Gable Rear
see LC 12

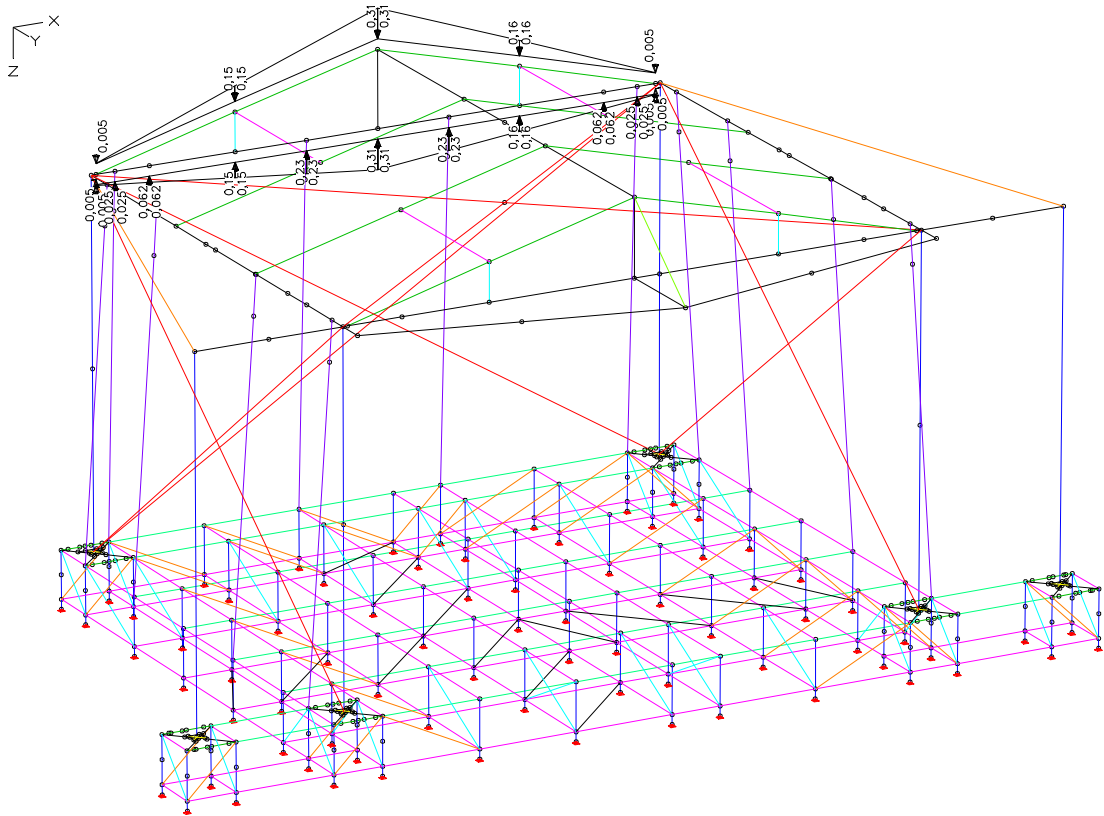


LC 14: Load. Wind Gable Rear

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Load case 15: Membrane-tension Gable Rear

see LC 13



LC 15: Load, Membrane-tension Gable Rear

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Load case 16: Wind Rear Wall

The canopy is fixed at the keder profiles.

$h < 8m \quad 0,20 \text{ kN/m}^2$

$h > 8m \quad 0,30 \text{ kN/m}^2 \quad c_{pe} = 1.00$

$w_1 = 0,20 \times 1,0 \times (0,72 + 4,14/2) = 0,55 \text{ kN/m}$

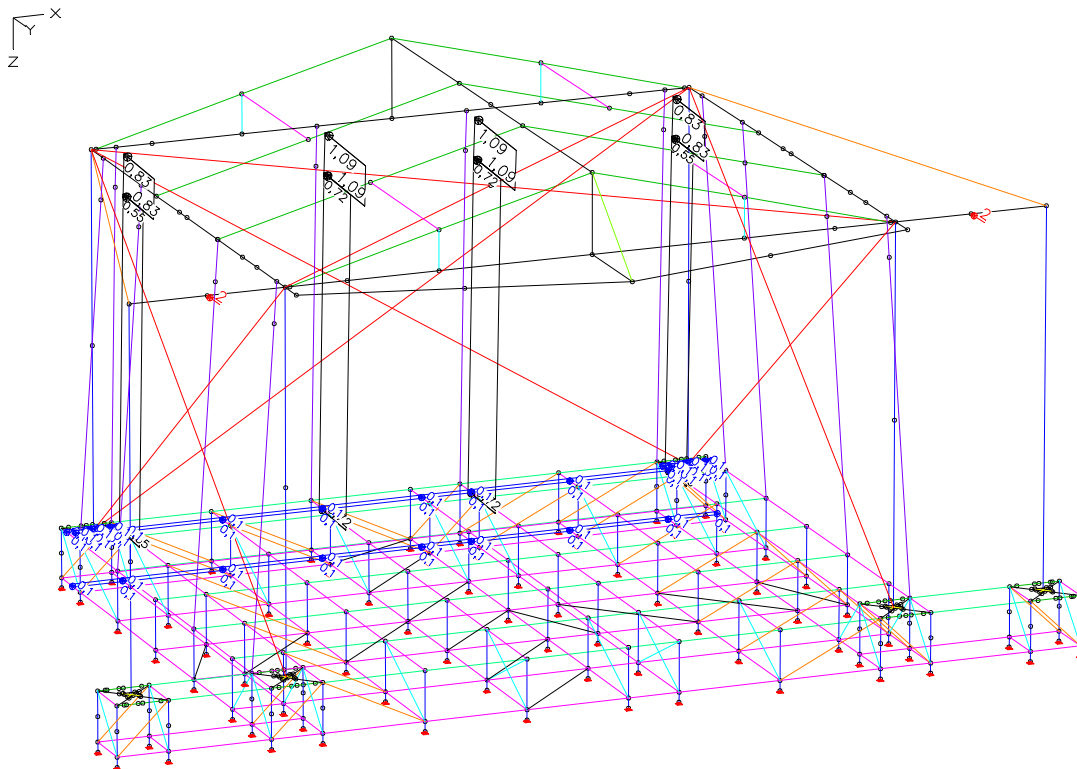
$w_2 = 0,30 \times 1,0 \times (0,72 + 4,14/2) = 0,83 \text{ kN/m}$

$w_3 = 0,20 \times 1,0 \times (4,14/2 + 3,10/2) = 0,72 \text{ kN/m}$


$w_4 = 0,30 \times 1,0 \times (4,14/2 + 3,10/2) = 1,09 \text{ kN/m}$

on PA:

$w_5 = 1,8 / 1,3 \times 0,3 \times 5,0 = 2,08 \text{ kN}$

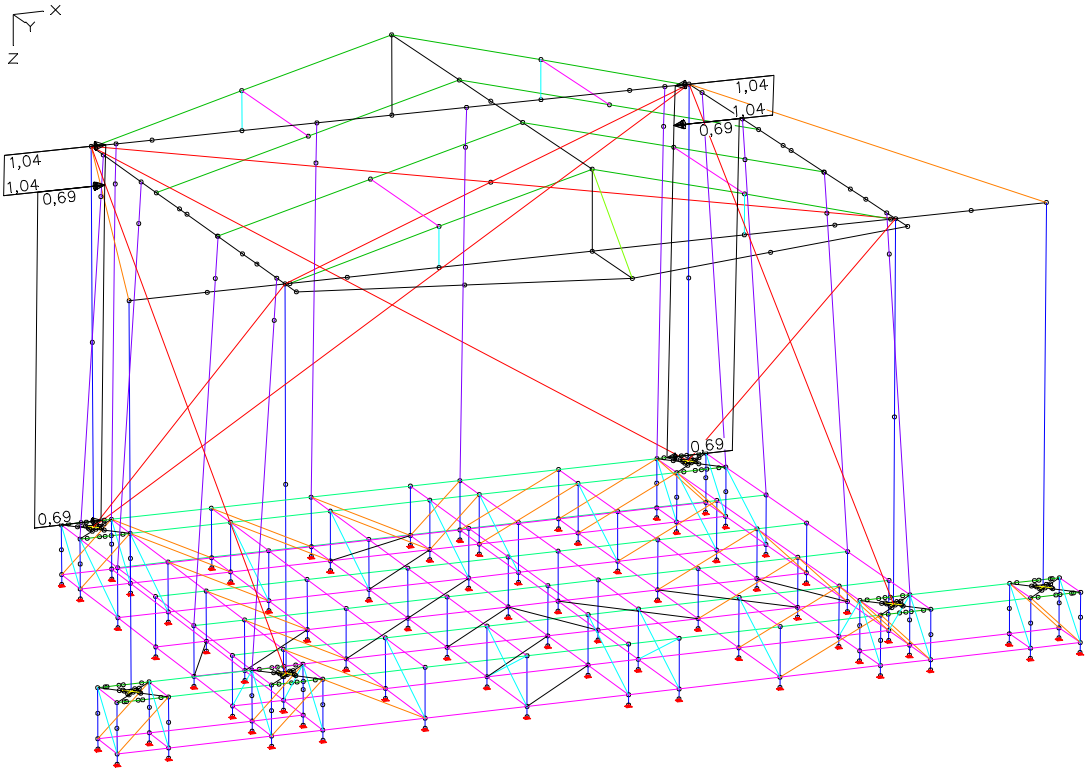


LC 16: Load, Wind Rear Wall

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Load case 17: Membrane-tension Rear Wall

$$\begin{aligned} z_1 &= 0,55 / 0,8 && = 0,6875 \text{ kN/m} \\ z_2 &= 0,83 / 0,8 && = 1,0375 \text{ kN/m} \end{aligned}$$



LC 17: Load, Membrane-tension Rear Wall

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Load case 18: Wind Left Wall

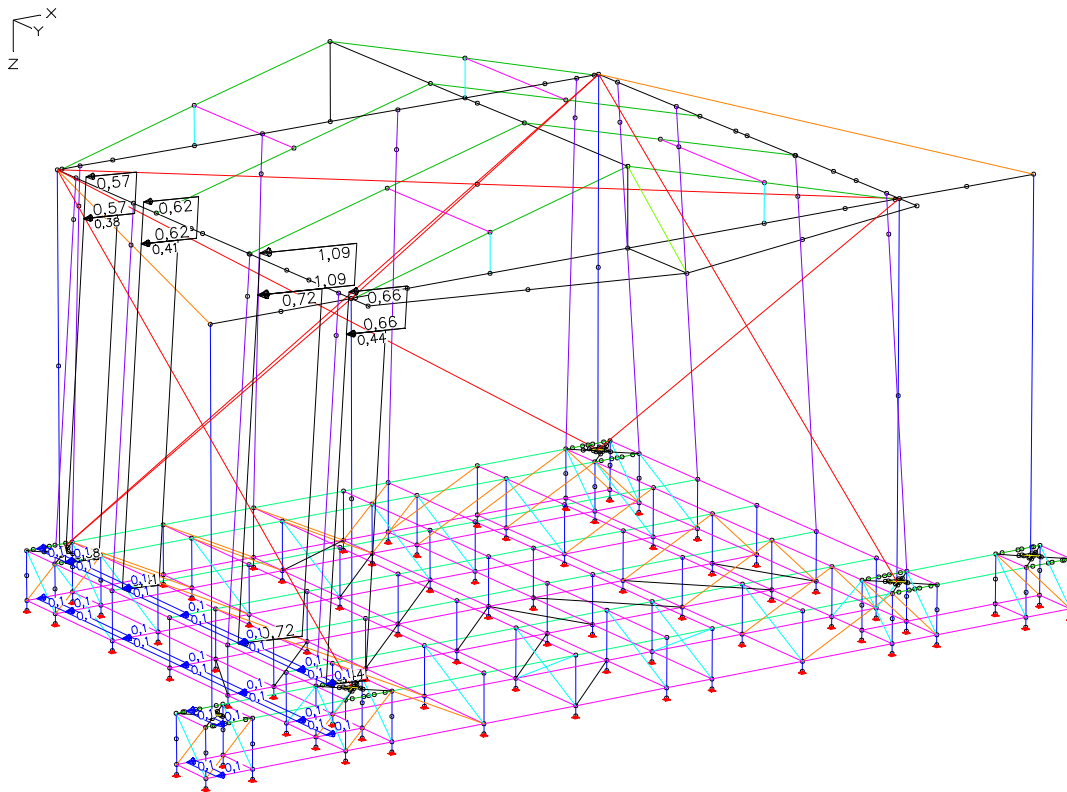
The canopy is fixed at the keder profiles.

$h < 8m \quad 0,20 \text{ kN/m}^2$
 $h > 8m \quad 0,30 \text{ kN/m}^2 \quad c_{pe} = 1.00$


$$\begin{aligned}
 w_1 &= 0,20 \times 1,0 \times (0,64+3,10/2) && = 0,438 \text{ kN/m} \\
 w_2 &= 0,30 \times 1,0 \times (0,64+3,10/2) && = 0,657 \text{ kN/m} \\
 w_3 &= 0,20 \times 1,0 \times (4,14/2+3,10/2) && = 0,724 \text{ kN/m} \\
 w_4 &= 0,30 \times 1,0 \times (4,14/2+3,10/2) && = 1,086 \text{ kN/m} \\
 w_5 &= 0,20 \times 1,0 \times (4,14/2) && = 0,414 \text{ kN/m} \\
 w_6 &= 0,30 \times 1,0 \times (4,14/2) && = 0,621 \text{ kN/m} \\
 w_7 &= 0,20 \times 1,0 \times (0,87+2,07/2) && = 0,381 \text{ kN/m} \\
 w_8 &= 0,30 \times 1,0 \times (0,87+2,07/2) && = 0,572 \text{ kN/m}
 \end{aligned}$$

on Podium:

$$w_9 = 0,20 \times 1,0 \times 1,0 / 2 = 0,10 \text{ kN/m}$$



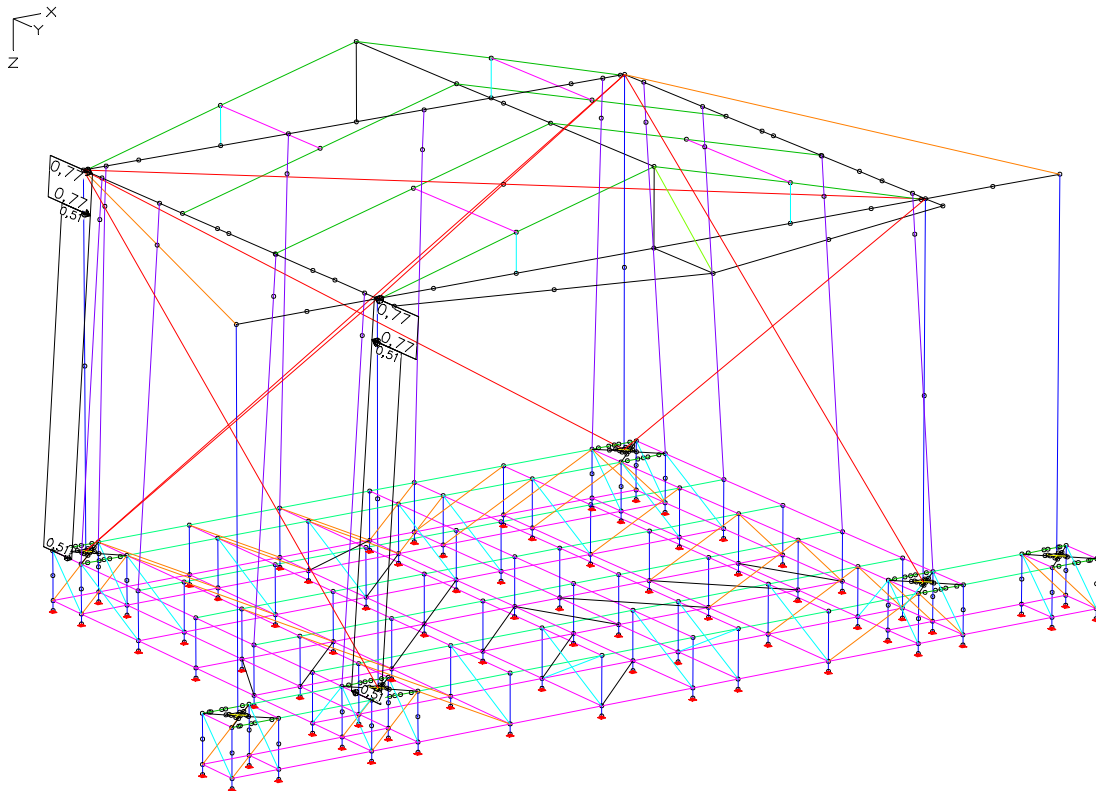
LC 18: Load, Wind Left Wall

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022


Load case 19: Membrane-tension Left Wall

$$\begin{aligned}
 z_1 &= 0,438 / 0,8 &= 0,548 \text{ kN/m} \\
 z_2 &= 0,657 / 0,8 &= 0,821 \text{ kN/m} \\
 z_3 &= 0,381 / 0,8 &= 0,476 \text{ kN/m} \\
 z_4 &= 0,572 / 0,8 &= 0,715 \text{ kN/m}
 \end{aligned}$$

(evenly distributed on towers)

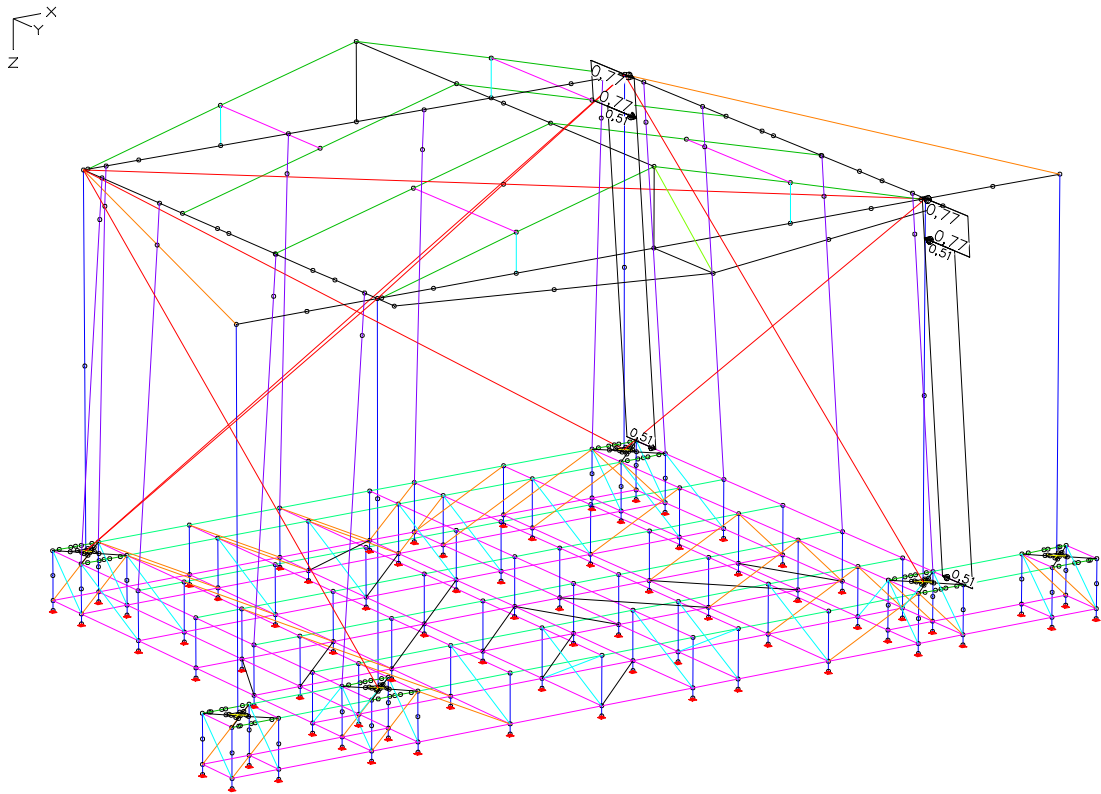


LC 19: Load, Membrane-tension Left Wall

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Load case 21: Membrane-tension Right Wall

see load case 19



LC 21: Load, Membrane-tension Right Wall

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Load case 22: Wind on podium top

$$q = 0,20 \text{ kN/km}^2 \quad c_{pe} = 1.0$$

$$w_1 = 0,20 \times 1,0 \times 2,072 = 0,414 \text{ kN/m}$$

$$w_2 = 0,20 \times 1,0 \times (2,072+1,036)/ 2 = 0,311 \text{ kN/m}$$

$$w_3 = 0,20 \times 1,0 \times 1,036/2 = 0,1036 \text{ kN/m}$$



LC 22: Load, Wind on podium top

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
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Load case 24: Wind on Structure without wall canopies -y-direction

column H30V – 50% permeable:

$$1,30 \times 0,625 \times 0,30 \times 0,50 = 0,125 \text{ kN/m} \quad (\text{black})$$

H40V – 50% permeable:

$$1,30 \times 0,625 \times 0,40 \times 0,50 = 0,167 \text{ kN/m} \quad (\text{black})$$

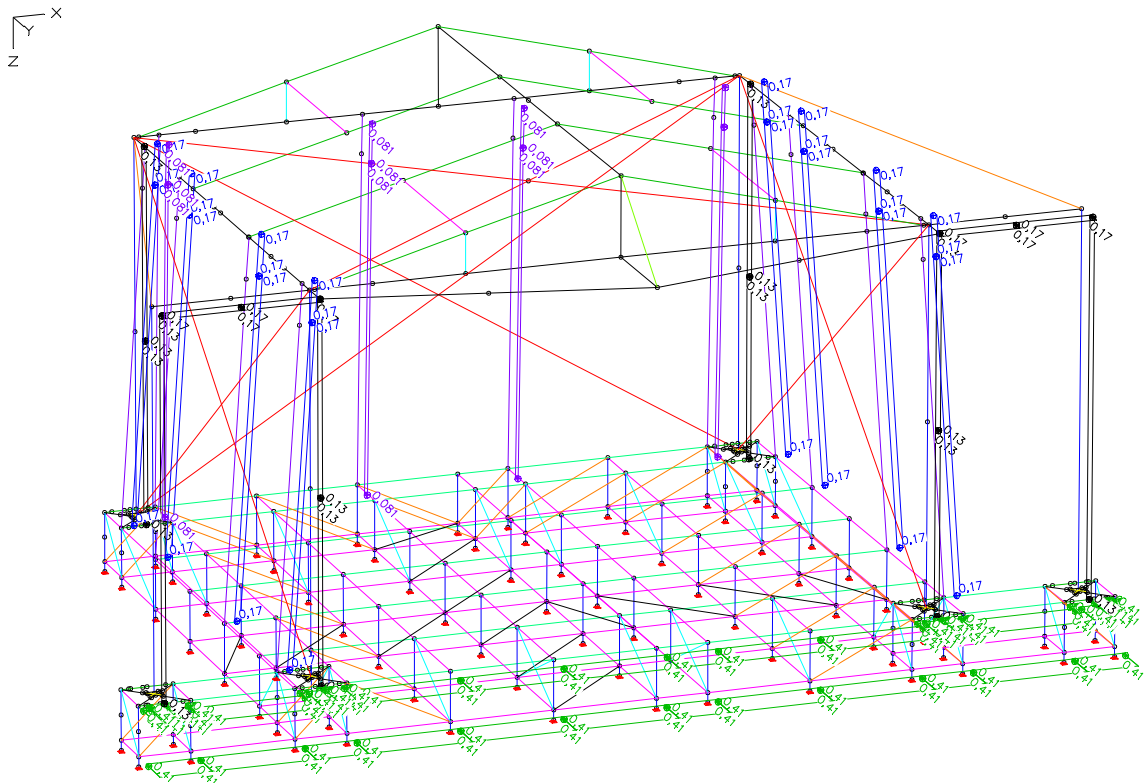
Keder:

$$1,30 \times 0,625 \times 0,10 = 0,081 \text{ kN/m} \quad (\text{violet})$$


$$1,30 \times 0,625 \times 0,20 = 0,1625 \text{ kN/m} \quad (\text{blue})$$

Podium:

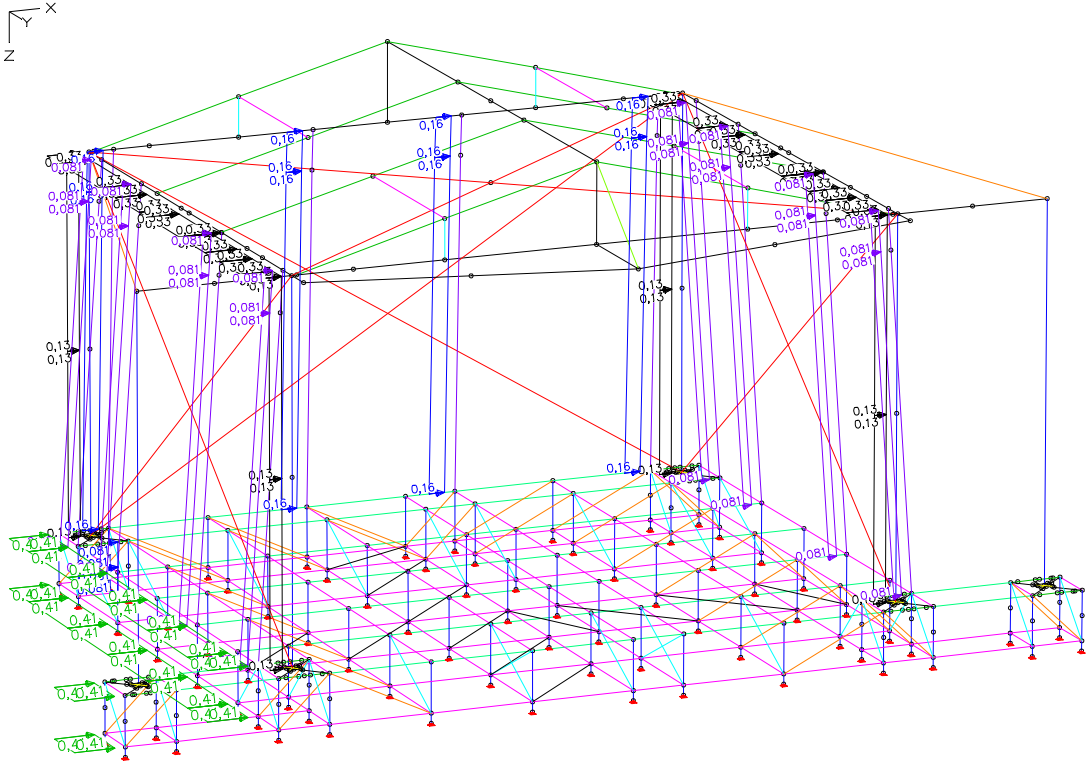
$$1,30 \times 0,625 \times 1,0/2 = 0,406 \text{ kN/m} \quad (\text{green})$$




LC 24: Load, Wind on Structure without canopies -y-direction

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
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Load case 25: Wind on Structure without wall canopies + x-direction
see LC 24



LC 25: Load, Wind on Structure without canopies +x-direction

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To regard various wind directions, each single wind loading scenario will be multiplied with a factor based on the weighting c_{pe} - value according to the direction of wind:

1. roof, back wall and sides enclosed with fully closed canvas wall + dead weight/ ballast


LC101-103

(LC201-203 dead weight/ ballast + payloads)

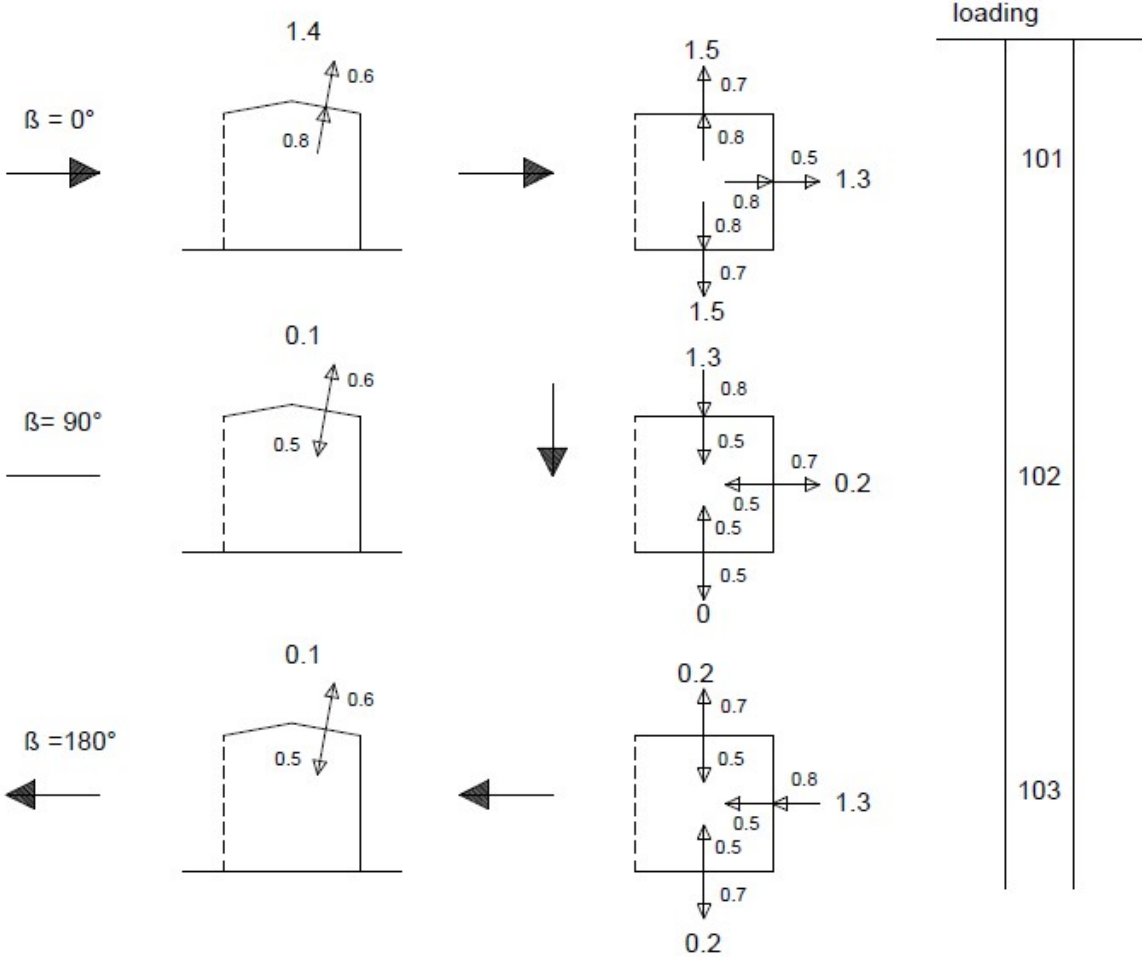
2. roof enclosed with fully closed canvas wall, back wall and sides removed + dead weight/ ballast


LC 301-303

(LC401-403 dead weight/ ballast + payloads)

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1. roof, back wall and sides enclosed: fully closed canvas wall for roof and walls



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load case 100 **g + p (deadweight + ballast + payload)**

load case 1+2	=	1,0
load case 3	=	1,0
load case 4	=	1,0
load case 9	=	1,0

load case 101 **Wind in service $\beta = 0^\circ + g$**

load case 10-11	=	1,40
load case 12-13	=	0
load case 14-17	=	1,30
load case 18-21	=	1,50
load case 22	=	0,80
load case 1+2	=	1,0

load case 102 **Wind in service $\beta = 90^\circ + g$**

load case 10-11	=	0,10
load case 12-13	=	0
load case 14-17	=	0,20
load case 18	=	-1,30
load case 19	=	1,30
load case 22	=	-0,50
load case 1+2	=	1,0

load case 103 **Wind in service $\beta = 180^\circ + g$**

load case 10-11	=	0,10
load case 12-13	=	0
load case 14+16	=	-1,30
load case 15+17	=	1,30
load case 18-21	=	0,20
load case 22	=	-0,50
load case 1+2	=	1,0

load case 201**Wind in service $\beta = 0^\circ +g+p$**

load case 10-11	=	1,40
load case 12-13	=	0
load case 14-17	=	1,30
load case 18-21	=	1,50
load case 22	=	0,80
load case 1+2	=	1,0
load case 3	=	1,0
load case 4	=	1,0
load case 9	=	1,0

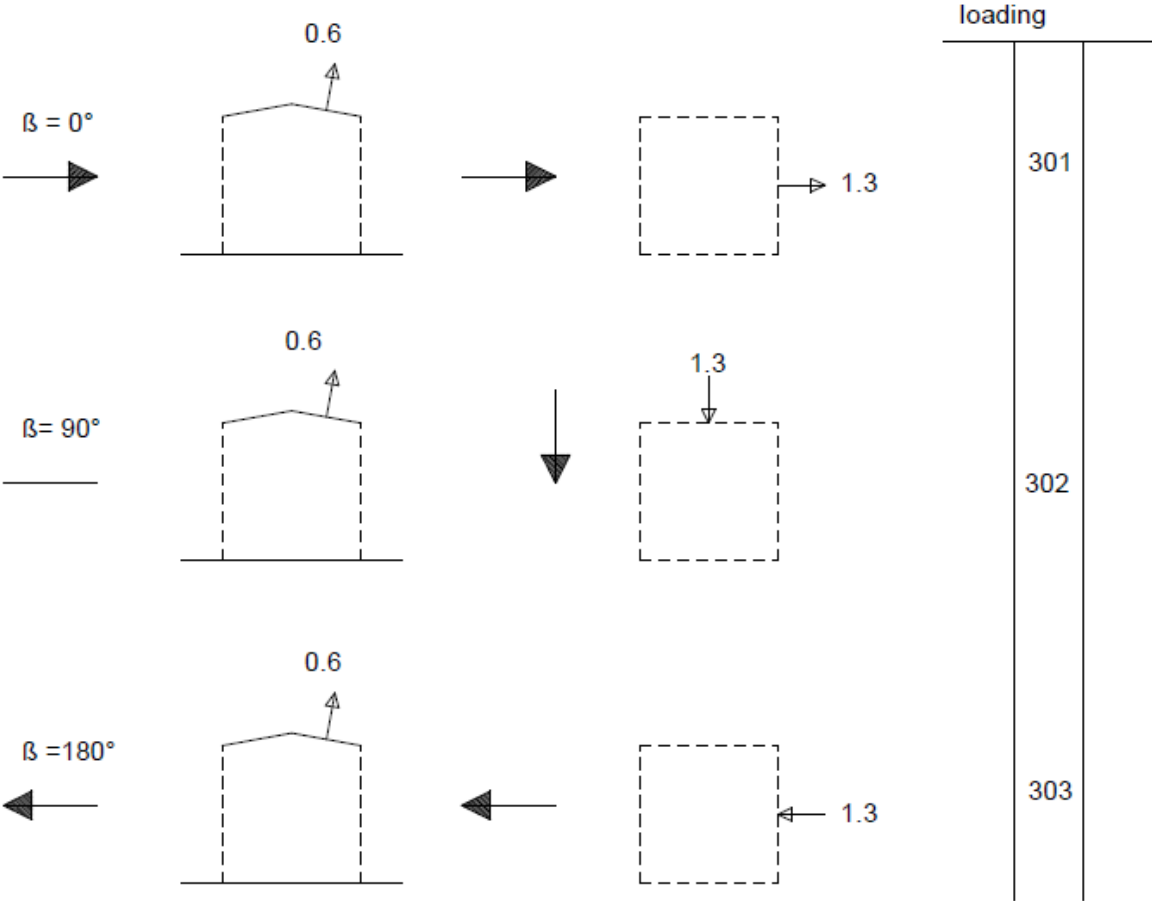
load case 202**Wind in service $\beta = 90^\circ +g+p$**

load case 10-11	=	0,10
load case 12-13	=	0
load case 14-17	=	0,20
load case 18	=	-1,30
load case 19	=	1,30
load case 22	=	-0,50
load case 1+2	=	1,0
load case 3	=	1,0
load case 4	=	1,0
load case 9	=	1,0

load case 203**Wind in service $\beta = 180^\circ +g+p$**

load case 10-11	=	0,10
load case 12-13	=	0
load case 14+16	=	-1,30
load case 15+17	=	1,30
load case 18-21	=	0,20
load case 22	=	-0,50
load case 1+2	=	1,0
load case 3	=	1,0
load case 4	=	1,0
load case 9	=	1,0

2. roof closed, wall canopy removed



load case 301

Wind out of service $\beta = 0^\circ +g$

load case 10-11	$0,6 \times 0,625 / 0,3$	=	1,25
load case 12	$-1,3 \times 0,625 / 0,3$	=	-2,71
load case 13	$1,3 \times 0,625 / 0,3$	=	2,71
load case 24		=	1,00
load case 1+2		=	1,0

load case 302

Wind out of service $\beta = 90^\circ +g$

load case 10-11	$0,6 \times 0,625 / 0,3$	=	1,25
load case 25		=	1,00
load case 1+2		=	1,0

load case 303

Wind out of service $\beta = 180^\circ +g$

load case 10-11	$0,6 \times 0,625 / 0,3$	=	1,25
load case 14	$-1,3 \times 0,625 / 0,3$	=	-2,71
load case 15	$1,3 \times 0,625 / 0,3$	=	2,71
load case 24		=	- 1,00
load case 1+2		=	1,0

load case 401**Wind out of service $\beta = 0^\circ +g+p$**

load case 10-11	$0,6 \times 0,625 / 0,3$	=	1,25
load case 12	$-1,3 \times 0,625 / 0,3$	=	-2,71
load case 13	$1,3 \times 0,625 / 0,3$	=	2,71
load case 24		=	1,00
load case 1+2		=	1,0
load case 3+4		=	1,0

load case 402**Wind out of service $\beta = 90^\circ +g+p$**

load case 10-11	$0,6 \times 0,625 / 0,3$	=	1,25
load case 25		=	1,00
load case 1+2		=	1,0
load case 3+4		=	1,0

load case 403**Wind out of service $\beta = 180^\circ +g+p$**

load case 10-11	$0,6 \times 0,625 / 0,3$	=	1,25
load case 14	$-1,3 \times 0,625 / 0,3$	=	-2,71
load case 15	$1,3 \times 0,625 / 0,3$	=	2,71
load case 24		=	- 1,00
load case 1+2		=	1,0
load case 3+4		=	1,0

The system is calculated with supports with planned tension loss. All dead weights and the ballast loads (LC 1+2) and the payloads (LC3+4+(9)) are incorporated into the insert load cases and all redirections of forces inside the Layher Podium are calculated directly in the system.

The shown load cases are combined in load case combinations for the calculation.

NOTICE:

Load case combination 91-94 with incorporate partial safety factors $\gamma_Q = 1,35$ for variable loads on the safe side.
The values for the partial safety factors are given in the DIN EN 13814 for fairground and amusement park machinery and structures.

load case combinations with characteristic values:

LCC 81: LC(101-103)

LCC 82: LC(201-203)

LCC 83: LC(301-303)

LCC 84: LC(401-403)

LCC85: LCC(81-84)

load case combinations with design values:


LCC 91: 1,35 x LC(101-103)

LCC 91: 1,35 x LC(201-203)

LCC 93: 1,35 x LC(301-303)

LCC 91: 1,35 x LC(401-403)

LCC95: LCC(91-94)

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4 CALCULATION

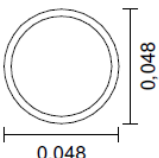
System characteristics


462 Nodes		832 Beams
832 Elements		0 Slabs
75 Supports		0 Plains
0 Link elements		0 Shells
12 Material properties		0 Cables
12 Section properties		0 Solids
37 Load cases		0 Spring elements
10 LC Combinations		
0 Tendon groups		

Result location in area elements: Node
 5 Result locations in beam elements

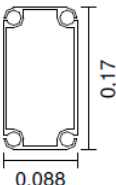

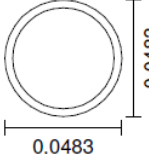
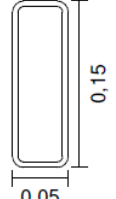
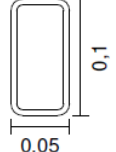
Rotated element systems
 0 Element systems
 0 Internal force systems
 0 Reinforcement systems

Section properties

1	Beam	H40V Area [m ²] Moments of inertia [m ⁴]	A = 1,696e-03 I _x = 1,000e-05 I _z = 4,179e-05	I _y = 4,179e-05 I _{yz} = 0,000e+00
2	Beam	H30V Area [m ²] Moments of inertia [m ⁴]	A = 1,696e-03 I _x = 1,000e-05 I _z = 2,096e-05	I _y = 2,096e-05 I _{yz} = 0,000e+00
3	Beam	H30D Area [m ²] Moments of inertia [m ⁴]	A = 1,272e-03 I _x = 1,000e-05 I _z = 1,048e-05	I _y = 1,057e-05 I _{yz} = 0,000e+00
4	Tension member	Guy wire Area [m ²]	A = 1,000e-04	
5	Polygon 	48x3mm Centroid [m] Area [m ²] Moments of inertia [m ⁴] Main axis angle [Grad]	ys = -0,000 A = 4,2140e-04 I _x = 2,1272e-07 I _y = 1,0645e-07 I _z = 1,0645e-07 Phi = 0,000	zs = -0,000 I ₁ = 1,0645e-07 I ₂ = 1,0645e-07 I _{yz} = 0,0000e+00


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Section properties

6	<p>Polygon</p> 	<p>Keder 170x88 Centroid [m] $y_s = 0,000$ $z_s = 0,000$ Area [m²] $A = 1,9554e-03$ Moments of inertia [m⁴] $I_x = 4,2491e-06$ $I_y = 7,9022e-06$ $I_1 = 7,9022e-06$ $I_z = 2,3673e-06$ $I_2 = 2,3673e-06$ Main axis angle [Grad] $\Phi = -0,016$ $I_{yz} = 1,5251e-09$ Averaging of the lateral force shear stress over section width</p>
7	<p>Beam</p>	<p>S36R Area [m²] $A = 2,312e-03$ Moments of inertia [m⁴] $I_x = 7,000e-05$ $I_y = 4,445e-05$ $I_z = 1,250e-05$ $I_{yz} = 0,000e+00$</p>
8	<p>Library section</p> 	<p>RRO 100 x 60 x 4 (EN 10219-2); 100x60x4 Centroid [m] $y_s = 0,000$ $z_s = 0,000$ Area [m²] $A = 1,1700e-03$ Moments of inertia [m⁴] $I_x = 1,5600e-06$ $I_y = 1,5300e-06$ $I_1 = 1,5300e-06$ $I_z = 6,8700e-07$ $I_2 = 6,8700e-07$ Main axis angle [Grad] $\Phi = 0,000$ $I_{yz} = 0,0000e+00$ Averaging of the lateral force shear stress over section width</p>
9	<p>Library section</p> 	<p>RO 48,3 x 3,2 (MSH); Layher tubes Centroid [m] $y_s = 0,000$ $z_s = 0,000$ Area [m²] $A = 4,5300e-04$ Moments of inertia [m⁴] $I_x = 2,3200e-07$ $I_y = 1,1600e-07$ $I_1 = 1,1600e-07$ $I_z = 1,1600e-07$ $I_2 = 1,1600e-07$ Main axis angle [Grad] $\Phi = 0,000$ $I_{yz} = 0,0000e+00$</p>
10	<p>Polygon</p> 	<p>Support beams - Base Centroid [m] $y_s = 0,025$ $z_s = 0,000$ Area [m²] $A = 1,8296e-03$ Moments of inertia [m⁴] $I_x = 2,3025e-06$ $I_y = 4,5313e-06$ $I_1 = 4,5313e-06$ $I_z = 7,7566e-07$ $I_2 = 7,7566e-07$ Main axis angle [Grad] $\Phi = -0,000$ $I_{yz} = 0,0000e+00$ Averaging of the lateral force shear stress over section width Specified cross-section class according to 1993-1-1: 3</p>
11	<p>Library section</p> 	<p>RRO 100 x 50 x 5 (EN 10219-2); chord lattice girder Centroid [m] $y_s = 0,000$ $z_s = 0,000$ Area [m²] $A = 1,3400e-03$ Moments of inertia [m⁴] $I_x = 1,3500e-06$ $I_y = 1,5800e-06$ $I_1 = 1,5800e-06$ $I_z = 5,2500e-07$ $I_2 = 5,2500e-07$ Main axis angle [Grad] $\Phi = 0,000$ $I_{yz} = 0,0000e+00$</p>

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<p>CUSTOMER/AUFTRAGGEBER: </p>	<p>DATE/DATUM: 15.03.2022</p>

Section properties

12	Library section 	RRO 100 x 60 x 4 (EN 10219-2); 100x60x4
		Centroid [m] $y_s = 0,000$ $z_s = 0,000$ Area [m ²] $A = 1,1700e-03$ Moments of inertia [m ⁴] $I_x = 1,5600e-06$ $I_y = 1,5300e-06$ $I_z = 6,8700e-07$ Main axis angle [Grad] $\Phi = 0,000$ $I_{11} = 1,5300e-06$ $I_{22} = 6,8700e-07$ Averaging of the lateral force shear stress over section width $I_{yz} = 0,0000e+00$

Material properties

	No.	Type	E-Modu. [MN/m ²]	G-Modu. [MN/m ²]	Poiss. ratio	alpha.t [1/K]	gamma [kN/m ³]	Miscellaneous
1	1	Frei	70000	27000	0,20	1,00e-05	0,000	
2	2	Frei	70000	27000	0,20	1,00e-05	0,000	
3	3	Frei	70000	27000	0,20	1,00e-05	0,000	
4	4	Stahl	110000	81000	0,00	1,20e-05	0,000	$f_{yk} = 240$ [MN/m ²]
5	5	Frei	70000	27000	0,20	1,00e-05	27,000	$f_c = 1e+06$ [MN/m ²] $f_t = 1e+06$
6	6	Frei	70000	27000	0,20	1,00e-05	27,000	$f_c = 1e+06$ [MN/m ²] $f_t = 1e+06$
7	7	Frei	70000	27000	0,20	1,00e-05	0,000	
8	8	Stahl	210000	81000	0,30	1,20e-05	0,000	$f_{yk} = 235$ [MN/m ²]
9	9	S235-EN	210000	81000	0,30	1,20e-05	78,500	
10	10	S235-EN	210000	81000	0,30	1,20e-05	78,500	
11	11	S355-EN	210000	81000	0,30	1,20e-05	78,500	
12	12	S235-EN	210000	81000	0,30	1,20e-05	78,500	

List of load cases

LC.	Label
1	deadweight
2	Ballast
3	payload podium
4	Distributed Load
5	Center Point Load
6	Third Point Load
7	Fourth Point Load
8	Fifth Point Load
9	PA-Load
10	Wind Roof
11	Membrane-tension Roof

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LC.	Label
12	Wind Gable Front
13	Membrane-tension Gable front
14	Wind Gable Rear
15	Membrane-tension Gable Rear
16	Wind Rear Wall
17	Membrane-tension Rear Wall
18	Wind Left Wall
19	Membrane-tension Left Wall
20	Wind Right Wall
21	Membrane-tension Right Wall
22	Wind on podium top
24	Wind on Structure without canopies -y-direction
25	Wind on Structure without canopies +x-direction
100	g+p
101	wind $\beta = 0^\circ$ +g
102	wind $\beta = 90^\circ$ +g
103	wind $\beta = 180^\circ$ +g
201	wind $\beta = 0^\circ$ +g+p
202	wind $\beta = 90^\circ$ +g+p
203	wind $\beta = 180^\circ$ +g+p
301	wind $\beta = 0^\circ$ only roof +g
302	wind $\beta = 90^\circ$ only roof +g
303	wind $\beta = 180^\circ$ only roof +g
401	wind $\beta = 0^\circ$ only roof +g+p
402	wind $\beta = 90^\circ$ only roof +g+p
403	wind $\beta = 180^\circ$ only roof +g+p

Load case combination 81

1. Variable exclusive action	Factor
100 g+p	1,000
101 wind $\beta = 0^\circ$ +g	1,000
102 wind $\beta = 90^\circ$ +g	1,000
103 wind $\beta = 180^\circ$ +g	1,000

Load case combination 82

1. Variable exclusive action	Factor
201 wind $\beta = 0^\circ$ +g+p	1,000
202 wind $\beta = 90^\circ$ +g+p	1,000
203 wind $\beta = 180^\circ$ +g+p	1,000

Load case combination 83

1. Variable exclusive action	Factor
301 wind $\beta = 0^\circ$ only roof +g	1,000
302 wind $\beta = 90^\circ$ only roof +g	1,000
303 wind $\beta = 180^\circ$ only roof +g	1,000

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Load case combination 84

1. Variable exclusive action		Factor
401	wind $\beta = 0^\circ$ only roof +g+p	1,000
402	wind $\beta = 90^\circ$ only roof +g+p	1,000
403	wind $\beta = 180^\circ$ only roof +g+p	1,000

Load case combination 85

1. Variable exclusive action		Factor
K81	[Unnamed]	1,000
K82	[Unnamed]	1,000
K83	[Unnamed]	1,000
K84	[Unnamed]	1,000

Load case combination 91

1. Variable exclusive action		Factor
100	g+p	1,350
101	wind $\beta = 0^\circ$ +g	1,350
102	wind $\beta = 90^\circ$ +g	1,350
103	wind $\beta = 180^\circ$ +g	1,350

Load case combination 92

1. Variable exclusive action		Factor
201	wind $\beta = 0^\circ$ +g+p	1,350
202	wind $\beta = 90^\circ$ +g+p	1,350
203	wind $\beta = 180^\circ$ +g+p	1,350

Load case combination 93

1. Variable exclusive action		Factor
301	wind $\beta = 0^\circ$ only roof +g	1,350
302	wind $\beta = 90^\circ$ only roof +g	1,350
303	wind $\beta = 180^\circ$ only roof +g	1,350

Load case combination 94

4. Variable exclusive action		Factor
401	wind $\beta = 0^\circ$ only roof +g+p	1,350
402	wind $\beta = 90^\circ$ only roof +g+p	1,350
403	wind $\beta = 180^\circ$ only roof +g+p	1,350


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Load case combination 95

1. Variable exclusive action		Factor
K91	[Unnamed]	1,000
K92	[Unnamed]	1,000
K93	[Unnamed]	1,000
K94	[Unnamed]	1,000


Sum of installed loads and support reactions

LC.	Label	Fx [kN]	Fy [kN]	Fz [kN]
1	deadweight	0,000	-0,000	82,380
	Support reactions	-0,000	-0,000	82,380
2	Ballast	0,000	0,000	92,000
	Support reactions	0,000	-0,000	92,000
3	payload podium	0,000	0,000	799,606
	Support reactions	0,000	-0,000	799,606
4	Distributed Load	0,000	0,000	59,618
	Support reactions	0,000	0,000	59,618
5	Center Point Load	0,000	0,000	34,000
	Support reactions	-0,000	0,000	34,001
6	Third Point Load	0,000	0,000	47,000
	Support reactions	-0,000	0,000	47,001
7	Fourth Point Load	0,000	0,000	48,000
	Support reactions	-0,000	0,000	48,001
8	Fifth Point Load	0,000	0,000	54,500
	Support reactions	-0,000	0,000	54,501
9	PA-Load	0,000	0,000	20,000
	Support reactions	-0,000	-0,000	20,005
11	Membrane-tension Roof	-0,000	-0,000	-0,000
	Support reactions	0,000	-0,000	0,000
13	Membrane-tension Gable front	0,000	0,000	0,062
	Support reactions	-0,000	0,000	0,062
15	Membrane-tension Gable Rear	0,000	-0,000	0,062
	Support reactions	0,000	-0,000	0,069
17	Membrane-tension Rear Wall	-0,000	0,000	-0,000
	Support reactions	-0,000	-0,000	0,000
19	Membrane-tension Left Wall	-0,000	0,000	0,000
	Support reactions	-0,000	-0,000	0,000

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Sum of installed loads and support reactions

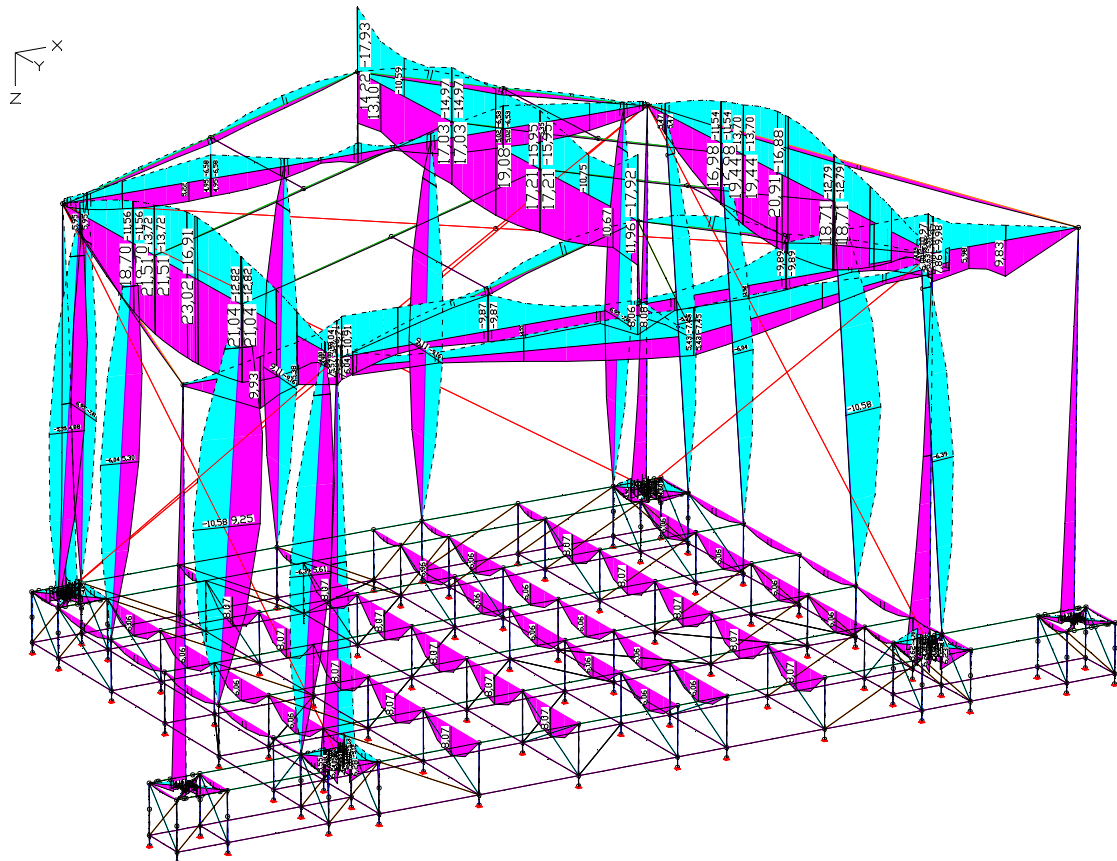
LC.	Label	Fx [kN]	Fy [kN]	Fz [kN]
21	Membrane-tension Right Wall	0,000	0,000	-0,000
	Support reactions	0,000	0,000	0,000
22	Wind on podium top	0,000	0,000	30,696
	Support reactions	0,000	0,000	30,696
100	g+p	0,000	-0,000	1053,603
	Support reactions	-0,000	-0,000	1053,603
101	wind $\beta = 0^\circ$ +g	-0,000	-41,293	130,969
	Support reactions	-0,000	-41,293	131,426
102	wind $\beta = 90^\circ$ +g	23,337	-6,353	155,722
	Support reactions	23,337	-6,353	155,722
103	wind $\beta = 180^\circ$ +g	0,000	41,293	155,409
	Support reactions	0,000	41,293	155,409
201	wind $\beta = 0^\circ$ +g+p	-0,000	-41,293	1010,192
	Support reactions	-0,000	-41,293	1010,192
202	wind $\beta = 90^\circ$ +g+p	23,337	-6,353	1034,945
	Support reactions	23,337	-6,353	1034,945
203	wind $\beta = 180^\circ$ +g+p	0,000	41,293	1034,632
	Support reactions	0,000	41,293	1034,632
301	wind $\beta = 0^\circ$ only roof +g	-0,000	-47,871	121,366
	Support reactions	-0,000	-47,871	121,366
302	wind $\beta = 90^\circ$ only roof +g	29,788	-0,000	117,659
	Support reactions	29,788	-0,000	117,659
303	wind $\beta = 180^\circ$ only roof +g	0,000	47,871	114,289
	Support reactions	0,000	47,871	114,289
401	wind $\beta = 0^\circ$ only roof +g+p	-0,000	-47,871	980,590
	Support reactions	-0,000	-47,871	981,051
402	wind $\beta = 90^\circ$ only roof +g+p	29,788	-0,000	976,882
	Support reactions	29,788	-0,000	977,588
403	wind $\beta = 180^\circ$ only roof +g+p	0,000	47,871	973,512
	Support reactions	0,000	47,871	973,690

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

design internal forces

load case combination 95:

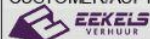
$M_{y,Ed}$



LCC 95: Internal forces min,max M_y [kNm]
 Value range (overall system, min/max): -17,93/23,02 [kNm]

PROJECT:
MPT-ROOF 12x10m

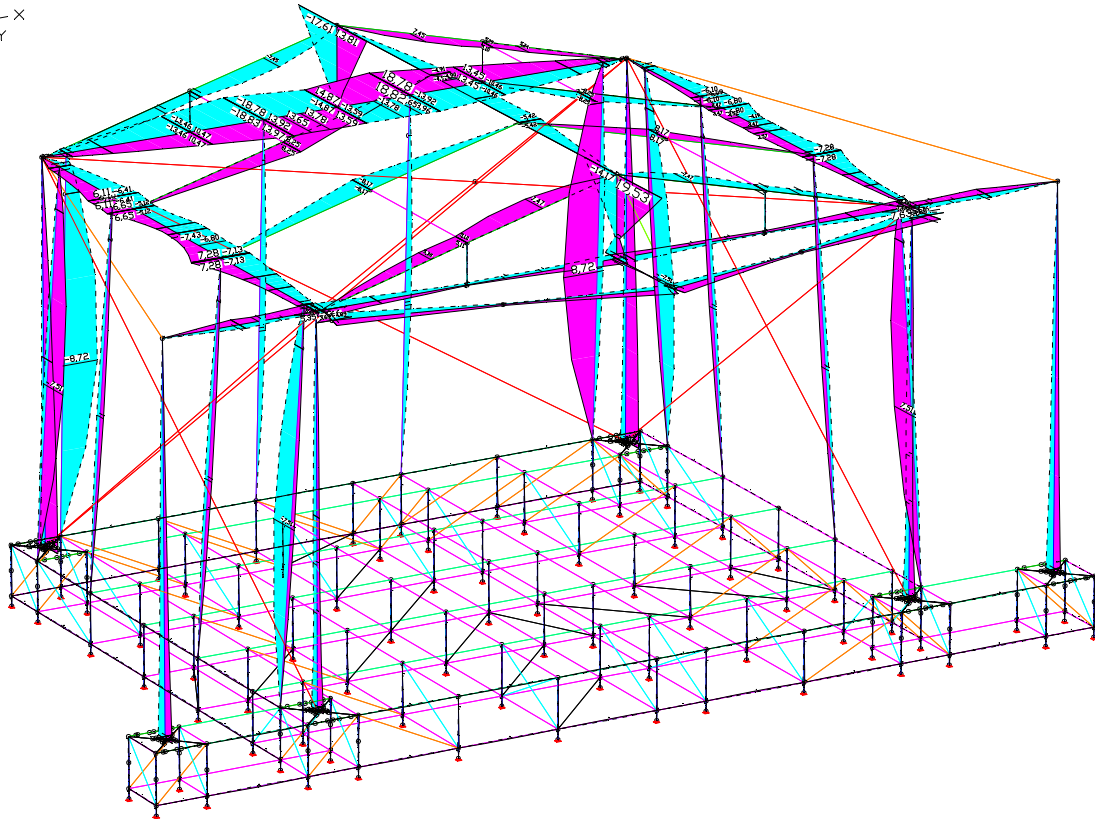
CUSTOMER/AUFTRAGGEBER:



PROJECT-NO.:
22012

DATE/DATUM:
15.03.2022

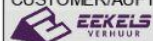
$M_{z,Ed}$



LCC 95: Internal forces min,max M_z [kNm]
 Value range (overall system, min/max): -18,83/19,53 [kNm]

PROJECT:
MPT-ROOF 12x10m

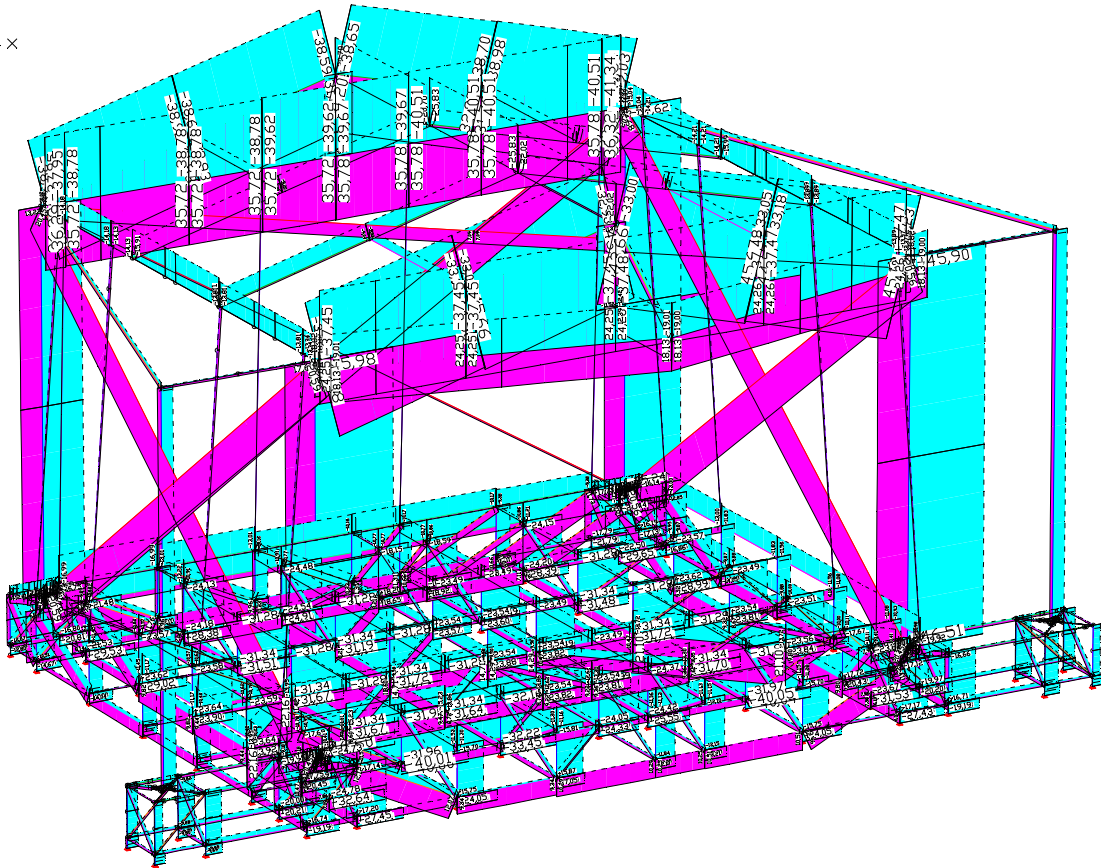
CUSTOMER/AUFTRAGGEBER:




PROJECT-NO.:
22012

DATE/DATUM:
15.03.2022

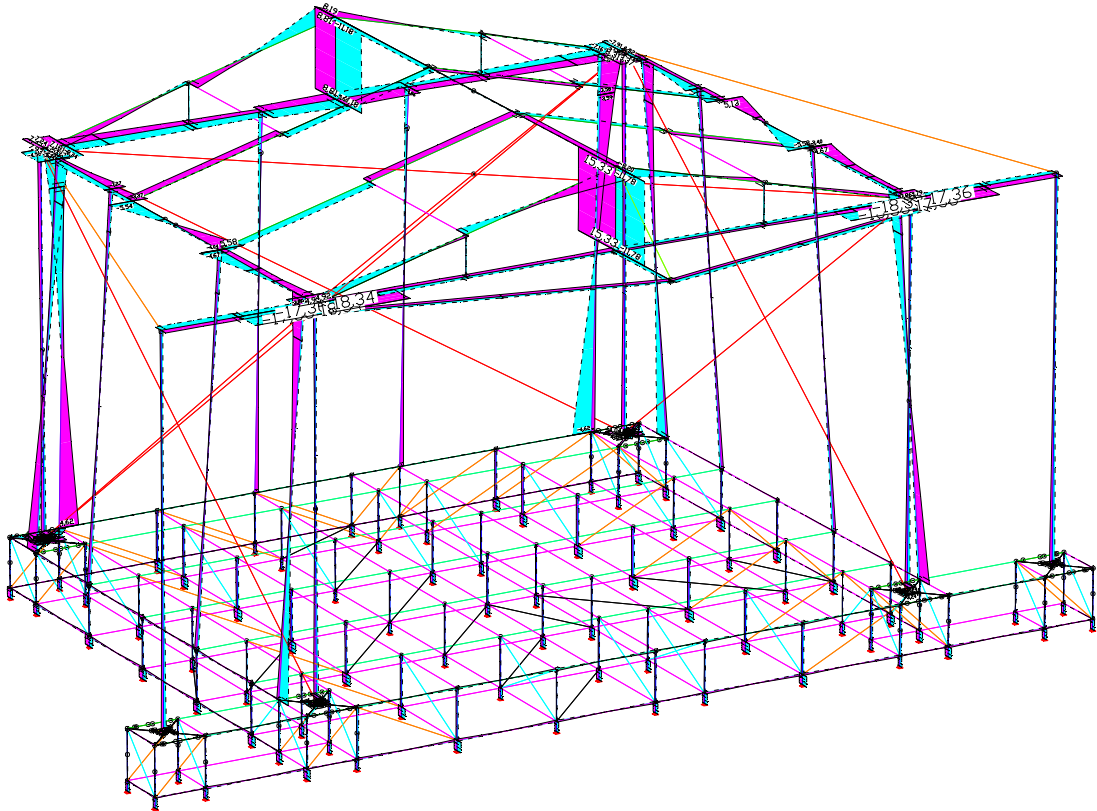
N_{Ed}



LCC 95: Internal forces min,max N_x [kN]
 Value range (overall system, min/max): -46,60/45,67 [kN]

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

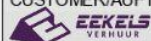
$V_{y,Ed}$



LCC 95: Internal forces min,max Q_y [kN]
 Value range (overall system, min/max): -18,33/18,34 [kN]

PROJECT:
MPT-ROOF 12x10m

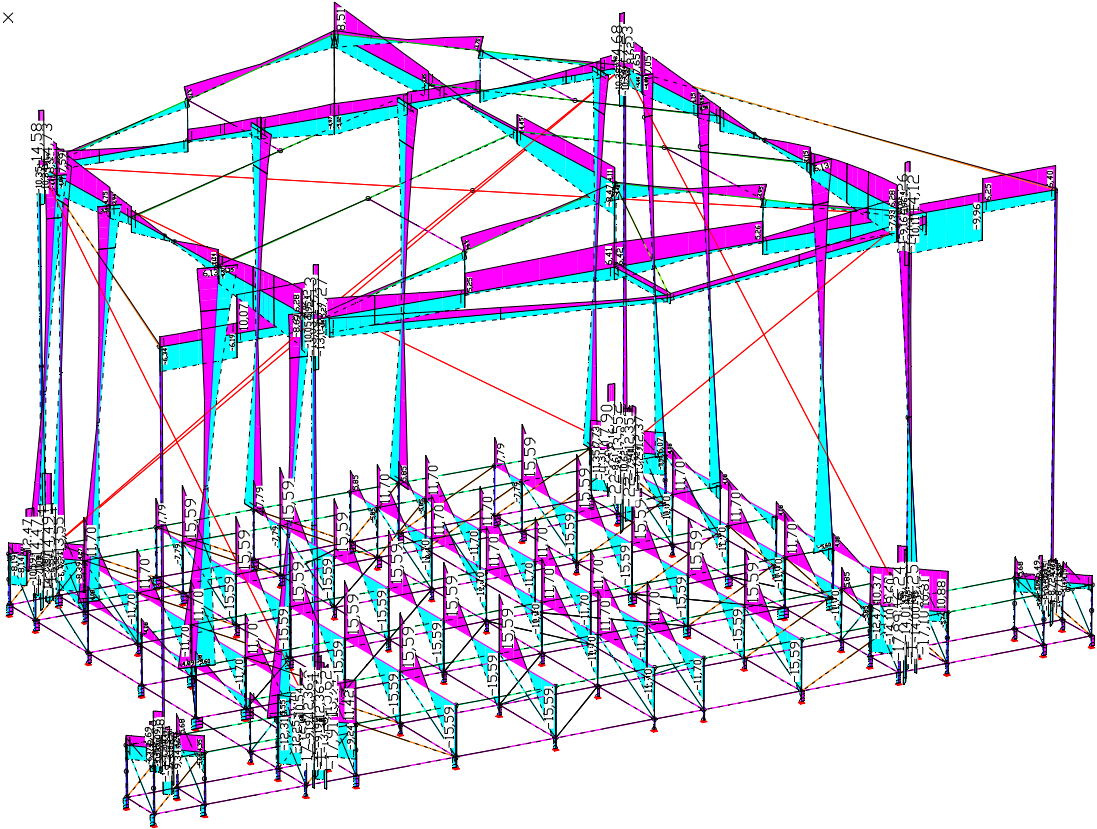
CUSTOMER/AUFTRAGGEBER:



PROJECT-NO.:
22012

DATE/DATUM:
15.03.2022

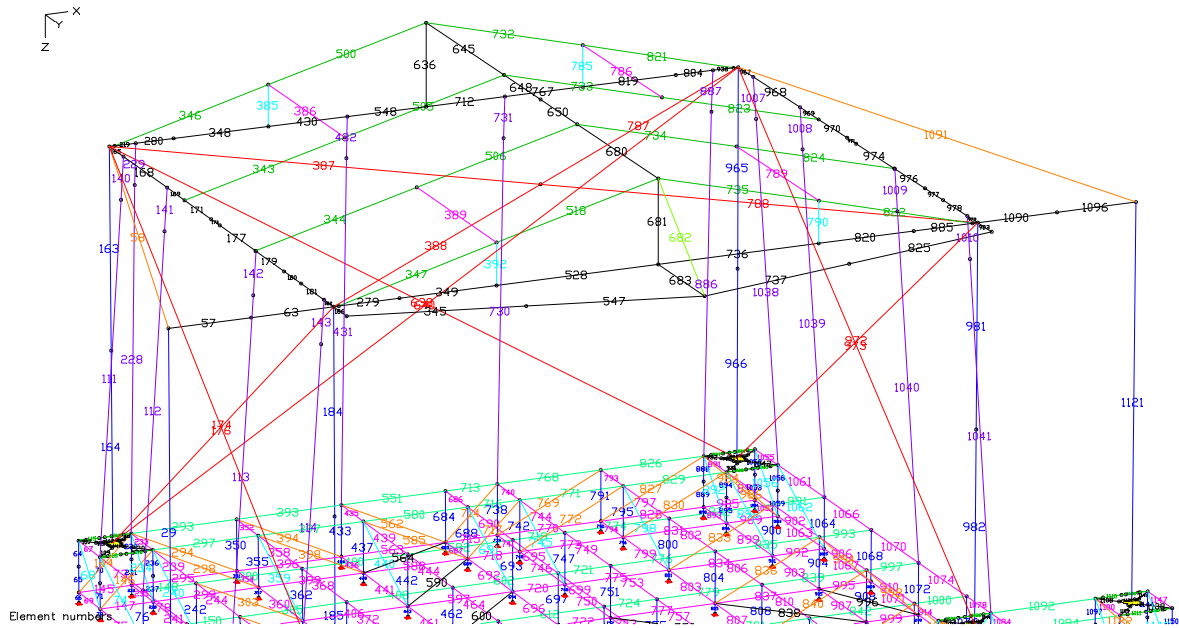
V_{z,Ed}



LCC 95: Internal forces min,max Qz [kN]
Value range (overall system, min/max): -22,18/22,04 [kN]

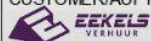
PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

5 PROOFS



PROJECT:
MPT-ROOF 12x10m

CUSTOMER/AUFTRAGGEBER:

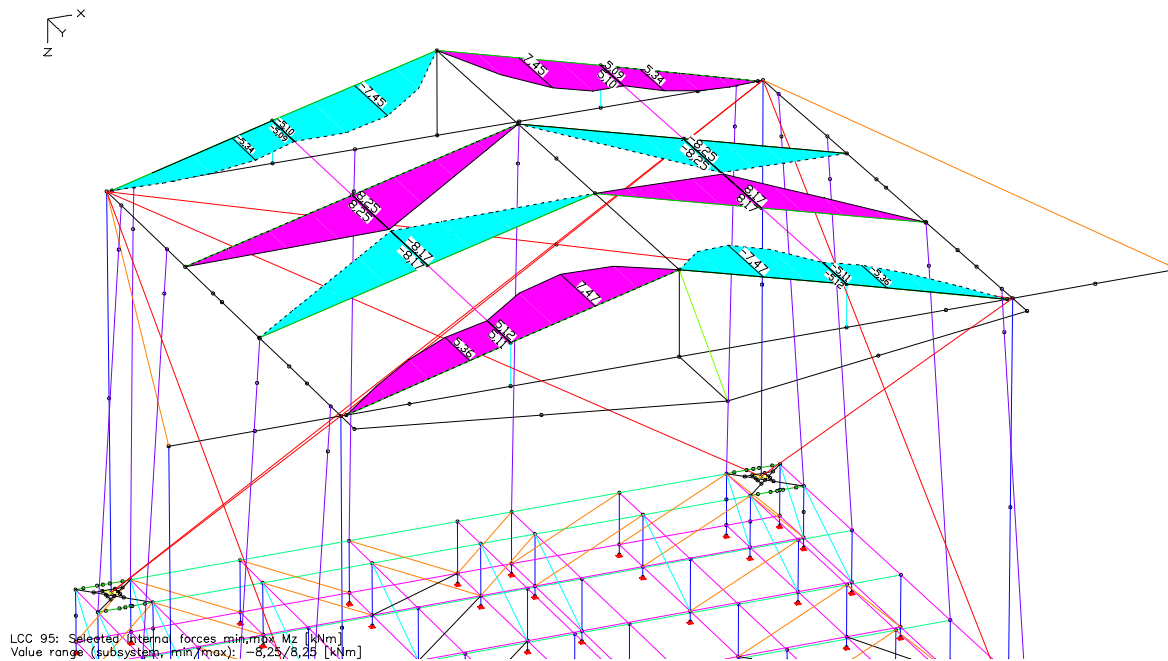
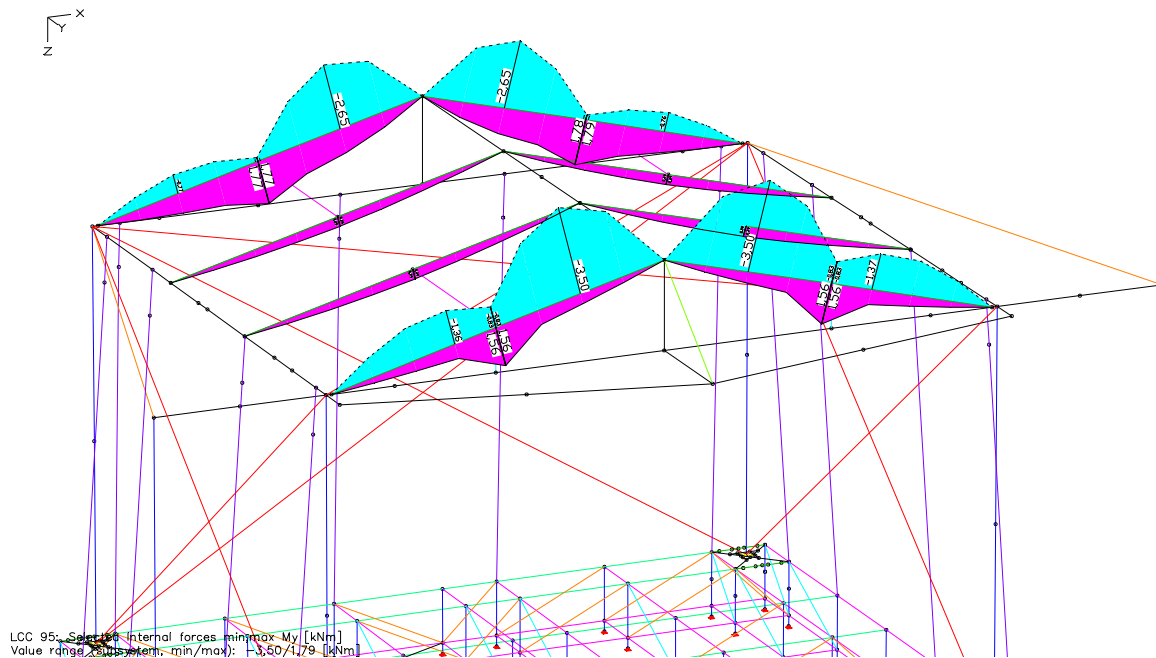



PROJECT-NO.:
22012

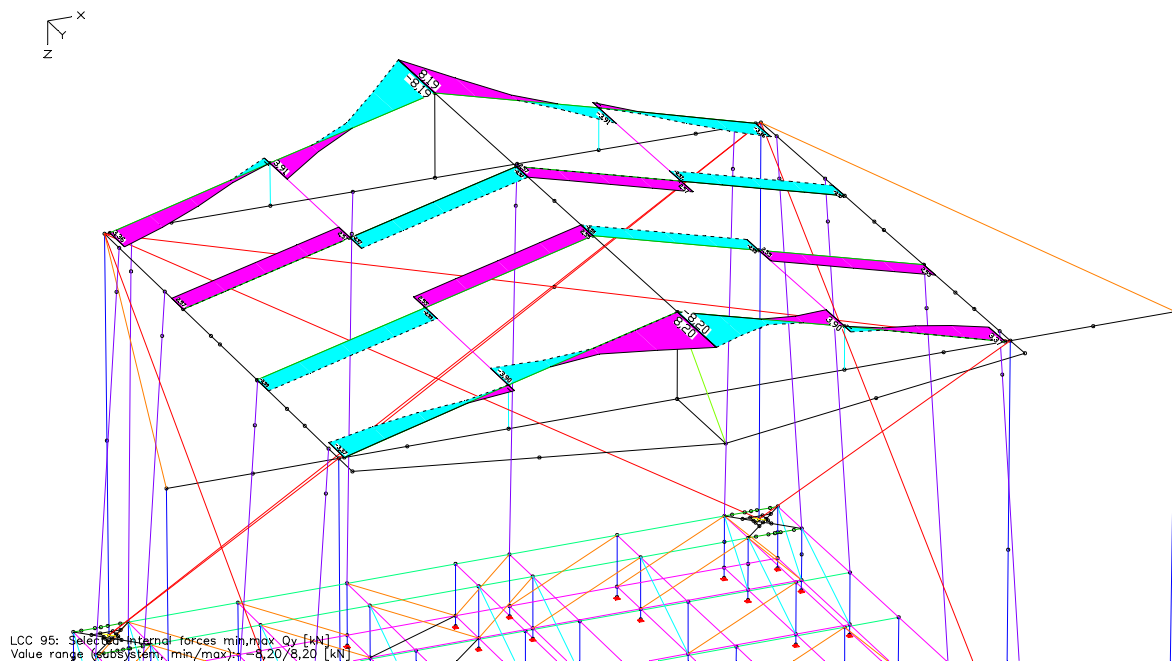
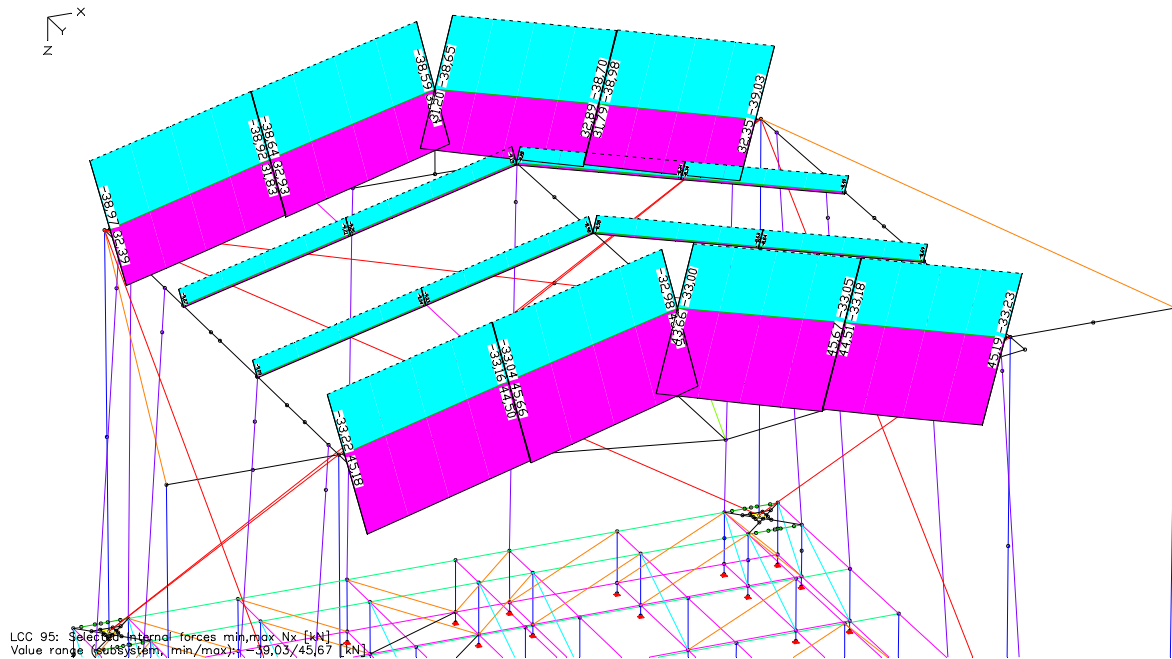
DATE/DATUM:
15.03.2022

5.1 RAFTER - H30D

LCC 95



PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022



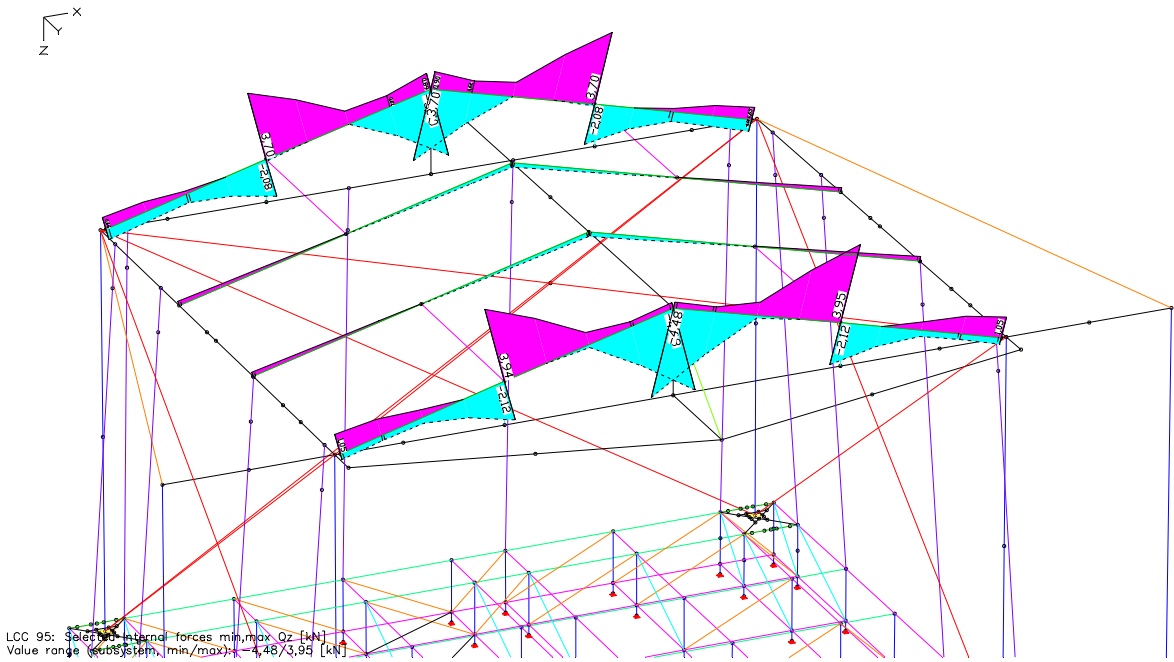
PROJECT:
MPT-ROOF 12x10m

CUSTOMER/AUFTRAGGEBER:



PROJECT-NO.:
22012

DATE/DATUM:
15.03.2022



PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Internal forces element 735

Location	Load case	Nx [kN]	My [kNm]	Mz [kNm]	Qy [kN]	Qz [kN]	Mx [kNm]
	K95	-33,02	0,42	0,00	0,00	0,21	-0,33
	,	44,82	-3,50	-6,34	-1,05	0,01	1,14
	,	44,82	-3,50	-6,34	-1,05	0,01	1,14
	,	-33,02	0,42	0,00	0,00	0,21	-0,33
	,	43,08	-2,19	-7,47	-1,30	-0,14	0,28
	,	-33,02	0,42	0,00	0,00	0,21	-0,33
	,	43,08	-2,19	-7,47	-1,30	-0,14	0,28
	,	-33,02	0,42	0,00	0,00	0,21	-0,33
	,	43,08	-2,19	-7,47	-1,30	-0,14	0,28
	,	1,90	-2,05	-5,64	-0,92	0,67	-0,45
	,	-30,33	0,24	-0,43	-0,06	0,26	-0,83
	,	44,82	-3,50	-6,34	-1,05	0,01	1,14

double chord:

$$N_{Ed} = 2,191 / (2 \times 0,207) + 7,47 / 0,239 + 43,09 / 3 = 50,91 \text{ kN} \sim 50,22 \text{ kN}$$

proof against buckling:

$$L_{cr} = 5,00 \text{ m} \quad i_{y,z} = 9,11 \text{ cm}$$

$$\begin{aligned} \bar{\lambda} &= L_{cr} / (i \times \pi) \times \sqrt{(A_{eff} \times f_0) / (A \times E)} \\ &= 500 / (9,11 \times 3,14) \times \sqrt{(250 / 70000)} = 1,044 \end{aligned}$$

$$\begin{aligned} \theta &= 0,5 \times (1 + \alpha \times (\bar{\lambda} - \bar{\lambda}_0) + \bar{\lambda}^2) \\ &= 0,5 \times (1 + 0,2 \times (1,044 - 0,10) + 1,044^2) = 1,139 \end{aligned}$$

$$\begin{aligned} \chi &= 1 / (\theta + \sqrt{\theta^2 - \bar{\lambda}^2}) \\ &= 1 / (1,139 + \sqrt{1,139^2 - 1,044^2}) = 0,627 \end{aligned}$$

with:

$$\omega_0 = 1,00 \quad (\text{already regarded in truss calculation})$$

$$\psi_c = 0,80$$

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

$$N_{Rd} = 3 \times 50,22 = 150,66 \text{ kN}$$

$$M_{y,Rd} = 10,39 \text{ kNm}$$

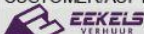
$$M_{z,Rd} = 12,00 \text{ kNm}$$

proof:

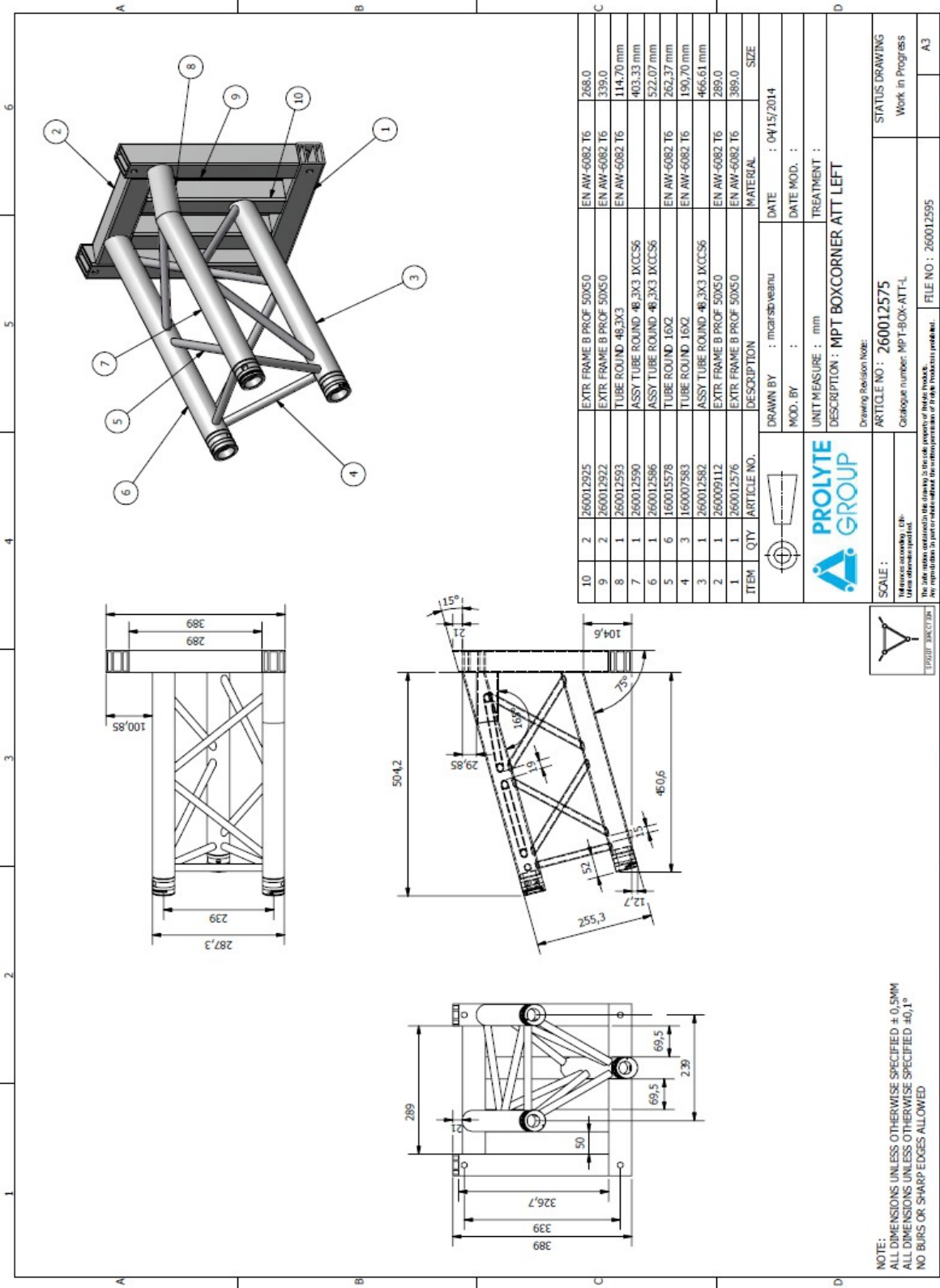
$$(N_{Ed} / (\chi_{min} \times N_{Rd}))^{\psi_c} + [(M_{y,Ed} / M_{y,Rd})^{1,7} + (M_{z,Ed} / M_{z,Rd})^{1,7}]^{0,6} \leq 1,0$$

$$= (38,67 / (0,627 \times 150,66))^{0,8} + [(0,85 / 10,39)^{1,7} + (0 / 12,00)^{1,7}]^{0,6}$$

$$= 0,489 + 0,079 = 0,577 < 1,0$$

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

gable rafter on top of H30D to boxcorner:



NOTE:
 ALL DIMENSIONS UNLESS OTHERWISE SPECIFIED +0,5MM
 ALL DIMENSIONS UNLESS OTHERWISE SPECIFIED 10,1°
 NO BURRS OR SHARP EDGES ALLOWED

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

The proof is done for maximum forces on the connection point.

load case 1: min N_{Ed} + related $V_{y,zEd}$ – front

$$N_{Ed} = -33,0 / 3 = -11,0 \text{ kN}$$

$$V_{y,Ed} = 0 \text{ kN}$$

$$V_{z,Ed} = 0,32 / 3 = 0,11 \text{ kN}$$

load case 2: max N_{Ed} + related $V_{y,zEd}$ – front

$$N_{Ed} = 43,66 / 3 = 14,55 \text{ kN}$$

$$V_{y,Ed} = 7,0 / 3 = 2,33 \text{ kN}$$

$$V_{z,Ed} = 4,48 / 3 = 1,49 \text{ kN}$$

load case 3: min N_{Ed} + related $V_{y,zEd}$ – rear

$$N_{Ed} = -38,59 / 3 = -12,86 \text{ kN}$$

$$V_{y,Ed} = 0 \text{ kN}$$

$$V_{z,Ed} = 0,57 / 3 = 0,19 \text{ kN}$$

load case 4: max N_{Ed} + related $V_{y,zEd}$ – rear

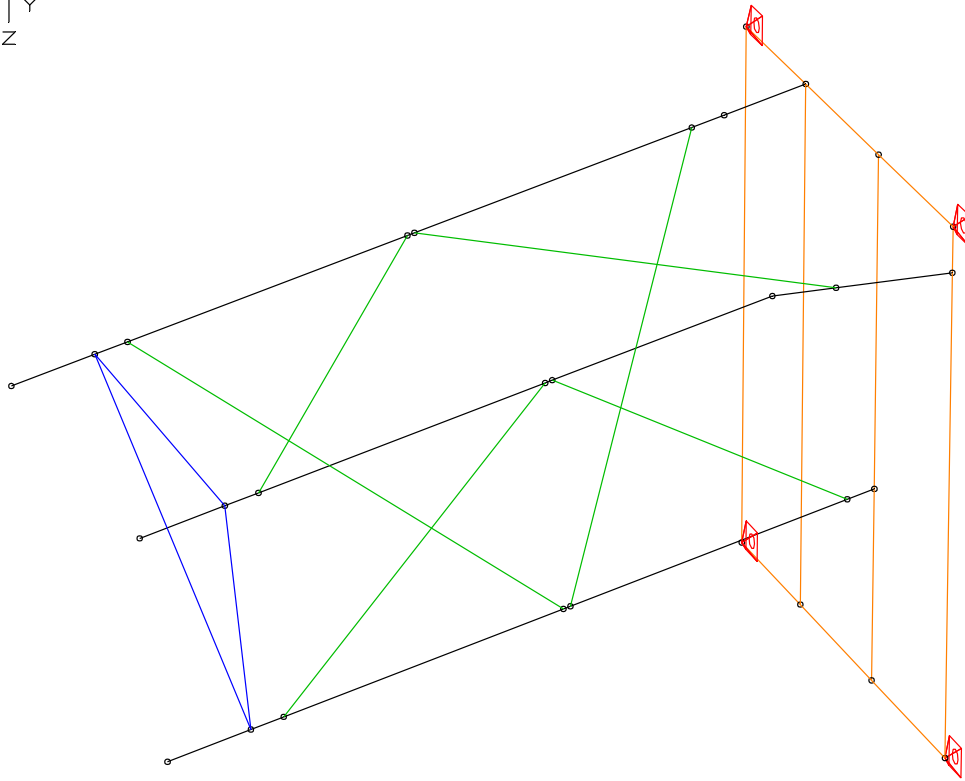
$$N_{Ed} = 31,24 / 3 = 10,41 \text{ kN}$$

$$V_{y,Ed} = 6,06 / 3 = 2,02 \text{ kN}$$

$$V_{z,Ed} = 3,54 / 3 = 1,18 \text{ kN}$$

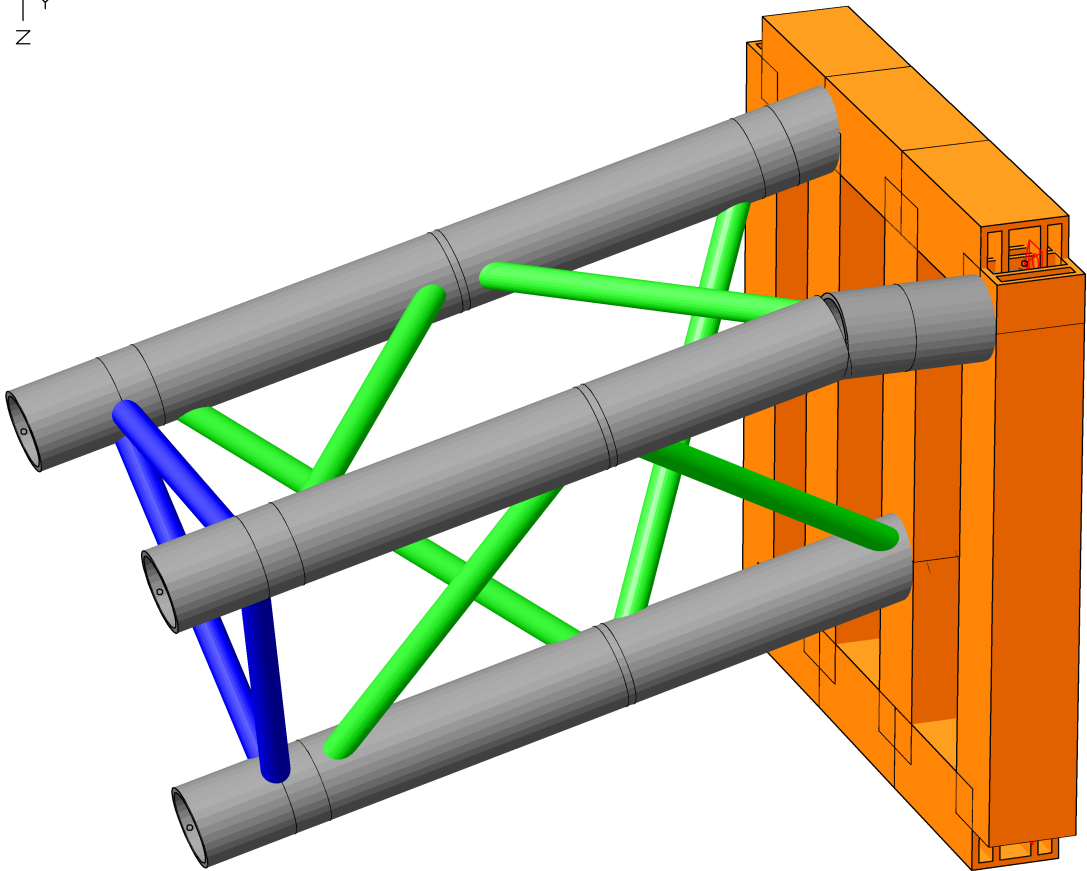
The load cases are combined exclusively in a load case combination 91.

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022



black: Ø48,3x3mm (EN AW 6082 T6)
 green, blue: Ø16x2mm (EN AW 6082 T6)
 orange: 50x50x4mm (EN AW 6082 T6)

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022



PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Material Properties

	No.	Type	E-Modu. [MN/m ²]	GModule [MN/m ²]	alpha.t [1/K]	gamma [kN/m ³]	Miscellaneous
1	1	Frei	70000	27000	1,0e-05	27,000	fc = 25 [MN/m ²] ft = 0
2	2	Frei	70000	27000	1,0e-05	27,000	fc = 20 [MN/m ²] ft = 0
3	3	Frei	70000	27000	1,0e-05	27,000	fc = 20 [MN/m ²] ft = 0
4	4	Frei	70000	27000	1,0e-05	27,000	fc = 240 [MN/m ²] ft = 0

List of load cases


LC.	Label
1	min NEd+VEd-vorne
2	max NEd+VEd-vorne
3	min NEd.VEd-hinten
4	max NEd+VEd-hinten

Load case combination 91

1. Variable exclusive action		Factor
1	min NEd+VEd-vorne	1,000
2	max NEd+VEd-vorne	1,000
3	min NEd.VEd-hinten	1,000
4	max NEd+VEd-hinten	1,000

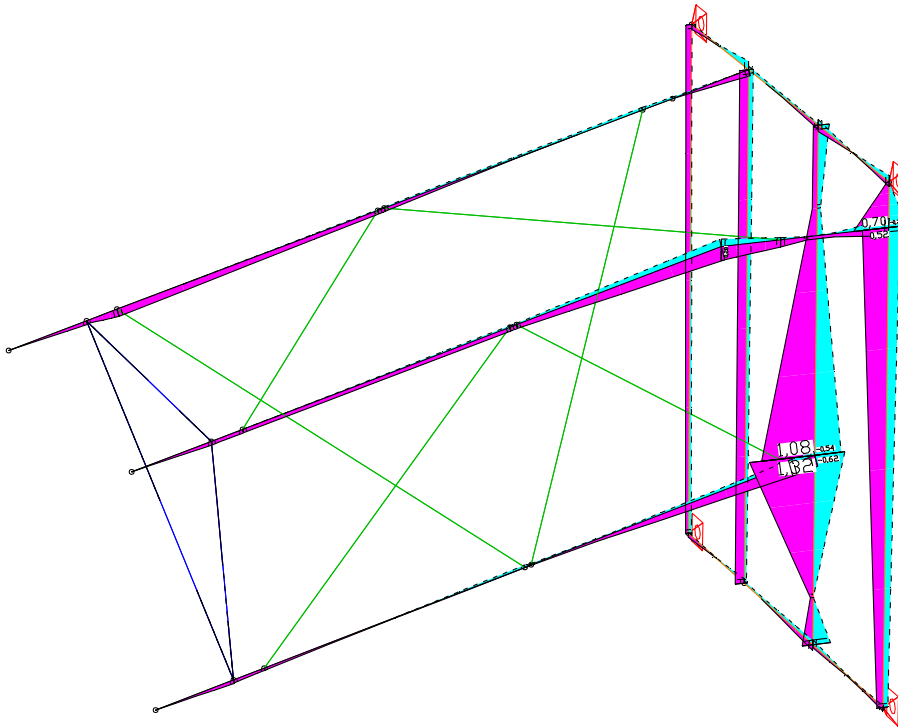
Sum of installed loads and support reactions

LC.	Label	Fx [kN]	Fy [kN]	Fz [kN]
1	min NEd+VEd-vorne	31,790	0,000	-8,860
	Support reactions	31,790	0,000	-8,860
2	max NEd+VEd-vorne	-43,234	-6,990	7,299
	Support reactions	-43,234	-6,990	7,299
3	min NEd.VEd-hinten	37,118	0,000	-10,536
	Support reactions	37,118	0,000	-10,536
4	max NEd+VEd-hinten	-31,082	-6,060	4,664
	Support reactions	-31,082	-6,060	4,664


PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

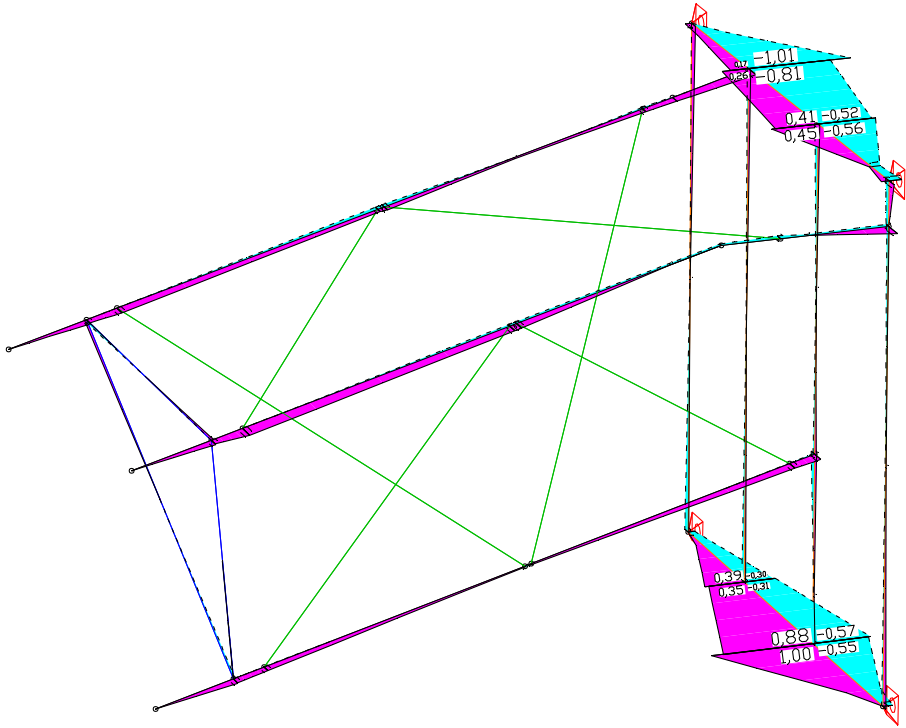
internal forces:

LCC 91



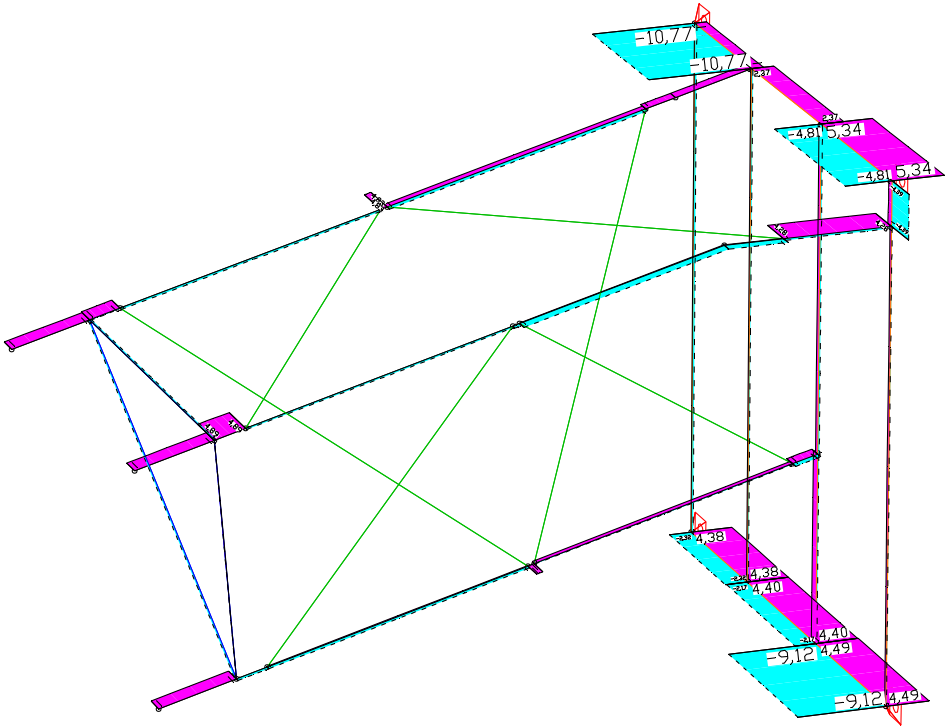
LCC 91: Internal forces min,max My [kNm]
 Value range (overall system, min/max): -0,62/1,32 [kNm]

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022




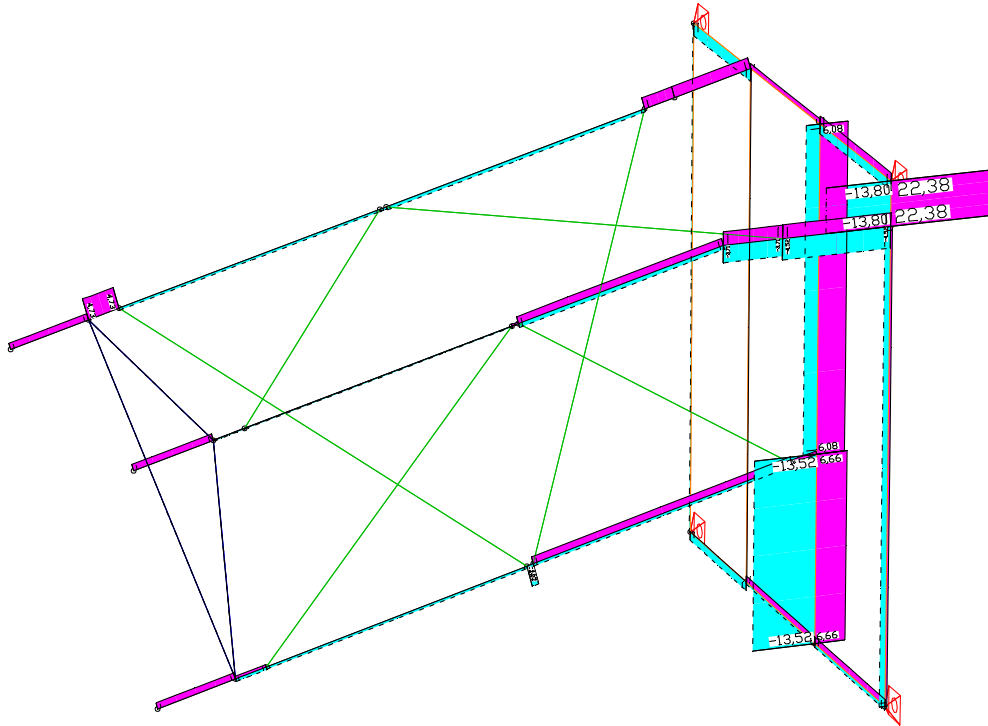
LCC 91: Internal forces min,max Mz [kNm]
Value range (overall system, min/max): -1.01/1.00 [kNm]

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

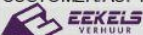


LCC 91: Internal forces min,max Q_y [kN]
Value range (overall system, min/max): -10.77/5.34 [kN]

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022



LCC 91: Internal forces min,max Qz [kN]
 Value range (overall system, min/max): -13.80/22.38 [kN]

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

gable rafter bottom H30D: (MPR-005R/L)

The gable rafter is being connected with the use of 6 couplers to the lower gable girder H40V.

The proof is done for maximum forces. (Actual forces are smaller)

load case 1:

min. $N_{Ed} = -43,17 \text{ kN}$

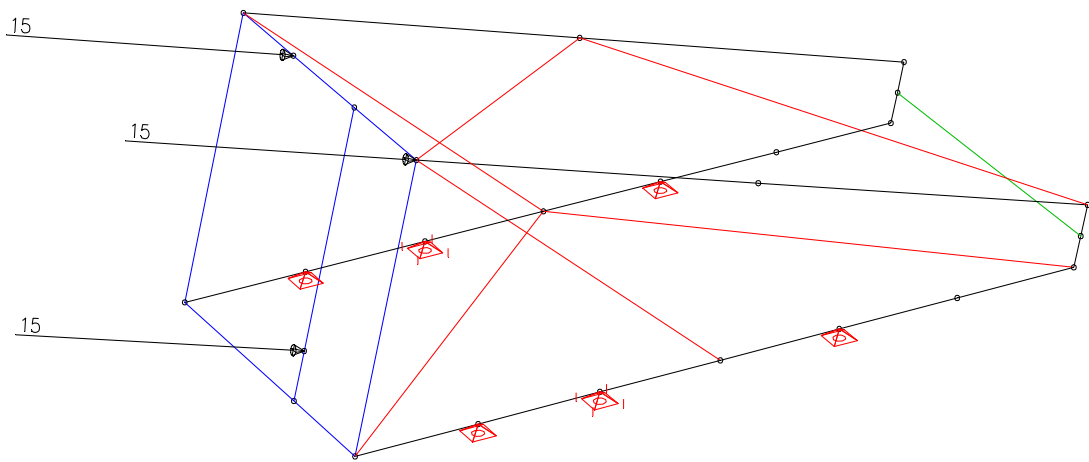
$45,0 / 3 = 15,0 \text{ kN}$

load case 2:

max. $N_{Ed} = 45,19 \text{ kN}$

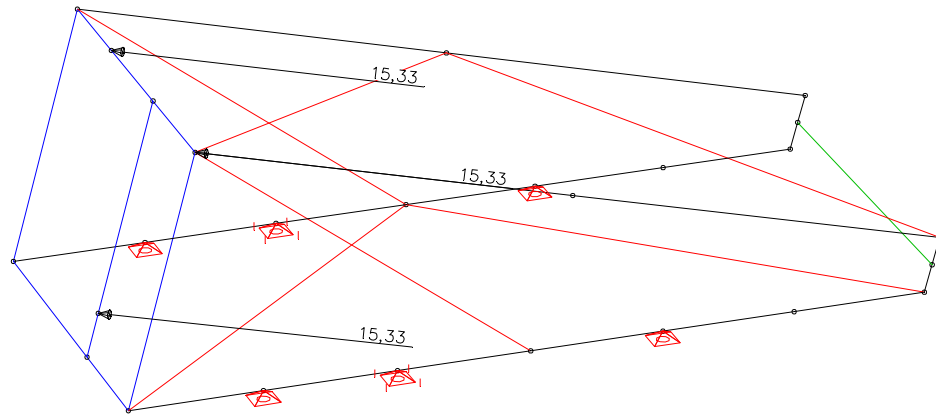
$46,0 / 3 = 15,33 \text{ kN}$

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022



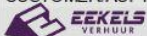
LC 1: Load, min. NEd

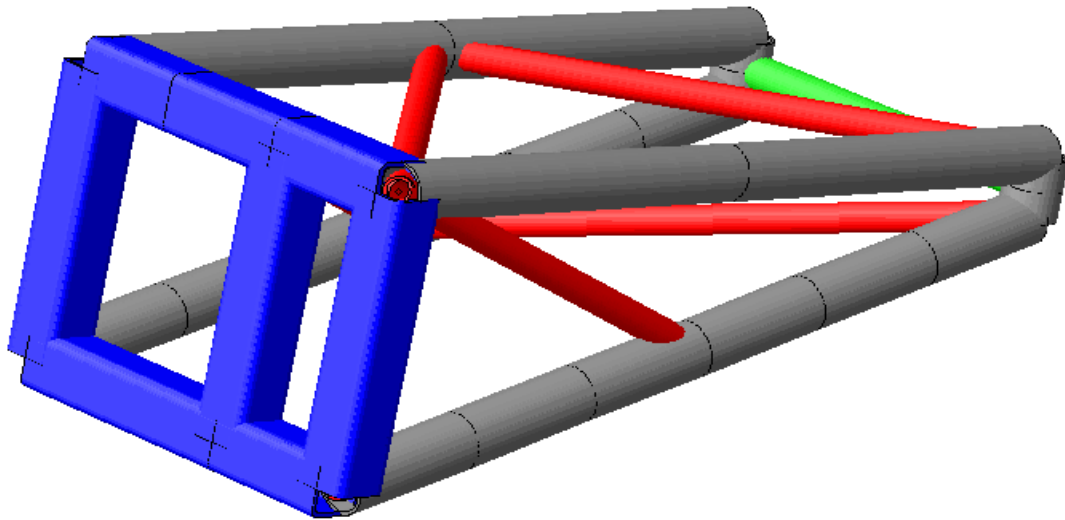
PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022



LC 2: Load, max. NEd

Both load cases are combined exclusively in a LCC 91.

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
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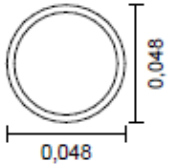
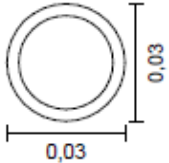
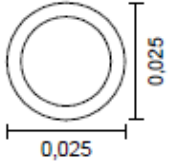
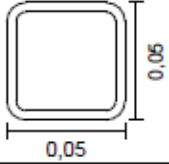
black:	48x3mm
red:	25x3mm
green:	30x3mm
blue:	50x50x4mm

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

System characteristics

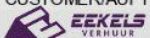
- 26 Nodes
- 36 Beams
- 6 Supports
- 0 Link elements
- 4 Material properties
- 4 Section properties
- 2 Load cases
- 1 Load case combinations
- 5 Result locations in beam elements

Section properties

1	Polygon 	Centroid [m] $y_s = -0,000$ $z_s = -0,000$ Area [m ²] $A = 4,2140e-04$ Moments of inertia [m ⁴] $I_x = 2,1272e-07$ $I_{yz} = 0,0000e+00$ $I_y = 1,0645e-07$ $I_1 = 1,0645e-07$ $I_z = 1,0645e-07$ $I_2 = 1,0645e-07$ Main axis angle [Grad] $\Phi = 0,000$ Ignore Iyz in member stiffness.
2	Polygon 	Centroid [m] $y_s = -0,000$ $z_s = -0,000$ Area [m ²] $A = 2,5284e-04$ Moments of inertia [m ⁴] $I_x = 4,6324e-08$ $I_{yz} = 0,0000e+00$ $I_y = 2,3175e-08$ $I_1 = 2,3175e-08$ $I_z = 2,3175e-08$ $I_2 = 2,3175e-08$ Main axis angle [Grad] $\Phi = 0,000$ Ignore Iyz in member stiffness.
3	Polygon 	Centroid [m] $y_s = -0,000$ $z_s = -0,000$ Area [m ²] $A = 2,0602e-04$ Moments of inertia [m ⁴] $I_x = 2,5217e-08$ $I_{yz} = 0,0000e+00$ $I_y = 1,2614e-08$ $I_1 = 1,2614e-08$ $I_z = 1,2614e-08$ $I_2 = 1,2614e-08$ Main axis angle [Grad] $\Phi = 0,000$ Ignore Iyz in member stiffness.
4	Library 	QRO 50 x 50 x 4 (EN 10219-2) Centroid [m] $y_s = 0,000$ $z_s = 0,000$ Area [m ²] $A = 6,9500e-04$ Moments of inertia [m ⁴] $I_x = 4,0420e-07$ $I_{yz} = 0,0000e+00$ $I_y = 2,3700e-07$ $I_1 = 2,3700e-07$ $I_z = 2,3700e-07$ $I_2 = 2,3700e-07$ Main axis angle [Grad] $\Phi = 0,000$

Material Properties

No.	Type	E-Modul [MN/m ²]	GModule [MN/m ²]	alpha.t [1/K]	gamma [kN/m ³]	Miscellaneous

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Material Properties

	No.	Type	E-Modu. [MN/m ²]	GModule [MN/m ²]	alpha.t [1/K]	gamma [kN/m ³]	Miscellaneous
1	1	Frei	70000	27000	1,0e-05	27,000	fc = 20 [MN/m ²] ft = 0
2	2	Frei	70000	27000	1,0e-05	27,000	fc = 20 [MN/m ²] ft = 0
3	3	Frei	70000	27000	1,0e-05	27,000	fc = 20 [MN/m ²] ft = 0
4	4	Frei	70000	27000	1,0e-05	27,000	fc = 20 [MN/m ²] ft = 0

List of load cases

LC.	Label
1	min. NEd
2	max. NEd

Load case combination 91

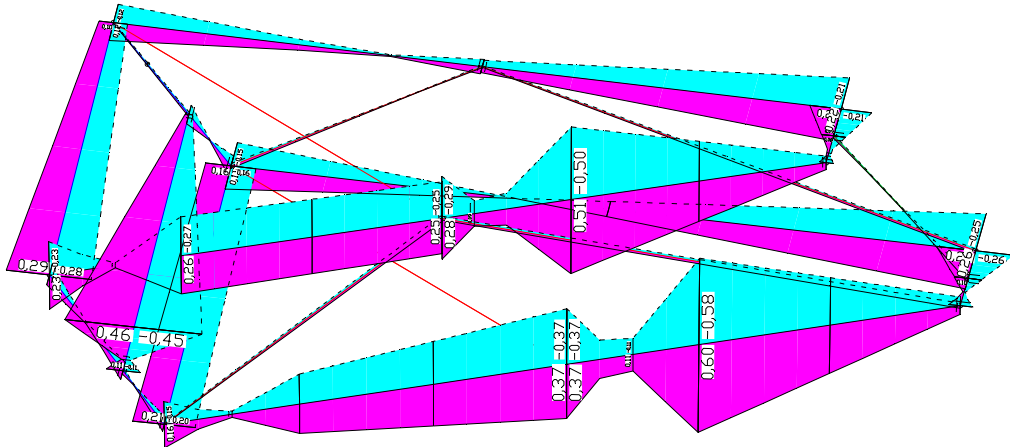
1. Variable exclusive action		Factor
1	min. NEd	1,000
2	max. NEd	1,000

Sum of installed loads and support reactions


LC.	Label	Fx [kN]	Fy [kN]	Fz [kN]
1	min. NEd	43,470	0,000	11,640
	Support reactions	43,470	-0,000	11,640
2	max. NEd	-44,430	0,000	-11,880
	Support reactions	-44,430	0,000	-11,880

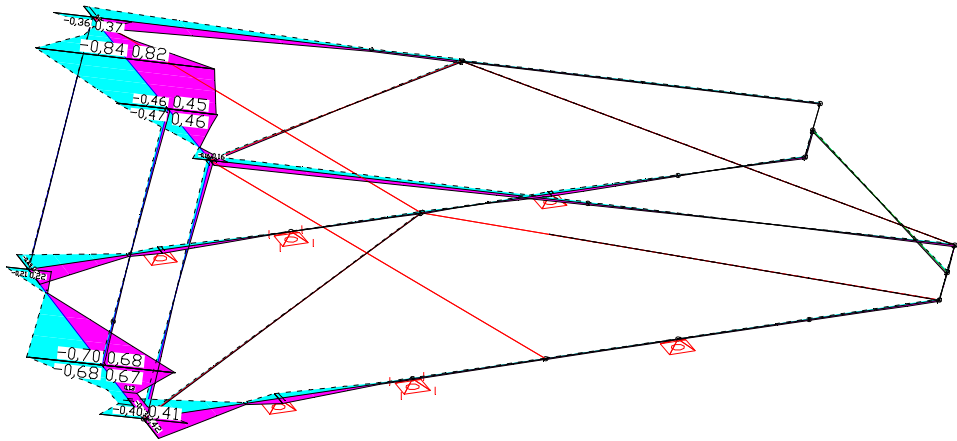
PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

internal forces:



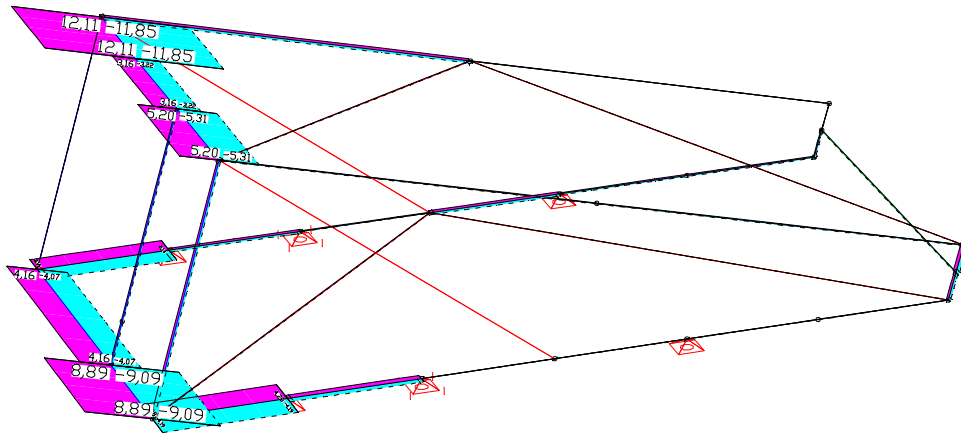
LCC 91: Internal forces min,max My [kNm]
 Value range (overall system, min/max): -0,58/0,60 [kNm]

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
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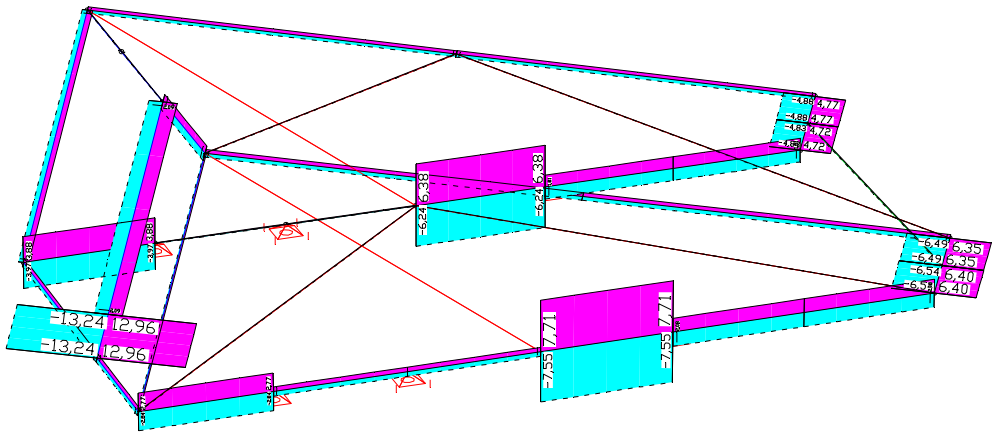
LCC 91: Internal forces min,max Mz [kNm]
Value range (overall system, min/max): -0,84/0,82 [kNm]

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022



LCC 91: Internal forces min,max Qy [kN]
 Value range (overall system, min/max): -11,85/12,11 [kN]

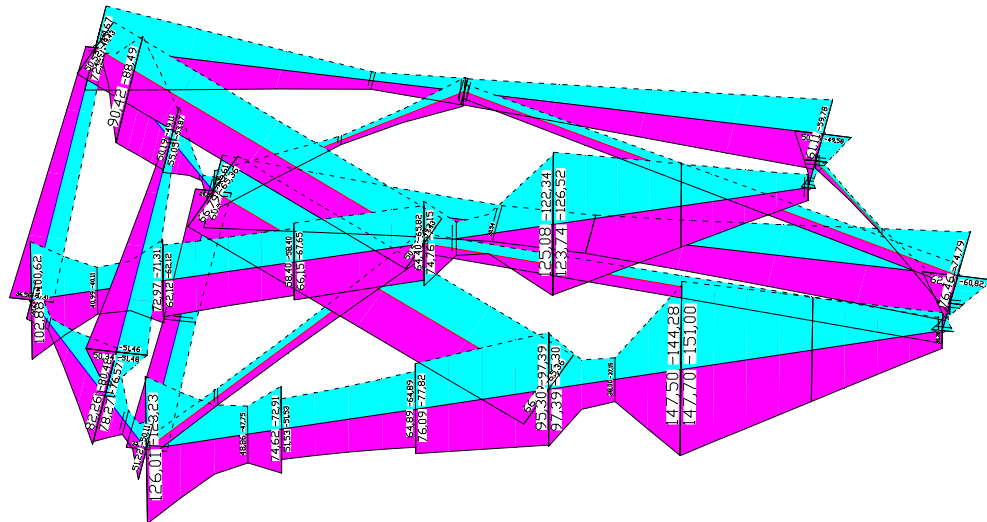
PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
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LCC 91: Internal forces min,max Qz [kN]
Value range (overall system, min/max): -13,24/12,96 [kN]

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stresses:



LCC 91: Stresses (general – elastic, directly from internal forces) min,max Sigma.x [MN/m²]
 Value range (overall system, min/max): -151,00/147,70 [MN/m²]

$$\begin{aligned}
 < \sigma_{Rd,WEZ} &= 0,80 \times 185 / 1,25 = 118,40 \text{ N/mm}^2 && \text{(HAZ)} \\
 < \sigma_{Rd} &= 250 / 1,1 = 227,27 \text{ N/mm}^2 && \text{(undisturbed material)}
 \end{aligned}$$

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
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diagonals: (Ø25x3mm, i = 0,785, A = 2,073 cm²)

$$N_{Rd,WEZ} = 2,073 \times 113,63 = 23,55 \text{ kN} > 13,76 \text{ kN}$$

proof against buckling:

$$L_{cr} = 0,75 \times 39,5 \text{ cm} = 29,63 \text{ cm}$$


$$\bar{\lambda} = L_{cr} / (i \times \pi) \times \sqrt{(A_{eff} \times f_0) / (A \times E)} = 29,63 / (0,785 \times 3,14) \times \sqrt{(250 / 70000)} = 0,718$$

$$\theta = 0,5 \times (1 + \alpha \times (\bar{\lambda} - \bar{\lambda}_0) + \bar{\lambda}^2) = 0,5 \times (1 + 0,2 \times (0,718 - 0,10) + 0,718^2) = 0,820$$

$$\chi = 1 / (\theta + \sqrt{(\theta^2 - \bar{\lambda}^2)}) = 1 / (0,82 + \sqrt{(0,82^2 - 0,718^2)}) = 0,822$$

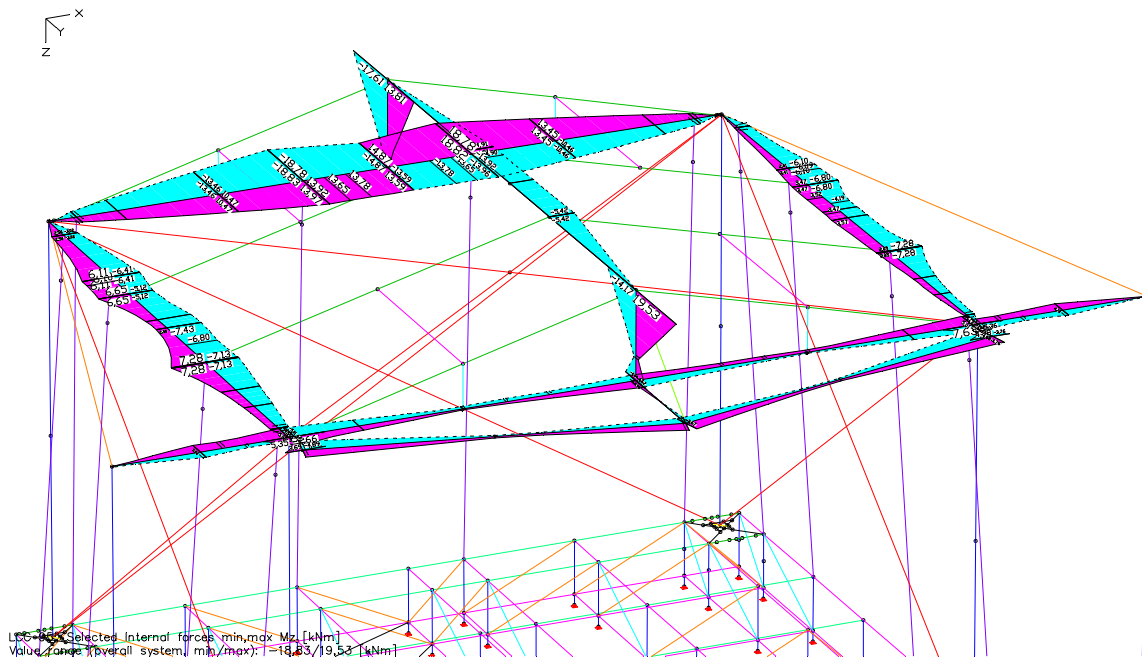
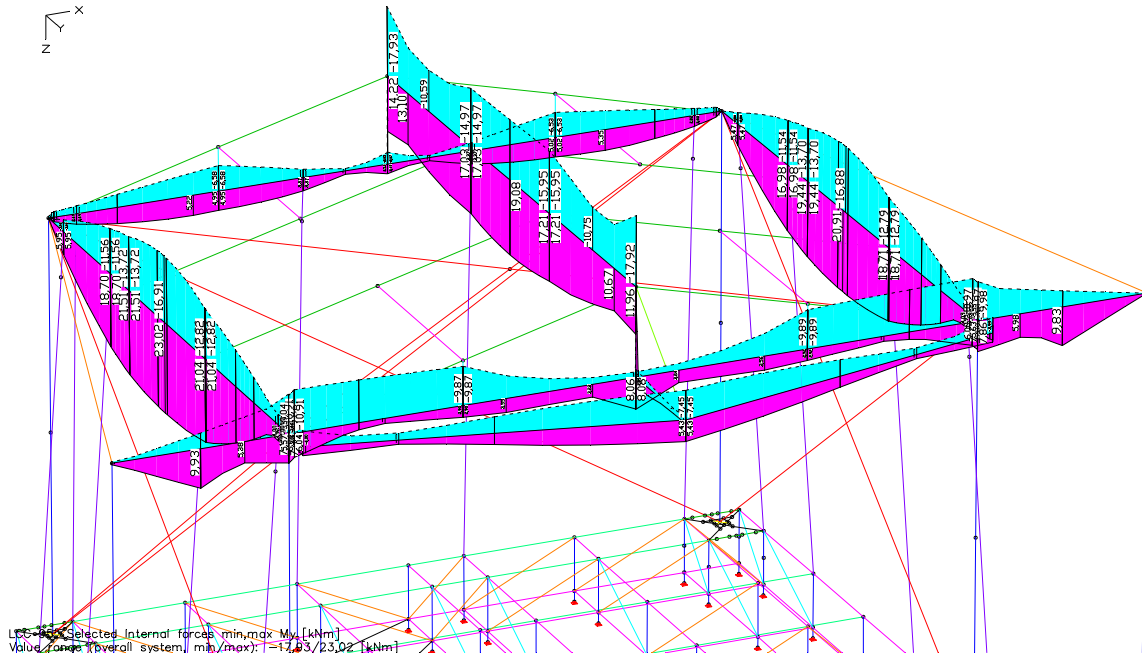
$$N_{b,Rd} = 0,822 \times 2,073 \times 25,0 / 1,1 = 38,73 \text{ kN} > 13,46 \text{ kN}$$

no further proof

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

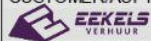
5.2 ROOF GIRDER H40V

LCC 95



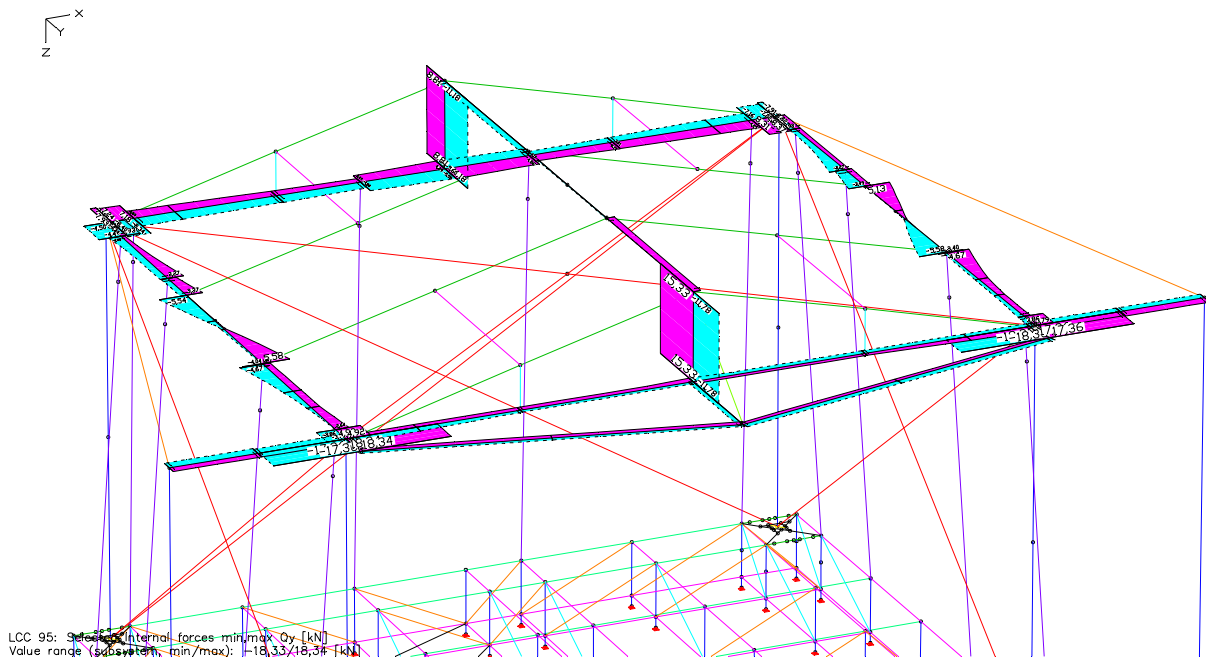
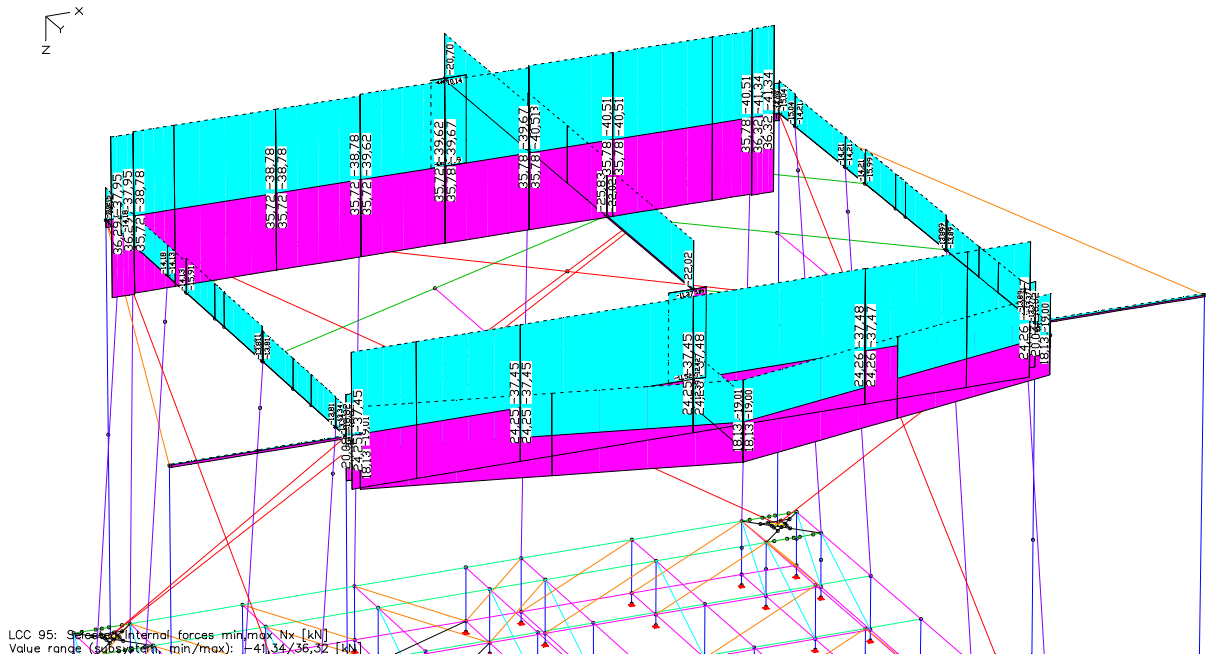
PROJECT:
MPT-ROOF 12x10m

CUSTOMER/AUFTRAGGEBER:



PROJECT-NO.:
22012

DATE/DATUM:
15.03.2022



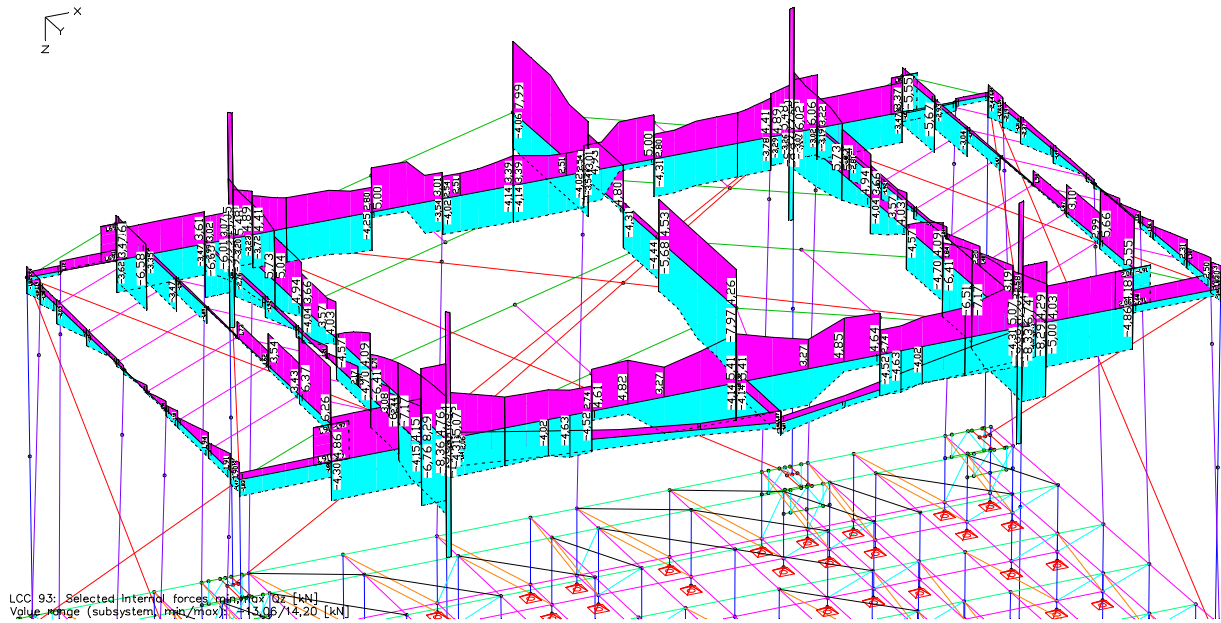
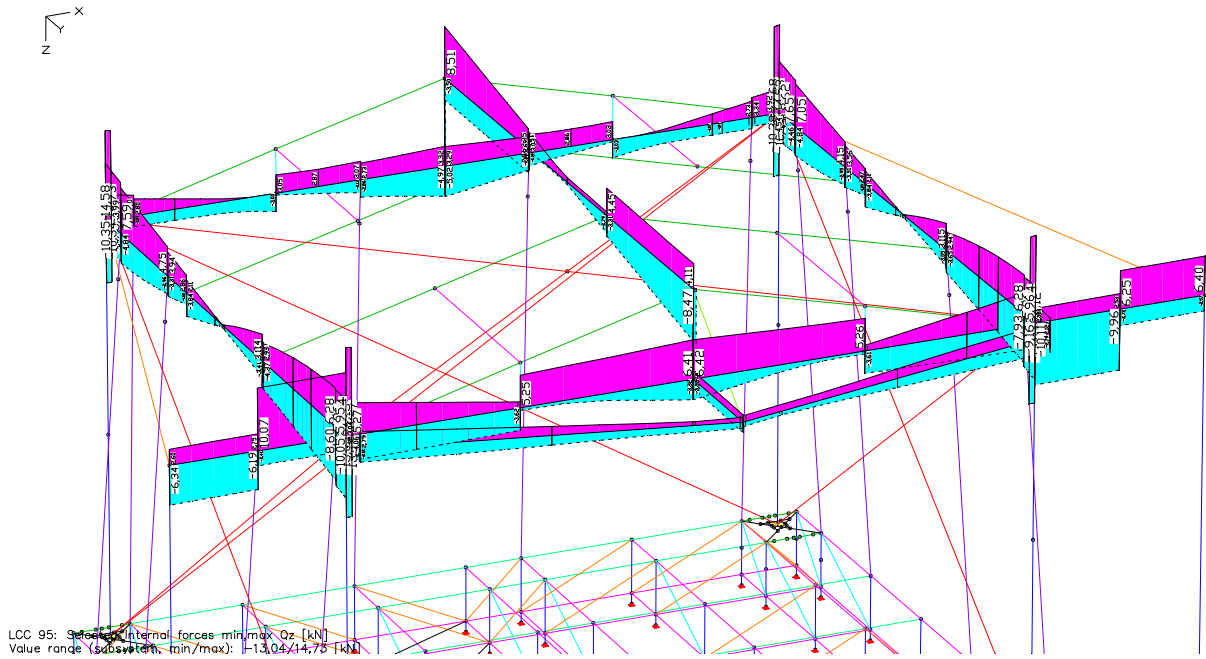
PROJECT:
MPT-ROOF 12x10m

CUSTOMER/AUFTRAGGEBER:



PROJECT-NO.:
22012

DATE/DATUM:
15.03.2022



PROJECT:
MPT-ROOF 12x10m

CUSTOMER/AUFTRAGGEBER:



PROJECT-NO.:
22012

DATE/DATUM:
15.03.2022

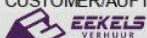
Side truss

Internal forces element 173

Location	Load case	Nx [kN]	My [kNm]	Mz [kNm]	Qy [kN]	Qz [kN]	Mx [kNm]
	K95	-15,91	-16,91	2,30	-0,20	-0,04	0,16
		0,09	20,87	-0,89	0,03	-0,12	0,13
		-15,91	-16,91	2,30	-0,20	-0,04	0,16
		-5,12	23,02	-6,35	-0,61	0,00	0,11
		-6,45	5,59	-7,41	-0,42	-0,17	0,01
		-15,91	-16,91	2,30	-0,20	-0,04	0,16
		-6,16	6,00	-5,82	-0,63	0,10	-0,00
		-9,29	16,92	-3,43	0,21	-0,37	0,12
		-11,32	1,47	-3,54	-0,47	-0,40	0,01
		-6,16	6,00	-5,82	-0,63	0,10	-0,00
		-13,57	-15,58	-3,01	-0,50	-0,31	-0,06
		-15,91	-16,91	2,30	-0,20	-0,04	0,16

chord:

$$N_{Ed} = (23,02+6,35) / (2 \times 0,339) + 5,12 / 4 = 44,60 \text{ kN} < 50,22 \text{ kN}$$

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Rear truss

Internal forces element 819

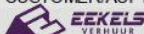
Location	Load case	Nx [kN]	My [kNm]	Mz [kNm]	Qy [kN]	Qz [kN]	Mx [kNm]
	K95	-40,51	-6,19	-2,90	-1,00	-2,03	-0,01
	'	35,78	5,02	4,99	1,73	-1,02	-0,03
	'	-33,10	-6,53	9,17	2,13	-1,69	-0,16
	'	35,78	5,02	4,99	1,73	-1,02	-0,03
	'	0,69	0,20	-10,46	-2,49	-0,00	0,18
	'	-1,60	-2,35	13,45	3,61	-2,76	-0,18
	'	-30,05	-5,19	-10,39	-2,55	-1,09	0,13
	'	-1,60	-2,35	13,45	3,61	-2,76	-0,18
	'	-8,58	-2,06	1,33	0,51	-3,03	-0,04
	'	0,00	0,00	0,00	0,00	0,00	0,00
	'	-1,60	-2,35	13,45	3,61	-2,76	-0,18
	'	0,69	0,20	-10,46	-2,49	-0,00	0,18

chord:

$$N_{Ed} = (6,53+9,17) / (2 \times 0,339) + 33,10 / 4 = 31,43 \text{ kN} < 50,22 \text{ kN}$$

proof against buckling: see next page

$$L_{cr} = 12,0\text{m} \quad i_{y,z} = 15,70 \text{ cm}$$

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
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Geometrie		Traverse			
Stützenlänge	L [m]	12	Trägheitsradius	i_y [cm]	15,7
Knicklängenbeiwert	β_y	1		i_z [cm]	15,7
	β_z	1			
Materialeigenschaften		Belastung			
nach Tabelle 3.2b		f_o	250	N_{Ed} [kN]	33,1
		f_u	290	$M_{y,Ed}$ [kNm]	6,53
		$\rho_{u,haz}$	0,64	$M_{z,Ed}$ [kNm]	9,17
	BC	A			

In Anlehnung an DIN 1999-1-1, Kapitel 6.3.3.4 erfolgt der Nachweis an der Stelle des Querschnitts mit der kleinsten Tragfähigkeit:

Belastbarkeit aus Traversenberechnung:

$$N_{Rd} = 200,9 \text{ kN}$$

$$M_{y,Rd} = 34,05 \text{ kNm}$$

$$M_{z,Rd} = 34,05 \text{ kNm}$$

Nachweis Biegeknicken

$$L_{cr,y} = 1 \times 12 = 12 \text{ m} \quad \alpha = 0,20 \quad \bar{\lambda}_0 = 0,10 \quad L_{cr,z} = 1 \times 12 = 12 \text{ m}$$

Die Gurtrohre sind alle der Querschnittsklasse 3, oder besser, zuzuordnen, somit gilt: $A_{eff} = A$

$$\bar{\lambda} = \frac{L_{cr}}{i} \times \frac{1}{\pi} \times \sqrt{\frac{A_{eff}}{A} \times \frac{f_o}{E}} = \frac{L_{cr}}{i \times \pi} \times \sqrt{\frac{f_o}{E}}$$

$$\bar{\lambda}_y = 12 / (0,157 \times \pi) \times \sqrt{(250 / 70000)} = 1,454$$

$$\bar{\lambda}_z = 12 / (0,157 \times \pi) \times \sqrt{(250 / 70000)} = 1,454$$

$$\phi = 0,5 \times (1 + \alpha \times (\bar{\lambda} - \bar{\lambda}_2) + \bar{\lambda}^2)$$

$$\phi_y = 0,5 \times (1 + 0,2 \times (1,454 - 0,1) + 1,454^2) = 1,692$$

$$\phi_z = 0,5 \times (1 + 0,2 \times (1,454 - 0,1) + 1,454^2) = 1,692$$

$$\chi = \frac{1}{\phi + \sqrt{\phi^2 - \bar{\lambda}^2}}$$

$$\chi_y = 1 / (1,692 + \sqrt{(1,692^2 - 1,454^2)}) = 0,391$$

$$\chi_z = 1 / (1,692 + \sqrt{(1,692^2 - 1,454^2)}) = 0,391$$

$$\chi_{min} = 0,391$$

ω_0 ist bereits in der Traversenberechnung berücksichtigt und wird deshalb zu 1 gesetzt.

$$\left(\frac{N_{Ed}}{\chi_{min} \times N_{Rd}} \right)^{\psi_c} + \left[\left(\frac{M_{y,Ed}}{M_{y,Rd}} \right)^{1,7} + \left(\frac{M_{z,Ed}}{M_{z,Rd}} \right)^{1,7} \right]^{0,6} \leq 1$$

mit $\psi_c = 0,8$:

$$(33,1 / (0,391 \times 200,9))^{0,8} + [(6,53 / 34,05)^{1,7} + (9,17 / 34,05)^{1,7}]^{0,6} = 0,844 < 1$$

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Front truss

Internal forces element 188

Location	Load case	Nx [kN]	My [kNm]	Mz [kNm]	Qy [kN]	Qz [kN]	Mx [kNm]
	K95	-18,82	-4,24	-4,80	1,30	12,55	1,88
	'	20,08	-10,91	3,23	-3,58	-12,52	-2,58
	'	20,08	-10,91	3,23	-3,58	-12,52	-2,58
	'	-6,55	6,04	-3,05	-1,21	-12,83	0,38
	'	-18,82	-4,24	-4,80	1,30	12,55	1,88
	'	17,74	-4,95	4,28	-5,73	-13,03	-0,80
	'	17,74	-4,95	4,28	-5,73	-13,03	-0,80
	'	-18,82	-4,24	-4,80	1,30	12,55	1,88
	'	17,74	-4,95	4,28	-5,73	-13,03	-0,80
	'	-7,77	-6,41	-0,68	0,14	14,13	0,74
	'	20,08	-10,91	3,23	-3,58	-12,52	-2,58
	'	-18,82	-4,24	-4,80	1,30	12,55	1,88

chord:

$$N_{Ed} = (10,91+3,23) / (2 \times 0,339) + 20,08 / 4 = 25,88 \text{ kN} < 50,22 \text{ kN}$$

M+Q-Interaction:

$$Q_{Ed,res} = (3,58^2 + 12,52^2)^{1/2} = 13,02 \text{ kN}$$

$$\Delta M_{Q,res} = 13,02 / 4 \times 0,05 = 0,163 \text{ kNm}$$

equation 6.43: DIN EN 1999-1-1


$$\left(\frac{N_{Ed}}{\omega_0 N_{Rd}} \right)^\psi + \left[\left(\frac{M_{y,Ed}}{\omega_0 M_{y,Rd}} \right)^{1,7} + \left(\frac{M_{z,Ed}}{\omega_0 M_{z,Rd}} \right)^{1,7} \right]^{0,6} \leq 1,00 \tag{6.43}$$

$$\psi = 1,30$$

$$M_{y,z,Rd} = 1,25 \times W_{el} \times 0,80 \times 0,64 \times 290 / 1,25$$

$$= 1,25 \times 4,493 \times 0,80 \times 0,64 \times 290 / 1,25 \times 10^{-3} = 0,667 \text{ kNm}$$

$$\eta = (25,88 / 50,22)^{1,3} + [(0,163 / 0,667)^{1,7}]^{0,6} = 0,66 < 1,0$$

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022


First truss

Internal forces element 650

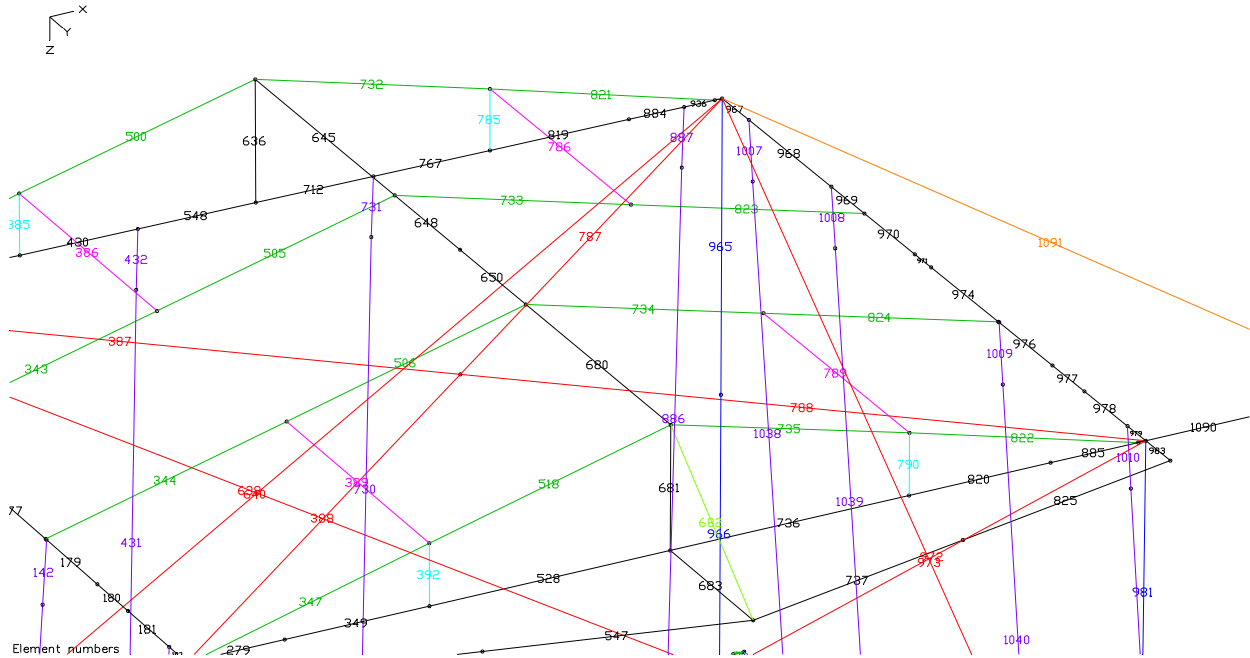
Location	Load case	Nx [kN]	My [kNm]	Mz [kNm]	Qy [kN]	Qz [kN]	Mx [kNm]
	K95	-25,83	-2,05	0,00	0,00	-0,41	0,00
	'	0,43	0,65	-5,11	-0,19	-0,08	0,01
	'	-22,85	-15,33	0,00	0,00	-0,30	-0,00
	'	-9,84	19,08	-0,00	-0,00	0,05	-0,00
	'	-2,56	14,00	-5,11	-0,19	-0,17	0,00
	'	-22,85	-15,33	0,00	0,00	-0,30	-0,00
	'	-2,56	14,00	-5,11	-0,19	-0,17	0,00
	'	-14,42	-8,41	-4,86	0,03	0,12	0,08
	'	-25,83	-2,05	0,00	0,00	-0,41	0,00
	'	-15,25	-5,89	-0,00	-0,00	0,75	-0,00
	'	0,00	0,00	0,00	0,00	0,00	0,00
	'	-14,42	-8,41	-4,86	0,03	0,12	0,08

chord:

$$N_{Ed} = 15,33 / (2 \times 0,339) + 22,85 / 4 = 28,32 \text{ kN} < 50,22 \text{ kN}$$

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

5.3 BOXCORNER H40V HD




Internal forces element 645

Location	Load case	Nx [kN]	My [kNm]	Mz [kNm]	Qy [kN]	Qz [kN]	Mx [kNm]
	K95	-20,70	-6,73	-0,00	0,00	3,53	0,00
		0,63	2,14	0,02	-1,35	-0,25	0,01
		-14,03	-17,93	0,01	-0,00	8,51	-0,00
		-3,31	14,22	0,01	-0,00	-2,28	-0,00
		-17,70	-1,86	-0,01	0,00	-3,50	-0,00
		-2,38	-2,73	0,03	-1,35	6,79	0,00
		-13,63	-1,69	0,02	-1,38	3,87	0,01
		-17,70	-1,86	-0,01	0,00	-3,50	-0,00
		-17,70	-1,86	-0,01	0,00	-3,50	-0,00
		-14,03	-17,93	0,01	-0,00	8,51	-0,00
		0,00	0,00	0,00	0,00	0,00	0,00
		-10,62	3,15	0,01	-1,38	-3,16	0,08

$M_{Ed} = 17,93 \text{ kNm}$

$V_{z,Ed} = 8,51 \text{ kN}$

The capacity of the Boxcorner is sufficient, see next page.

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Extract from structural report no. 16094

overview/ Übersicht:

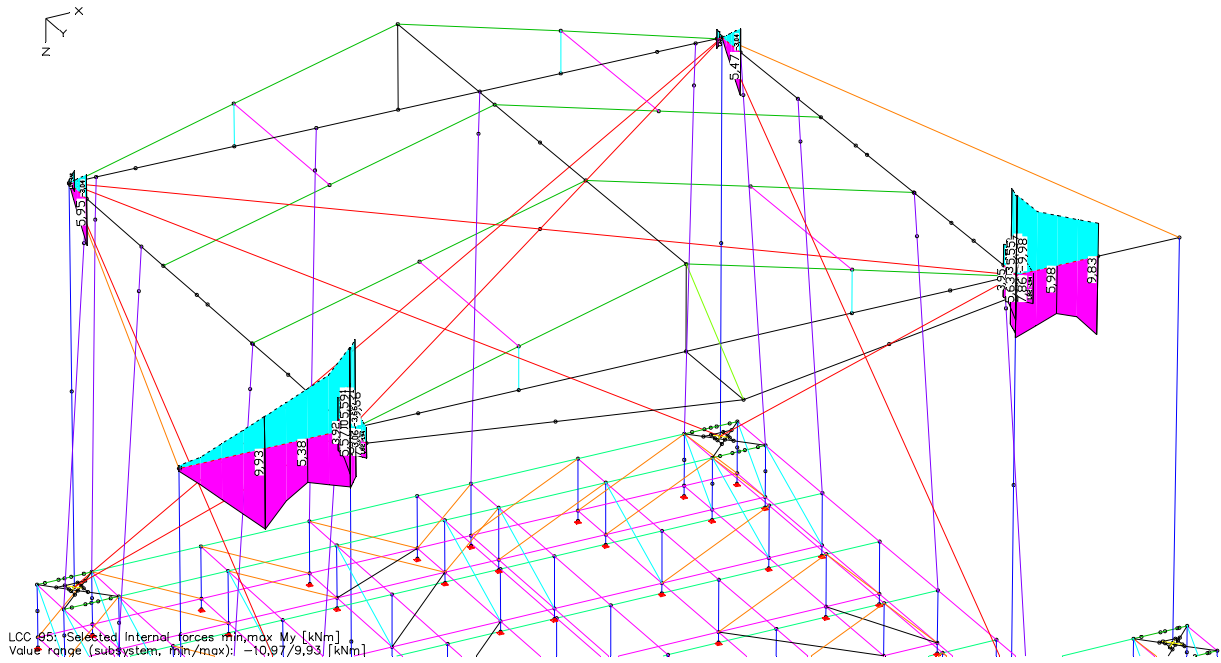
interaction between bending moment and additional transversal force/
 Interaktion aus Biegemoment und zusätzlicher Querkraft

bending moment/ Biegemoment M_{Rd}	transversal force/ Querkraft $V_{z,Rd}$	tension resistance bolt/ Grenzzugkraft $F_{t,Rd,bolt (M12, 8.8)}$
[kNm]	[kN]	[kN]
≤ 20,00	18,94	48,60
21,00	18,80	48,60
22,00	17,23	48,60
23,00	15,66	48,60
24,00	14,08	48,60
25,00	12,51	48,60
26,00	10,94	48,60
27,00	9,36	48,60
28,00	7,79	48,60
29,00	6,22	48,60
30,00	4,64	48,60
31,00	3,07	48,60
32,00	1,50	48,60
32,95	0,00	48,60

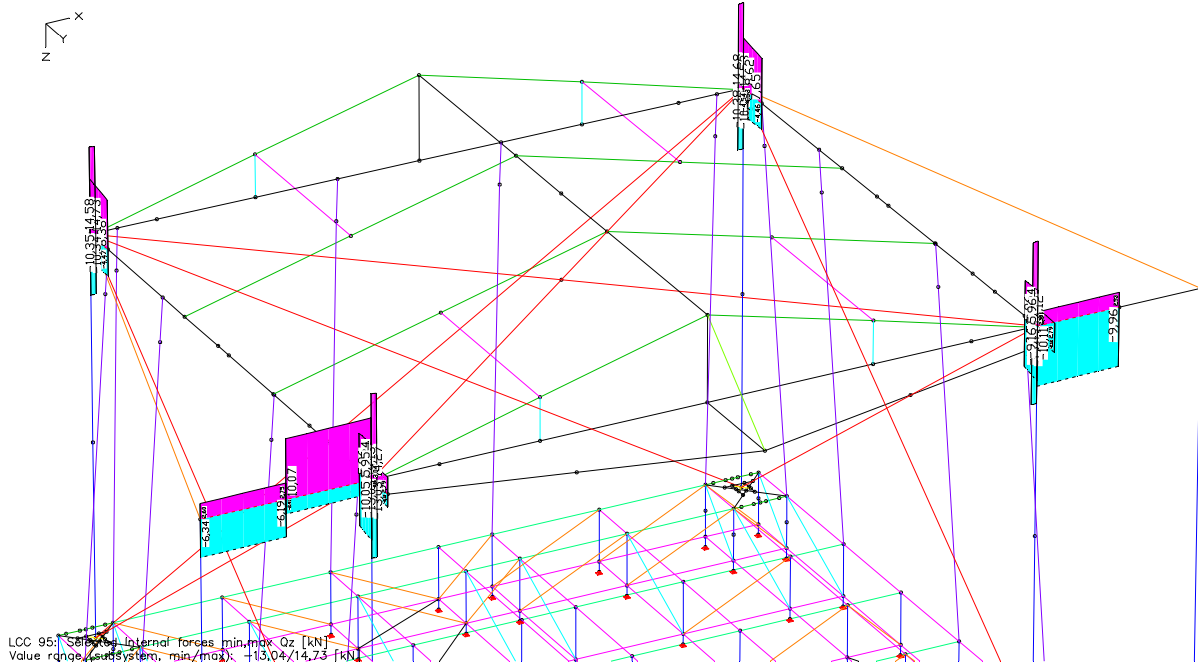
PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

5.4 SLEEVE BLOCK

$M_{y.Ed}$

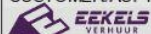


$V_{z.Ed}$



PROJECT:
MPT-ROOF 12x10m

CUSTOMER/AUFTRAGGEBER:



PROJECT-NO.:
22012

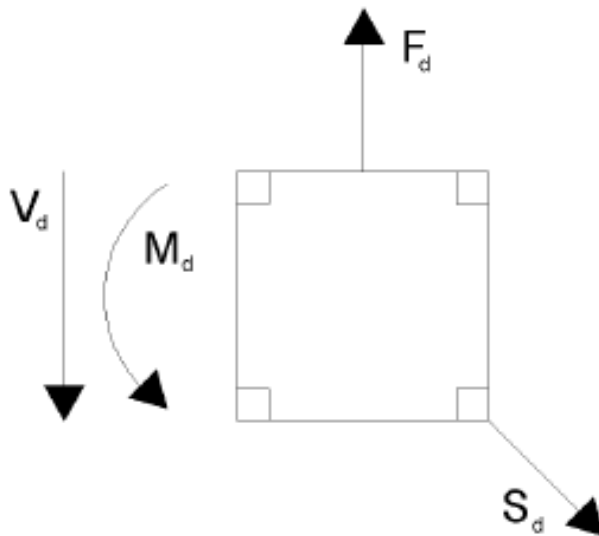
DATE/DATUM:
15.03.2022

$$M_d < 11,00 \text{ kNm}$$

$$V_d < 15,00 \text{ kN}$$

The capacity of the Sleeveblock is sufficient, see next page.

Permissible design loads / zulässige Beanspruchbarkeiten



F_{Rd} = total load at deadhang / Gesamtlast Sicherung

S_{Rd} = force guy wire / Kraft aus Aussteifungsseil

$V_{z,Rd}$ = Transversal force truss / Querkraft Traverse

M_{Rd} = Bending moment truss / Biegemoment Traverse

max. $F_{Rd} = 50,00$ kN

max. $S_{Rd} = 25,00$ kN

max. $V_{z,Rd} = 18,94$ kN

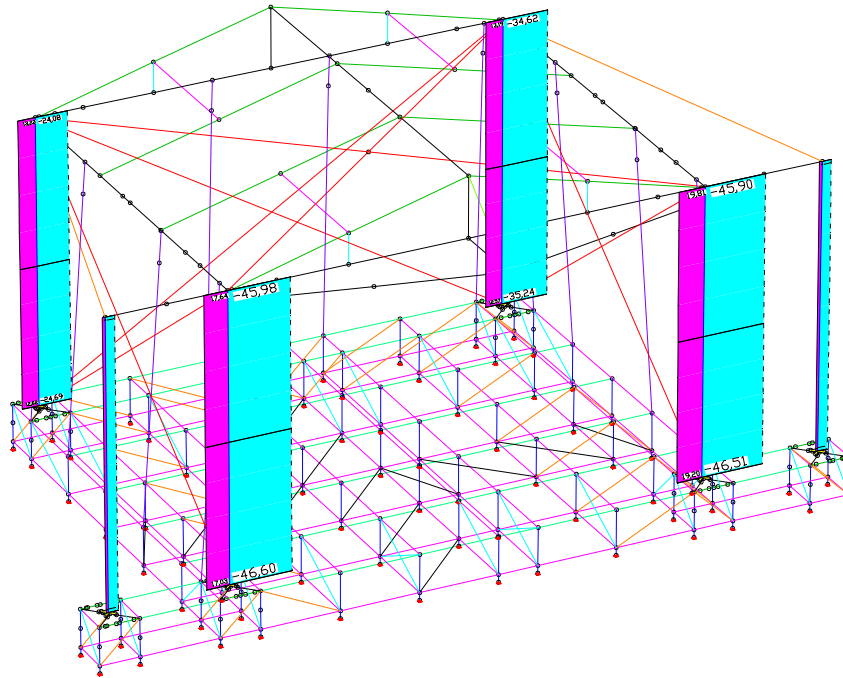
max. $M_{Rd} = 32,95$ kN

Interaction between $V_{z,Rd}$ and M_{Rd} : (due to truss)

bending moment/ Biegemoment M_{Rd}	transversal force/ Querkraft $V_{z,Rd}$
[kNm]	[kN]
$\leq 20,00$	18,94
21,00	18,80
22,00	17,23
23,00	15,66
24,00	14,08
25,00	12,51
26,00	10,94
27,00	9,36
28,00	7,79
29,00	6,22
30,00	4,64
31,00	3,07
32,00	1,50
32,95	0,00

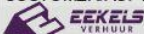
All given values are design loads

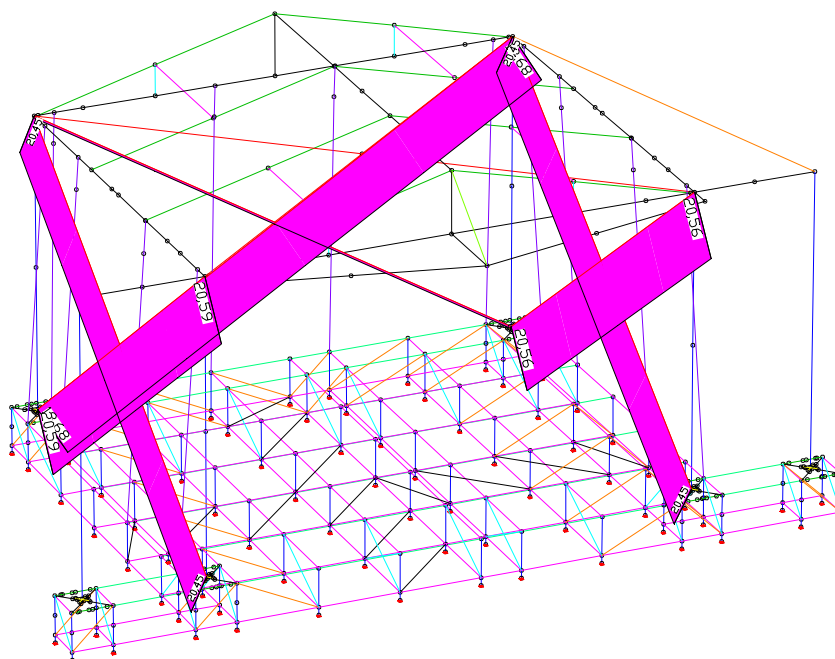
PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
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LCC 95: Selected Internal forces min,max Nx [kN]
 Value range (subsystem, min/max): -46,60/19,81 [kN]

$$F_d = 46,60 \text{ kN} < 50,0 \text{ kN}$$

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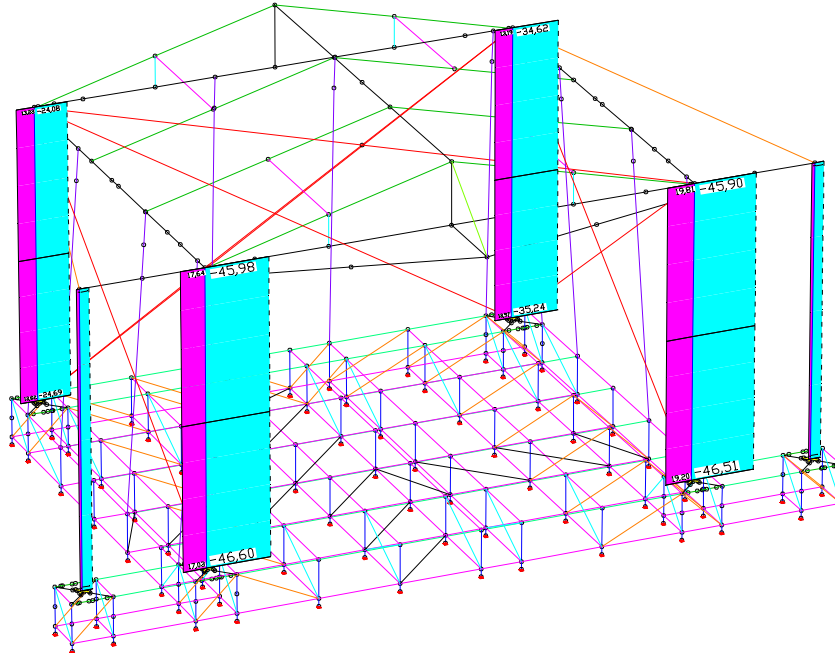


LCC 95: Selected Internal forces min,max Nx [kN]
 Value range (subsystem, min/max): 0,00/20,59 [kN]


$$S_d = 20,59 < 25,0 \text{ kN}$$

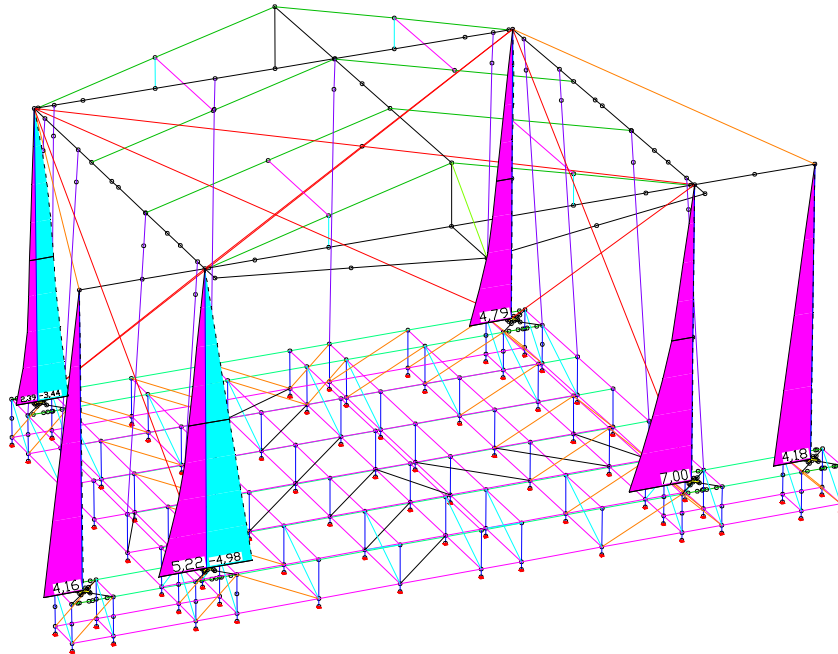
PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

5.5 COLUMNS

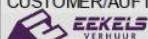


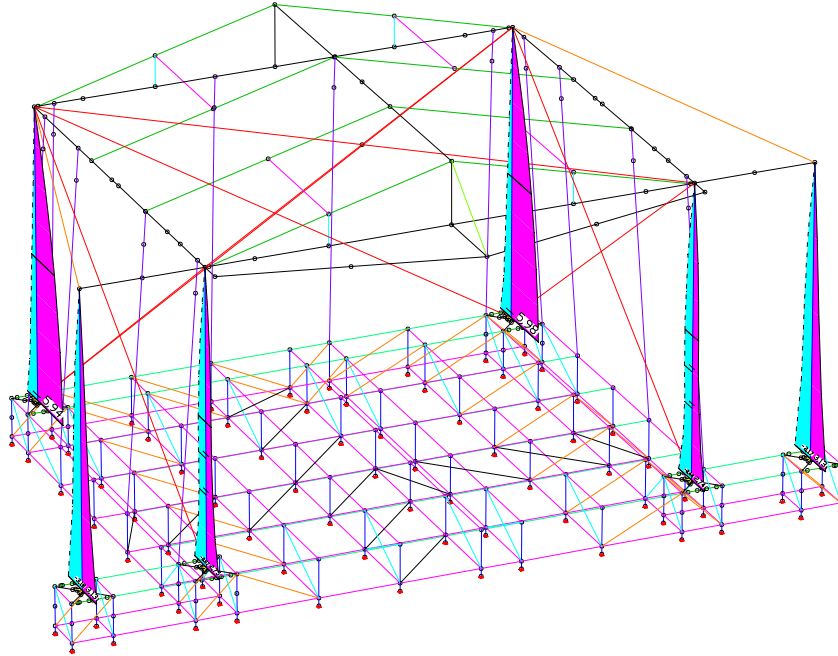
LCC 95: Selected Internal forces min,max Nx [kN]
 Value range (subsystem, min/max): -46,60/19,81 [kN]

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LCC 95: Selected Internal forces min,max My [kNm]
 Value range (subsystem, min/max): -4,98/7,00 [kNm]

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LCC 95: Selected Internal forces min,max Mz [kNm]
 Value range (subsystem, min/max): -3,18/5,98 [kNm]

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proof against buckling:

Geometrie		Traverse			
Stützenlänge	L [m]	7	Trägheitsradius	i_y [cm]	11,12
Knicklängenbeiwert	β_y	1		i_z [cm]	11,12
	β_z	1			
Materialeigenschaften		Belastung			
nach Tabelle 3.2b	f_o	250	N_{Ed} [kN]	35,24	
	f_u	290	$M_{y,Ed}$ [kNm]	1,62	
	$\rho_{u,haz}$	0,64	$M_{z,Ed}$ [kNm]	1,26	
	BC	A			

In Anlehnung an DIN 1999-1-1, Kapitel 6.3.3.4 erfolgt der Nachweis an der Stelle des Querschnitts mit der kleinsten Tragfähigkeit:

Belastbarkeit aus Traversenberechnung:

$$\begin{aligned}
 N_{Rd} &= 200,9 \text{ kN} \\
 M_{y,Rd} &= 24,00 \text{ kNm} \\
 M_{z,Rd} &= 24,00 \text{ kNm}
 \end{aligned}$$

Nachweis Biegeknicken

$$\begin{aligned}
 L_{cr,y} &= 1 \times 7 = 7 \text{ m} & \bar{\lambda}_0 &= 0,10 \\
 \alpha &= 0,20 & L_{cr,z} &= 1 \times 7 = 7 \text{ m}
 \end{aligned}$$

Die Gurtrohre sind alle der Querschnittsklasse 3, oder besser, zuzuordnen, somit gilt: $A_{eff} = A$

$$\begin{aligned}
 \bar{\lambda} &= \frac{L_{cr}}{i} \times \frac{1}{\pi} \times \sqrt{\frac{A_{eff}}{A} \times \frac{f_o}{E}} = \frac{L_{cr}}{i \times \pi} \times \sqrt{\frac{f_o}{E}} \\
 \bar{\lambda}_y &= 7 / (0,1112 \times \pi) \times \sqrt{(250 / 70000)} = 1,197 \\
 \bar{\lambda}_z &= 7 / (0,1112 \times \pi) \times \sqrt{(250 / 70000)} = 1,197
 \end{aligned}$$

$$\phi = 0,5 \times (1 + \alpha \times (\bar{\lambda} - \bar{\lambda}_2) + \bar{\lambda}^2)$$

$$\phi_y = 0,5 \times (1 + 0,2 \times (1,197 - 0,1) + 1,197^2) = 1,326$$

$$\phi_z = 0,5 \times (1 + 0,2 \times (1,197 - 0,1) + 1,197^2) = 1,326$$

$$\chi = \frac{1}{\phi + \sqrt{\phi^2 - \lambda^2}}$$

$$\chi_y = 1 / (1,326 + \sqrt{(1,326^2 - 1,197^2)}) = 0,527$$

$$\chi_z = 1 / (1,326 + \sqrt{(1,326^2 - 1,197^2)}) = 0,527$$

$$\chi_{min} = 0,527$$

ω_0 ist bereits in der Traversenberechnung berücksichtigt und wird deshalb zu 1 gesetzt.

$$\left(\frac{N_{Ed}}{\chi_{min} \times N_{Rd}} \right)^{\psi_c} + \left[\left(\frac{M_{y,Ed}}{M_{y,Rd}} \right)^{1,7} + \left(\frac{M_{z,Ed}}{M_{z,Rd}} \right)^{1,7} \right]^{0,6} \leq 1$$

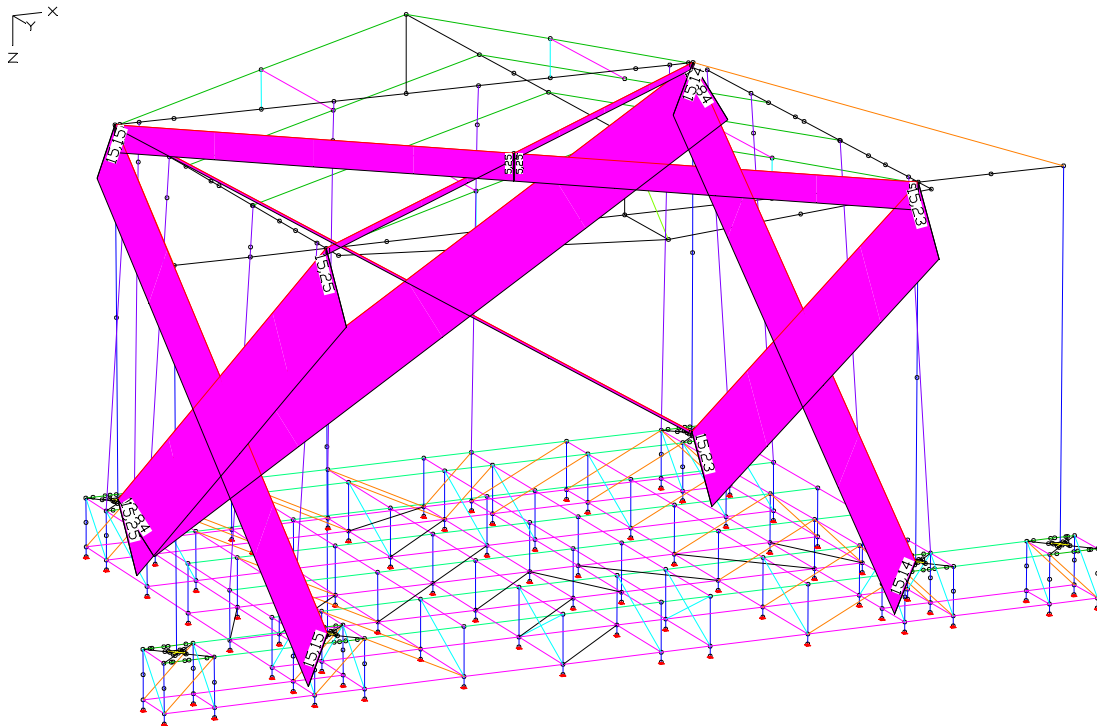
mit $\psi_c = 0,8$:

$$(35,24 / (0,527 \times 200,9))^{0,8} + [(1,62 / 24)^{1,7} + (1,26 / 24)^{1,7}]^{0,6} = 0,501 < 1$$

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5.6 GUY WIRES

LCC85



LCC 85: Selected Internal forces min,max Nx [kN]
Value range (subsystem, min/max): 0,00/15,25 [kN]

wall wires: max. $N_{Ek} = 15,25$ kN

Ø 10 mm z.B. wire class 6x7 1770 N/mm² with steel inlay DIN 12385
ultimate load 63,5 kN Safety factor: $\gamma = 3,0$

$$63,5 / 3 = 21,17 \text{ kN} > 15,25 \text{ kN}$$

Attachments of the wall wires directly on the Sleeve blocks and on the Base sections over shackles. (welded on or bolted through)

roof wires: max. $N_{Ek} = 5,25$ kN

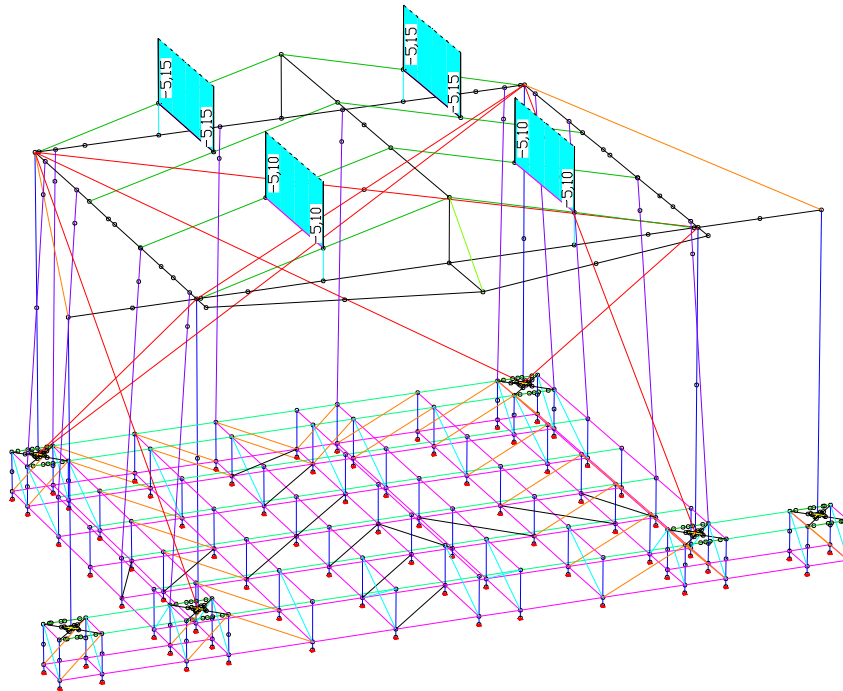
Ø 8 mm z.B. wire class 6x7 1770 N/mm² with steel inlay DIN 12385
ultimate load 40,7 kN Safety factor: $\gamma = 3,0$
40,7 / 3 = 13,57 kN > 5,25 kN

Attachments of the roof wires bolted directly in the nodes of the Sleeve blocks. The specifications of the steel cables are only examples. Equal constructions are possible.

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5.7 COMPRESSION STRUT

telescope pipe Ø60x5 (+ insert profile)




LCC 95: Selected Internal forces min,max Nx [kN]
 Value range (subsystem, min/max): -5,15/0,02 [kN]

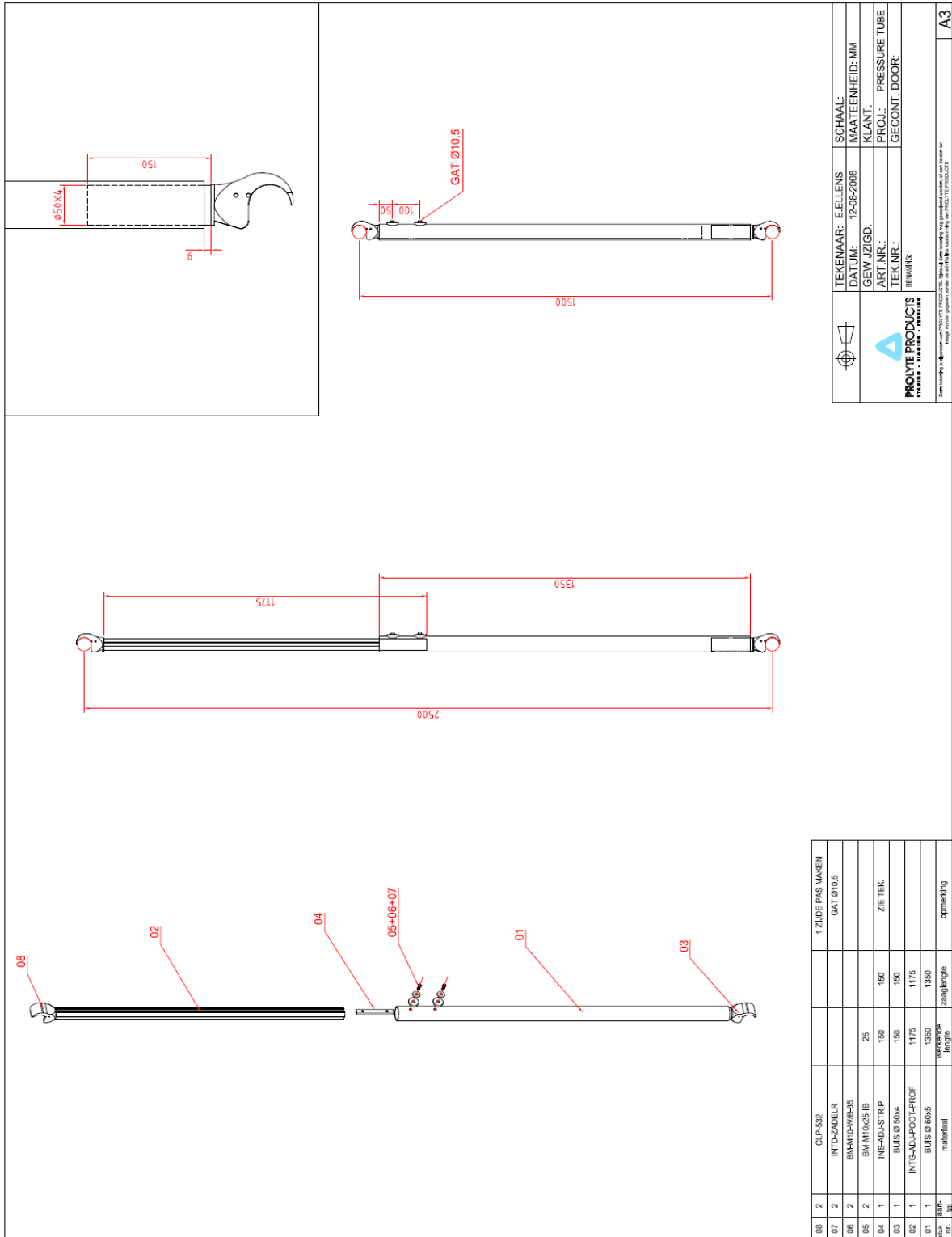
$N_{Ed} = -5,15 \text{ kN}$

buckling length:

~ 3,20 m

The connection of the compression struts is placed near the nodes of the rafters H30D.

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TEKENAAR: EELLENS	SCHAAL:
DATEUM: 12-08-2008	MAATEENHEID: MM
GEWUZZIGD:	KLANT:
ART. NR.:	PROJ.: PRESSURE TUBE
TEK. NR.:	GECONT. DOOR:
BEMERK:	
<small>Deen (aan) te tekenen en PROXYTE PRODUCTIS, N.V. is een merk van PROXYTE PRODUCTIS, N.V. en kan ook worden gebruikt door andere bedrijven. Het is niet toegestaan te kopiëren of te verspreiden. Het is niet toegestaan te kopiëren of te verspreiden. Het is niet toegestaan te kopiëren of te verspreiden.</small>	
A3	

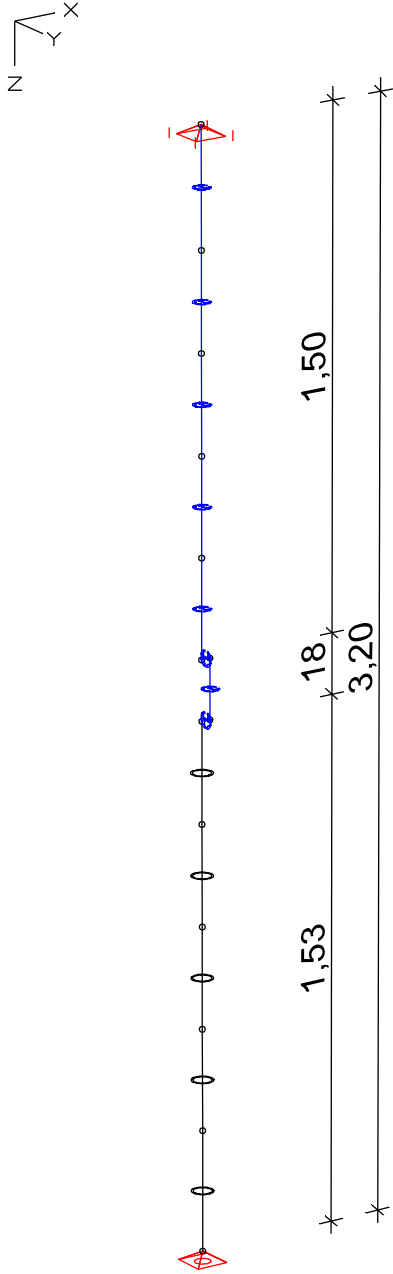
08	2	CLIP-SZ	1-ZIJDE PAS MAKEN
07	2	INT-ZADEL	GAT Ø10,5
06	2	BM-M10-WB-3E	
05	2	BM-M10-25-B	25
04	1	INS-AD-STRIP	150
03	1	BUIS Ø 50x4	150
02	1	INTG-ADJ-POOT-PROF	1175
01	1	BUIS Ø 60x5	1350
00	1	material	verschillen lengte
			opmerking


The length of the used strut in this case is 3,20m.

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A calculation for theory 2nd order is done to estimate the buckling of the compression strut.

system:




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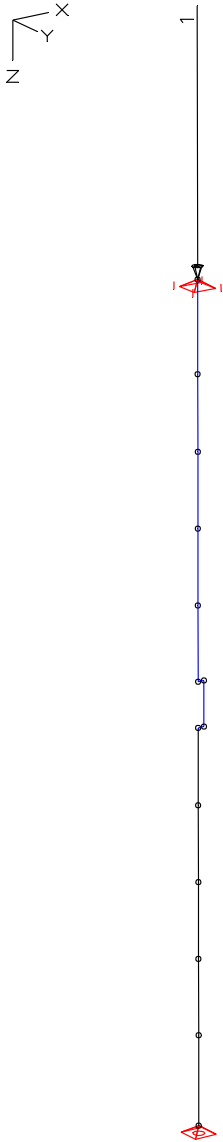
Loading:**load case 1:** dead weight

Is regarded within the software over the cross section.

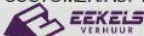
load case 2: pressure, unit load

A unit load of 1,0 kN is calculated for an easier factorizing in later load cases.
A predeformation of $l/300$ in x- and y-direction is taken into account.

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
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LF 2: Belastung, Druckkraft, Einheitslast

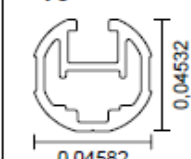
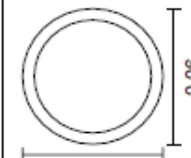
PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

calculation:

Systemkenngrößen

- 14 Knoten
- 13 Stäbe
- 2 Festhaltungen
- 0 Koppelungen
- 2 Materialkennwerte
- 2 Querschnittswerte
- 4 Lastfälle
- 0 LF-Kombinationen
- 5 Ergebnisorte in den Stäben

Querschnittswerte

1	Polygon 	Schwerpunkt [m] $y_s = -0,160$ $z_s = -0,013$ Fläche [m²] $A = 7,1488e-04$ Trägheitsmomente [m4] $I_x = 1,1291e-07$ $I_y = 1,3310e-07$ $I_z = 1,4415e-07$ $I_1 = 1,3310e-07$ $I_2 = 1,4415e-07$ Hauptachsenwinkel [Grad] $\Phi = 0,000$ Mittelung der Querkraft-Schubspannungen über die Qu.-breite
2	Polygon 	60x5 Schwerpunkt [m] $y_s = -0,000$ $z_s = -0,000$ Fläche [m²] $A = 8,5840e-04$ Trägheitsmomente [m4] $I_x = 6,4990e-07$ $I_y = 3,2517e-07$ $I_z = 3,2517e-07$ $I_1 = 3,2517e-07$ $I_2 = 3,2517e-07$ Hauptachsenwinkel [Grad] $\Phi = 0,000$ Mittelung der Querkraft-Schubspannungen über die Qu.-breite

Materialkennwerte

	Nr.	Art	E-Modul [MN/m²]	G-Modul [MN/m²]	alpha.t [1/K]	gamma [kN/m³]	Verschiedenes
1	1	Frei	70000	27000	1,00e-05	27,000	$f_c = 240$ [MN/m²] $f_t = 240$
2	2	Frei	70000	27000	1,00e-05	27,000	$f_c = 20$ [MN/m²] $f_t = 0$

Übersicht der Lastfälle

LF.	Bezeichnung
1	Eigengewicht
2	Druckkraft, Einheitslast
3	Theorie 2.Ordnung, Verformung 1

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LF.	Bezeichnung
4	Theorie 2.Ordnung, Verformung 2

Summe der aufgebrauchten Lasten und Auflagerreaktionen

LF.	Bezeichnung	Fx [kN]	Fy [kN]	Fz [kN]
1	Eigengewicht	0,000	0,000	0,069
	Auflagerreaktionen	0,000	0,000	0,069
2	Druckkraft, Einheitslast	0,000	0,000	1,000
	Auflagerreaktionen	0,000	0,000	1,000
3	Theorie 2.Ordnung, Verformung	-0,000	0,000	10,366
	Auflagerreaktionen	0,000	0,000	10,366
4	Theorie 2.Ordnung, Verformung	0,000	0,000	10,366
	Auflagerreaktionen	-0,000	-0,000	10,366

Lastdaten Lastfall 1: Eigengewicht

Eigengewicht (EG) aus Material- und Querschnittsbeschreibung

LfdNr	Wichtungsfaktoren in Richtung		
	X [-]	Y [-]	Z [-]
1	0,0000	0,0000	1,0000

Lastdaten Lastfall 2: Druckkraft, Einheitslast

Knotenlast (KNL)

LfdNr	Knoten		Px [kN]	Py [kN]	Pz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
	von	bis						
1	12	12	0,00	0,00	1,00	0,00	0,00	0,00

Lastdaten Lastfall 3: Theorie 2.Ordnung, Verformung 1

Lasten einfügen (EINF)

LfdNr	Lastfall		Wichtung
	von	bis	
1	1	2	9,700

LfdNr	
2	Berechnungstheorie (TH), Theorie 2. Ordnung, max. Iterationen = 1, max. Fehler = 1,00 % Bettung mit Zugspannungen

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Lastdaten Lastfall 3: Theorie 2.Ordnung, Verformung 1


LfdNr	Vorverformung (VV)	
	Nummer	
3	1	

Lastdaten Lastfall 4: Theorie 2.Ordnung, Verformung 2

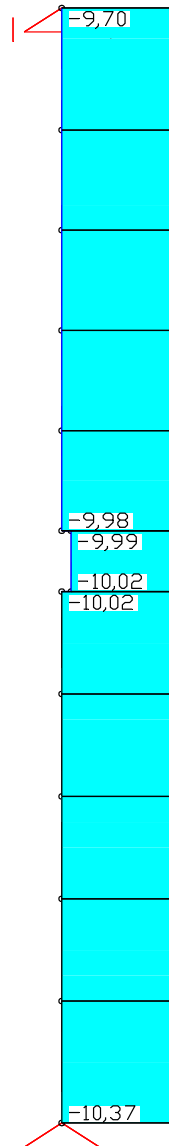
LfdNr	Lasten einfügen (EINF)		Wichtung
	von	bis	
1	1	2	9,700

LfdNr	
2	Berechnungstheorie (TH), Theorie 2. Ordnung, max. Iterationen = 1, max. Fehler = 1,00 % Bettung mit Zugspannungen

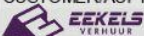
LfdNr	Vorverformung (VV)	
	Nummer	
3	2	

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
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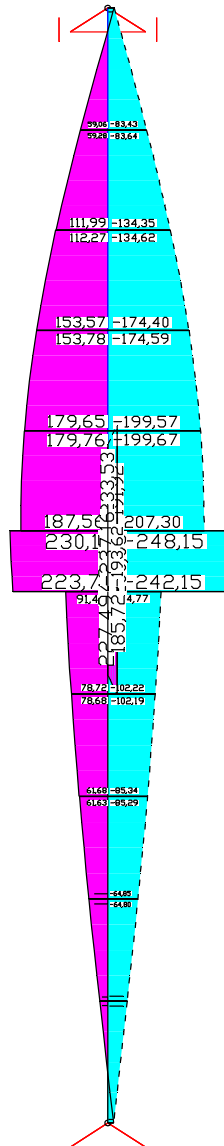
internal forces:



LF 3: Theorie 2.Ordnung, Verformung 1
 Schnittgrößen Nx. 6,55 [kN] = $\overline{\quad}$
 Wertebereich (Gesamtsystem, min/max): -10,37/0,01 [kN]

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
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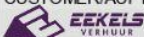
stresses:



LF 3: Theorie 2.Ordnung, Verformung 1
 Spannungen (allgemein – elastisch, direkt aus Schnittgrößen)
 Wertebereich (Gesamtsystem, min/max): -248,15/243,45 [MN]

$\sigma_{Rd} = 250 \text{ N/mm}^2$


(EN AW 6082 T6)

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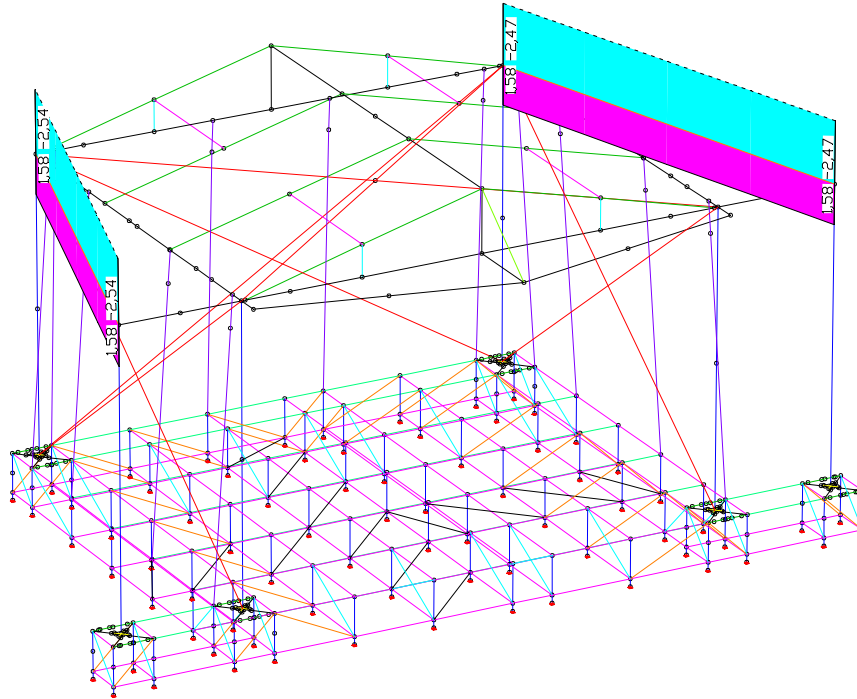
The compression strut is able to take up a pressure force of $N_{Ed} = 9,7 / 1,1 = 8,80$ kN

$$\eta = 5,15 / 8,80 = 0,59 < 1,0$$

The connection of the compression struts is placed near the nodes of the rafters H30D.

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5.8 SIDE WING SUPPORT H30V



LCC 95: Selected Internal forces min,max Nx [kN]
 Value range (subsystem, min/max): -2,54/1,58 [kN]

$$N_{Ed} = 2,54 \text{ kN}$$

Proof against buckling is not decisive.

Attachment constructively with truss adapters in the back.


Bending of half coupler bolted in the sleeve block plates:

$$M_{Ed} = 2,54 / 2 \times 0,07 = 0,089 \text{ kNm} = 8,9 \text{ kNcm}$$

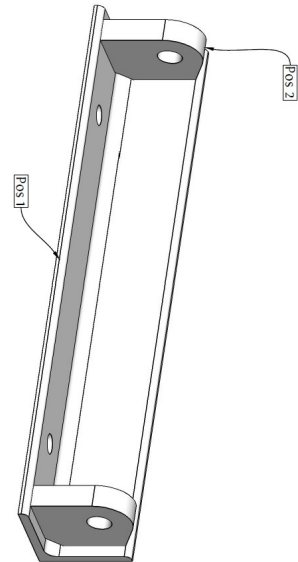
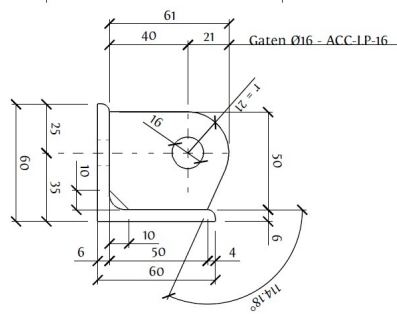
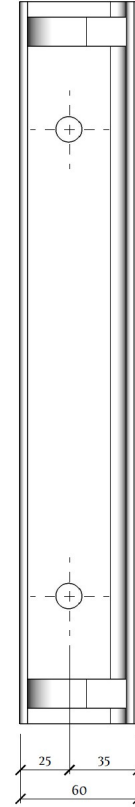
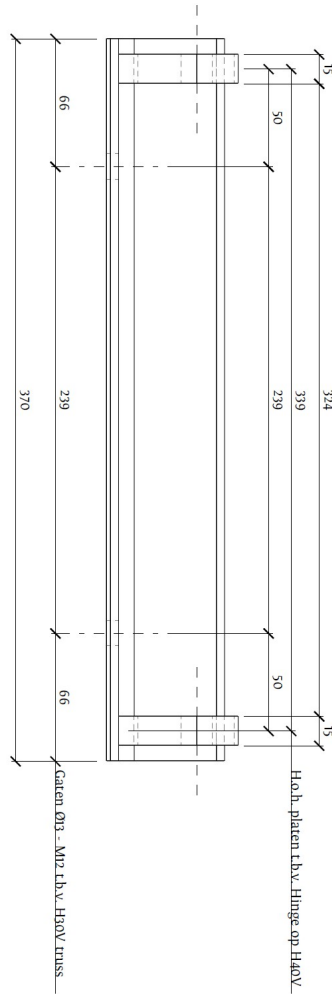
tension force in M12, 8.8 of the Sleeve

$$N_{Ed} = 8,9 / 2,5 = 3,56 \text{ kN} < 48,6 \text{ kN}$$

no further proof

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
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Resort: Aantallevering		Material
1	WGW L60x60x6 L=770	S235JR
2	WGW Plaat 61x50 d=15	S235JR



Aantal: 2 stuks



360MPT H40-30V_HingeAdapter

Projectname: 360MPT-Truss Adapters
 Projectnumber: Intern
 City / Venue: Schilde

Page name: A3 - 4 Views
Draft by: R. Slegers
Date: 29-jan-22
Units: mm

PROJECT:
MPT-ROOF 12x10m

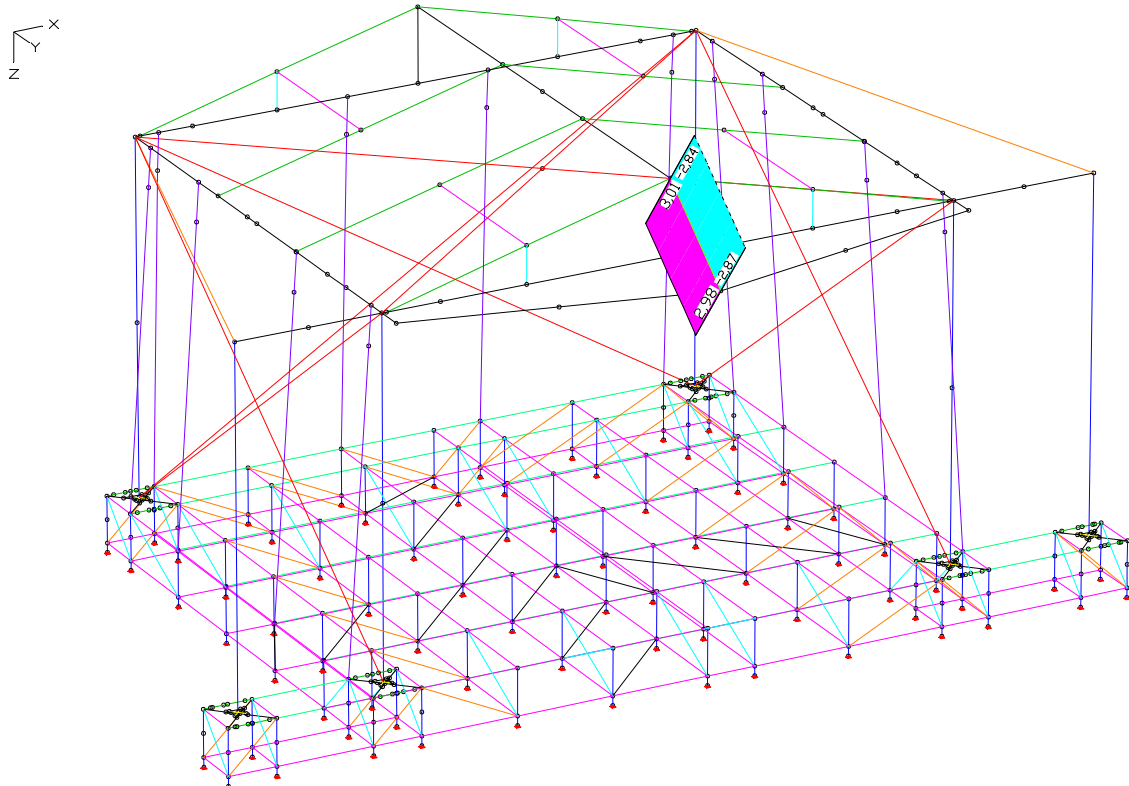
CUSTOMER/AUFTRAGGEBER:



PROJECT-NO.:
22012

DATE/DATUM:
15.03.2022

5.9 SUPPORT CANTILEVER FRONT



LCC 95: Selected internal forces min,max Nx [kN]
Value range (subsystem, min/max): -2,87/3,01 [kN]

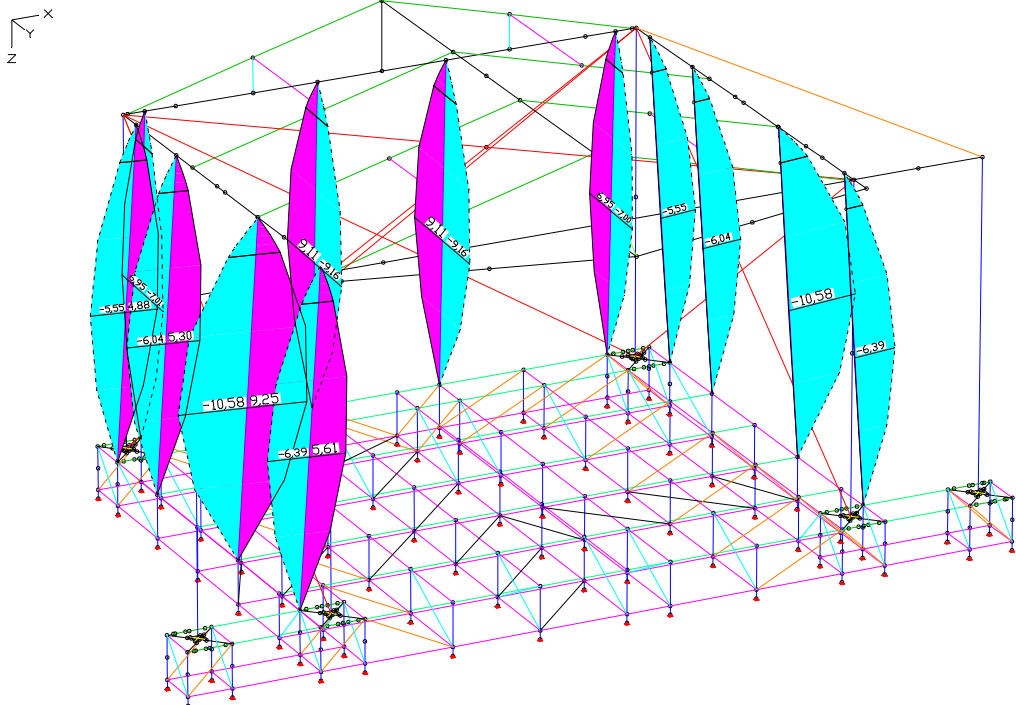
$$N_{Ed} = 3,01 \text{ kN}$$

The front support is carried out with a ladder truss H30L attached constructively over two gable couplers on top and a reinforced profile 50x50x4mm with two half clamps on the bottom.

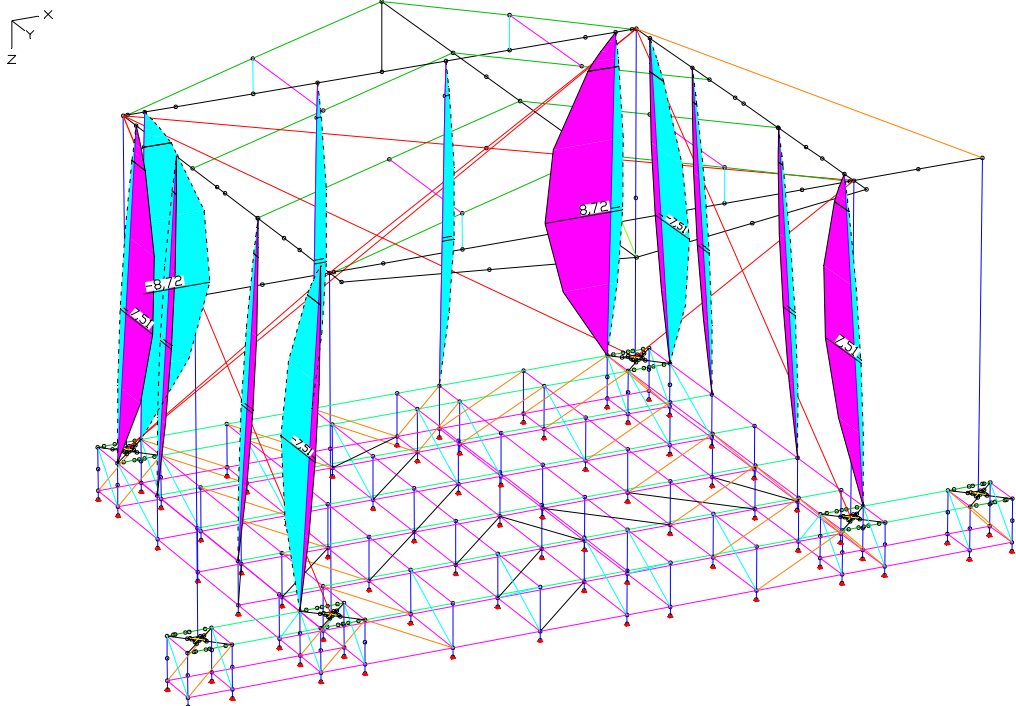
no further proof

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

5.10 KEDER PROFILES 170x88x3mm



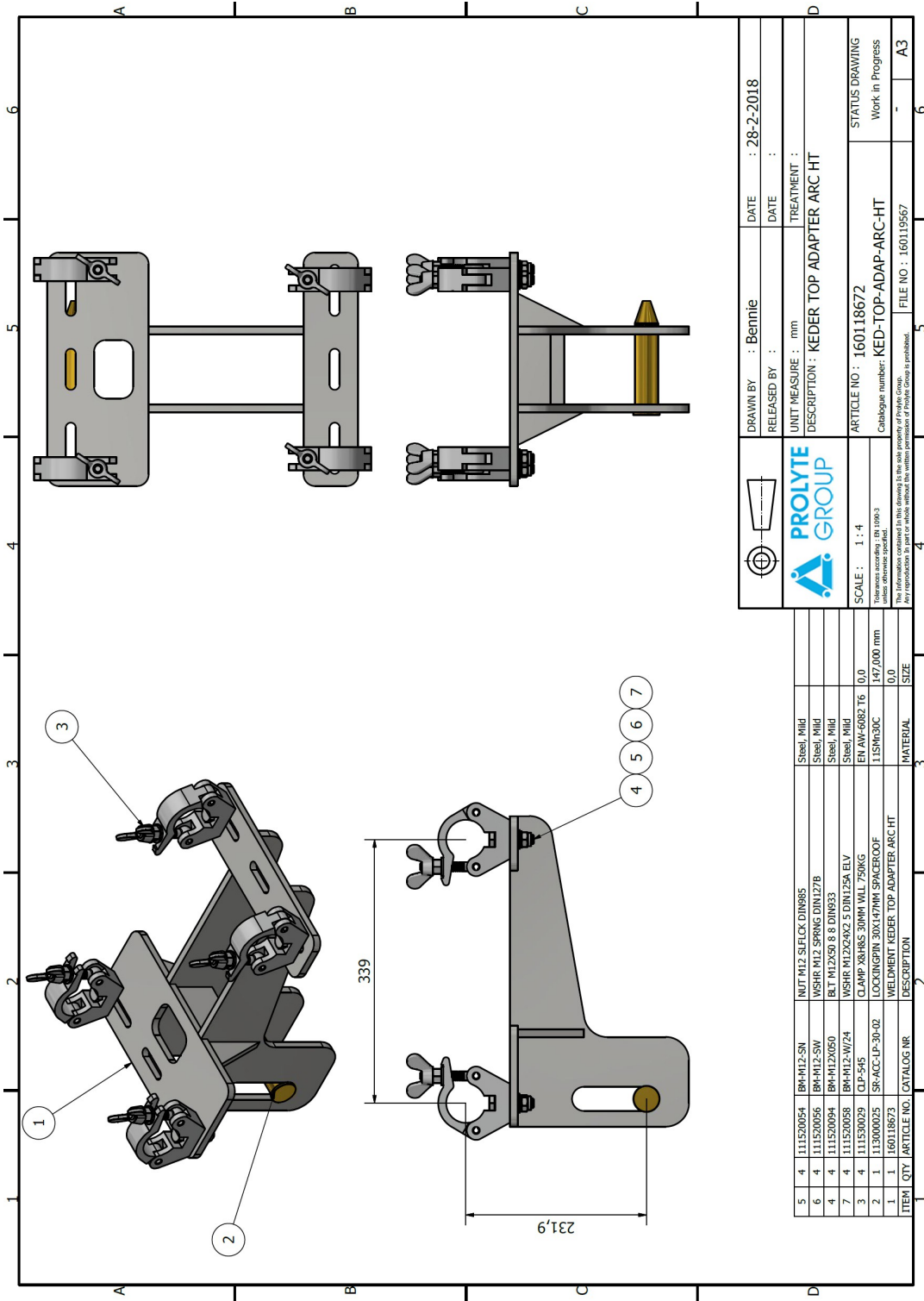
LCC 95: Selected Internal forces min,max My [kNm]
Value range (subsystem, min/max): -10,58/9,25 [kNm]



LCC 95: Selected Internal forces min,max Mz [kNm]
Value range (subsystem, min/max): -8,72/8,72 [kNm]

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Keder Top Adapter



PROLYTE GROUP	DRAWN BY : Bennie	DATE : 28-2-2018
	RELEASED BY :	DATE :
	UNIT MEASURE : mm	TREATMENT :
	DESCRIPTION : KEDER TOP ADAPTER ARC HT	
SCALE : 1 : 4	ARTICLE NO : 160118672	STATUS DRAWING
Tolerances according to EN 10983 unless otherwise specified.	Catalogue number: KED-TOP-ADAP-ARC-HT	Work in Progress
Any reproduction in part or whole without the written permission of Prolyte Group is prohibited.	FILE NO : 160119567	-
		A3

ITEM	QTY	ARTICLE NO.	CATALOG NR	DESCRIPTION	MATERIAL	SIZE
5	4	111520054	BN-M12-SN	NUT M12 SLFCK DIN985	Steel, Mild	
6	4	111520056	BN-M12-SW	WSHR M12 SPRING DIN1278	Steel, Mild	
4	4	111520050	BN-M12-0650	BLT M12X60 8 E DIN933	Steel, Mild	
7	4	111520058	BN-M12-W/24	WSHR M12X42 5 DIN1254 ELV	Steel, Mild	
3	4	111530029	CLP-545	CLAMP X8H85 30MM WLL 750KG	EN AW-6082 T6	0,0
2	1	113000025	SP-ACC-LP-30-02	LOCKINGPIN 30X147MM SPACEROOF	1.15Mn30C	0,0
1	1	160118673		WELDMENT KEDER TOP ADAPTER ARC HT		

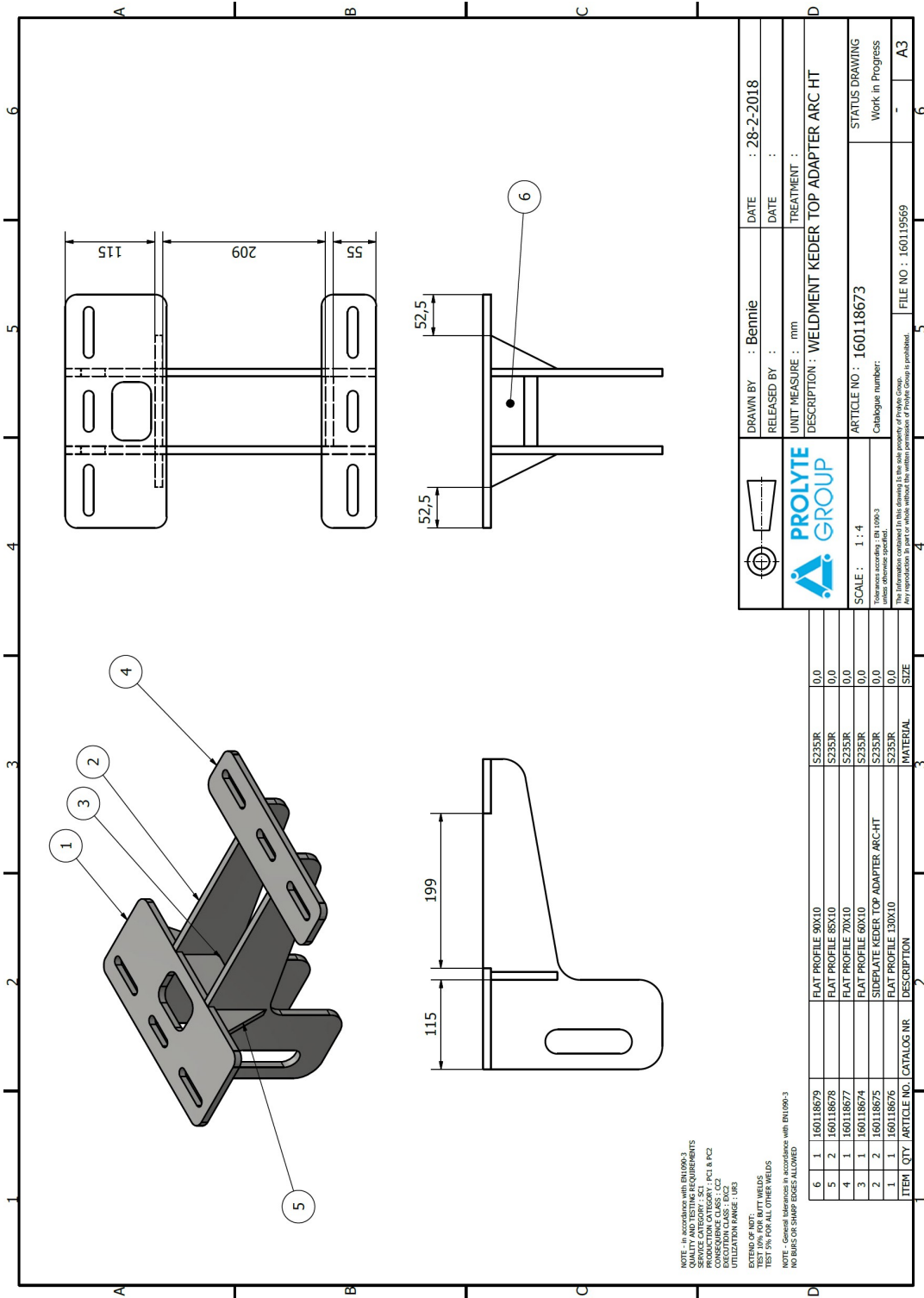
PROJECT:
MPT-ROOF 12x10m

CUSTOMER/AUFTRAGGEBER:



PROJECT-NO.:
22012

DATE/DATUM:
15.03.2022



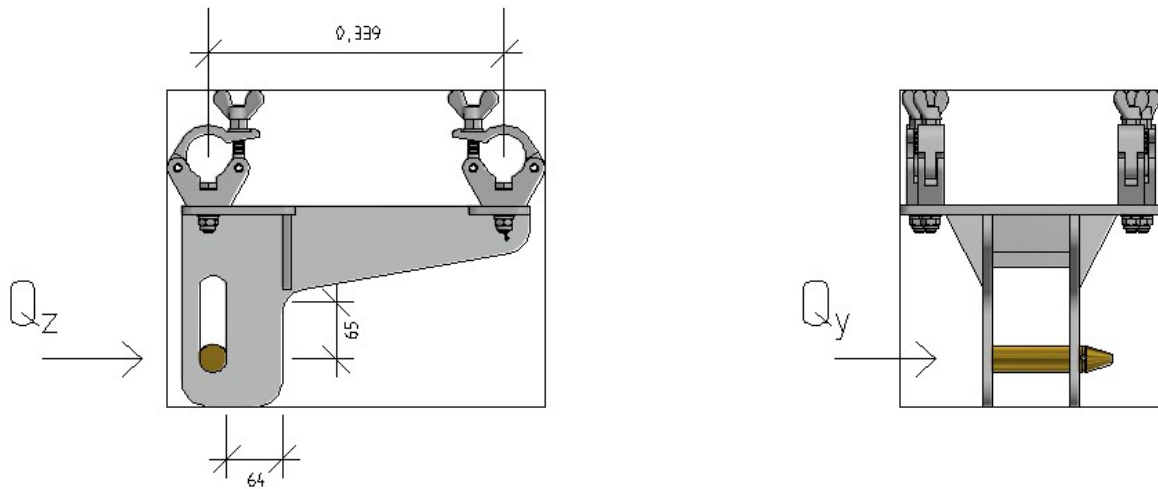
NOTE - In accordance with EN1090-3
 SERVICE CATEGORY: S3
 PRODUCTION CATEGORY: F, C1 & F/C2
 EXECUTION CLASS: EXC
 UTILIZATION RANGE: UR3
 EXTEND OF NOTCH: ALL
 TEST 5% FOR ALL OTHER WEEDS
 NOTE - General tolerances in accordance with EN1090-3
 NO BURRS OR SHARP EDGES ALLOWED

	DRAWN BY : Bennie	DATE : 28-2-2018
	RELEASED BY :	DATE :
	UNIT MEASURE : mm	TREATMENT :
	DESCRIPTION : WELDMENT KEDER TOP ADAPTER ARC-HT	
	ARTICLE NO : 160118673	STATUS DRAWING : Work in Progress
	Catalogue number :	
	File No : 160119569	

ITEM	QTY	ARTICLE NO.	CATALOG NR.	DESCRIPTION	MATERIAL	SIZE
6	1	160118679		FLAT PROFILE 90X10	S235JR	0,0
5	2	160118678		FLAT PROFILE 65X10	S235JR	0,0
4	1	160118677		FLAT PROFILE 70X10	S235JR	0,0
3	1	160118674		FLAT PROFILE 60X10	S235JR	0,0
2	2	160118675		SIDEPLATE KEDER TOP ADAPTER ARC-HT	S235JR	0,0
1	1	160118676		FLAT PROFILE 130X10	S235JR	0,0

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Sheet No 2:



$$Q_{z,Ed} = 4,03 \text{ kN}$$

$$Q_{y,Ed} = 5,07 \text{ kN}$$

$$W_{y,pl} = 1,0 \times 6,4^2/4 = 10,25 \text{ cm}^3$$

$$W_{z,pl} = 1,0^2 \times 6,4/4 = 1,61 \text{ cm}^3$$


$$M_{y,Rd} = 10,25 \times 23,5 = 241,0 \text{ kNcm}$$

$$M_{z,Ed} = 1,61 \times 23,5 = 37,8 \text{ kNcm}$$

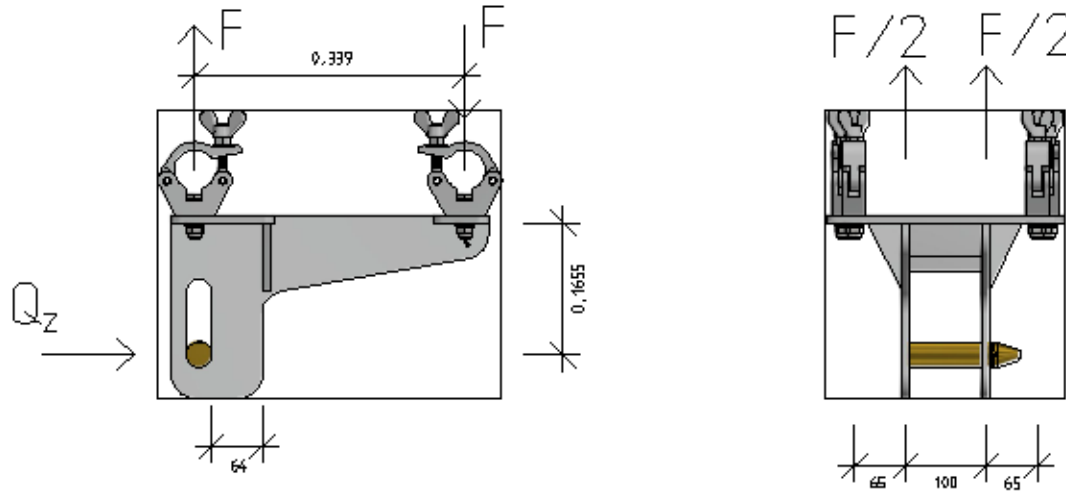
$$M_{y,Ed} = 4,03/2 \times 6,5 = 13,10 \text{ kNcm}$$

$$M_{z,Ed} = 5,07 \times 6,5 = 32,96 \text{ kNcm}$$

$$13,1/241 + 32,96/ 37,8 = 0,055 + 0,87 = 0,925 < 1,0$$

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Sheet No 4:



$$Q_{z,Ed} = 6,13 \text{ kN}$$

$$M_{Ed,Pos2} = 6,13 \times 0,1655 = 1,015 \text{ kNm}$$

$$F/2 = 1,015 / (2 \times 0,339) = 1,50 \text{ kN}$$

$$W_y = 1,0^2 \times 5,7/6 = 0,95 \text{ cm}^3$$

$$M_{y,Rd} = 0,95 \times 23,5 = 0,22 \text{ kNm}$$

$$M_{Ed,Pos4} = 1,50 \times 0,065 = 0,098 \text{ kNm}$$

$$0,098 / 0,22 = 0,44 < 1,0$$

Proof of local bending in truss chord:

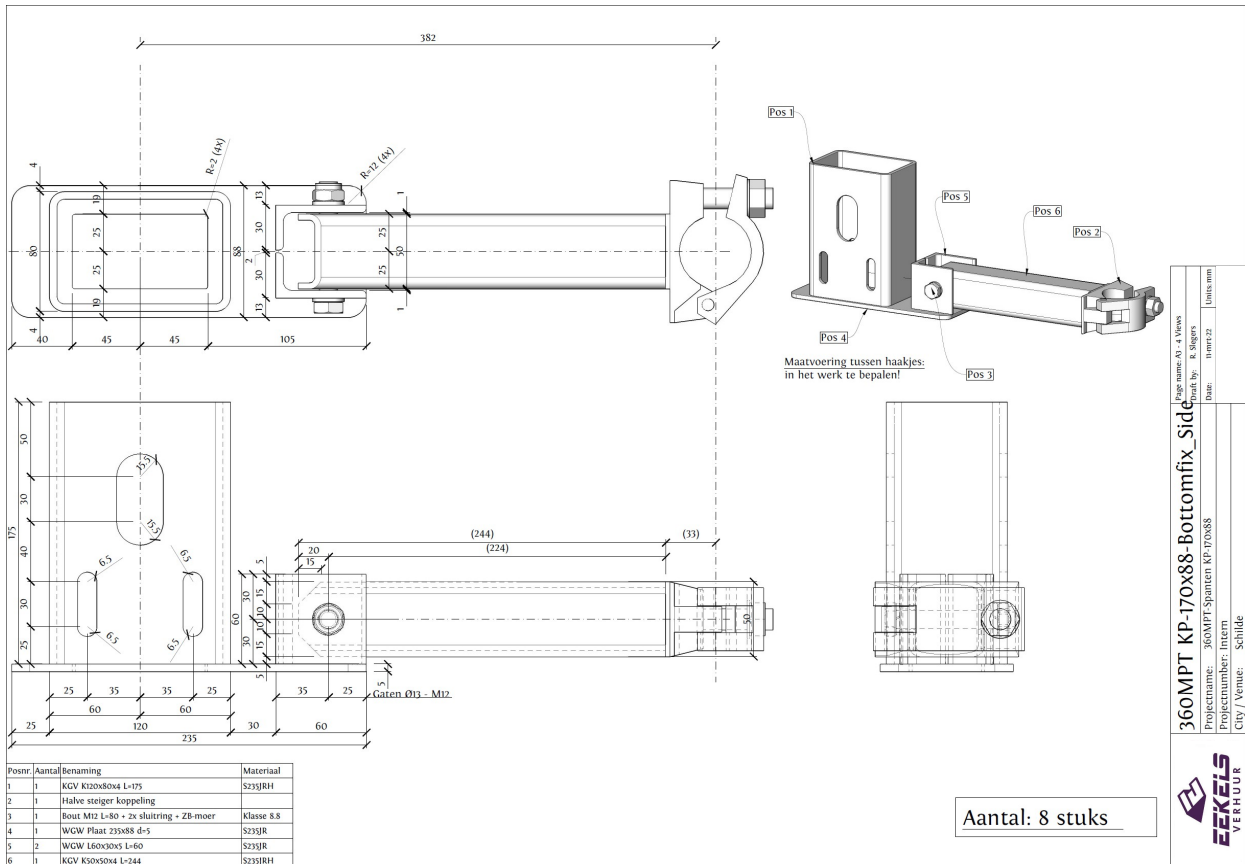
$$N_{Ed,chord} = (21,04 + 7,13) / (2 \times 0,339) + 4,96 / 4 = 42,79 \text{ kN} < 50,22 \text{ kN}$$

$$Q_{z,Ed} = 6,13 \text{ kN}$$

$$M_{Ed} = 6,13 / 2 \times 40 / 65 \times 0,25 = 0,47 \text{ kNm}$$

$$\sigma_{Ed} = 42,79 / 4,241 + 0,47 \times 100 / 4,493 = 20,55 \text{ kN/cm}^2 < 25 / 1,1 = 22,72 \text{ kN/cm}^2$$

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022



Aantal: 8 stuks

Page name: A - 4 Views
 Project: 360MPT-Spannen KP-700x88
 Projectname: 360MPT-Spannen KP-700x88
 Projectnumber: Intern
 City / Venue: Schilde

$Q_{y,Ed} = 3,97 \text{ kN}$

The horizontal force from membrane tension on the edge keders is constructively secured by fixing the keder bottoms with straps horizontally to the towers.

$Q_{z,Ed} = 5,60 \text{ kN}$

The horizontal force is lead over the fixed adapter (bolted, M12, 8.8) into the Layher columns.

$F_{v,Rd} = 2,5 \times 0,513 \times 36 \times 1,3 \times 2 \times 0,4 / 1,25 = 38,41 \text{ kN} > 5,60 \text{ kN}$

with $\alpha_b = 20 / (3 \times 13) = 0,513$ and $k_1 = 2,5$

Set off to layher plate: $h = 23,7 \text{ cm}$
 $M_{Ed} = 5,60 \times 0,237 = 1,34 \text{ kNm}$
 $< M_{Rd} = 4,73 \times 32,0 = 1,51 \text{ kNm}$

no further proof

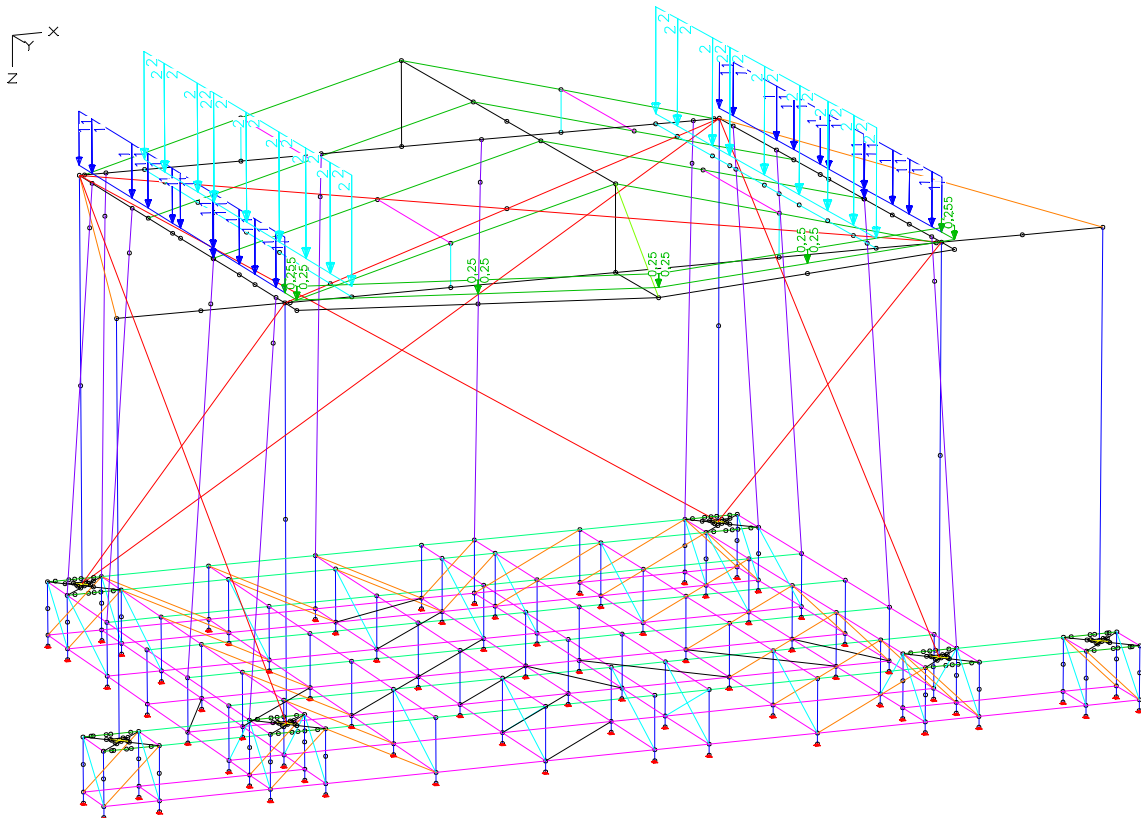
PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

6 LOAD SETUP WITH ADDITIONAL RIGGING TRUSS

Optionally an additional rigging truss (S36R) can be mounted. For that case special load setups are given in chapter 1.8.

In case of using the rigging truss (S36R) spanning from front to rear gable loads on the gables itself and on the ridge are not allowed.

distributed load [kN/m]




LC 4: Load, Distributed Load

1,00 kN/m = 100 kg/m

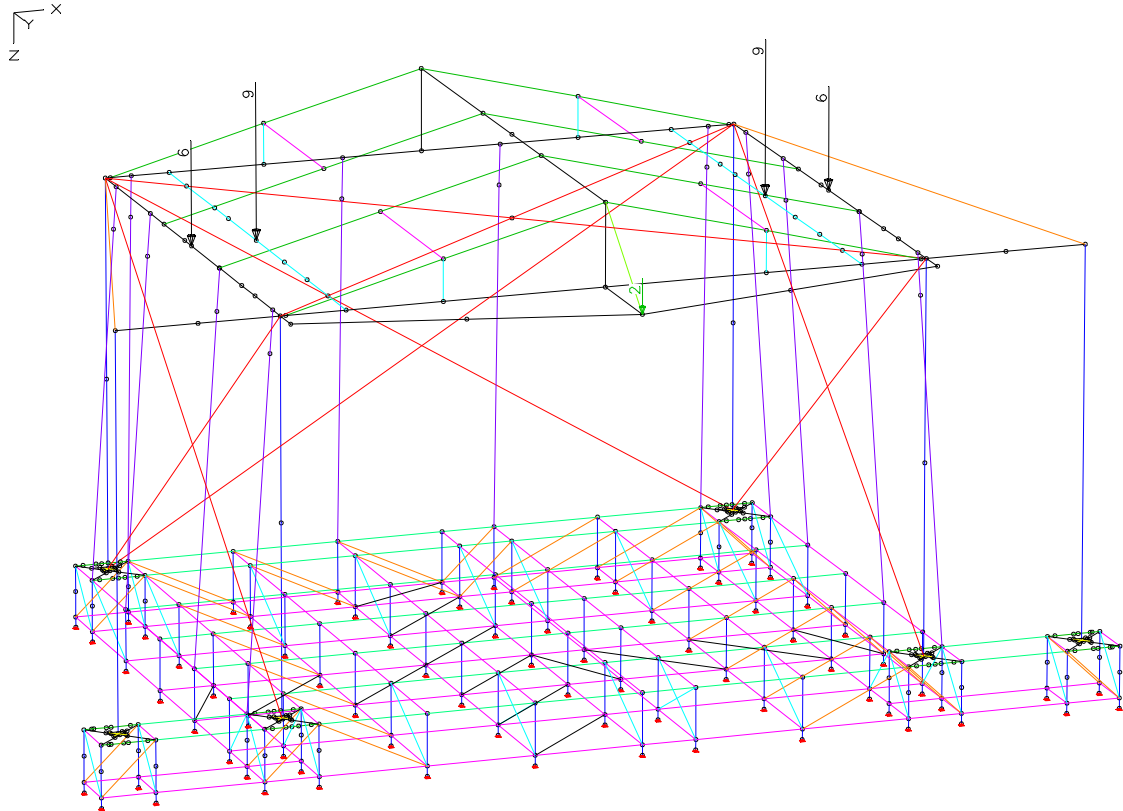
2,00 kN/m = 200 kg/m

0,25 kN/m = 25 kg/m

In case of building up the roof without the front cantilever, all loads from this cantilever truss can be added to the loads of the front truss. (load case specific)

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Center Point Load [kN]



LC 5: Load, Center Point Load

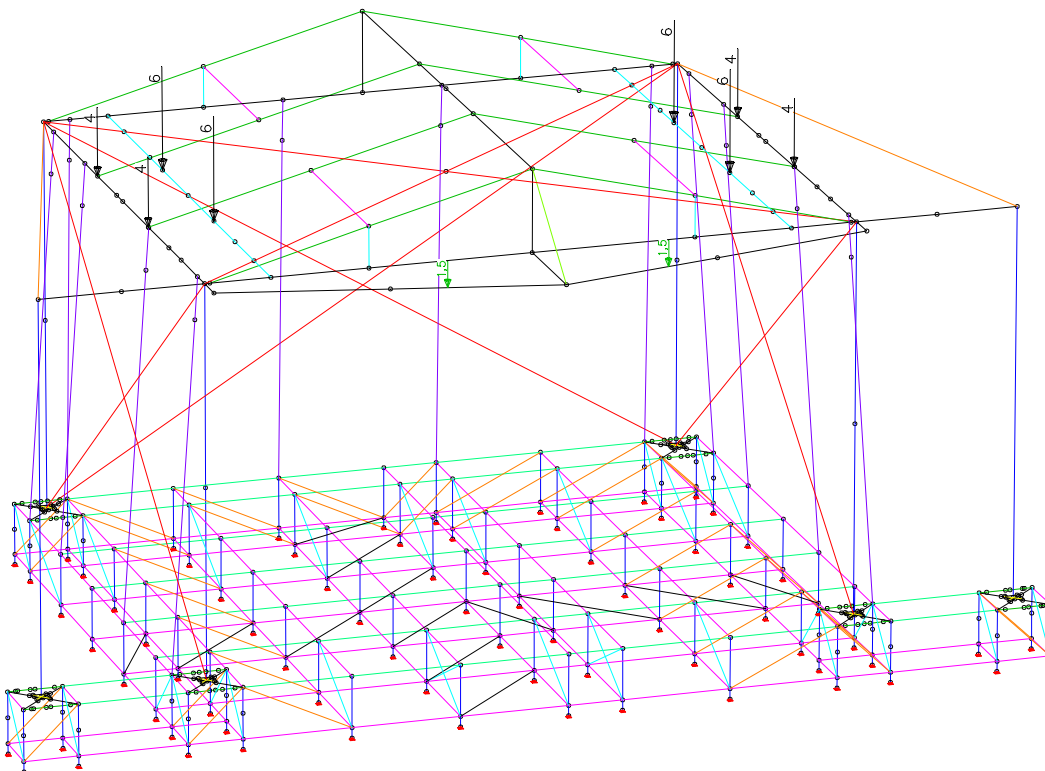
6,0 kN = 600 kg

9,0 kN = 900 kg

2,0 kN = 200 kg

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Third Point Load [kN]



LC 6: Load, Third Point Load

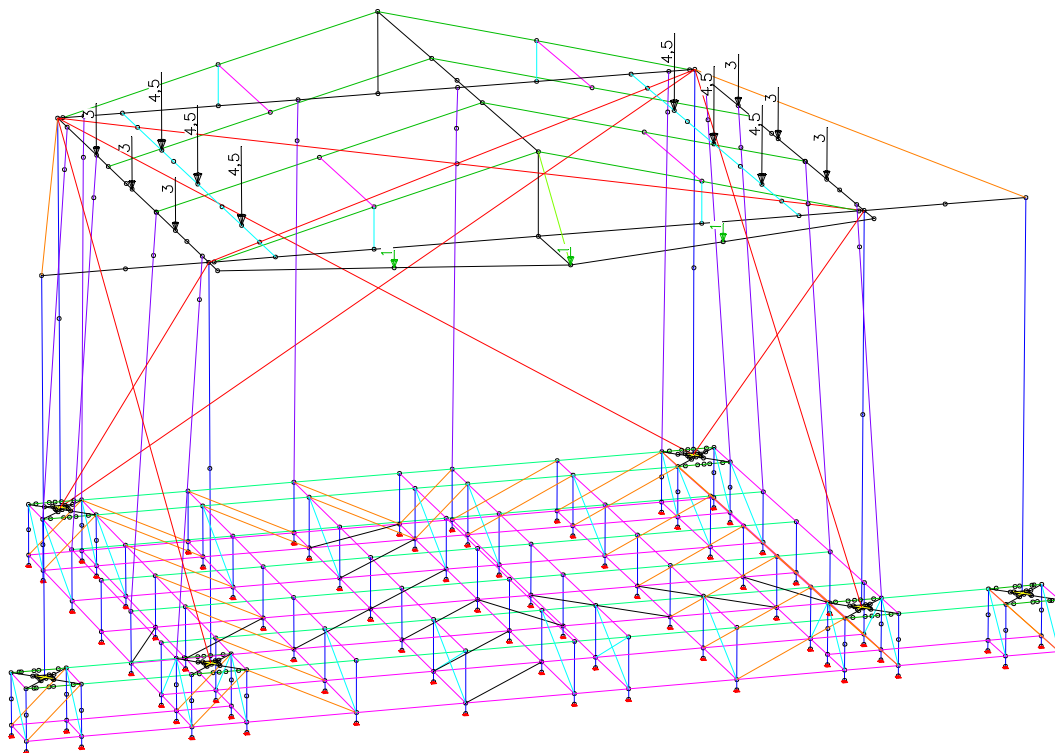
4,0 kN = 400 kg

6,0 kN = 600 kg

1,5 kN = 150 kg

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Fourth Point Load [kN]




LC 7: Load, Fourth Point Load

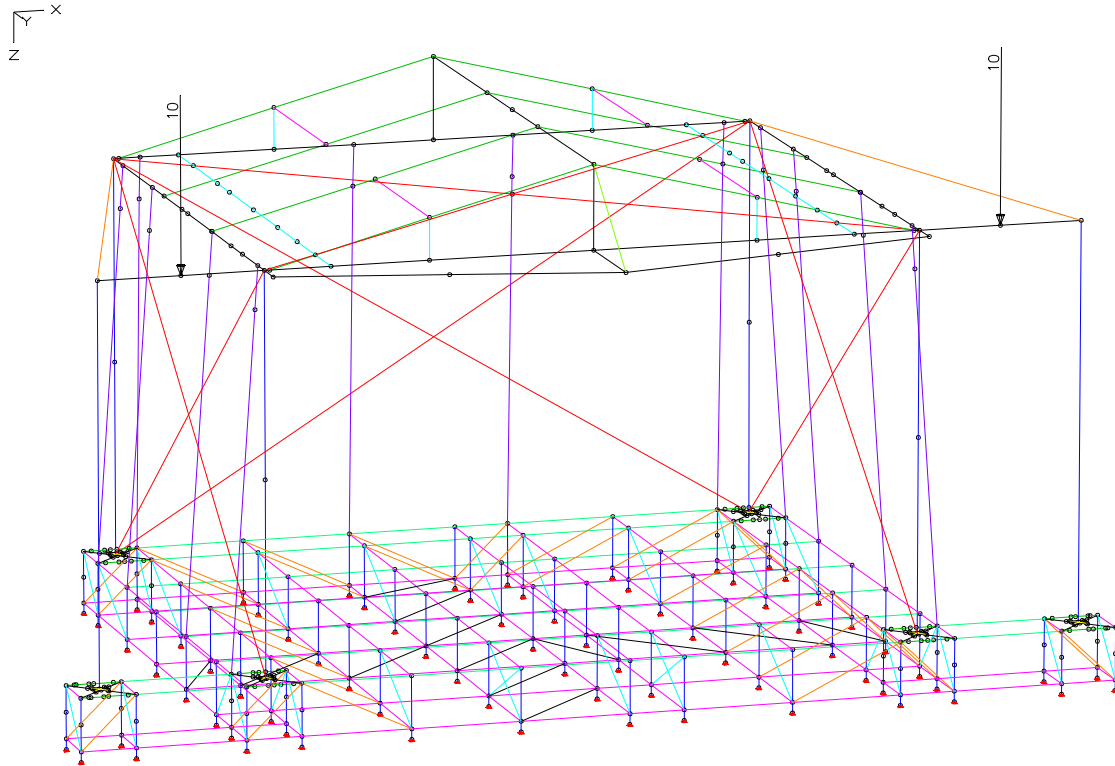
3,0 kN = 300 kg

4,5 kN = 450 kg

1,0 kN = 100 kg

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

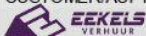
PA Load [kN]



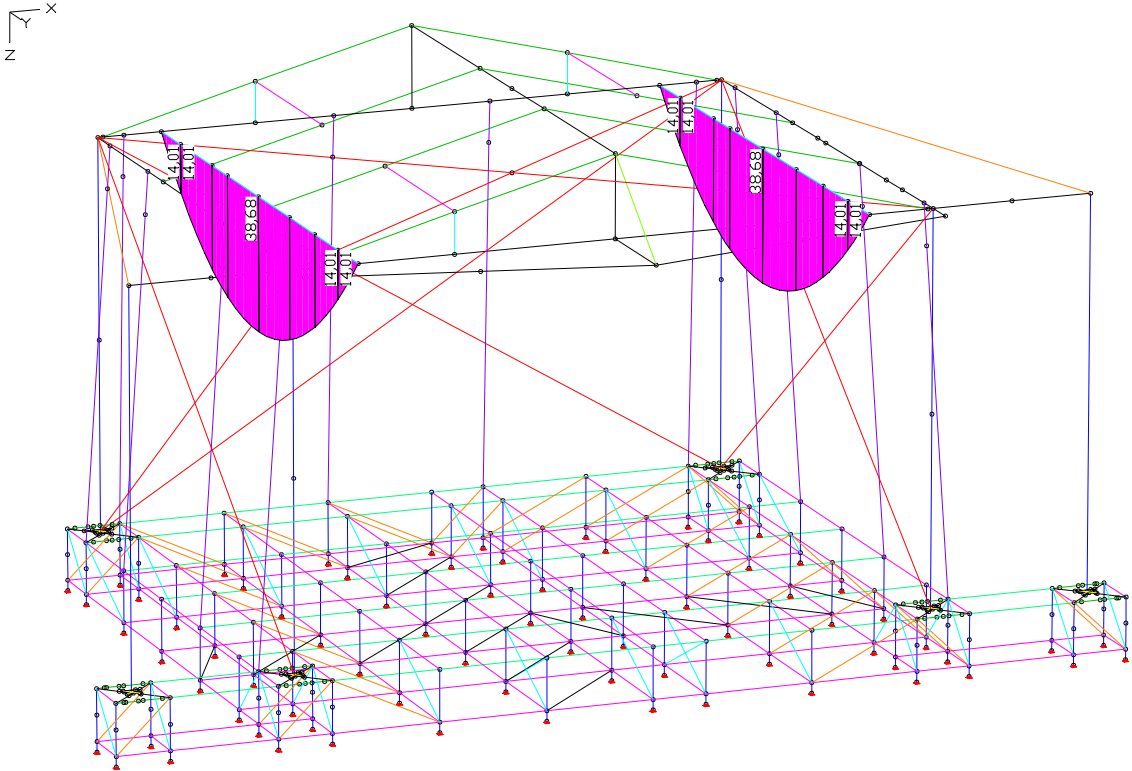
LC 9: Load, PA-Load

10 kN = 1000 kg (can also be 2 x 500 kg with a distance)

(wind exposed surface < 5m²)

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

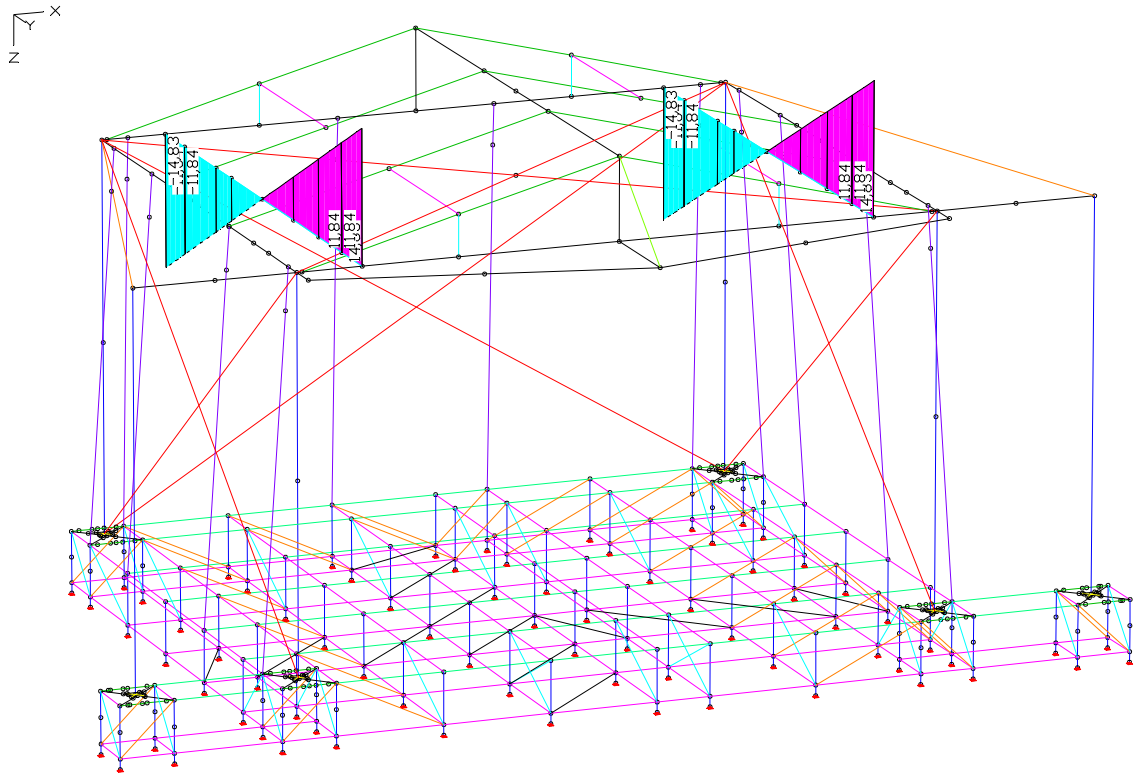
Internal forces rigging truss S36R



LCC 95: Selected internal forces min,max My [kNm]
Value range (subsystem, min/max): 0,00/38,68 [kNm]

< 40,93 kN

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

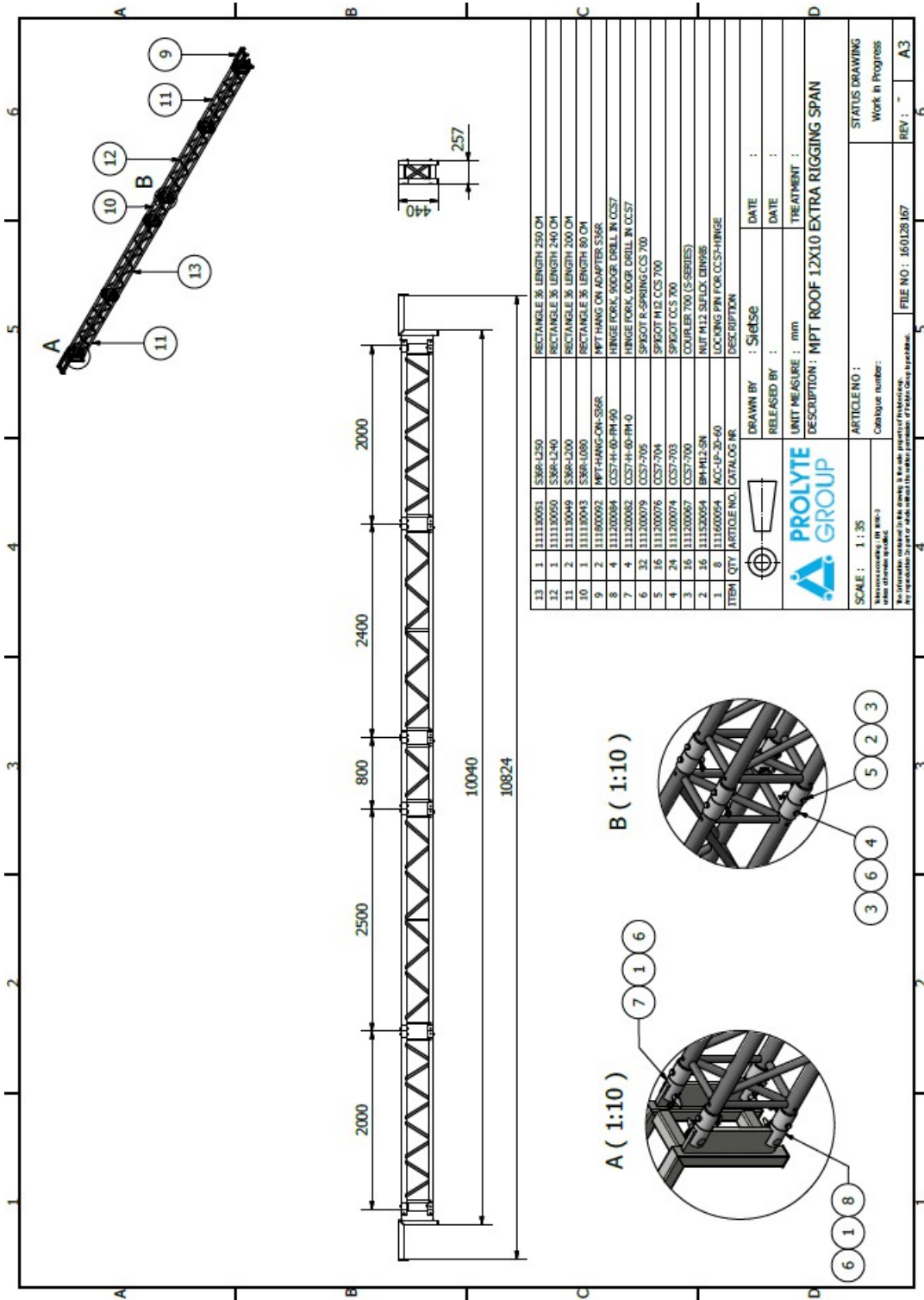


LCC 95: Selected Internal forces min,max Qz [kN]
Value range (subsystem, min/max): -14,83/14,83 [kN]

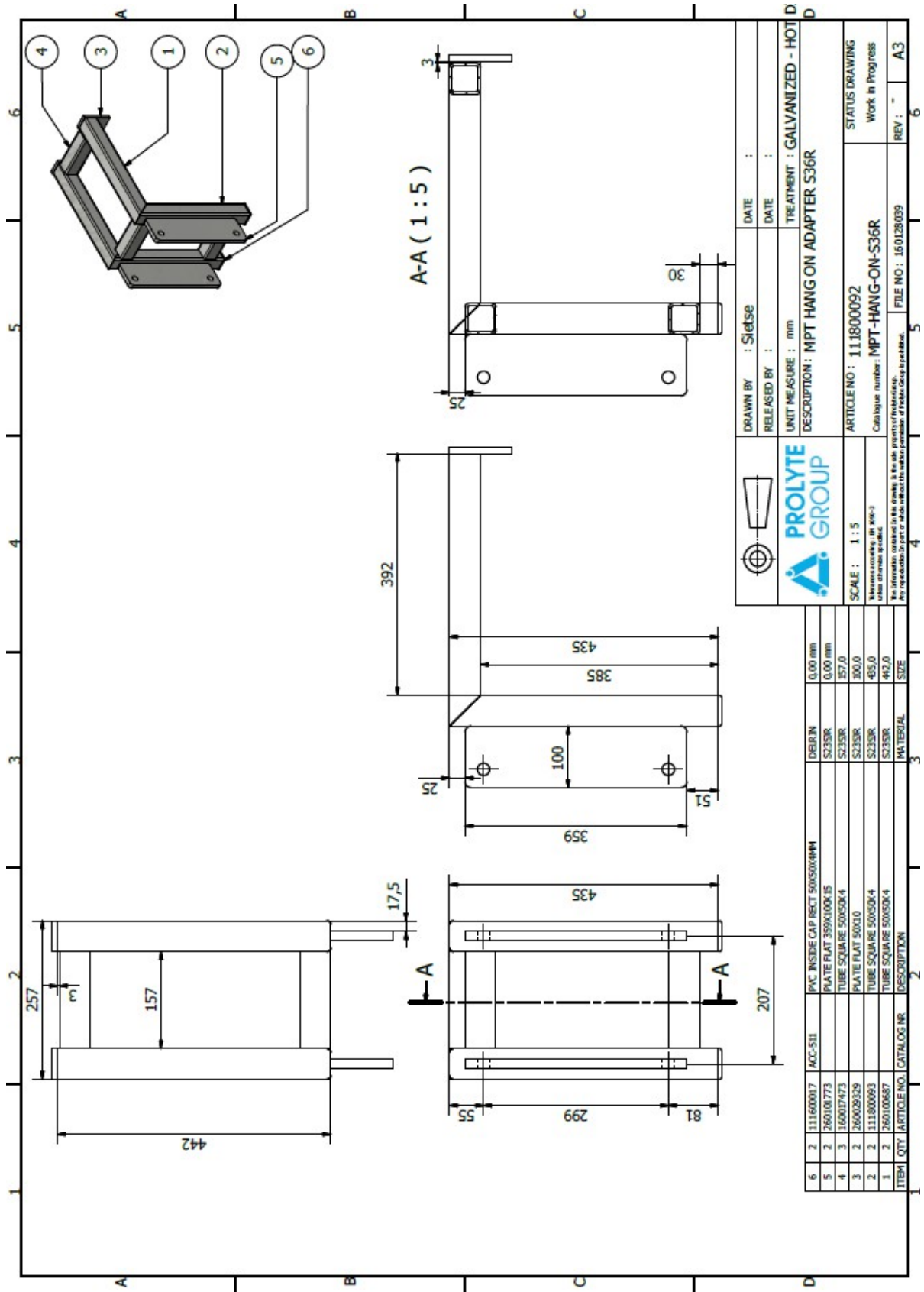
< 34,72 kN

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Attachment



PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022



PROLYTE GROUP	DRAWN BY : Sietse	DATE :
	RELEASED BY :	DATE :
	UNIT MEASURE : mm	TREATMENT : GALVANIZED - HOT
	DESCRIPTION : MPT-HANG-ON-ADAPTER-S36R	
	ARTICLE NO : 111800092	STATUS DRAWING
	Catalogue number : MPT-HANG-ON-S36R	Work in Progress
	FILE NO : 160128039	REV : - A3

ITEM	QTY	ARTICLE NO.	CATALOG NR.	DESCRIPTION	MATERIAL	SIZE
6	2	111600017	ACC-511	PVC INSIDE CAP RECT 500X50X4MM	DELFIN	0,00 mm
5	2	260100773		PLATE FLAT 359X100X1,5	S235R	0,00 mm
4	3	160007473		TUBE SQUARE 500X50X4	S235R	50,0
3	2	260009329		PLATE FLAT 500X10	S235R	300,0
2	2	111800092		TUBE SQUARE 500X50X4	S235R	405,0
1	2	260100687		TUBE SQUARE 500X50X4	S235R	442,0

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

7 LAYHER PODIUM

The platform flooring and the platform girder consist of Layher system components. The components must be designed for a payload of 350 kg/m² or 500 kg/m² with an own structural analysis.

vertical loads: wind + payload V

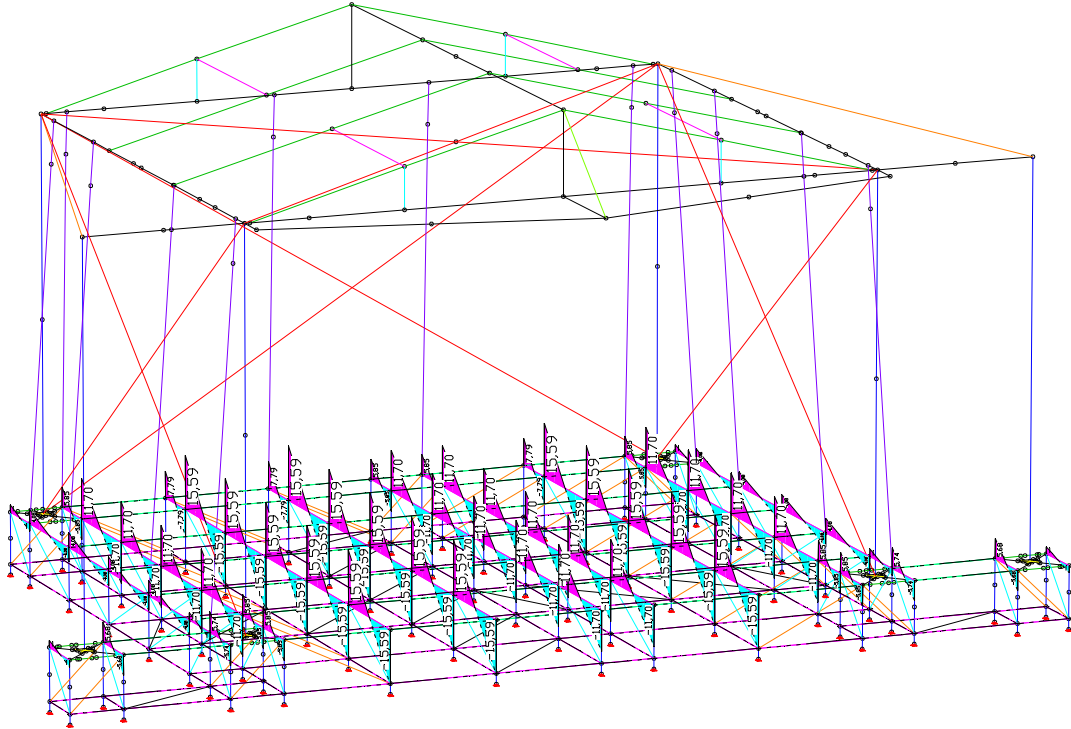
horizontal loads: wind + V/10

In the following a Layher-Podium with a system height of 1,0m is calculated.

A comparative calculation of a 2,0m system height podium is carried out and all proofs are fulfilled as well.


PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

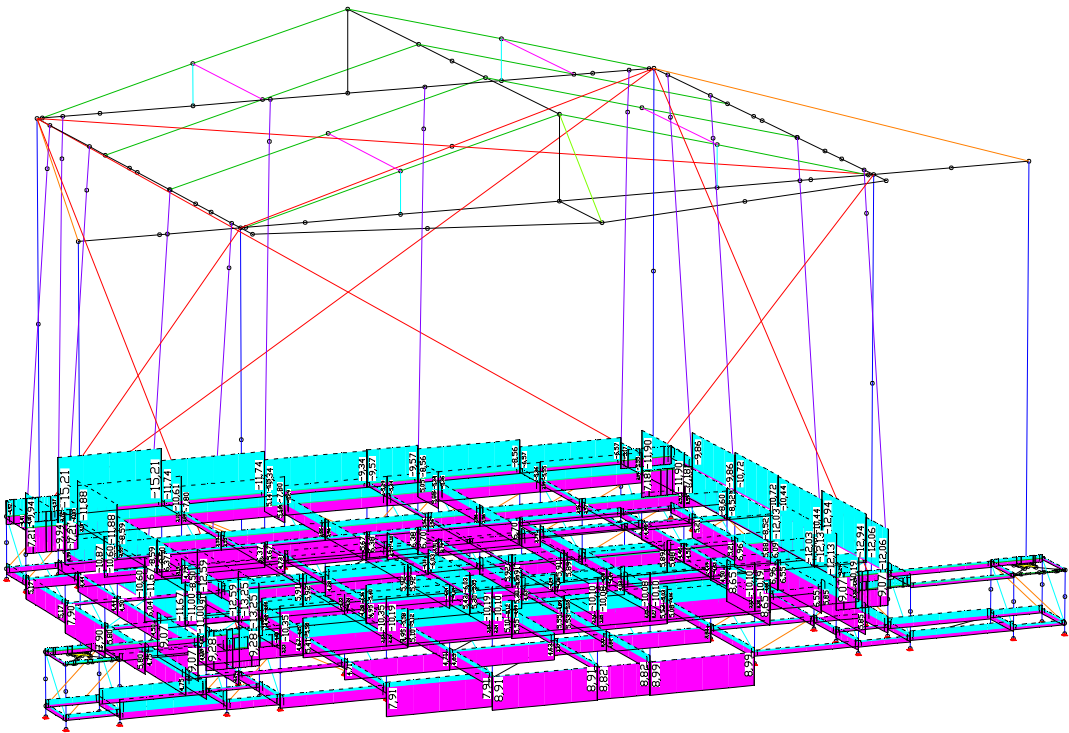
Ledgers



LCC 95: Selected Internal forces min,max Qz [kN]
 Value range (subsystem, min/max): -15,59/15,59 [kN]


$$< 26,4 \text{ kN} = V_{z,Rd}$$

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

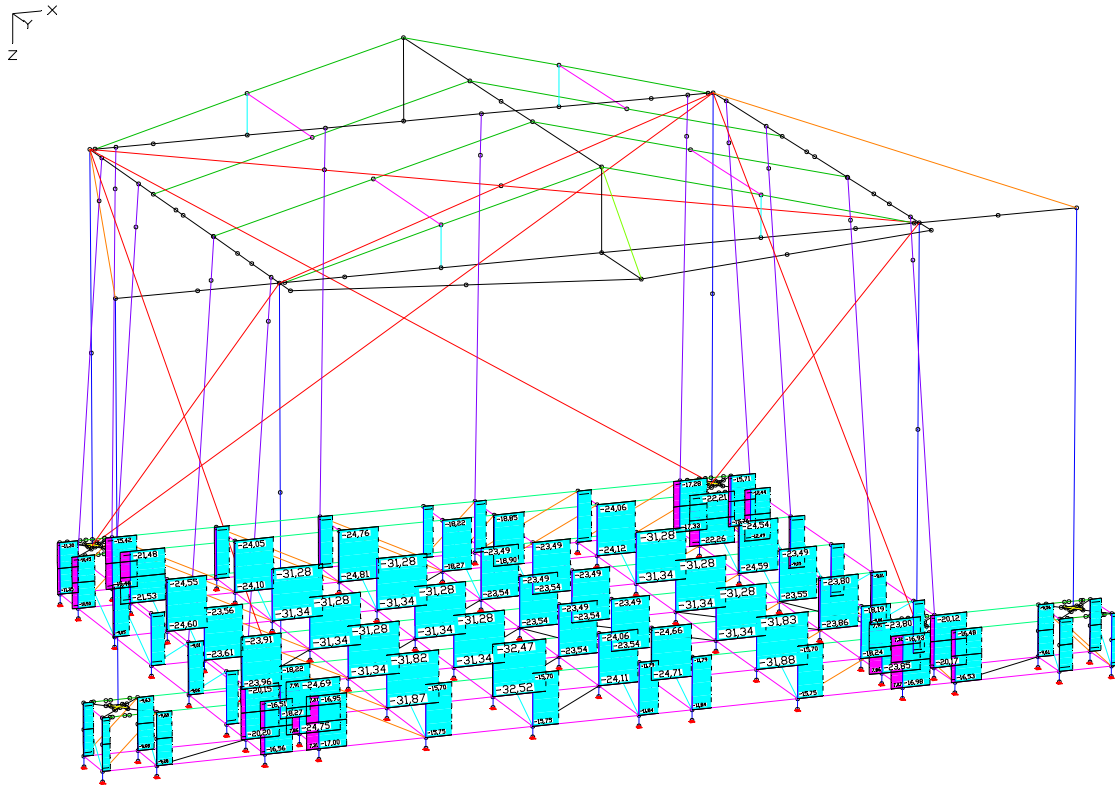


LCC 95: Selected Internal forces min,max Nx [kN]
Value range (subsystem, min/max): -15,21/9,28 [kN]

$< 31,0 \text{ kN} = N_{Rd}$

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Columns



LCC 95: Selected internal forces min,max Nx [kN]
 Value range (subsystem, min/max): -32,52/7,91 [kN]

column: Ø48,3x3,2 mm S235 JRH, $R_h = 320 \text{ N/mm}^2$
 (A = 4,53 cm², $W_{el} = 4,80 \text{ cm}^3$, i = 1,6 cm)

length 1,0 m

buckling length: 0,9 x 1,0 = 0,90m

$$\lambda = 90 / 1,6 = 56,25$$

$$\lambda_1 = 93,9 \times (235/320)^{1/2} = 80,5$$

$$\bar{\lambda} = 56,25 / 80,5 = 0,70$$

buckling curve c: $\chi = 0,73$

$$N_{Rd} = 4,53 \times 32 / 1,1 \times 0,73 = 96,2 \text{ kN}$$

$$N_{Ed} / N_{Rd} = 32,52 / 96,2 = 0,34 < 1$$

length 2,0 m

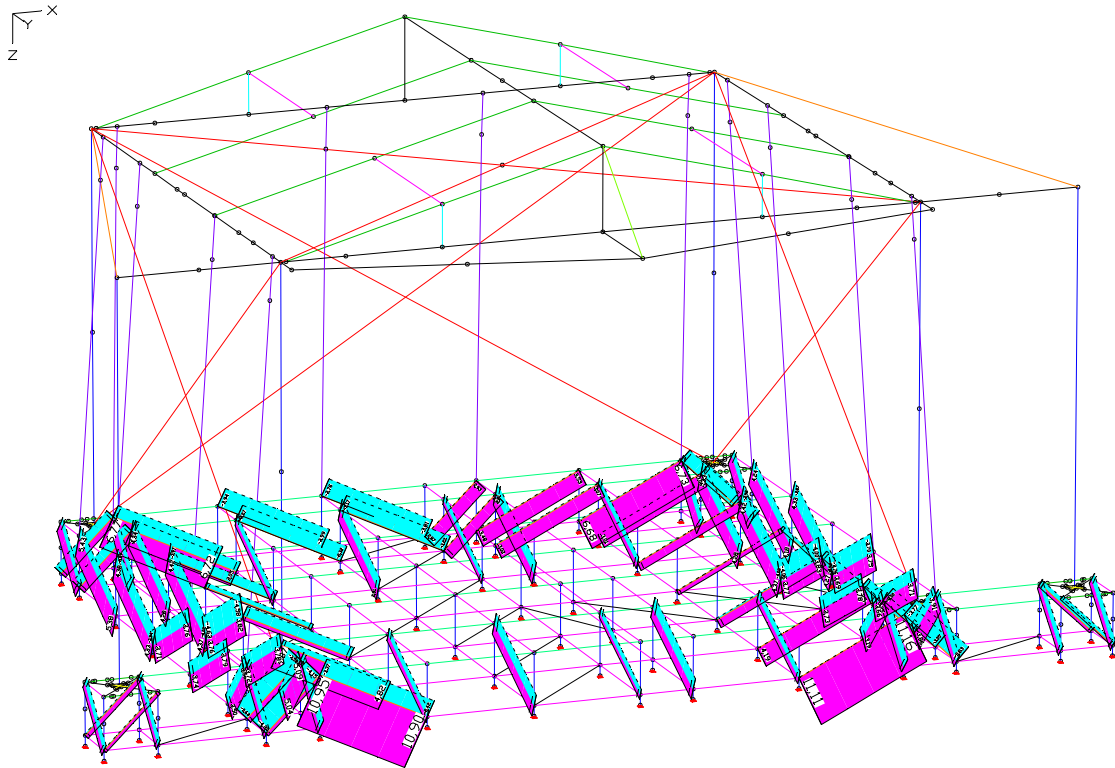
buckling length: 0,9 x 2,0 = 1,80m

buckling curve c: $\chi = 0,36$

$$N_{Rd} = 4,53 \times 32 / 1,1 \times 0,36 = 47,44 \text{ kN} > 32,52 \text{ kN}$$

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Diagonal braces vertical:



LCC 95: Selected Internal forces min,max Nx [kN]
Value range (subsystem, min/max): -4,63/11,16 [kN]

additional force due to stabilisation load $V/10$:

$$V/10 = 1,35 \times 5,0 \times 2,072 \times 11,39 / 10 = 15,93 \text{ kN}$$


$$D = 15,93 / \cos 45^\circ / 4 = 5,63 \text{ kN}$$

maximum system length: 2,072 m height: 1,0 m

$$N_{Rd} = -17,1 \text{ kN (pressure)}, N_{Rd} = +25,7 \text{ kN (tension)}$$

$$N_{Ed} = (-4,63) + (-5,63) = -10,26 \text{ kN} < -17,1 \text{ kN} \quad (< -12,80 \text{ kN, } h=2,0\text{m})$$

$$N_{Ed} = 12,41 \text{ kN} < 25,7 \text{ kN}$$

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022



Allgemeine bauaufsichtliche Zulassung
Nr. Z-8.22-64

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Tabelle 7: Beanspruchbarkeiten der Vertikaldiagonalen

H [mm]	L [mm]	Anschlusskopf											
		„K2000+“			„Variante II“			„Variante IB“			„Variante IC“		
		Lochscheibe											
		„K2000+“	„Variante II“	„Variante I“	„K2000+“	„Variante II“	„Variante I“	„K2000+“	„Variante II“	„Variante I“	„K2000+“	„Variante II“	„Variante I“
Zug-Normalkraft $N^{(+)}_{V,Rd}$ [kN]													
500	732	26,2	13,5	6,6	---								
	1088	25,8			---								
	1572	24,1			8,4	8,4	6,6	7,8	7,8	6,6	6,6	6,6	6,6
	2072	23,5			---								
	2572	23,2			8,4	8,4	6,6	7,8	7,8	6,6	6,6	6,6	6,6
	3072	23,1			---								
1000	732	21,7	13,5	6,6	---								
	1088	24,3			---								
	1572	27,6			8,4	8,4	6,6	7,8	7,8	6,6	6,6	6,6	6,6
	2072	25,7			---								
	2572	24,6			---								
	3072	24,1			---								
1500	732	19,8	13,5	6,6	---								
	1088	22,0			---								
	1572	24,4			8,4	8,4	6,6	7,8	7,8	6,6	6,6	6,6	6,6
	2072	27,3			---								
	2572	26,8			---								
	3072	25,6			---								
2000	732	18,0	13,5	6,6	8,4	8,4	6,6	7,8	7,8	6,6	6,6	6,6	6,6
	1036	20,8			---								
	1088	21,2			---								
	1400	22,0			---								
	1572	22,6			8,4	8,4	6,6	7,8	7,8	6,6	6,6	6,6	6,6
	2072	24,5			---								
	2572	26,7			---								
	3072	27,6			---								
	4144	25,5			---								
2500	6144	24,7	13,5	6,6									

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022



Allgemeine bauaufsichtliche Zulassung
Nr. Z-8.22-64

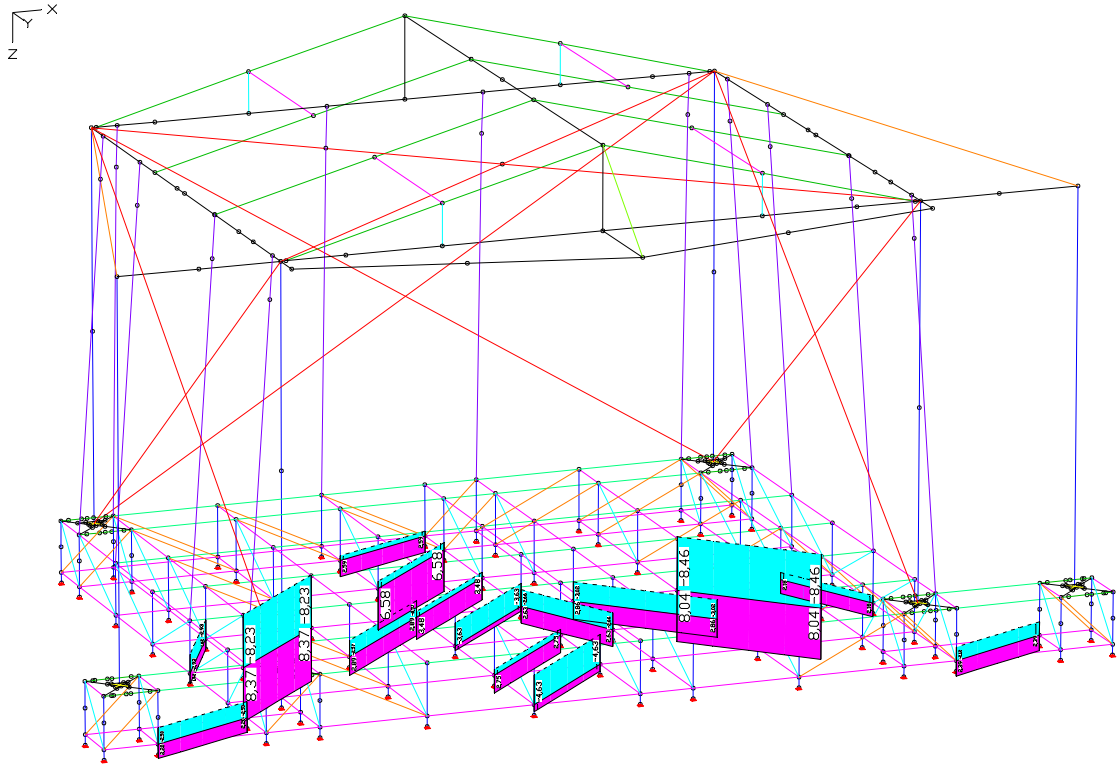
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Tabelle 7: (Fortsetzung)

H [mm]	L [mm]	Anschlusskopf											
		„K2000+“			„Variante II“			„Variante IB“			„Variante IC“		
		Lochscheibe											
		„K2000+“	„Variante II“	„Variante I“	„K2000+“	„Variante II“	„Variante I“	„K2000+“	„Variante II“	„Variante I“	„K2000+“	„Variante II“	„Variante I“
Druck-Normalkraft $N^{(c)}_{V,Rd}$ [kN]													
500	732	21,1	13,3	6,6	---								
	1088	17,2	13,3		---								
	1572	16,1	12,4		8,4	8,4	6,6	7,8	7,8	6,6	6,6	6,6	6,6
	2072	15,7	12,1		---								
	2572	15,2	11,9		8,4	8,4	6,6	7,8	7,8	6,6	6,6	6,6	6,6
	3072	11,5	11,2		---								
1000	732	20,0	13,5	6,6	---								
	1088	23,1	13,5		---								
	1572	18,7	13,5		8,4	8,4	6,6	7,8	7,8	6,6	6,6	6,6	6,6
	2072	17,1	13,2		---								
	2572	14,0	12,7		---								
	3072	10,8	10,5		---								
1500	732	17,8	12,5	6,6	---								
	1088	20,4	13,5		---								
	1572	19,3	13,5		8,4	8,4	6,6	7,8	7,8	6,6	6,6	6,6	6,6
	2072	15,5	13,5		---								
	2572	12,3	11,9		---								
	3072	9,7	9,6		---								
2000	732	16,6	12,2	6,6	8,4	8,4	6,6	7,8	7,8	6,6	6,6	6,6	6,6
	1036	17,9	12,8		---								
	1088	17,7	12,9		---								
	1400	16,3	13,5		---								
	1572	15,4	13,5		8,4	8,4	6,6	7,8	7,8	6,6	6,6	6,6	6,6
	2072	12,8	12,4		---								
	2572	10,5	10,2		---								
	3072	8,5	8,3		---								
	4144	5,4	5,3		5,3	5,3	5,3	4,1	4,1	4,1	4,1	4,1	4,1
2500	6144	2,2	2,1	2,1	2,1	2,1	2,1	1,6	1,6	1,6	1,6	1,6	1,6
L, H		siehe Anlage A, Seite 4											


PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Diagonal braces horizontal:



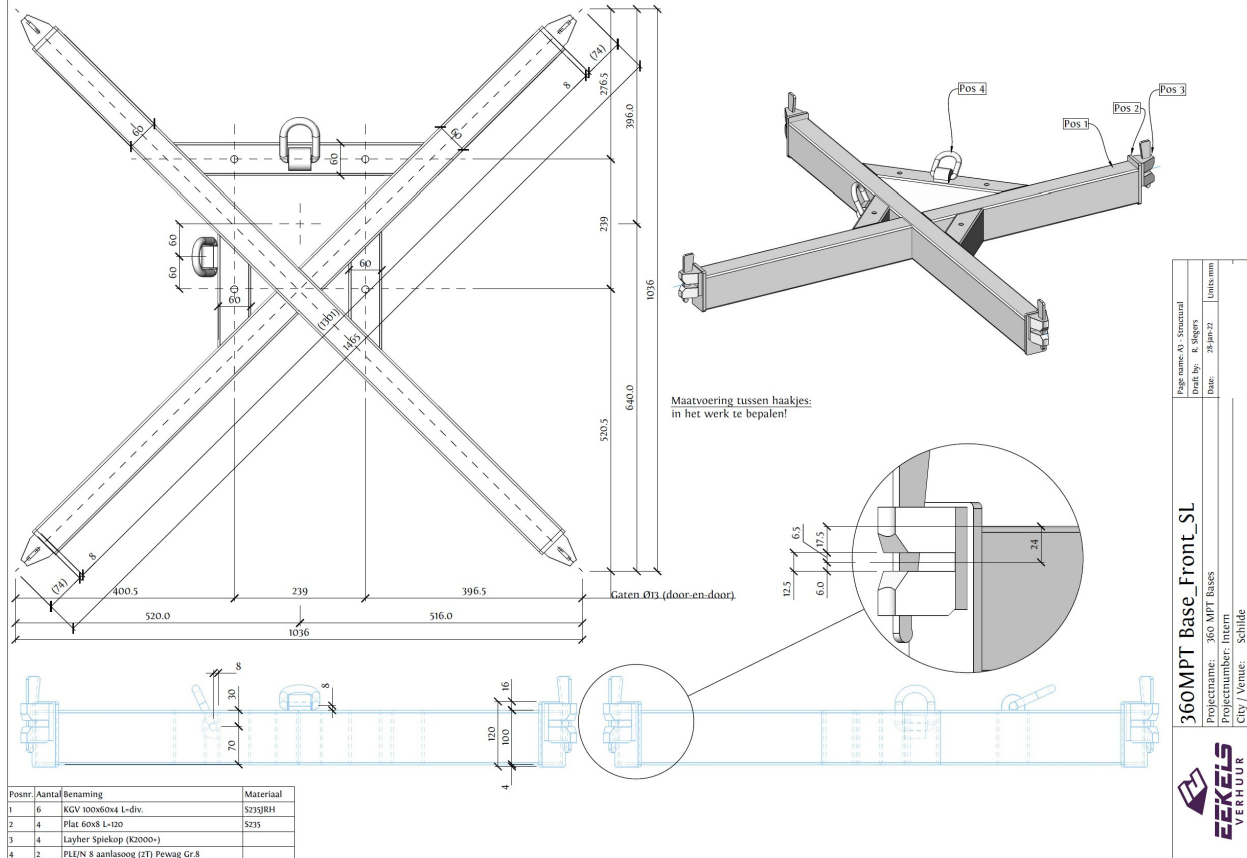
LCC 95: Selected Internal forces min,max Nx [kN]
Value range (subsystem, min/max): -8,46/8,37 [kN]

$< 31,0 \text{ kN} = N_{Rd}$

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Bases

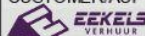
(only one drawing shown exemplarily)



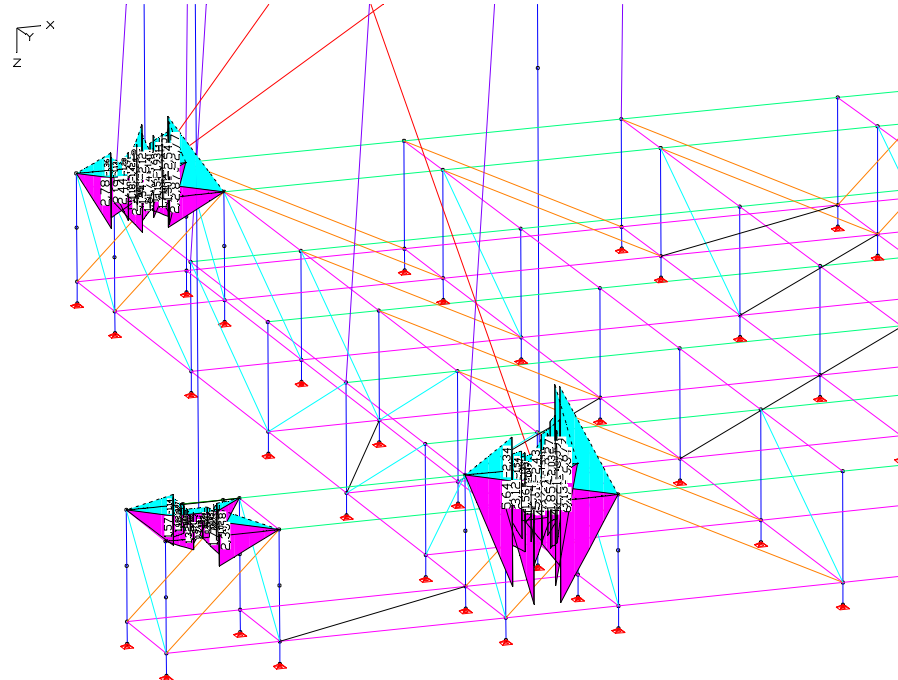
Page name: 0 - Structural
 Draw by: E. Stegers
 Date: 20-jan-22
 Units: mm

360MPT Base_Front_SL
 Projectname: 360 MPT Bases
 Projectnummer: inern
 City / Venue: Schilde

EKELS
 VERHUUR

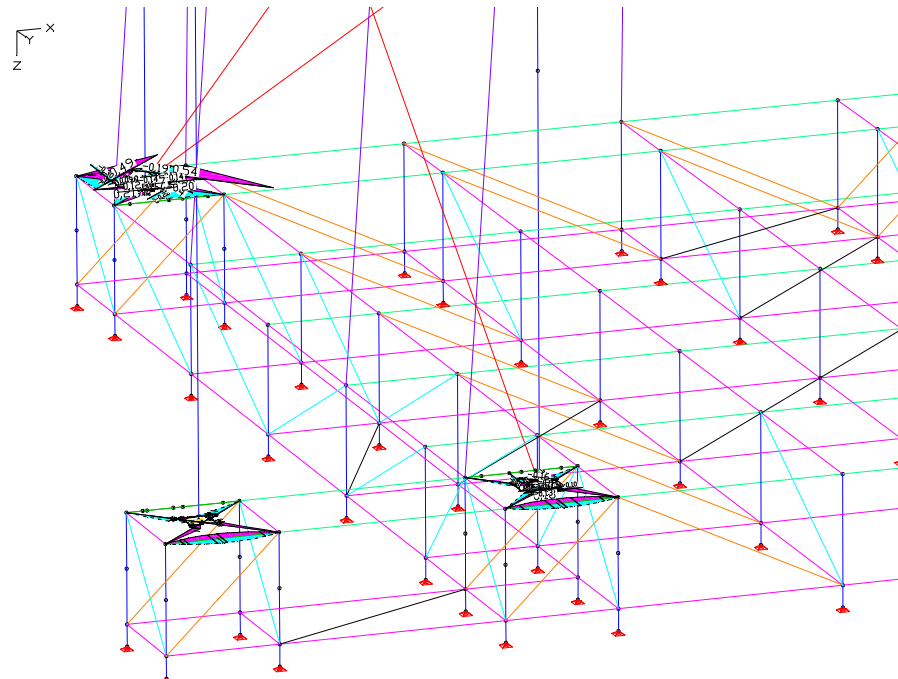
PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

$M_{y,Ed}$



LCC 95: Selected Internal forces min,max M_y [kNm]
Value range (subsystem, min/max): -5,49/6,17 [kNm]

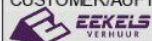
$M_{z,Ed}$



LCC 95: Selected Internal forces min,max M_z [kNm]
Value range (subsystem, min/max): -0,30/0,54 [kNm]

PROJECT:
MPT-ROOF 12x10m

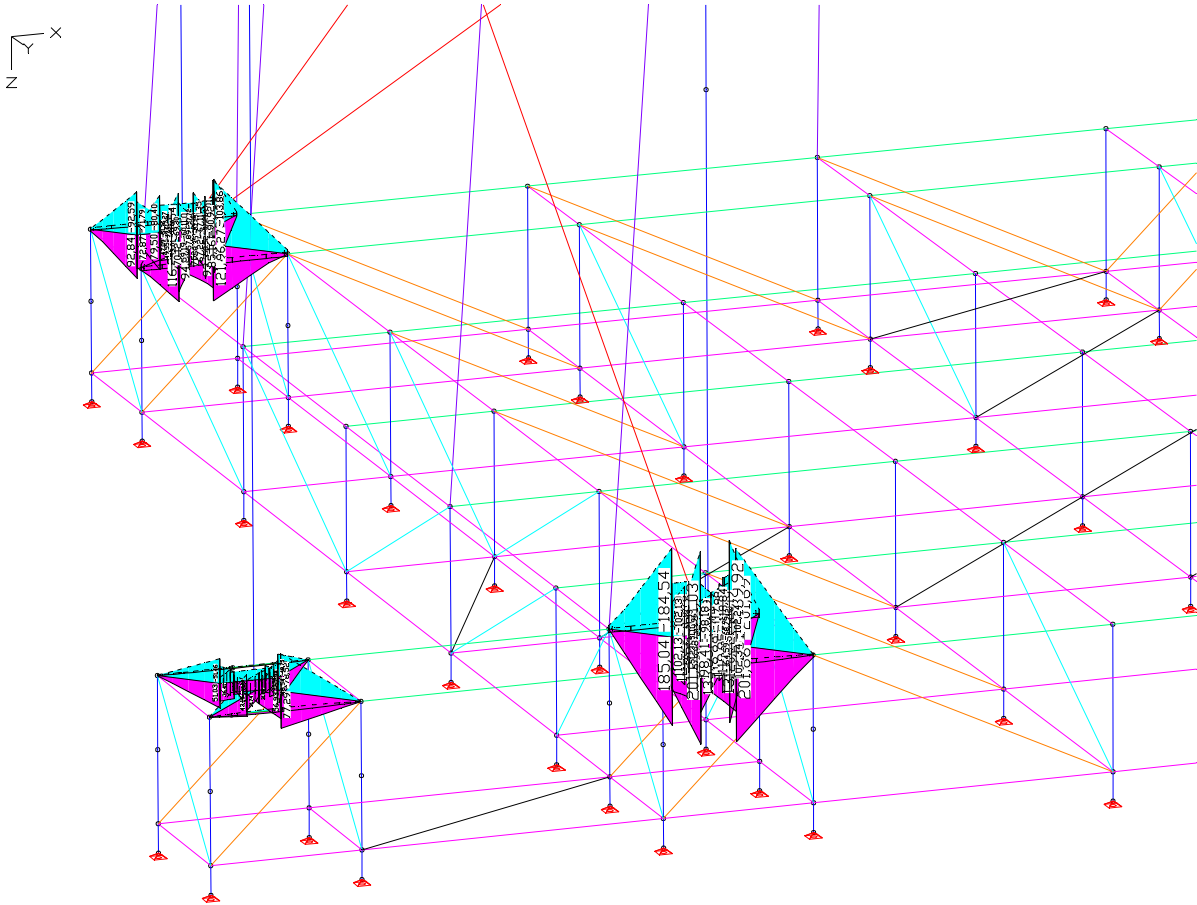
CUSTOMER/AUFTRAGGEBER:



PROJECT-NO.:
22012

DATE/DATUM:
15.03.2022

Stresses



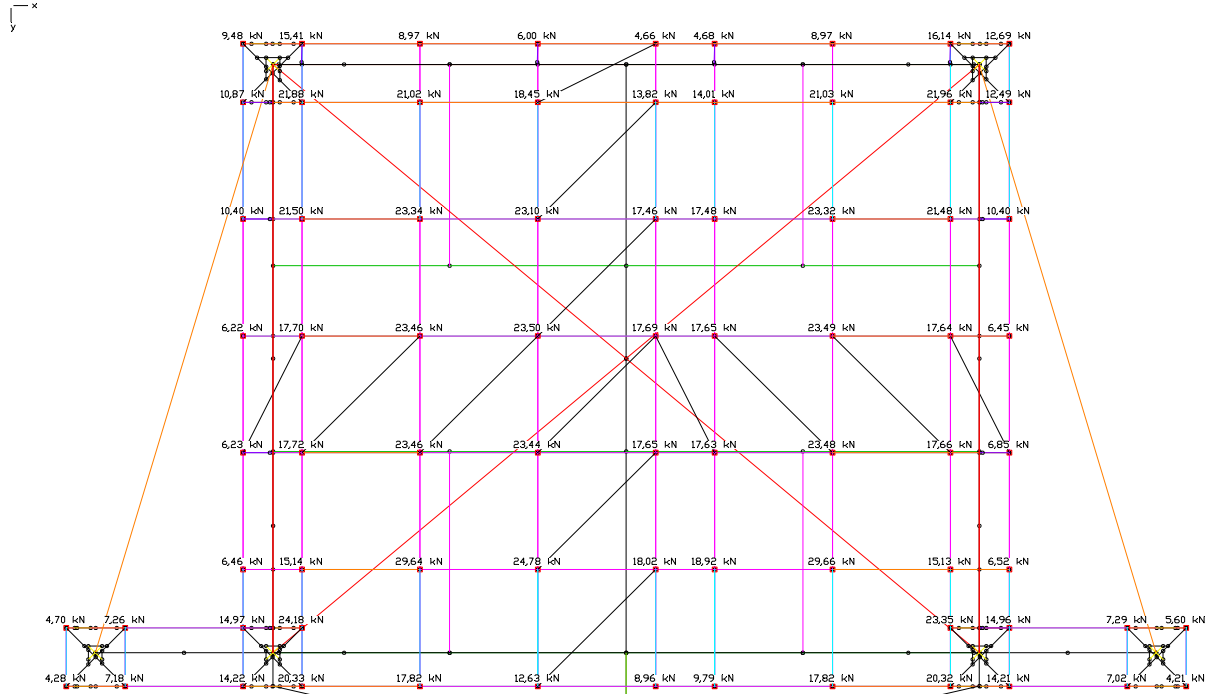
LCC 95: Selected Stresses (general – elastic, directly from internal forces) min,max Sigma.x [MN/m²]
Value range (subsystem, min/max): -201,69/201,88 [MN/m²]

< 235 MN/m²

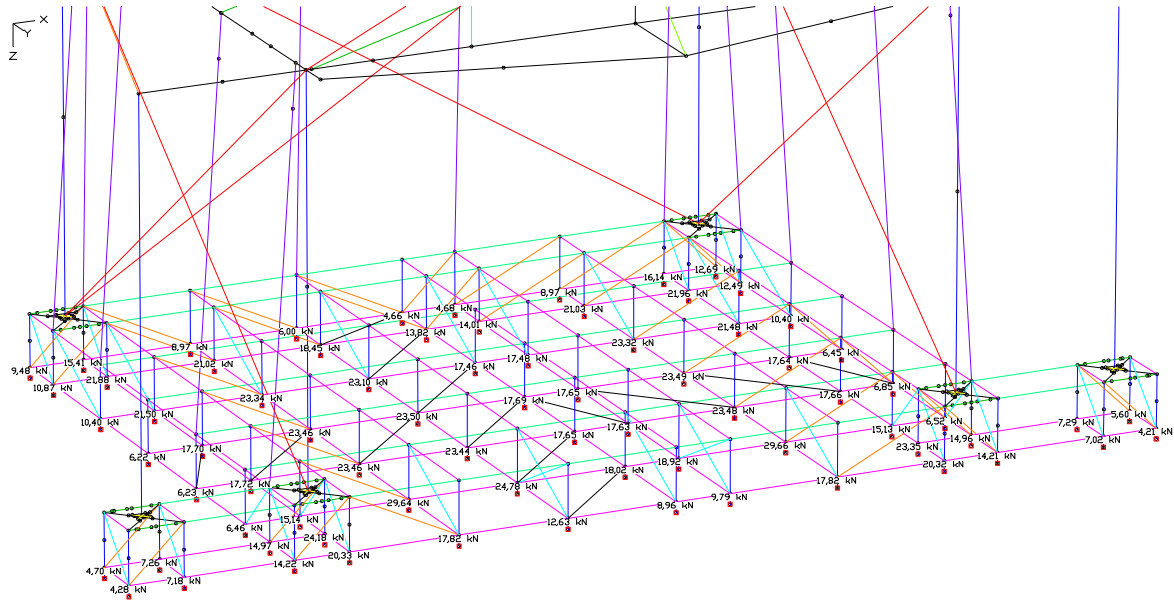
PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

8 BALLAST LOADS


LCC 85:



LCC 85: Support reactions in the system of the support lines max Rz(1), 1,18 [kN/m] =

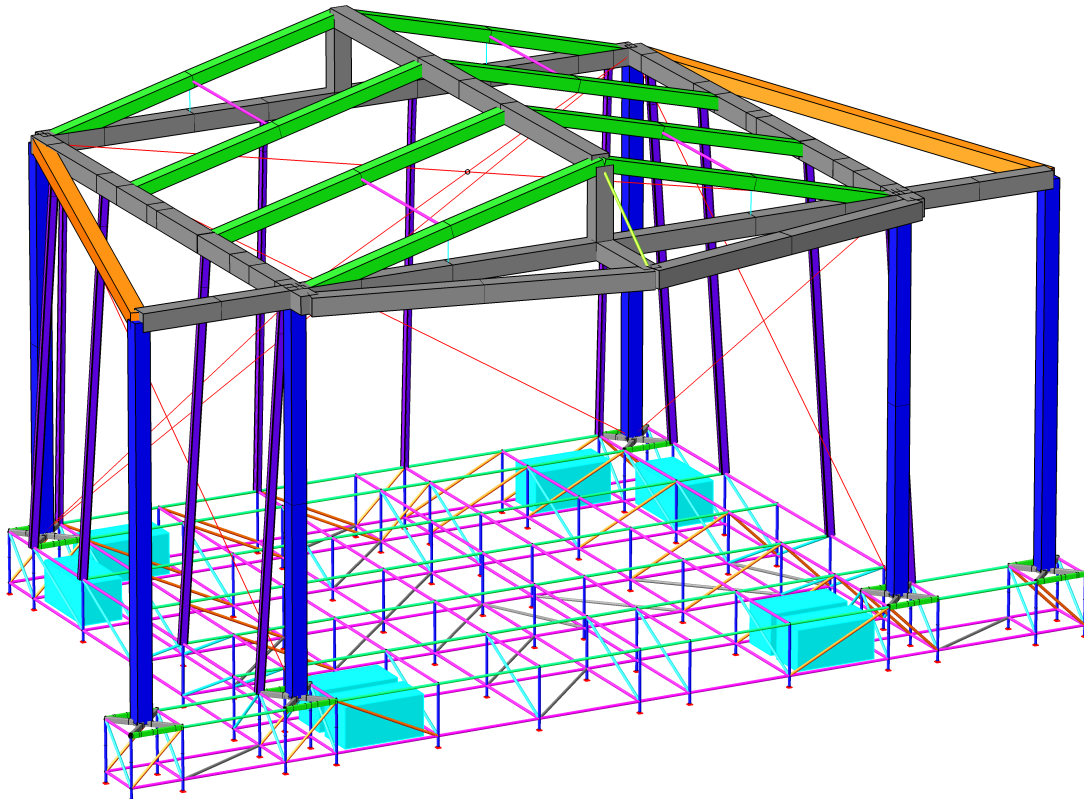


LCC 85: Support reactions in the system of the support lines max Rz(1) [kN/m]

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Ballast Overview

friction coefficient $\mu = 0,60$



The ballast is displayed schematically as preferred by the customer.

light blue block: at least 1150 kg for $h \leq 1,0\text{m}$ podium
 at least 1450 kg for $1,0\text{m} > h \leq 2,0\text{m}$ podium

The ballast constructively remains the same also for the build up without the side wings.

The ballast will be placed force-fitted on the bottom level of the Layher Podium without the usage of Layher Base Collars or it must be placed on a separate level +0,50m.

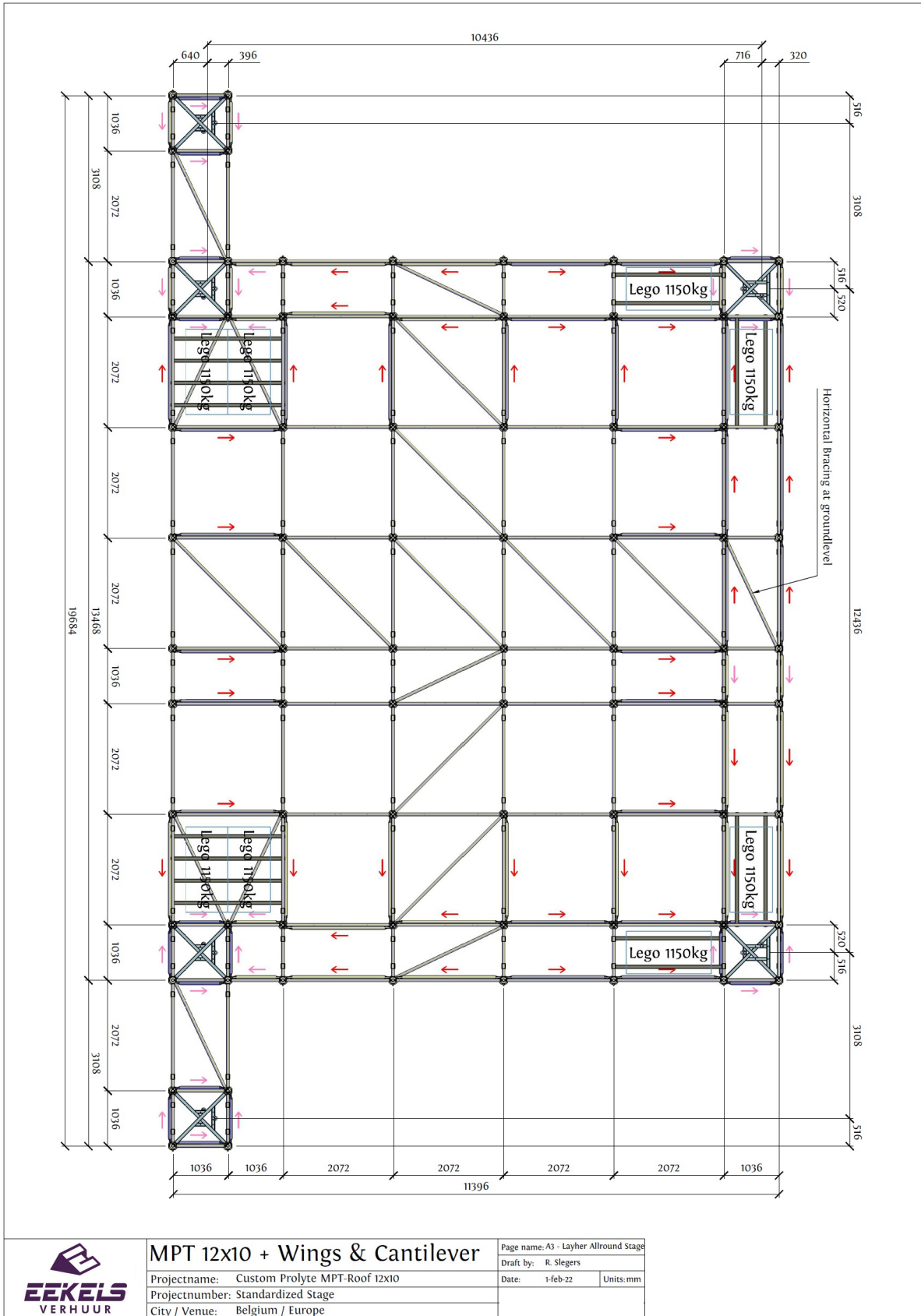
PROJECT:
MPT-ROOF 12x10m

CUSTOMER/AUFTRAGGEBER:



PROJECT-NO.:
22012

DATE/DATUM:
15.03.2022



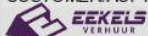
MPT 12x10 + Wings & Cantilever

Projectname: Custom Prolyte MPT-Roof 12x10
 Projectnumber: Standardized Stage
 City / Venue: Belgium / Europe

Page name: A3 - Layher Allround Stage
 Draft by: R. Slegers
 Date: 1-feb-22 Units:mm

PROJECT:
MPT-ROOF 12x10m

CUSTOMER/AUFTRAGGEBER:




PROJECT-NO.:
22012

DATE/DATUM:
15.03.2022

Sum of installed loads and support reactions

LC.	Label	Fx [kN]	Fy [kN]	Fz [kN]
1	deadweight	0,000	-0,000	82,380
	Support reactions	-0,000	-0,000	82,380
2	Ballast	0,000	0,000	92,000
	Support reactions	0,000	-0,000	92,000
3	payload podium	0,000	0,000	799,606
	Support reactions	0,000	-0,000	799,606
4	Distributed Load	0,000	0,000	59,618
	Support reactions	0,000	0,000	59,618
5	Center Point Load	0,000	0,000	34,000
	Support reactions	-0,000	0,000	34,001
6	Third Point Load	0,000	0,000	47,000
	Support reactions	-0,000	0,000	47,001
7	Fourth Point Load	0,000	0,000	48,000
	Support reactions	-0,000	0,000	48,001
8	Fifth Point Load	0,000	0,000	54,500
	Support reactions	-0,000	0,000	54,501
9	PA-Load	0,000	0,000	20,000
	Support reactions	-0,000	-0,000	20,005
11	Membrane-tension Roof	-0,000	-0,000	-0,000
	Support reactions	0,000	-0,000	0,000
13	Membrane-tension Gable front	0,000	0,000	0,062
	Support reactions	-0,000	0,000	0,062
15	Membrane-tension Gable Rear	0,000	-0,000	0,062
	Support reactions	0,000	-0,000	0,069
17	Membrane-tension Rear Wall	-0,000	0,000	-0,000
	Support reactions	-0,000	-0,000	0,000
19	Membrane-tension Left Wall	-0,000	0,000	0,000
	Support reactions	-0,000	-0,000	0,000
21	Membrane-tension Right Wall	0,000	0,000	-0,000
	Support reactions	0,000	0,000	0,000
22	Wind on podium top	0,000	0,000	30,696
	Support reactions	0,000	0,000	30,696
100	g+p	0,000	-0,000	1053,603
	Support reactions	-0,000	-0,000	1053,603
101	wind $\beta = 0^\circ +g$	-0,000	-41,293	130,969

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Sum of installed loads and support reactions

LC.	Label	Fx [kN]	Fy [kN]	Fz [kN]
	Support reactions	-0,000	-41,293	131,426
102	wind $\beta = 90^\circ$ +g	23,337	-6,353	155,722
	Support reactions	23,337	-6,353	155,722
103	wind $\beta = 180^\circ$ +g	0,000	41,293	155,409
	Support reactions	0,000	41,293	155,409
201	wind $\beta = 0^\circ$ +g+p	-0,000	-41,293	1010,192
	Support reactions	-0,000	-41,293	1010,192
202	wind $\beta = 90^\circ$ +g+p	23,337	-6,353	1034,945
	Support reactions	23,337	-6,353	1034,945
203	wind $\beta = 180^\circ$ +g+p	0,000	41,293	1034,632
	Support reactions	0,000	41,293	1034,632
301	wind $\beta = 0^\circ$ only roof +g	-0,000	-47,871	121,366
	Support reactions	-0,000	-47,871	121,366
302	wind $\beta = 90^\circ$ only roof +g	29,788	-0,000	117,659
	Support reactions	29,788	-0,000	117,659
303	wind $\beta = 180^\circ$ only roof +g	0,000	47,871	114,289
	Support reactions	0,000	47,871	114,289
401	wind $\beta = 0^\circ$ only roof +g+p	-0,000	-47,871	980,590
	Support reactions	-0,000	-47,871	981,051
402	wind $\beta = 90^\circ$ only roof +g+p	29,788	-0,000	976,882
	Support reactions	29,788	-0,000	977,588
403	wind $\beta = 180^\circ$ only roof +g+p	0,000	47,871	973,512
	Support reactions	0,000	47,871	973,690

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Podium height $h \leq 1,0\text{m}$ **Proof against sliding for whole system:**

Due to the calculation of the structure with supports with tension loss, the single wind load cases could not be calculated. The resulting lifting wind loads therefore must be calculated backwards.

LC 101:

dead weight: $G = 82,38 \text{ kN}$

ballast: $B = 92,0 \text{ kN}$ (8x11,5 kN)

wind lifting: $W_V = 131,43 - 82,38 - 92 - 0,8 \times 30,70 = -67,51 \text{ kN}$

wind horizontal: $W_H = 41,29 \text{ kN}$

$$\mu = 0,6: \quad (82,39+92,0)/(41,29/ 0,6 + 67,51) = 1,28 > 1,20$$

LC 303:

dead weight: $G = 82,38 \text{ kN}$

ballast: $B = 92,0 \text{ kN}$ (8x11,5 kN)

wind lifting: $W_V = 114,29 - 82,38 - 92 = - 60,09 \text{ kN}$

wind horizontal: $W_H = 47,87 \text{ kN}$

$$\mu = 0,6: \quad (82,39+92,0)/(47,87/ 0,6 + 60,09) = 1,25 > 1,20$$

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Proof against tilting for whole system:

LC 101:

Area podium A = 153 m²wind on podium: $W_{V1} = 0,2 \times 0,8 \times 153 = 24,48 \text{ kN}$ wind lifting: $W_{V2} = -67,51 \text{ kN}$ wind horizontal: $W_H = 41,29 \text{ kN}$ $M_{\text{tilt}} = 67,51 \times 12,46/2 + 41,29 \times 10,40/2 = 635,3 \text{ kNm}$ $M_{\text{stand}} = (82,38+24,48) \times 11,40/2 + 2 \times 23 \times 10,36 = 1085,6 \text{ kNm}$ $1085,6 / 635,3 = 1,71 > 1,20$


LC 303:

wind lifting: $W_{V2} = -60,09 \text{ kN}$

wind horizontal:	sum $W_H = 47,87 \text{ kN}$	
	$W_{\text{Gable}} = 12,78 \text{ kN}$	(in height 9,60 m)
	$W_{\text{truss}} = 19,11 \text{ kN}$	(in height 5,0 m)
	$W_{\text{podium}} = 15,98 \text{ kN}$	(in height 0,70 m)

 $M_{\text{tilt}} = 60,09 \times 12,46/2 + 12,78 \times 9,60 + 19,11 \times 5,0 + 15,98 \times 0,70 = 603,78 \text{ kNm}$ $M_{\text{stand}} = 82,38 \times 11,40/2 + 2 \times 11,5 \times 9,32 + 2 \times 11,5 \times 10,87 = 933,9 \text{ kNm}$ $933,9 / 603,78 = 1,55 > 1,20$

The chosen ballast is sufficient. The ballast will be placed force-fitted on the bottom level of the Layher Podium without the usage of Layher Base Collars or it must be placed on a separate level +0,50m.

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Podium height $1,0\text{m} < h \leq 2,0\text{m}$ (values from comparative system)**Proof against sliding for whole system:**

Due to the calculation of the structure with supports with tension loss, the single wind load cases could not be calculated. The resulting lifting wind loads therefore must be calculated backwards.

LC 101:

dead weight:	$G = 88,5 \text{ kN}$
ballast:	$B = 116 \text{ kN} \quad (8 \times 14,5 \text{ kN})$
wind lifting:	$W_V = 161,1 - 88,5 - 116 - 0,8 \times 30,70 = -67,96 \text{ kN}$
wind horizontal:	$W_H = 44,8 \text{ kN}$

$$\mu = 0,6: \quad (88,5 + 116,0) / (44,8 / 0,6 + 67,96) = 1,43 > 1,20$$

LC 303:

dead weight:	$G = 88,5 \text{ kN}$
ballast:	$B = 116 \text{ kN} \quad (8 \times 14,5 \text{ kN})$
wind lifting:	$W_V = 144,4 - 88,7 - 116 = -60,3 \text{ kN}$
wind horizontal:	$W_H = 63,9 \text{ kN}$

$$\mu = 0,6: \quad (88,5 + 116,0) / (63,9 / 0,6 + 60,3) = 1,23 > 1,20$$

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

Proof against tilting for whole system:

LC 101:

Area podium A = 153 m²

wind on podium: $W_{V1} = 0,2 \times 0,8 \times 153 = 24,48 \text{ kN}$

wind lifting: $W_{V2} = -67,96 \text{ kN}$

wind horizontal: $W_H = 44,8 \text{ kN}$

$M_{\text{tilt}} = 67,96 \times 12,46/2 + 44,8 \times 11,40/2 = 678,8 \text{ kNm}$

$M_{\text{stand}} = (88,5+24,48) \times 11,40/2 + 2 \times 29 \times 10,36 = 1244,9 \text{ kNm}$

$1244,9/678,8 = 1,83 > 1,20$

LC 303:

wind lifting: $W_{V2} = -60,30 \text{ kN}$

wind horizontal: $\text{sum } W_H = 63,90 \text{ kN}$
 $W_{\text{Gable}} = 12,78 \text{ kN}$ (in height 10,60 m)
 $W_{\text{truss}} = 19,11 \text{ kN}$ (in height 6,0 m)
 $W_{\text{podium}} = 31,92 \text{ kN}$ (in height 1,20 m)

$M_{\text{tilt}} = 60,3 \times 12,46/2 + 12,78 \times 10,60 + 19,11 \times 6,0 + 31,92 \times 1,2 = 662,9 \text{ kNm}$

$M_{\text{stand}} = 88,5 \times 11,40/2 + 2 \times 14,5 \times 9,32 + 2 \times 14,5 \times 10,87 = 1089,9 \text{ kNm}$

$1089,9/662,9 = 1,64 > 1,20$

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

9 TRUSS AND SCAFFOLDING DATA

PROLYTE H40V

DEADWEIGHT TRUSS / EIGENGEWICHT TRAVERSE

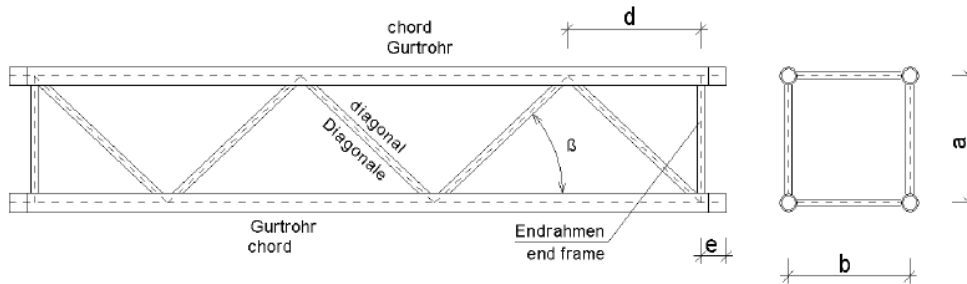
6,9 kg/m

CROSS SECTION TUBES / QUERSCHNITTSWERTE ROHRE

	D [mm]	t [mm]	A [cm ²]	W [cm ³]	I [cm ⁴]	I _r [cm ⁴]	i [cm]
chords/ Gurte	48,000	3,000	4,241	4,493	10,783	21,566	1,595
diagonals vertical/ Diagonale vertikal	20,000	2,000	1,131	0,464	0,464	0,927	0,640
diagonals horizontal/ Diagonale horizontal	20,000	2,000	1,131	0,464	0,464	0,927	0,640
end frame/ Endrahmen	20,000	2,000	1,131	0,464	0,464	0,927	0,640

TRUSS GEOMETRY/ TRAVERSENGEOMETRIE

Height / Höhe	a [cm]	33,90
Width / Breite	b [cm]	33,90
Distance diagonals vertical / Abstand Diagonalen vertikal	d[cm]	33,90
Angle diagonals vertical / Winkel Diagonalen vertikal	β _v	45,00
Distance diagonals horizontal /Abstand Diagonalen horizontal	d[cm]	33,90
Angle diagonals horizontal / Winkel Diagonalen horizontal	β _H	45,00
	e[cm]	5,00



CROSS SECTION TRUSS/ QUERSCHNITTSWERTE GESAMTTRAVERSE

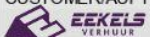
$$A = 4 \times A_{\text{single tube/Einzelrohr}}$$

$$I = 0,85 \times (4 \times I_{\text{single tube/Einzelrohr}} + 4 \times A_{\text{single tube/Einzelrohr}} \times (a/2)^2)$$

$$i = (I / A)^{1/2}$$

The moments of inertia are reduced for 15% due to the resilient connection between chords and diagonals.
Die Trägheitsmomente werden aufgrund der nachgiebigen Verbindung Gurte-Diagonalen um 15 % abgemindert.

A [cm ²]	I _y [cm ⁴]	I _z [cm ⁴]	i _y [cm]	i _z [cm]	I _r [cm ⁴]
16,96	4179,54	4179,54	15,70	15,70	900

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

PROLYTE H40V

MATERIAL

Characteristic values of 0,2% proof strength f_o , and ultimate tensile strength f_u according to EC9/ charakteristische Werte für Streckgrenze f_o und Zugfestigkeit f_u gemäß EC9 (see tab. 3.2b; 8.8⁽¹⁾/ siehe Tabelle 3.2b; 8.8⁽¹⁾)

EN AW 6082 T6	[N/mm ²]	normal stress/ Normalspannung	shear stress/ Schubspannung
		$\sigma_{R,d} = f / \gamma_{(M1,M2)}$	$\tau_{R,d} = f / (\gamma_{(M1,M2)} \times \sqrt{3})$
$f_o: t > 5\text{mm}$	260,0	236,4	136,5
$f_u: t > 5\text{mm}$	310,0	248,0	
$f_o: t < 5\text{mm}$	250,0	227,3	131,2
$f_u: t < 5\text{mm}$	290,0	232,0	
$f_{o,haz}$	125,0	113,6	65,6
$f_{u,haz}$	185,0	148,0	
$f_w^{(1)}$	190,0	152,0	87,8

All welding seams are done in TIG, according to tab. 3.2b, note 4 $\rho_{i,haz}$ has to be multiplied by 0,8 / Alle Schweißnähte sind WIG geschweißt, entsprechend Fußnote 4 der Tabelle 3.2b ist $\rho_{i,haz}$ mit dem Faktor 0,8 zu multiplizieren.

Partial safety factors for ultimate limit states/ Teilsicherheitsbeiwerte für Grenzzustände der Tragfähigkeit

γ_{M1}	1,10
γ_{M2}	1,25
γ_{MW}	1,25

(see tab. 6.1/ siehe Tabelle 6.1)

SUMMARY / ZUSAMMENFASSUNG

normal force chord / Normalkraft Gurte:	$N_{R,d} = \pm$	50,22 kN
normal force in the fittings / Normalkraft Verbinder:	$N_{R,d} = \pm$	52,58 kN
normal force diagonal vertical / Normalkraft Diagonale vertikal:	$N_{R,d} = \pm$	13,39 kN
normal force diagonal horizontal / Normalkraft Diagonale horizontal:	$N_{R,d} = \pm$	13,39 kN

DESIGN INTERNAL FORCES COMPLETE TRUSS / BEMESSUNGSSCHNITTGRÖSSEN GESAMTTRAVERSE

bending moment/Biegemoment:	$M_{y,R,d} = 2 \times N_{R,d, \text{chord tube/Gurtrohr}} \times 0,339 =$	34,05 kNm
bending moment/Biegemoment:	$M_{z,R,d} = 2 \times N_{R,d, \text{chord tube/Gurtrohr}} \times 0,339 =$	34,05 kNm
normal force/Normalkraft:	$N_{R,d} = 4 \times N_{R,d, \text{chord tube/Gurtrohr}} =$	200,86 kN
transversal force/Querkraft	$V_{z,R,d} = 2 \times N_{R,d, \text{diagonal}} \times \sin 45,00^\circ =$	18,94 kN
transversal force/Querkraft	$V_{y,R,d} = 2 \times N_{R,d, \text{diagonal}} \times \sin 45,00^\circ =$	18,94 kN

The values shown above are design values. "Permissible loads" or "Working loads" are obtained by dividing the stress capacity by 1.5. / Die oben angegebenen Werte sind Design-Werte. "Zulässige Lasten" bzw. "Gebrauchslasten" erhält man durch Division der Beanspruchbarkeit durch 1,5.

INTERACTION MOMENT-TRANSVERSAL FORCE / MOMENTEN-QUERKRAFT-INTERAKTION

In case of occurrence of bending moment and transversal force the following term has to be analysed: Bei Auftreten von Moment und Querkraft, ist folgende Bedingung einzuhalten:

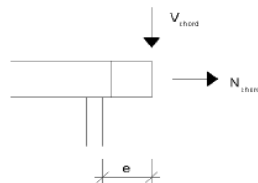
$$V_{d, \text{chor-Gurt}} = 0,25 \times V_{d, \text{total/gesamt}}$$

$$M_{d, \text{chord/Gurt}} = V_{d, \text{chord/Gurt}} \times e$$

$$e^* = 5,00$$

according to term / nach Gl. (6.43):

$$\eta = (N_{\text{chord/Gurt,Ed}} / N_{Rd})^{1,3} + M_{\text{chord/Gurt,Ed}} / M_{Rd} \leq 1$$



PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

PROLYTE H30V

DEADWEIGHT TRUSS / EIGENGEWICHT TRAVERSE

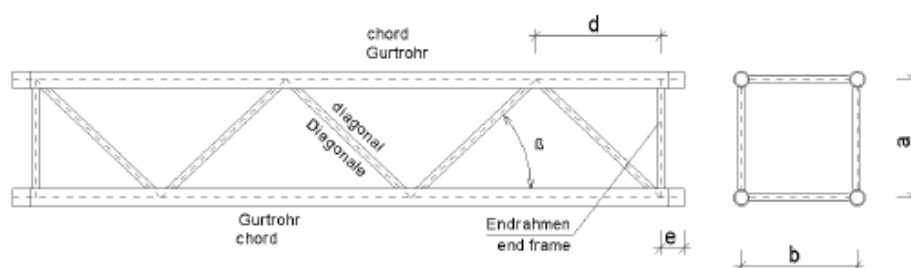
6,3 kg/m

CROSS SECTION TUBES / QUERSCHNITTSWERTE ROHRE

	D [mm]	t [mm]	A [cm ²]	W [cm ³]	I [cm ⁴]	I _y [cm ⁴]	i [cm]
chords/ Gurte	48,000	3,000	4,241	4,493	10,783	21,566	1,595
diagonals vertical/ Diagonale vertikal	16,000	2,000	0,880	0,275	0,220	0,440	0,500
diagonals horizontal/ Diagonale horizontal	16,000	2,000	0,880	0,275	0,220	0,440	0,500
end frame/ Endrahmen	16,000	2,000	0,880	0,275	0,220	0,440	0,500

TRUSS GEOMETRY/ TRAVERSENGEOMETRIE

Height / Höhe	a [cm]	23,90
Width / Breite	b [cm]	23,90
Distance diagonals vertical / Abstand Diagonalen vertikal	d[cm]	23,90
Angle diagonals vertical / Winkel Diagonalen vertikal	β _v	45,00
Distance diagonals horizontal /Abstand Diagonalen horizontal	d[cm]	23,90
Angle diagonals horizontal / Winkel Diagonalen horizontal	β _h	45,00
	e[cm]	5,00



CROSS SECTION TRUSS/ QUERSCHNITTSWERTE GESAMTTRAVERSE

$$A = 4 \times A_{\text{single tube/Einzeltrohr}}$$

$$I = 0,85 \times (4 \times I_{\text{single tube/Einzeltrohr}} + 4 \times A_{\text{single tube/Einzeltrohr}} \times (a/2)^2)$$

$$i = (I / A)^{1/2}$$

The moments of inertia are reduced for 15% due to the resilient connection between chords and diagonals./
Die Trägheitsmomente werden aufgrund der nachgiebigen Verbindung Gurte-Diagonalen um 15 % abgemindert.

A [cm ²]	I _y [cm ⁴]	I _z [cm ⁴]	i _y [cm]	i _z [cm]	I _y [cm ⁴]
16,96	2095,86	2095,86	11,12	11,12	500

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

PROLYTE H30V
MATERIAL

Characteristic values of 0,2% proof strength $f_{0,2}$ and ultimate tensile strength f_u according to EC9/ charakteristische Werte für Streckgrenze f_0 und Zugfestigkeit f_u gemäß EC9 (see tab. 3.2b; 8.8⁽¹⁾ / siehe Tabelle 3.2b; 8.8⁽¹⁾)

EN AW 6082 T6	[N/mm ²]	normal stress/ Normalspannung	shear stress/ Schubspannung
		$\sigma_{R,d} = f / \gamma_{M1,M2}$	$\tau_{R,d} = f / (\gamma_{M1,M2} \times \sqrt{3})$
$f_{0,2}$; t > 5mm	260,0	236,4	136,5
$f_{0,2}$; t > 5mm	310,0	248,0	
$f_{0,2}$; t < 5mm	250,0	227,3	131,2
$f_{0,2}$; t < 5mm	290,0	232,0	
$f_{0,Hzz}$	125,0	113,6	65,6
$f_{0,Hzz}$	185,0	148,0	
$f_u^{(1)}$	190,0	152,0	87,8

All welding seams are done in TIG, according to tab. 3.2b, note 4 ρ_{Hzz} has to be multiplied by 0,8 / Alle Schweißnähte sind WIG geschweißt, entsprechend Fußnote 4 der Tabelle 3.2b ist ρ_{Hzz} mit dem Faktor 0,8 zu multiplizieren.

Partial safety factors for ultimate limit states/ Teilsicherheitsbeiwerte für Grenzzustände der Tragfähigkeit (see tab. 6.1/ siehe Tabelle 6.1)

γ_{M1}	1,10
γ_{M2}	1,25
γ_{Mw}	1,25

SUMMARY / ZUSAMMENFASSUNG

normal force chord / Normalkraft Gurte:	$N_{R,d} = \pm$	50,22 kN
normal force in the fittings / Normalkraft Verbinder:	$N_{R,d} = \pm$	52,58 kN
normal force diagonal vertical / Normalkraft Diagonale vertikal:	$N_{R,d} = \pm$	10,42 kN
normal force diagonal horizontal / Normalkraft Diagonale horizontal:	$N_{R,d} = \pm$	10,42 kN

DESIGN INTERNAL FORCES COMPLETE TRUSS / BEMESSUNGSSCHNITTGRÖSSEN GESAMTTTRAVERSE

bending moment/Biegemoment:	$M_{x,R,d} = 2 \times N_{R,d, chord tube/Gurtrohr} \times$	0,239 =	24,00 kNm
bending moment/Biegemoment:	$M_{z,R,d} = 2 \times N_{R,d, chord tube/Gurtrohr} \times$	0,239 =	24,00 kNm
normal force/Normalkraft:	$N_{R,d} = 4 \times N_{R,d, chord tube/Gurtrohr} =$		200,86 kN
transversal force/Querkraft	$V_{x,R,d} = 2 \times N_{R,d, diagonal} \times \sin$	45,00 ° =	14,73 kN
transversal force/Querkraft	$V_{y,R,d} = 2 \times N_{R,d, diagonal} \times \sin$	45,00 ° =	14,73 kN

The values shown above are design values. "Permissible loads" or "Working loads" are obtained by dividing the stress capacity by 1.5. / Die oben angegebenen Werte sind Design-Werte. "Zulässige Lasten" bzw. "Gebrauchslasten" erhält man durch Division der Beanspruchbarkeit durch 1,5.

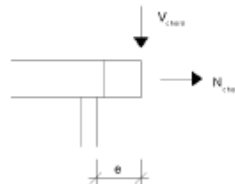
INTERACTION MOMENT-TRANSVERSAL FORCE / MOMENTEN-QUERKRAFT-INTERAKTION

In case of occurrence of bending moment and transversal force the following term has to be analysed: Bei Auftreten von Moment und Querkraft, ist folgende Bedingung einzuhalten:

$$V_{d, chord-Gurt} = 0,25 \times V_{d, totalgesamt}$$

$$M_{d, chord-Gurt} = V_{d, chord-Gurt} \times e$$

$$e^* = 5,00$$



according to term / nach Gl. (6.43):

$$\eta = (N_{d, chord-Gurt, Ed} / N_{Rd})^{1,2} + M_{d, chord-Gurt, Ed} / M_{Rd} \leq 1$$

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

PROLYTE S36R

DEADWEIGHT TRUSS / EIGENGEWICHT TRAVERSE

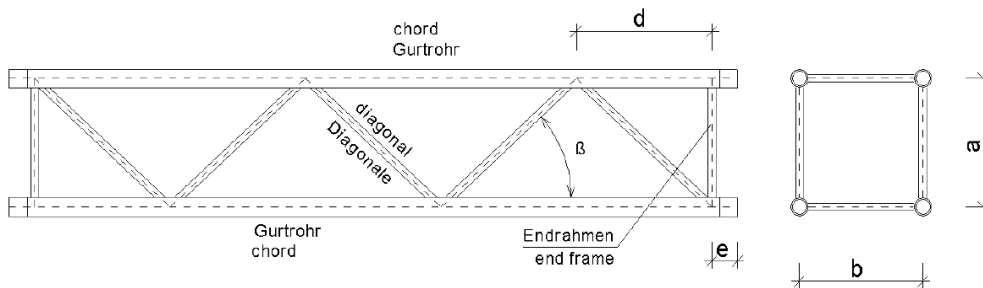
10,5 kg/m

CROSS SECTION TUBES / QUERSCHNITTSWERTE ROHRE

	D [mm]	t [mm]	A [cm ²]	W [cm ³]	I [cm ⁴]	I _T [cm ⁴]	i [cm]
chords/ Gurte	50,000	4,000	5,781	6,162	15,405	30,810	1,632
diagonals vertical/ Diagonale vertikal	25,000	3,000	2,073	1,022	1,278	2,556	0,785
diagonals horizontal/ Diagonale horizontal	25,000	3,000	2,073	1,022	1,278	2,556	0,785
end frame/ Endrahmen	25,000	3,000	2,073	1,022	1,278	2,556	0,785

TRUSS GEOMETRY/ TRAVERSENGEOMETRIE

Height / Höhe	a [cm]	29,90
Width / Breite	b [cm]	20,70
Distance diagonals vertical / Abstand Diagonalen vertikal	d[cm]	29,90
Angle diagonals vertical / Winkel Diagonalen vertikal	β _v	45,00
Distance diagonals horizontal / Abstand Diagonalen horizontal	d[cm]	0,00
Angle diagonals horizontal / Winkel Diagonalen horizontal	β _h	90,00
	e[cm]	8,00



CROSS SECTION TRUSS/ QUERSCHNITTSWERTE GESAMTTRAVERSE


$$A = 4 \times A_{\text{single tube/Einzelrohr}}$$

$$I = 0,85 \times (4 \times I_{\text{single tube/Einzelrohr}} + 4 \times A_{\text{single tube/Einzelrohr}} \times (a/2)^2)$$

$$i = (I / A)^{1/2}$$

The moments of inertia are reduced for 15% due to the resilient connection between chords and diagonals./
Die Trägheitsmomente werden aufgrund der nachgiebigen Verbindung Gurte-Diagonalen um 15 % abgemindert.

A [cm ²]	I _y [cm ⁴]	I _z [cm ⁴]	i _y [cm]	i _z [cm]	I _T [cm ⁴]
23,12	4445,05	1250,00	13,87	7,35	700

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

PROLYTE S36R

MATERIAL

Characteristic values of 0,2% proof strength $f_{0,2}$ and ultimate tensile strength f_u according to EC9/ charakteristische Werte für Streckgrenze f_0 und Zugfestigkeit f_u gemäß EC9 (see tab. 3.2b; 8.8⁽¹⁾/ siehe Tabelle 3.2b; 8.8⁽¹⁾)

EN AW 6082 T6	[N/mm ²]	normal stress/ Normalspannung	shear stress/ Schubspannung
		$\sigma_{R,d} = f / \gamma_{(M1,M2)}$	$\tau_{R,d} = f / (\gamma_{(M1,M2)} \times \sqrt{3})$
$f_0; t > 5mm$	260,0	236,4	136,5
$f_u; t > 5mm$	310,0	248,0	
$f_0; t < 5mm$	250,0	227,3	131,2
$f_u; t < 5mm$	290,0	232,0	
$f_{0,haz}$	125,0	113,6	65,6
$f_{u,haz}$	185,0	148,0	
$f_w^{(1)}$	190,0	152,0	87,8

All welding seams are done in TIG, according to tab. 3.2b, note 4 $\rho_{1,haz}$ has to be multiplied by 0,8 /
 Alle Schweißnähte sind WIG geschweißt, entsprechend Fußnote 4 der Tabelle 3.2b ist $\rho_{1,haz}$ mit dem Faktor 0,8 zu multiplizieren.

Partial safety factors for ultimate limit states/ Teilsicherheitsbeiwerte für Grenzzustände der Tragfähigkeit

γ_{M1}	1,10
γ_{M2}	1,25
γ_{MW}	1,25

(see tab. 6.1/ siehe Tabelle 6.1)

SUMMARY / ZUSAMMENFASSUNG

normal force chord / Normalkraft Gurte:	$N_{R,d} = +- 68,44$	68,44 kN
normal force in the fittings / Normalkraft Verbinder:	$N_{R,d} = +- 87,86$	87,86 kN
normal force diagonal vertical / Normalkraft Diagonale vertikal:	$N_{R,d} = +- 24,55$	24,55 kN
normal force diagonal horizontal / Normalkraft Diagonale horizontal:	$N_{R,d} = +- 24,55$	24,55 kN

**DESIGN INTERNAL FORCES COMPLETE TRUSS /
 BEMESSUNGSSCHNITTGRÖSSEN GESAMTTRAVERSE**

bending moment/Biegemoment:	$M_{y,R,d} = 2 \times N_{R,d, \text{chord tube/Gurtrohr}} \times 0,299 =$	40,93 kNm
normal force/Normalkraft:	$N_{R,d} = 4 \times N_{R,d, \text{chord tube/Gurtrohr}} =$	273,77 kN
transversal force/Querkraft	$V_{z,R,d} = 2 \times N_{R,d, \text{diagonal}} \times \sin 45,00^\circ =$	34,72 kN

The values shown above are design values. "Permissible loads" or "Working loads" are obtained by dividing the stress capacity by 1.5. /
 Die oben angegebenen Werte sind Design-Werte. "Zulässige Lasten" bzw. "Gebrauchslasten" erhält man durch Division der Beanspruchbarkeit durch 1,5.

INTERACTION MOMENT-TRANSVERSAL FORCE / MOMENTEN-QUERKRAFT-INTERAKTION

In case of occurrence of bending moment and transversal force the following term has to be analysed:
 Bei Auftreten von Moment und Querkraft, ist folgende Bedingung einzuhalten:

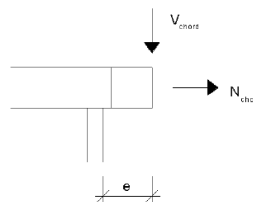
$$V_{d, \text{chord/Gurt}} = 0,25 \times V_{d, \text{total/gesamt}}$$

$$M_{d, \text{chord/Gurt}} = V_{d, \text{chord/Gurt}} \times e$$

$$e^* = 8,00$$

according to term / nach Gl. (6.43):

$$\eta = (N_{\text{chord/Gurt,Ed}} / N_{R,d})^{1,3} + M_{\text{chord/Gurt,Ed}} / M_{R,d} \leq 1$$

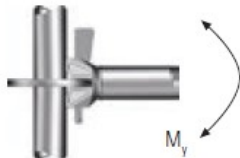


PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
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On the following pages extracts from the catalogue of the firm Layher are shown.

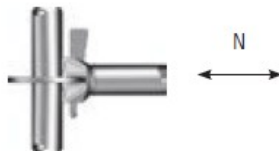
Z-8.22-64: K 2000+

Bending moment



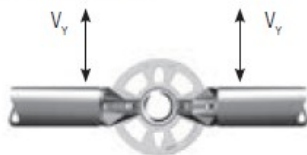
Bending moment
 $M_{y,Rd} = \pm 101.0 \text{ kNcm}$

Normal force

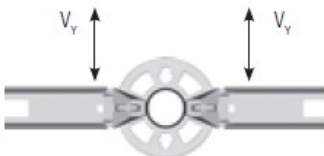


$N_{Rd} = \pm 31.0 \text{ kN}$

Horizontal lateral force

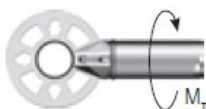


O-ledge: $V_{y,Rd} = \pm 10.0 \text{ kN}$



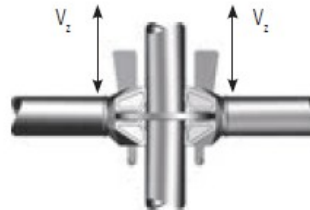
U-ledge: $V_{y,Rd} = \pm 5.9 \text{ kN}$

Torsional moment



$M_{t,Rd} = \pm 52.5 \text{ kNcm}$

Vertical lateral force



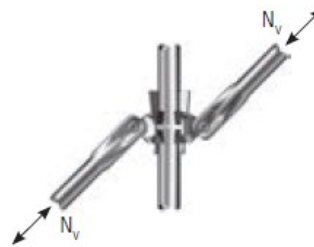
Vertical lateral force, single connection

$V_z, Rd = \pm 26.4 \text{ kN}$

Vertical lateral force per rosette

$\sum V_z, Rd = \pm 105.6 \text{ kN}$

Normal force, diagonal braces



Load-bearing capacities of the vertical diagonal braces for bay height 2.00 m for K 2000+:

	Pressure								Tension
Bay length [m]	0.73	1.09	1.40	1.57	2.07	2.57	3.07	4.14	all bay length
$N_{v,Rd}$ [kN]	-16.1	-16.8	-15.5	-14.8	-12.4	-10.2	-8.3	-5.3	+17.9

K 2000+ components can be mixed with components from the LW, Variant II and Variant I versions. See the approvals Z-8.22-64 and Z-8.22-949 for load-bearing capacities.

Rd = stress capacity, (incorporates part safety coefficient γ_M)

**"Permissible loads" or "working loads" are obtained by dividing the load-bearing capacity by 1.5 (= γ_F)

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
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LOADING CAPACITY TABLES

ALLROUND STEEL, ALL THE GIVEN LOADS ARE WORKING LOADS.

K 2000+

on K 2000+ standards



Tab. 3 Load-bearing capacity of O-ledge K 2000+

Ledge length (system dimension) [m]	0.73	1.09	1.40	1.57	2.07	2.57	3.07
Evenly distributed line load (q) [kN/m]	22.1	10.4	6.5	5.3	3.1	2.1	1.5
Individual load (P) in bay centre [kN]	7.4	5.2	4.2	3.8	3.0	2.4	2.1

VARIANT II

at Variant II standards



Tab. 6 Load-bearing capacity of O-ledge Variant II

Ledge length (system dimension) [m]	0.73	1.09	1.40	1.57	2.07	2.57	3.07
Evenly distributed line load (q) [kN/m]	22.1	8.8	4.6	3.5	1.8	1.1	0.7
Individual load (P) in bay centre [kN]	7.4	5.2	4.1	3.5	2.4	1.8	1.4

K 2000+

on K 2000+ standards



Tab. 8 Load-bearing capacity of U-lattice beams, K 2000+

Beam length [m]	2.07	2.57	3.07	4.14	5.14	6.14
Evenly distributed line load (q) [kN/m]*	17.3	12.5	10.2	7.3	5.2	4.3
Individual load (P) in bay centre [kN]*	25.1	26.6	$\frac{8.2^1}{19.5^2}$	16.2	15.9	10.9

- ¹ Individual load exactly in the centre of the lattice beam (= between the two central posts)
- ² Individual load above one of the central posts

Tab. 4 Load-bearing capacity of diagonal braces, LW H = 2.00 m

Bay length [m]	0.73	1.09	1.40	1.57	2.07	2.57	3.07
Diagonal brace dia. 48 mm	+119	+119	+119	+119	+119	+119	+119
Load-bearing capacity perm. D [kN]	-10.7	-11.2	-10.3	-9.9	-8.3	-6.8	-5.5

Tab. 5 Load-bearing capacity of diag. braces, K 2000+ H = 2.00 m

Bay length [m]	0.73	1.09	1.40	1.57	2.07	2.57	3.07
Diagonal brace dia. 48 mm	+119	+119	+119	+119	+119	+119	+119
Load-bearing capacity perm. D [kN]	-10.7	-11.2	-10.3	-9.9	-8.3	-6.8	-5.5

Tab. 7 Load-bearing capacity of diag.II braces, Variant II H = 2.00 m

Bay length [m]	0.73	1.09	1.40	1.57	2.07	2.57	3.07
Diagonal brace dia. 48 mm	± 5.6	± 5.6	± 5.6	± 5.6	± 5.6	± 5.6	± 5.6
Load-bearing capacity perm. D [kN]							

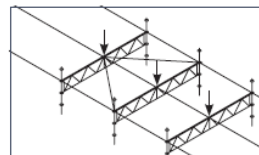
K 2000+

on K 2000+ standards



Tab. 10 Load-bearing capacity of O-lattice beams, K 2000+

Beam length [m]	2.07	2.57	3.07	4.14	5.14	6.14
Evenly distributed line load (q) [kN/m]*	16.7	12.7	10.1	7.3	3.7	3.1
Individual load (P) in bay centre [kN]*	25.4	26.7	$\frac{11.2^1}{23.3^2}$	25.9	13.9	9.4



Bracing the 4.14 m lattice beam

LIGHTWEIGHT, K 2000+ AND VARIANT II



Tab. 11 a Load-bearing capacity of U/O-ledge LW reinforced

Ledge type	U-LW-V						O-LW-V					
Length [m]	1.40	1.57	2.07	2.57	3.07	1.09	1.40	1.57	2.07	2.57	3.07	
Evenly distributed line load (q) [kN/m]	17.1	17.7	13.0	8.4	5.0	21.4	17.1	17.7	13.0	8.4	5.0	
Individual load (P) in bay centre [kN]	19.2	17.1	12.9	10.4	8.7	19.6	19.2	17.1	12.9	10.4	8.7	

Tab. 11 b Load-bearing capacity of U-ledge (U), reinforced ledge (V), O-ledge (O)

Ledge type and length [m]	U 0.73	U-V 1.09	U-V 1.40	O-V 1.09	O-V 1.29	U-LW 1.09	U-LW 1.40
Evenly distributed line load (q) [kN/m]	19.0	17.3	10.4	21.8	15.6	17.5	10.8
Individual load (P) in bay centre [kN]	6.1	8.8	6.8	11.0	9.3	8.6	6.4

PROJECT: MPT-ROOF 12x10m	PROJECT-NO.: 22012
CUSTOMER/AUFTRAGGEBER: 	DATE/DATUM: 15.03.2022

LOADING CAPACITY TABLES

ALLROUND ALUMINIUM, ALL THE GIVEN LOADS ARE WORKING LOADS.

Tab. 29 Inner standard 2.00 m level height

Bay width [m]	0.73	1.09	1.57	2.07	2.57	3.07
Diagonal bracing	A	B	A, B	A, B	B	B
Permissible vertical load V_A [kN]	15.5	13.7	14.7	14.6	14.4	14.0

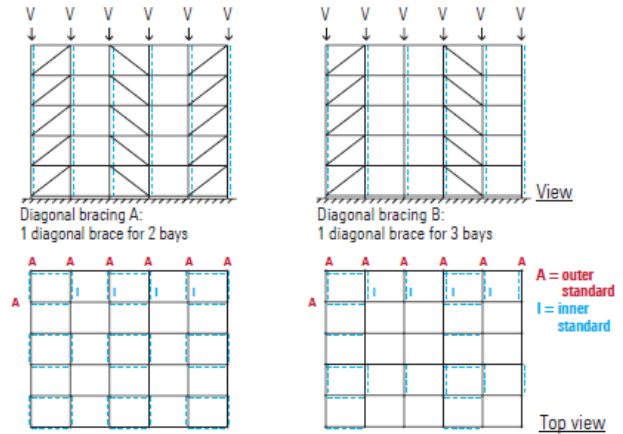
Tab. 30 Outer standard 2.00 m level height

Bay width [m]	0.73	1.09	1.57	2.07	2.57	3.07
Diagonal bracing	A	B	B	B	B	B
Permissible vertical load V_A [kN]	13.5	11.5	12.5	12.5	12.1	11.7

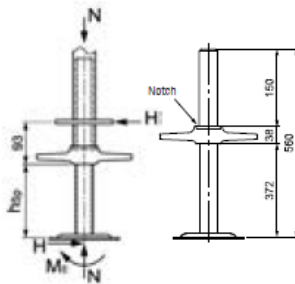
Tab. 31 Load-bearing capacity of aluminium U-ledger (U) and U-ledger reinforced (U-V)

Ledger type and length [m]	0.73 (U)	1.09 (U-V)	1.40 (U-V)
Evenly distributed line load [q] [kN/m]	17.8	10.7	8.4
Individual load (P) in bay centre [kN]	5.9	7.2	5.7

Load-bearing capacity of the aluminium Allround standard



BASE PLATE 60



Substitute cross-sectional values of the spindle

- A = 3.84 cm²
- W_{el} = 2.61 cm³
- W_{pl} = 3.26 cm³
- I = 3.74 cm⁴

Material: EN 10219-S235JRH

→ Rolled thread: f_{yk} = 280.0 N/mm²

Tab. 12 Base plate loading

Spindle extension length h_{sp} [cm]	Permissible vertical spindle load N [kN]* with simultaneous effect of a horizontal load H [kN]														Perm. Horizontal load H [kN] if N = 0														
	H = 0.0		H = 0.5		H = 1.0		H = 1.5		H = 2.0		H = 2.5		H = 3.0			H = 3.5		H = 4.0		H = 4.5		H = 5.0		H = 5.5		H = 6.0			
	N_1	N_2	N_1	N_2	N_1	N_2	N_1	N_2	N_1	N_2	N_1	N_2	N_1	N_2		N_1	N_2	N_1	N_2	N_1	N_2	N_1	N_2	N_1	N_2	N_1	N_2	N_1	N_2
0	39	53	39	51	39	51	39	51	39	50	39	49	39	49	38	-	38	-	37	-	36	-	36	-	35	-	-	-	26.3
5	39	52	39	51	39	50	39	48	38	-	37	-	36	-	35	-	34	-	33	-	32	-	31	-	30	-	-	-	7.8
10	39	51	39	49	38	-	37	-	36	-	34	-	33	-	30	-	29	-	28	-	28	-	25	-	-	-	-	-	4.6
15	39	49	38	-	36	-	35	-	33	-	31	-	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.2	
20	38	-	36	-	34	-	32	-	29	-	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	
25	37	-	34	-	31	-	28	-	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.0	
30	35	-	31	-	27	-	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.7	
35	32	-	27	-	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.5	
37	30	-	25	-	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.4	

*The permissible vertical loads are calculated by application of the calculation model according to DIN EN 12811-1, para. 10.2.3.2. To obtain the bending stiffness of the upright tube, the internal force components from second-order theory and the maximum load-bearing capacity of the uprights, the following birdcage scaffolding with configuration dimension 2.57 x 2.57 m was considered: 2.00 m level height for compression forces in the standard $N_1 \leq 39$ kN 1.50 m level height for compression forces in the standard 39 kN < $N_2 \leq 54$ kN

(-) With this combination of spindle extension length and horizontal load, the bending stress capacity of the spindle is exceeded.

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