



VANDKULTURHUSET PAPIRØEN

DANSK STÅLDAG 2024
14. NOVEMBER



ABOUT VAP

VAP is located on Christiansholm (Papirøen).

Papirøen was established in 1696

Future plans: residential area & water culture center.

VAP will be open to the public and will contain:

- Swimming areas
- Spa/wellness areas
- Association areas
- Fitness areas
- Offices and meeting facilities

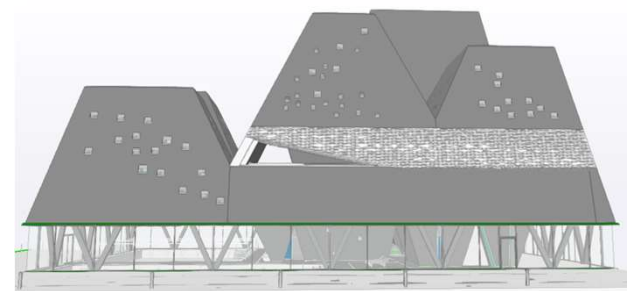
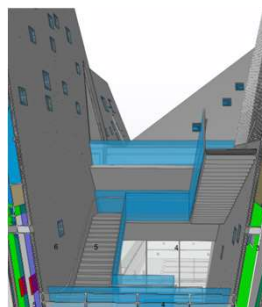
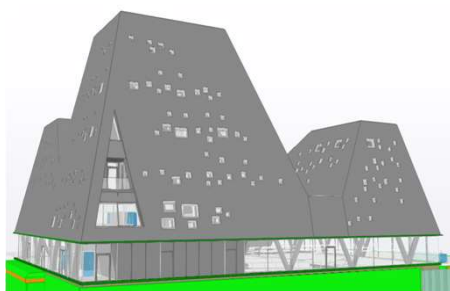


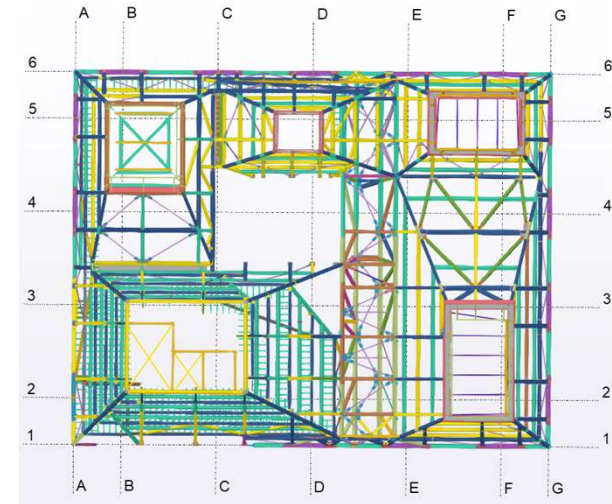
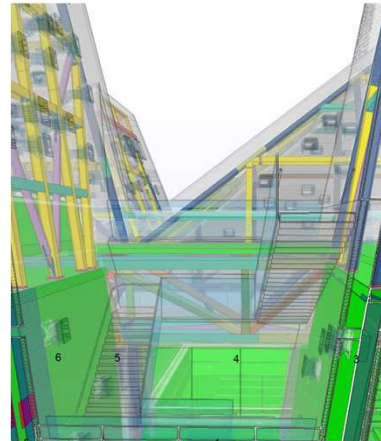
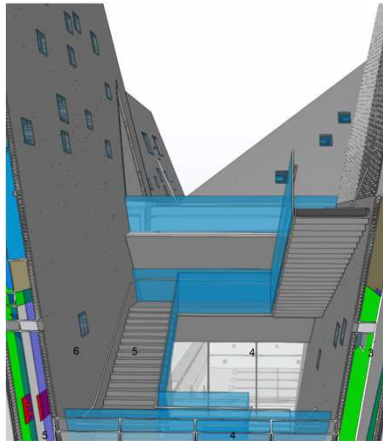
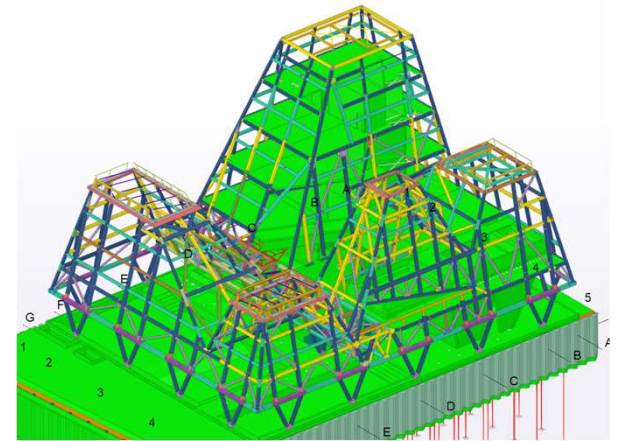
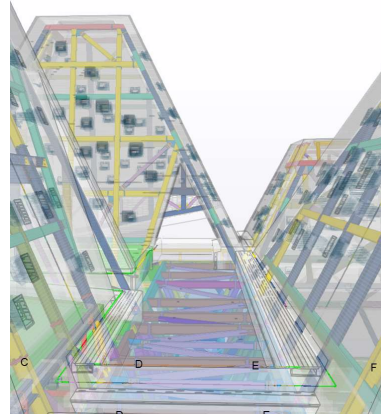
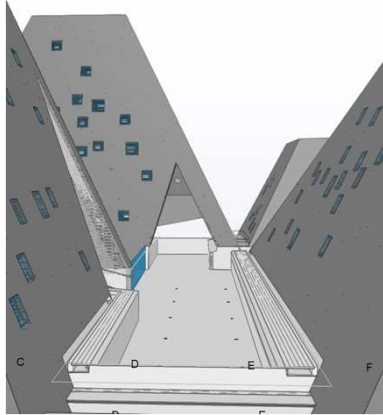
ABOUT VAP

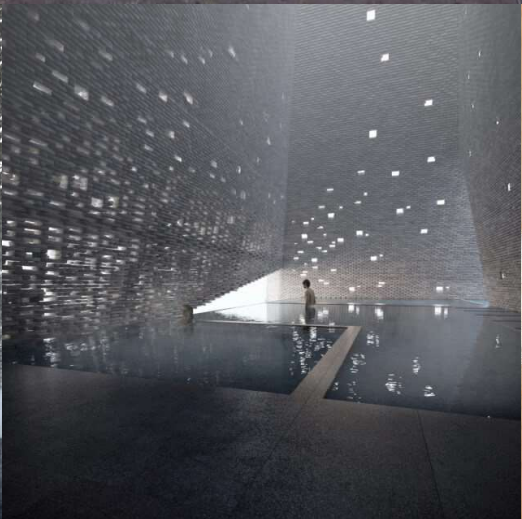
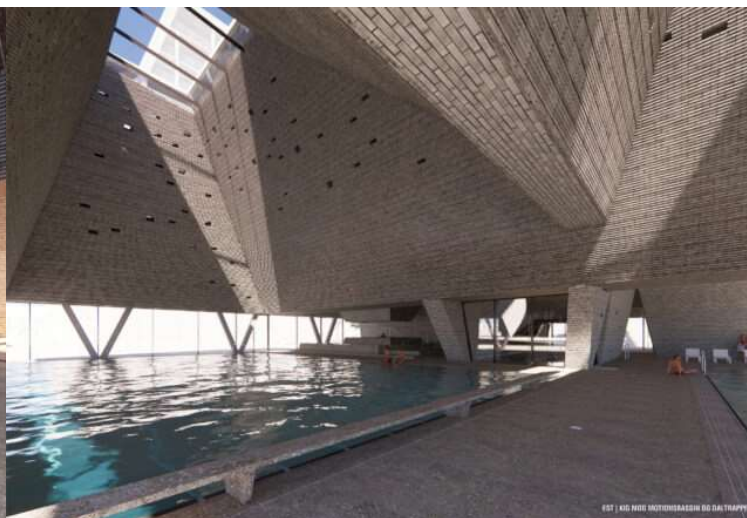
WATER CULTURAL CENTRE

- 5.000 m²
- Developer: Ejendomsfonden Vandkulturhuset Papirøen
(founded by Nordea Fonden)
- Contractor (turnkey): MT Højgaard
- Architect: Kengo Kuma / VLA
- Main Engineer: Søren Jensen
- KI scope:
 - Structural steel design (superstructure)
 - Assistance to SJ with design of concrete core and slabs
(superstructure)

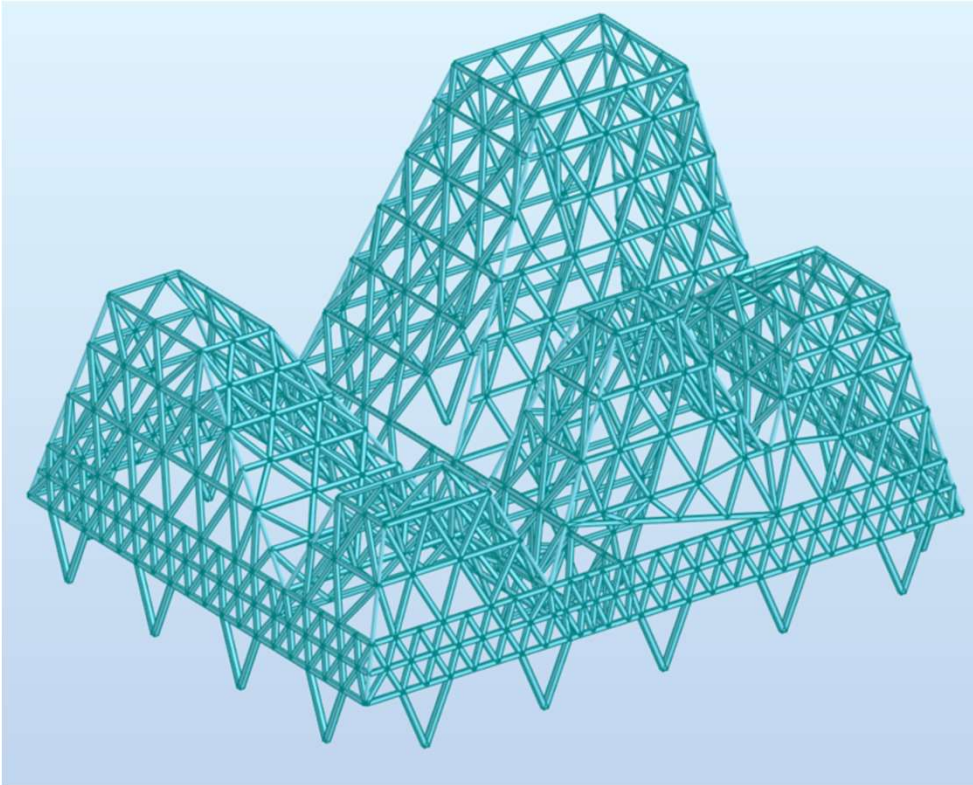




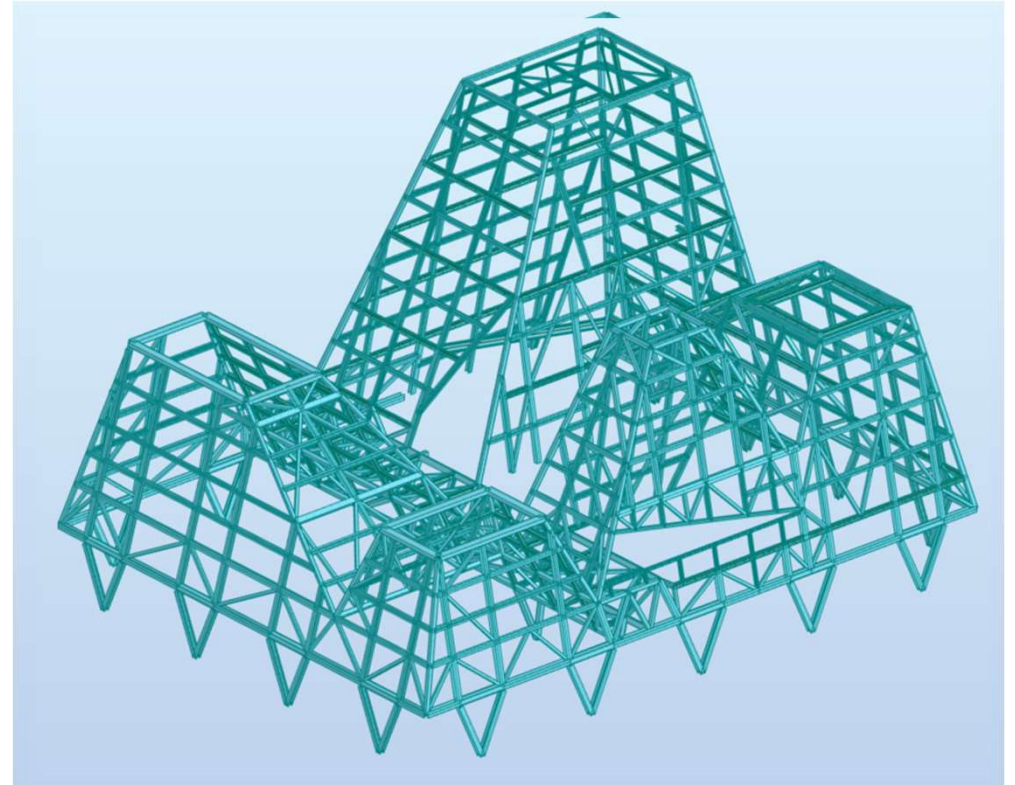




THE STRUCTURE

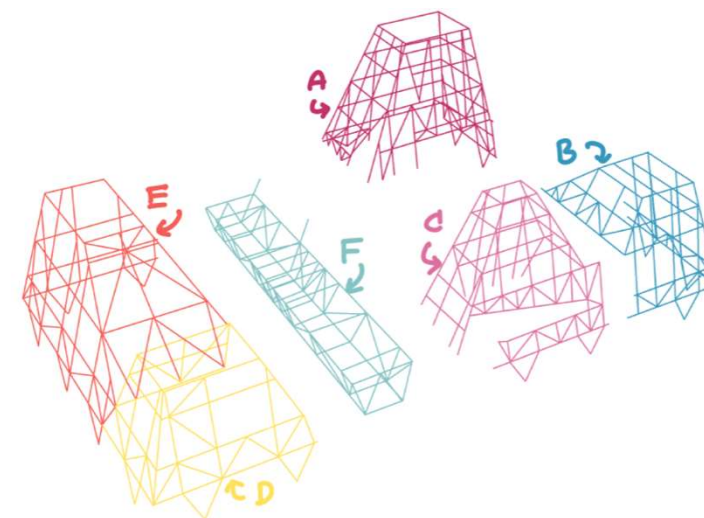
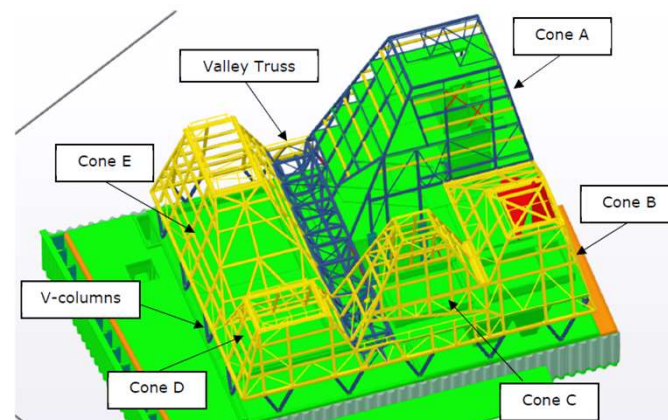
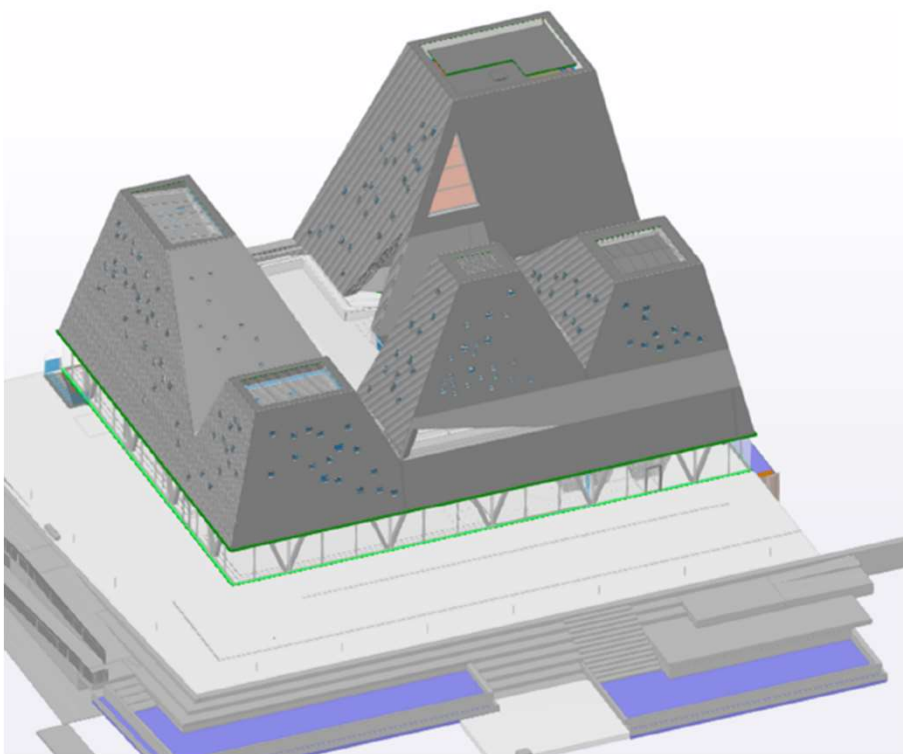


CONCEPT & BASIC DESIGN

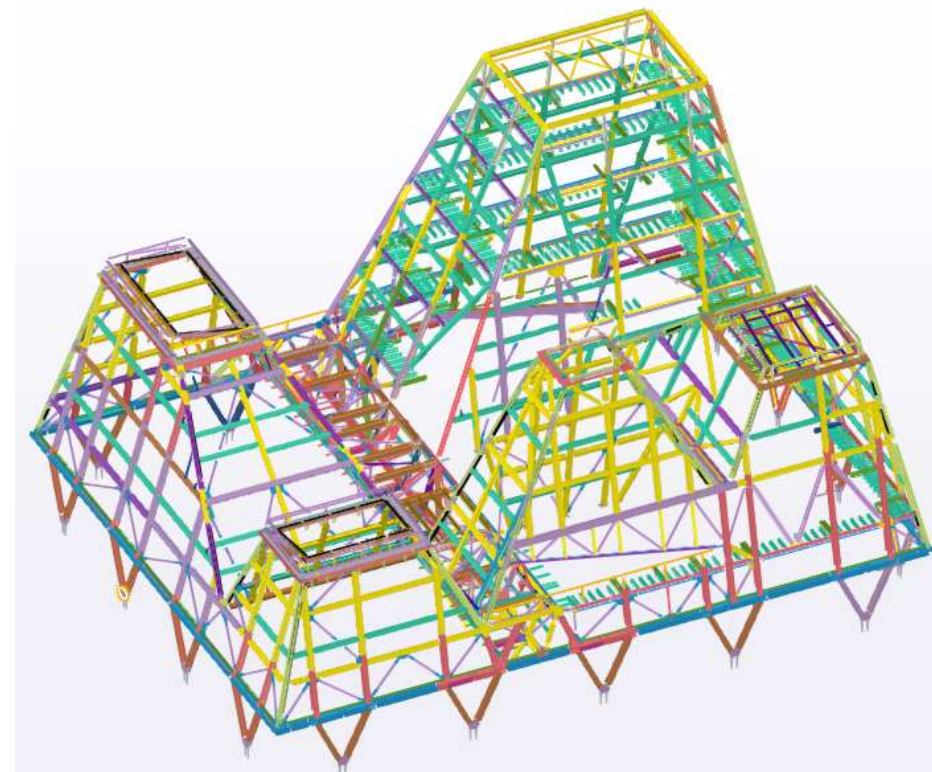
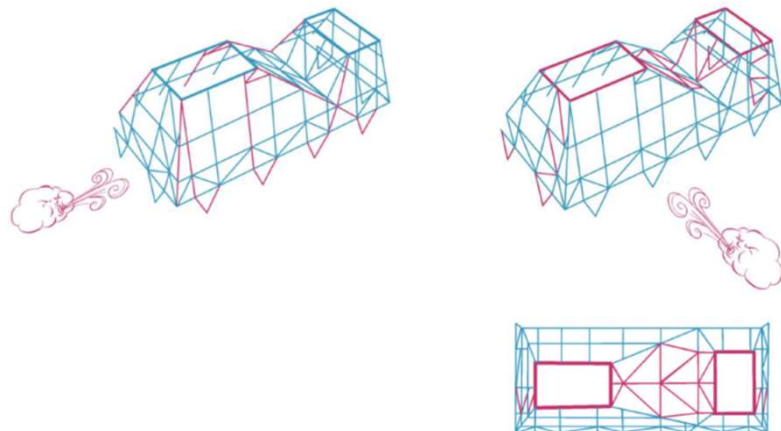
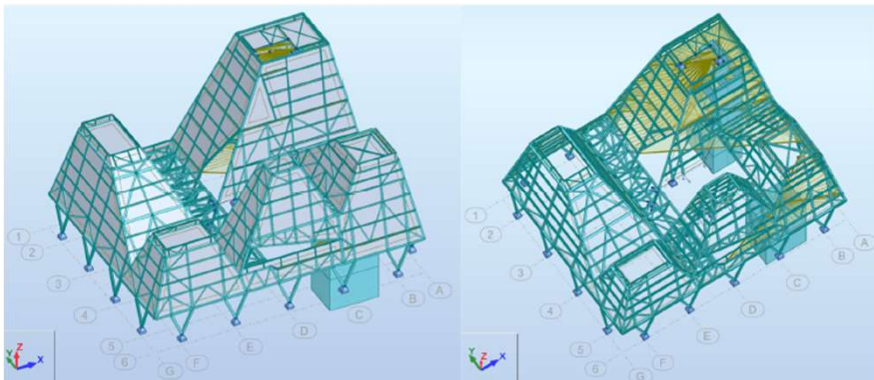


DETAILED DESIGN

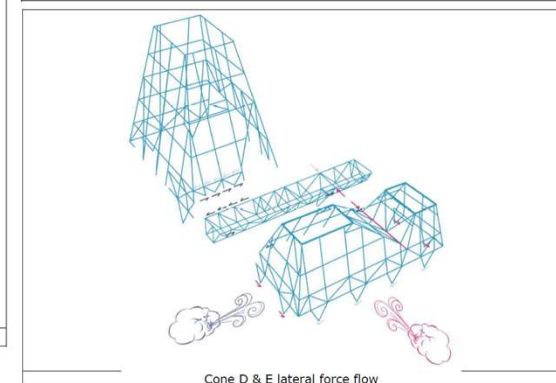
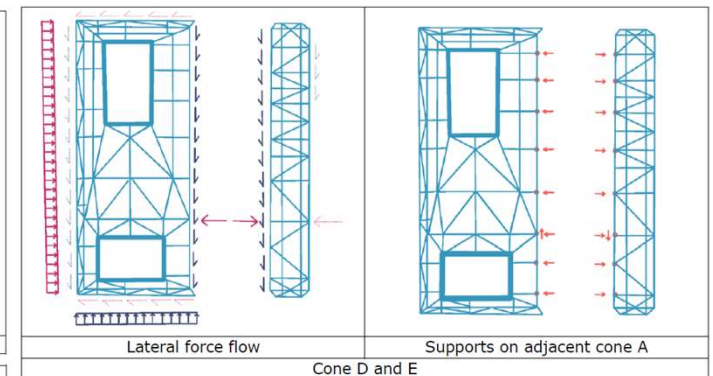
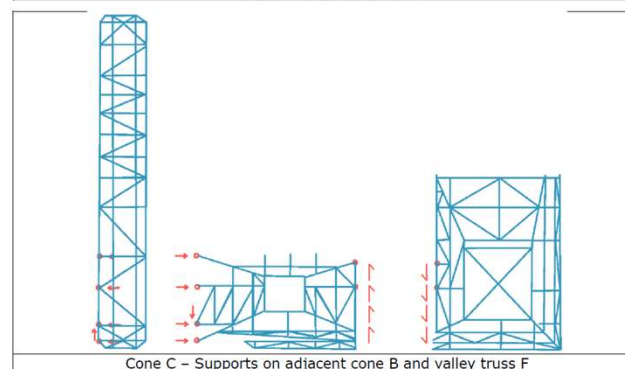
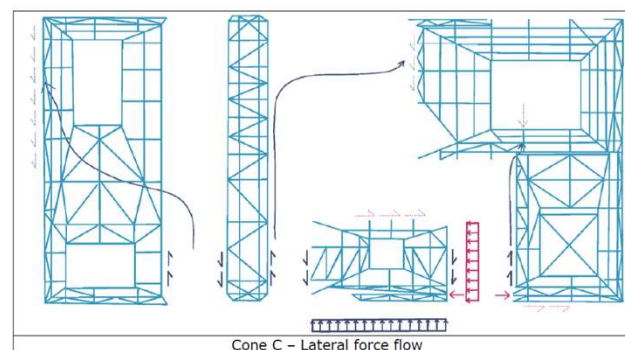
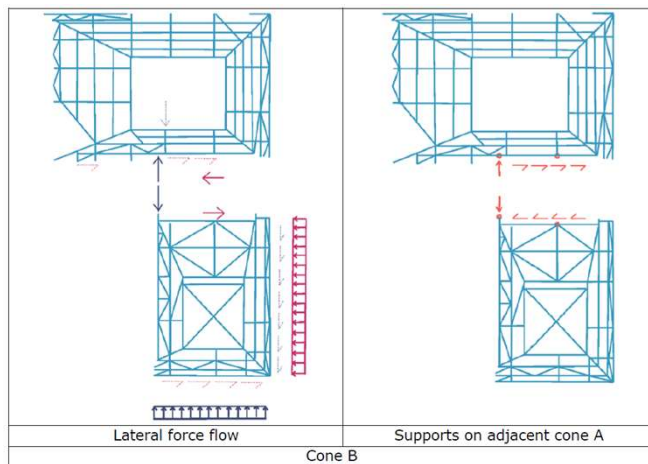
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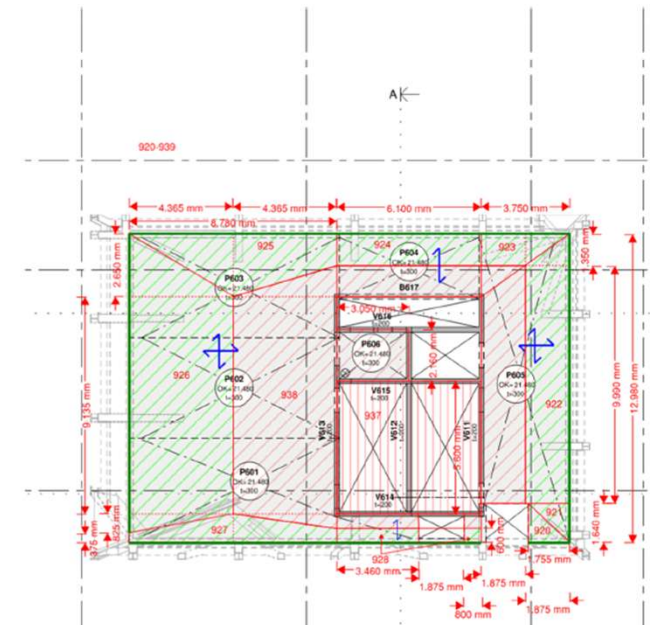
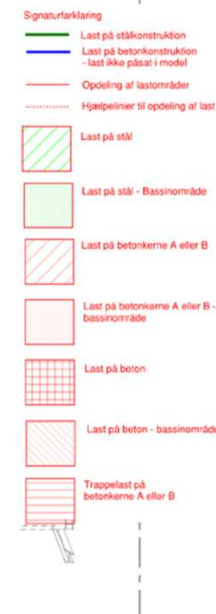
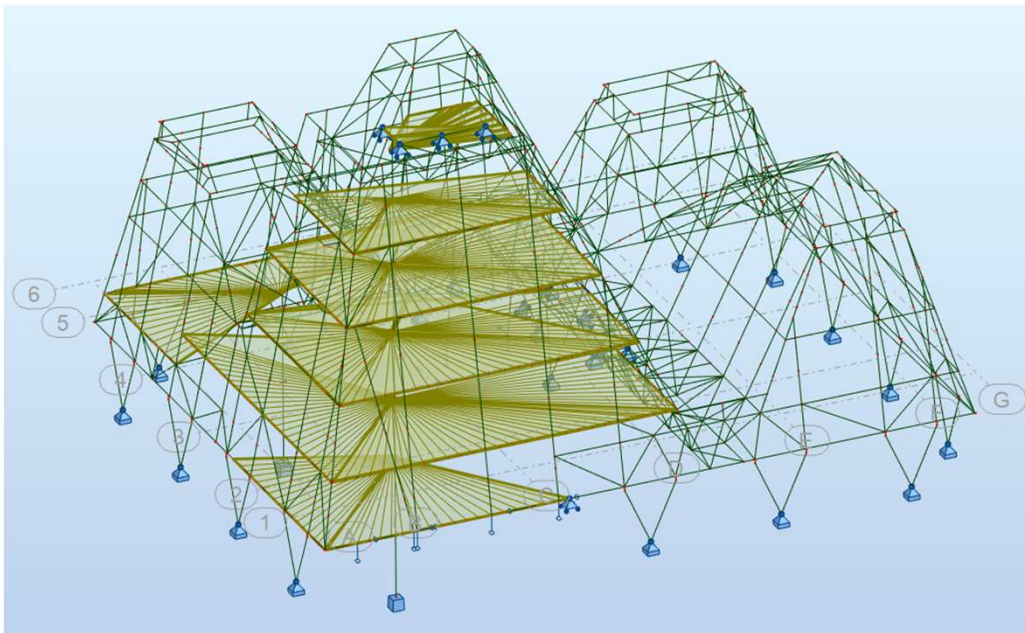
THE STRUCTURE



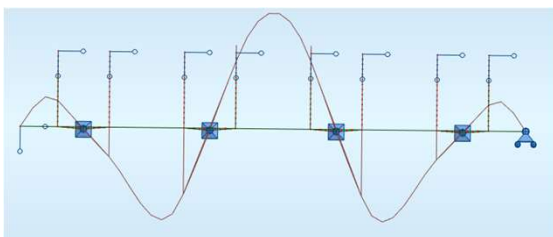
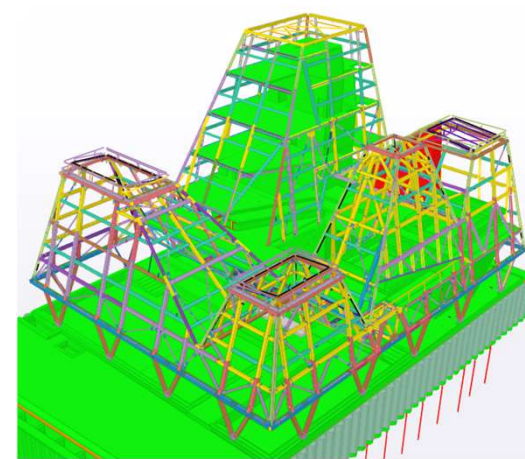
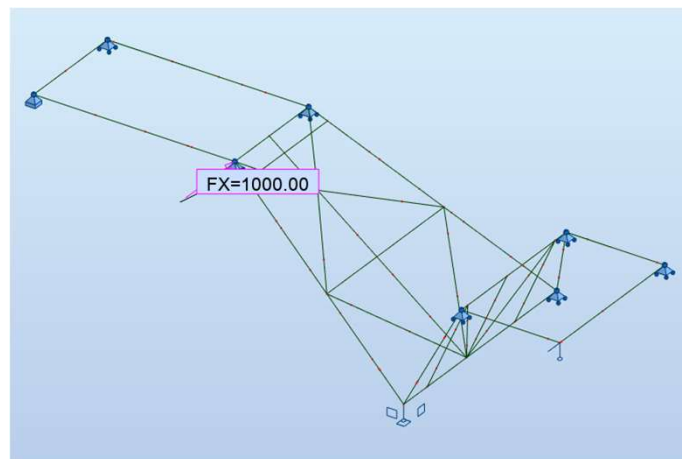
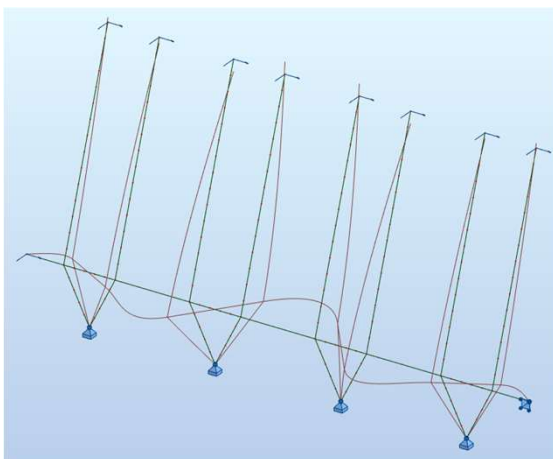
THE STRUCTURE



APPLICATION AND LOADS & RIGID LINKS



BUCKLING STABILITY & KEY ELEMENTS



Functional requirements

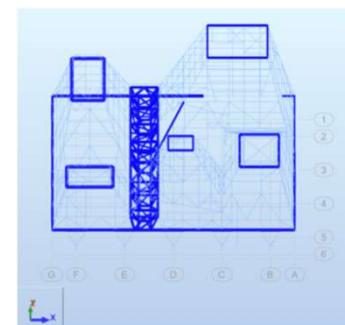
As written previous (in this document), the roof structure of cone D and E is partly braced and partly framed. The overall lateral stiffness of the roof shall be calculated to determine if the roof is classified as braced/un-braced and sway/non-sway.

For cone D and E to be classified as non-sway the stiffness of the roof should fulfill:

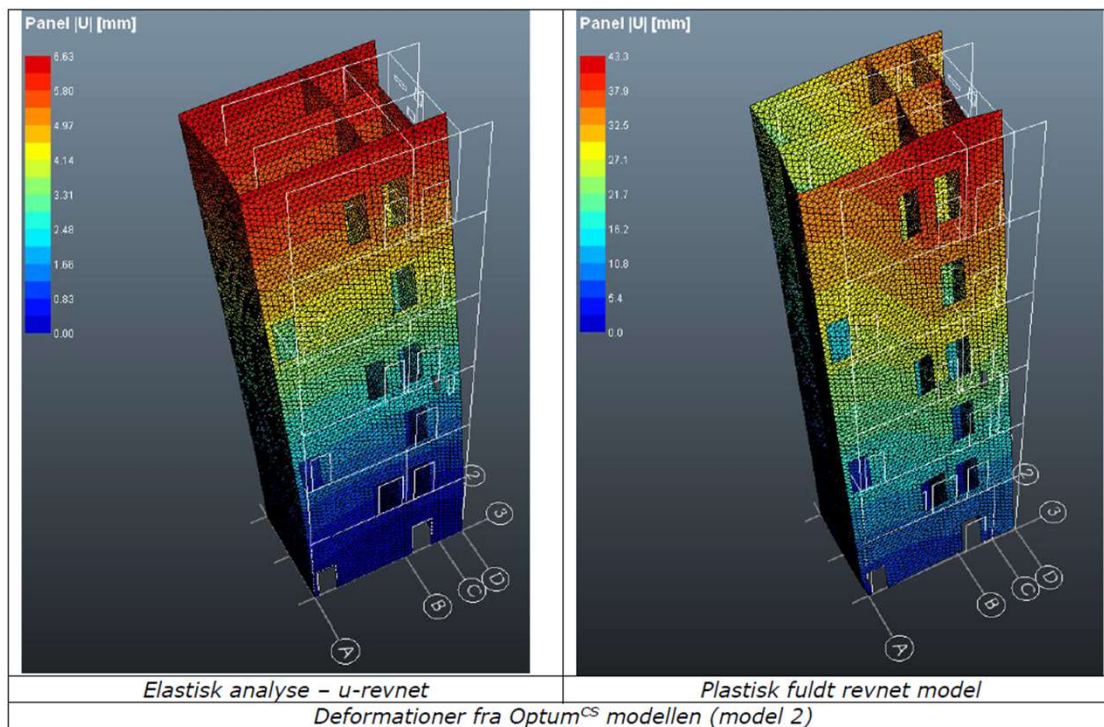
- EN 1993-1-1 rule: $\alpha_{cr} = F_{cr}/F_{Ed} \geq 10$
- Elastic theory: $k_{roof,min} = 2 \cdot F_{Ed} / (\phi \cdot L)$
(ref. [15]) F_{Ed} = Design column compression
 L = Length of column



For the cone D and E design both of the requirements above should be shown fulfilled, otherwise the buckling length of the columns should be taken higher than 1.0L according to the results from a buckling analysis.



LATERAL STIFFNESS OF CONE A



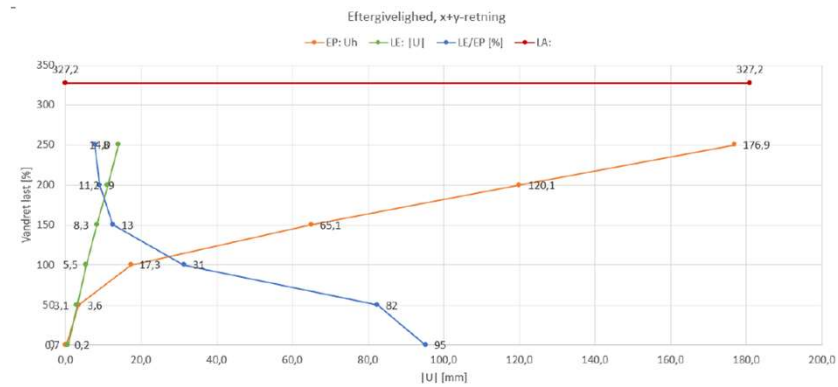
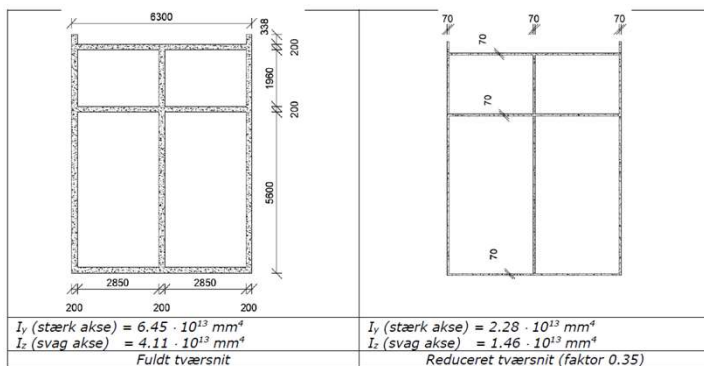
Af ref. [1] og [2] findes følgende anbefalede "stiffness modifiers":

- Bjælker: $0.35 I_g$
- Søjler: $0.70 I_g$
- Vægge: $0.35 I_g$ for revnede vægge og $0.70 I_g$ for urevnede vægge.

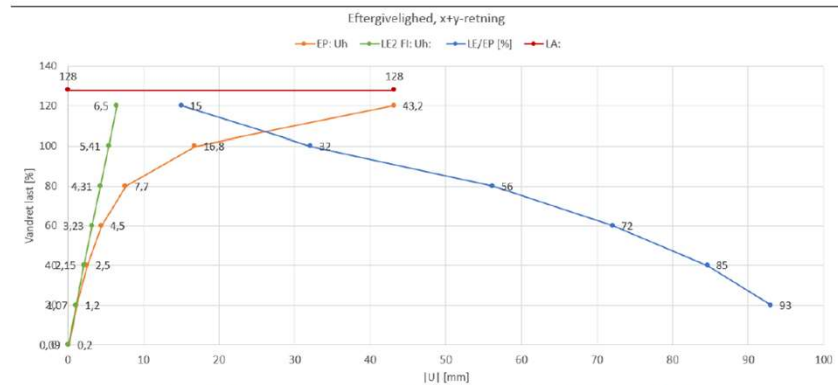
Hvor I_g er det u-revnede inertimoment af det rene betontværsnit (uden armering)

Værdien for vægge skal forså således, at der indledningsvist foretages en analyse af væggen i det u-revnede tilfælde. Hvis hele eller dele af væggene af denne analyse vurderes revnede, så ændres stivheden i disse områder til den revnede værdi, og analysen gentages.

LATERAL STIFFNESS OF CONE A



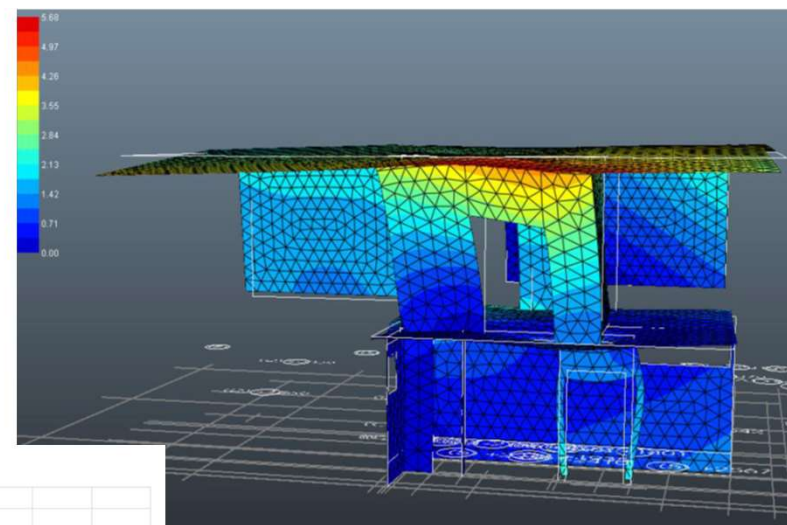
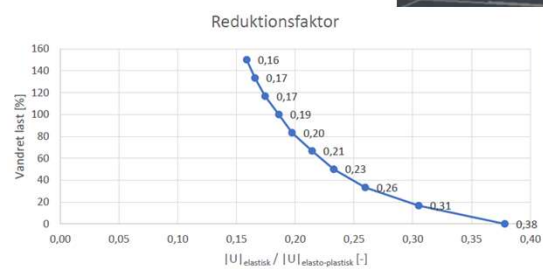
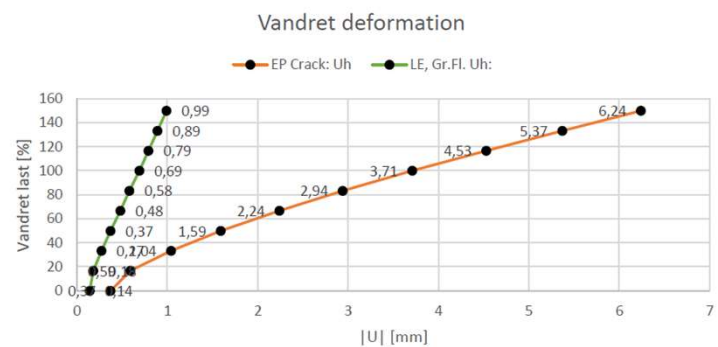
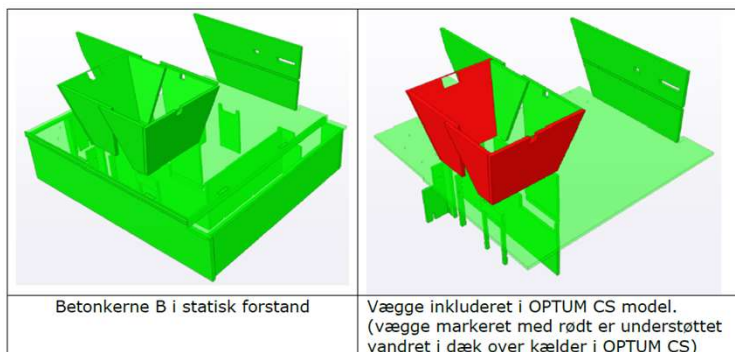
Model 1 – Kerne regnes fast indspændt i bundpladen



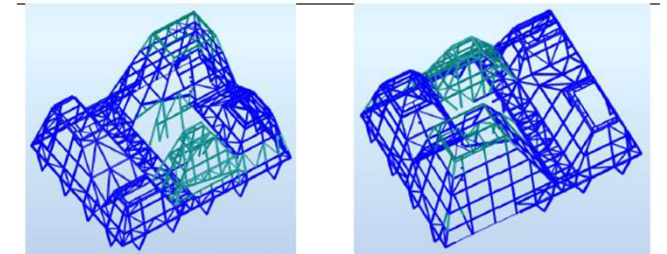
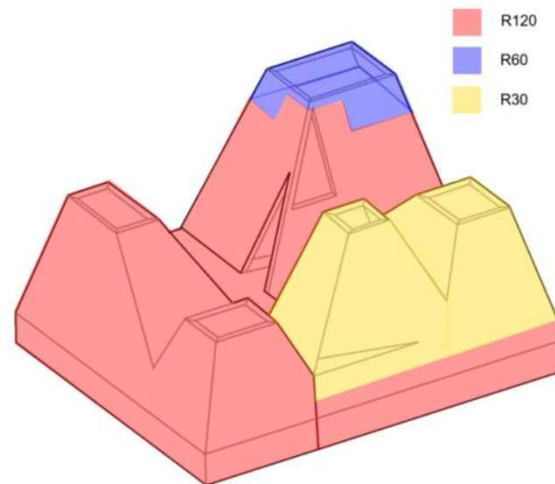
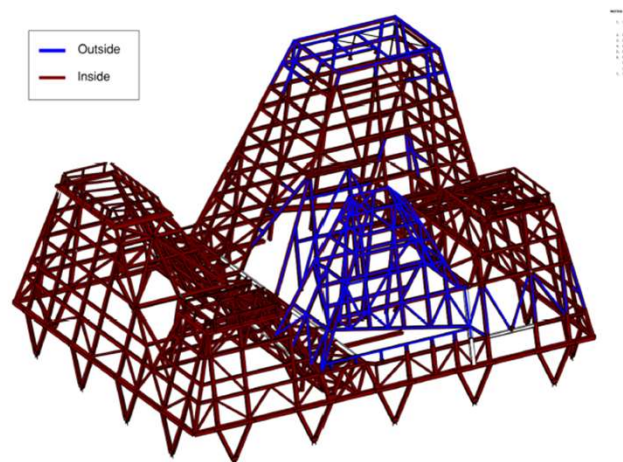
Model 2 – kernen regnes stående frit på bundpladen



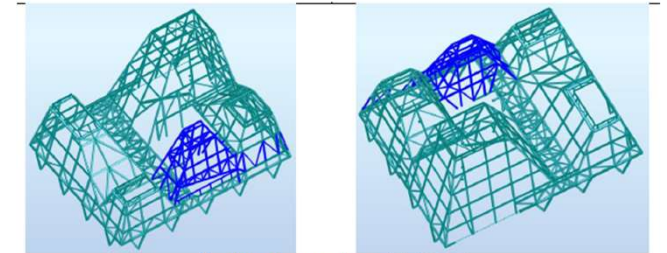
LATERAL STIFFNESS OF CONE B



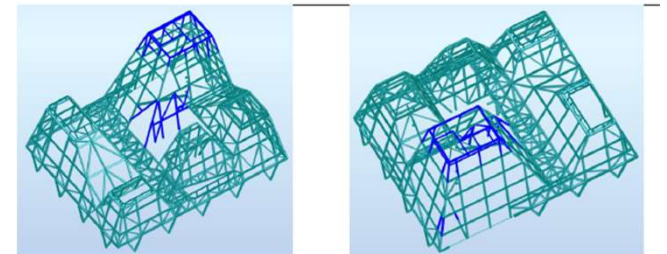
TEMPERATURE & FIRE



Members designed to resist 450 °C



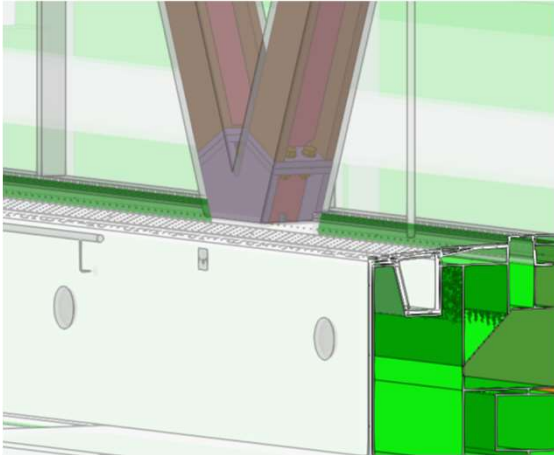
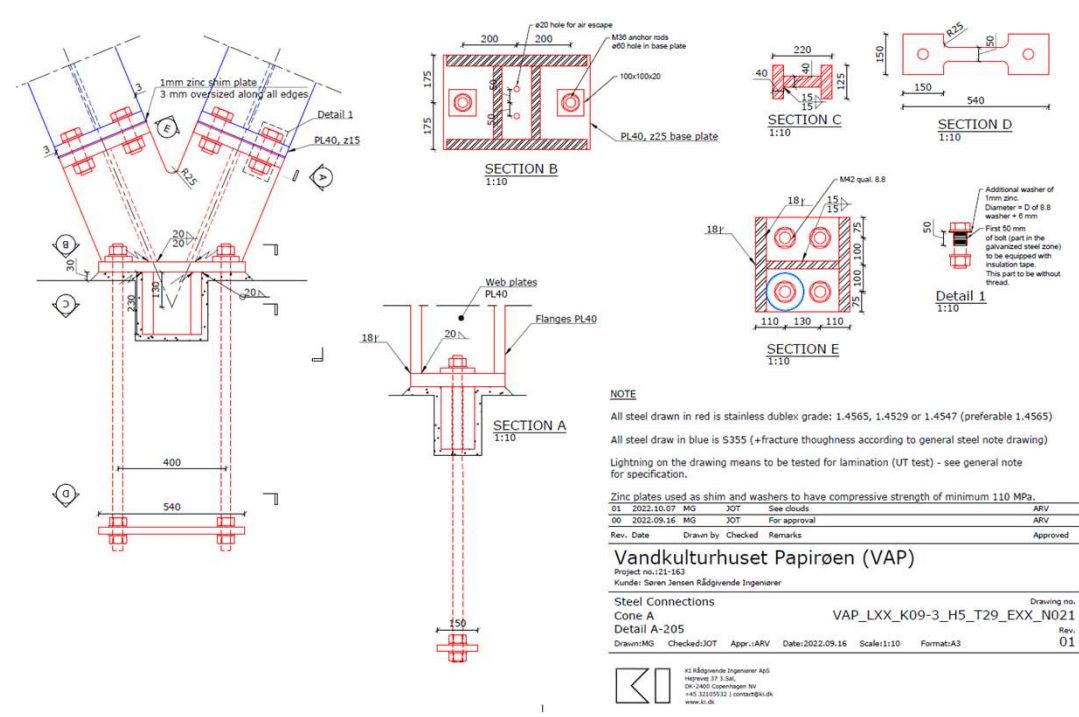
Members designed to resist 500 °C



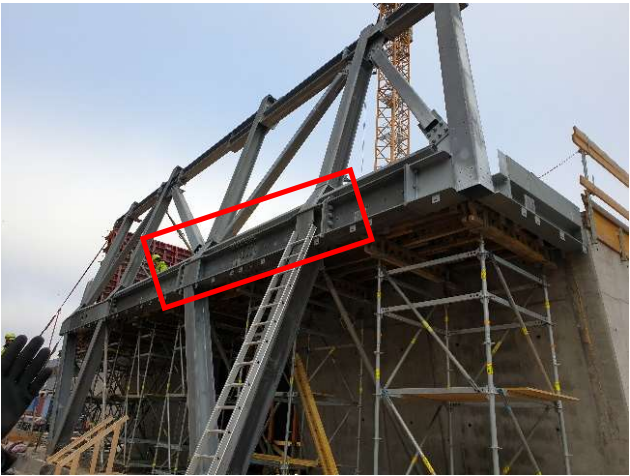
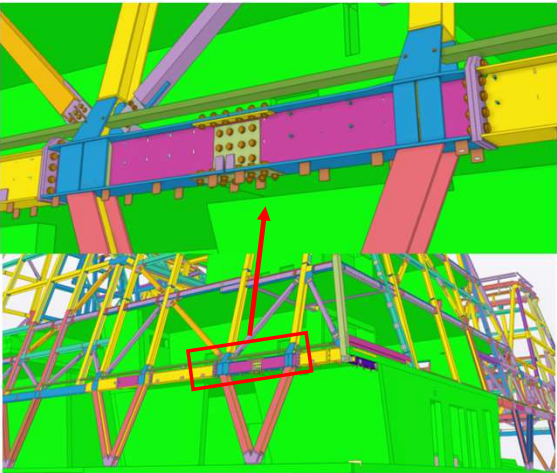
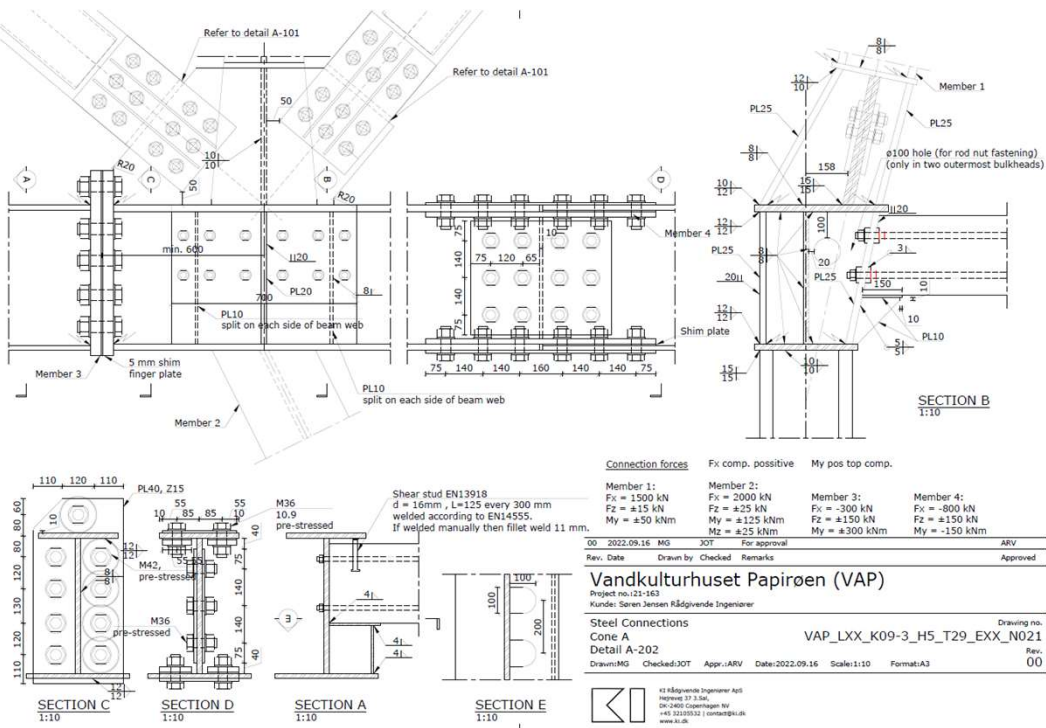
Members designed to resist 600 °C



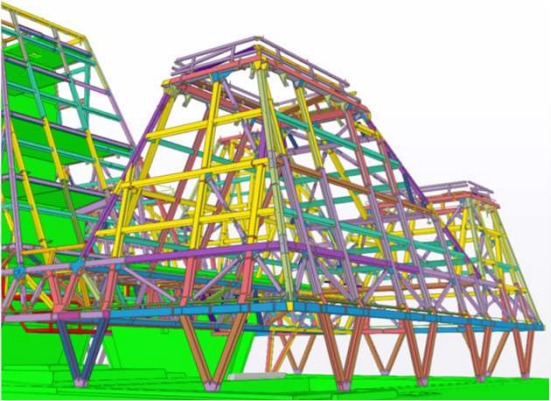
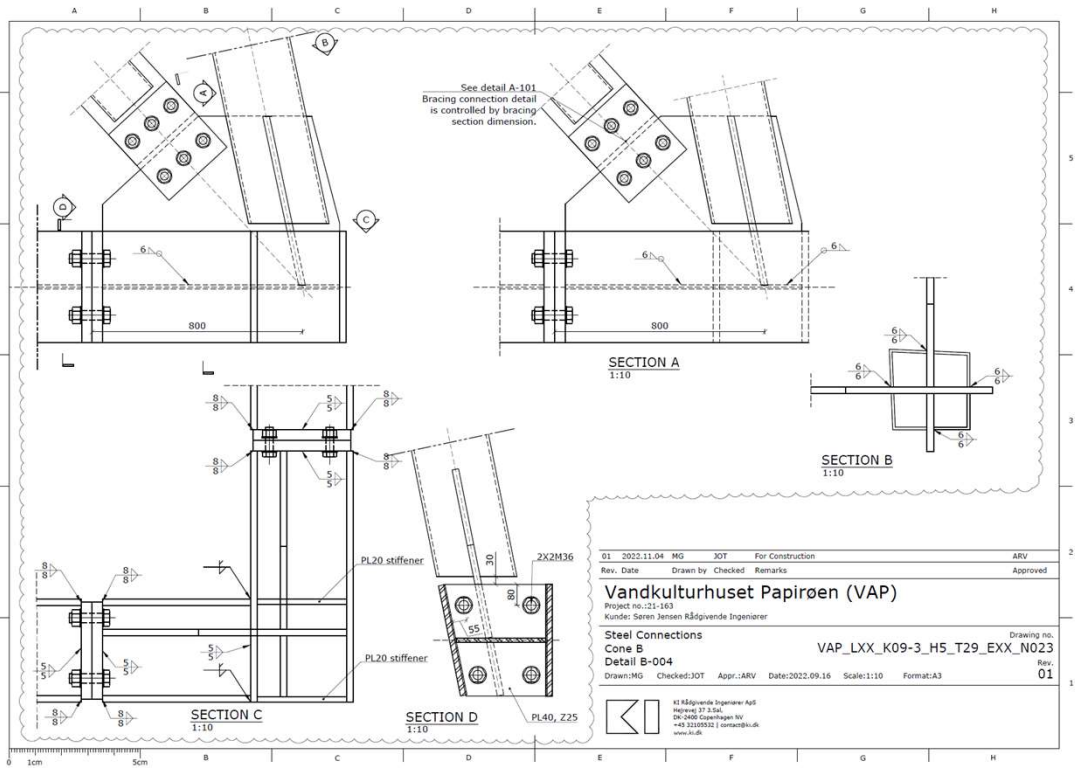
V-COLUMN BASE DETAILS



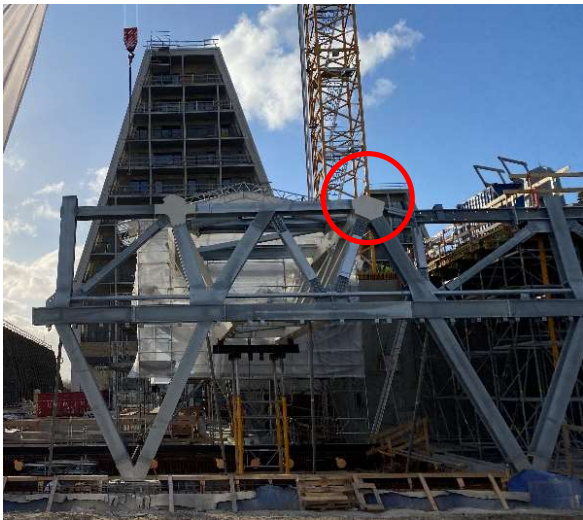
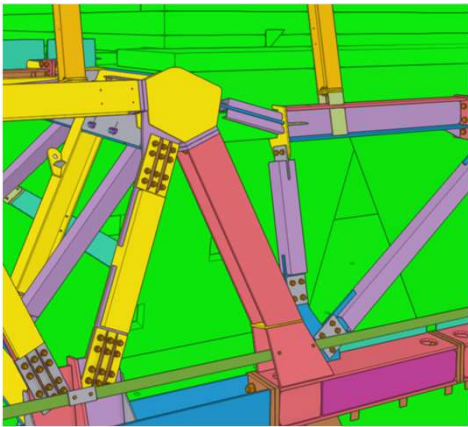
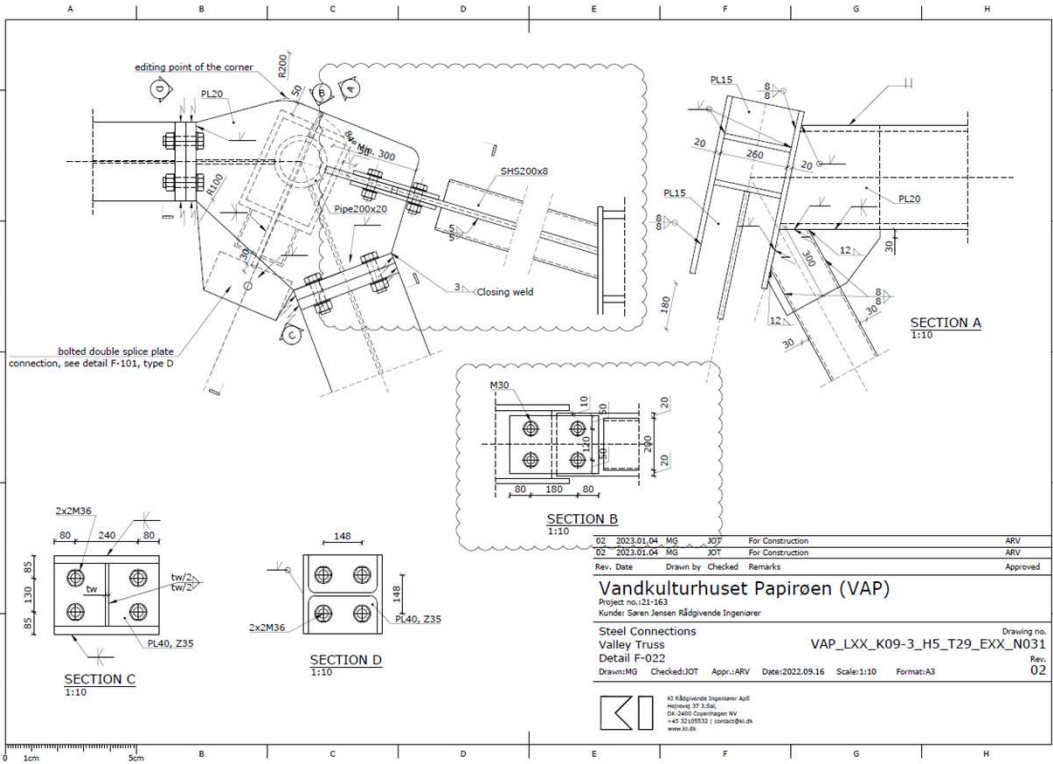
DETAILS



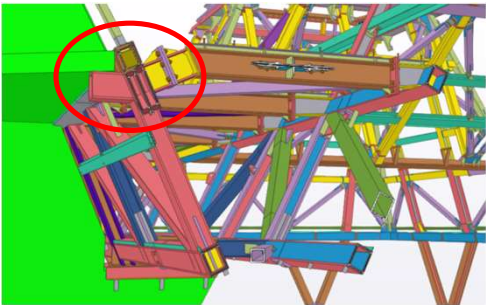
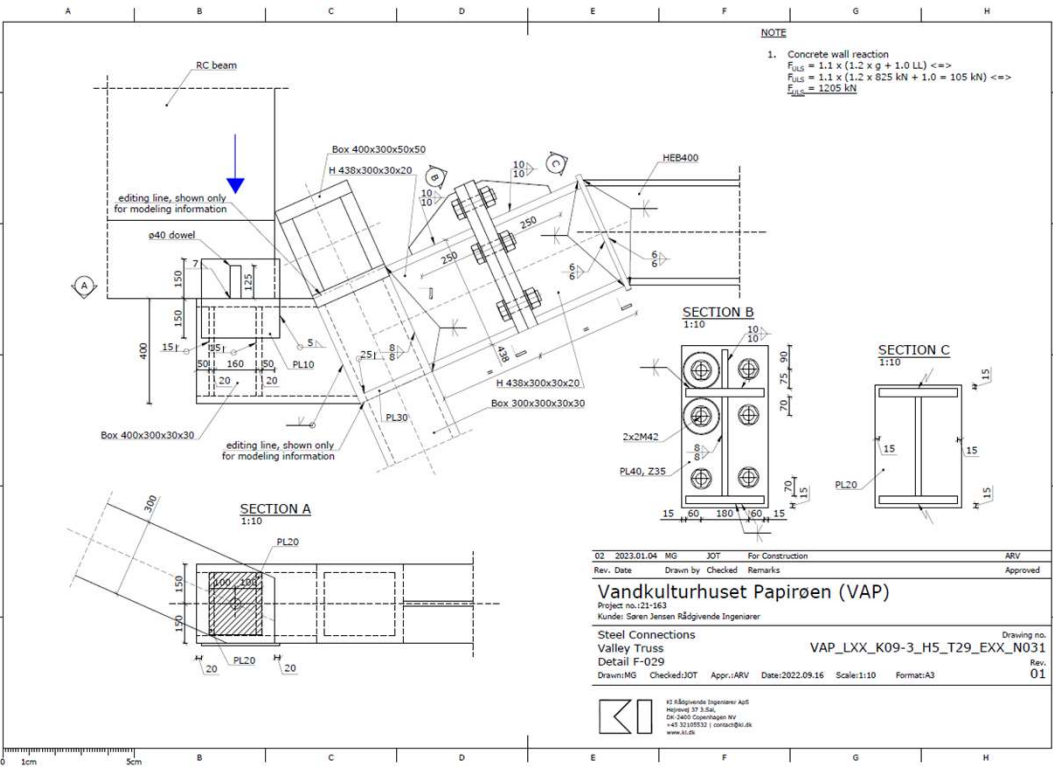
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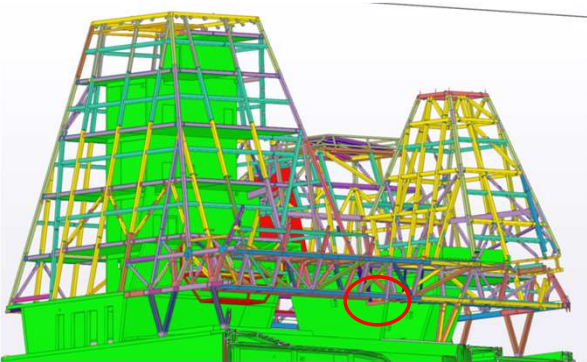
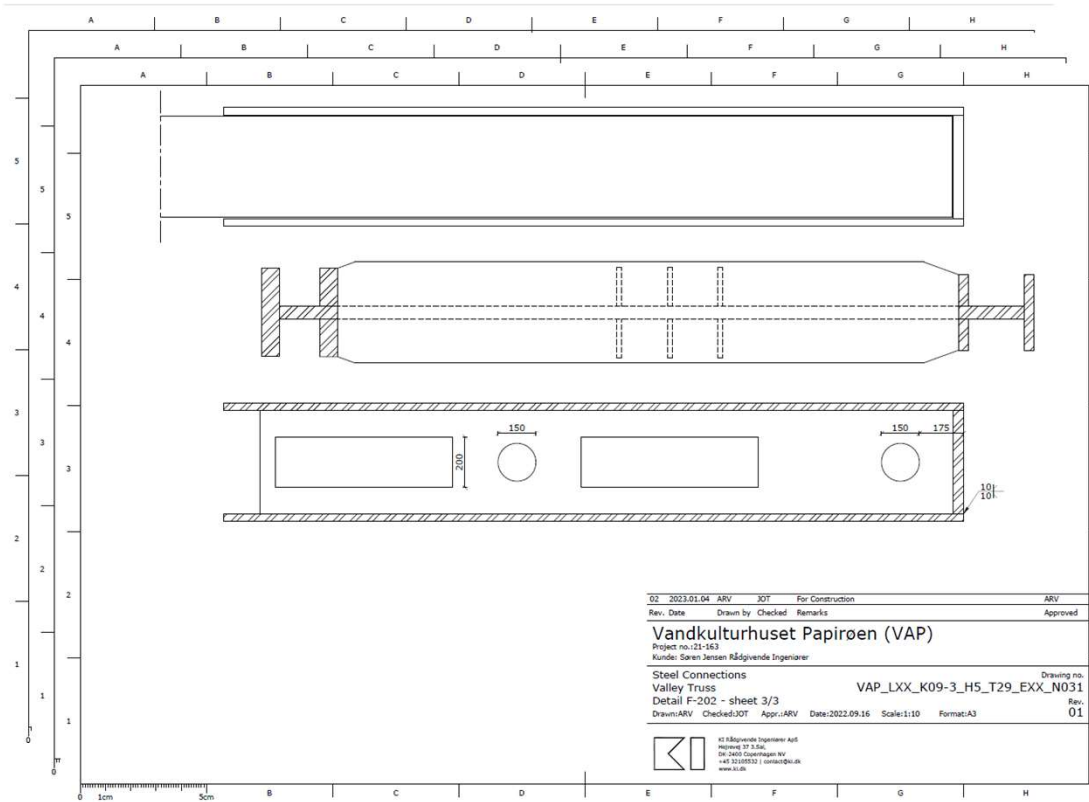
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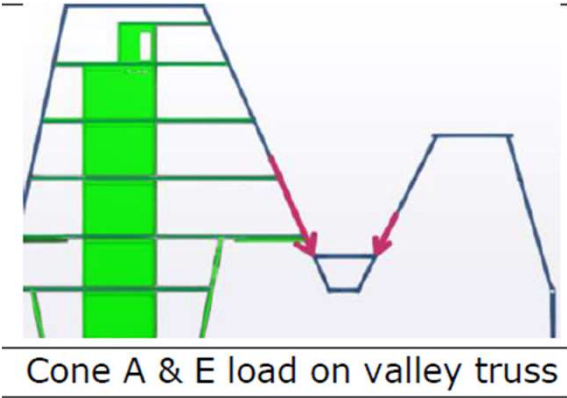
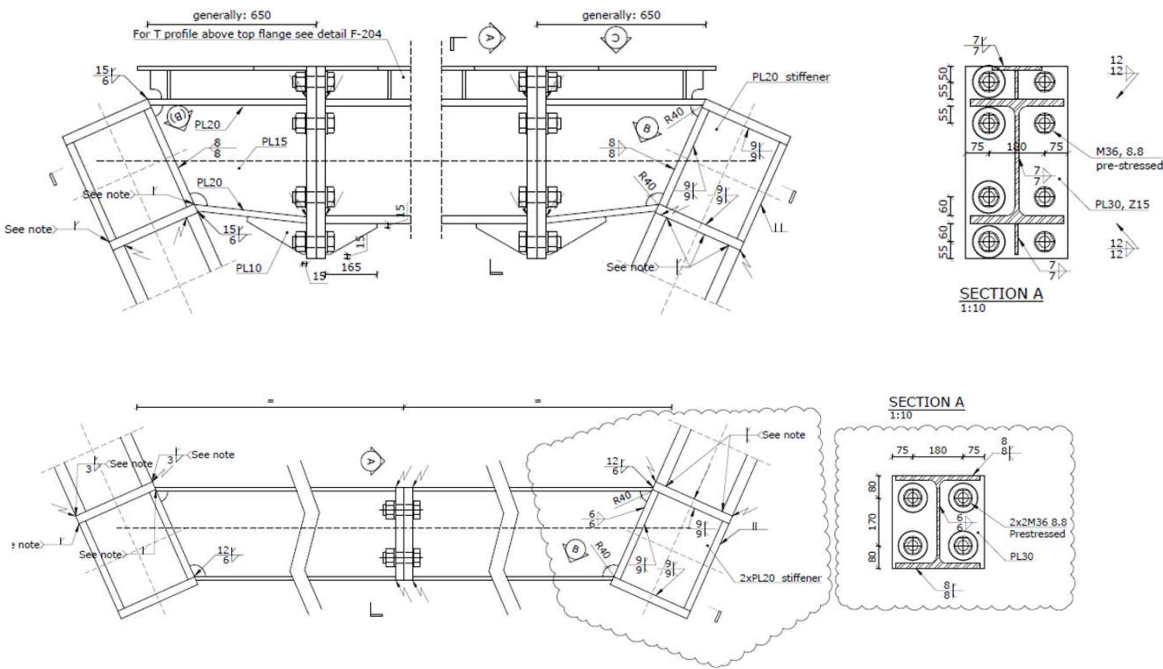
DETAILS



DETAILS



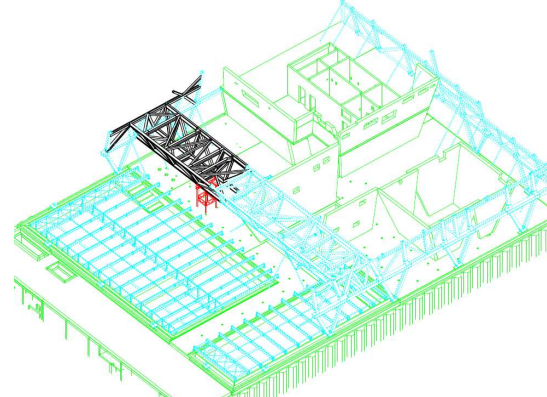
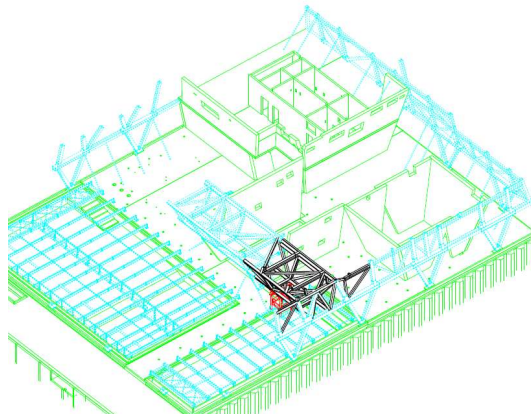
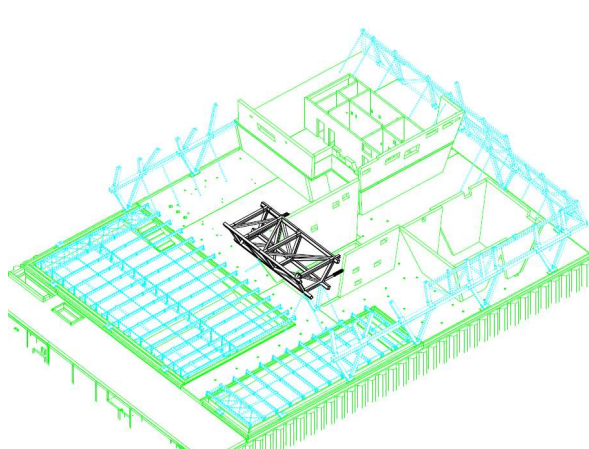
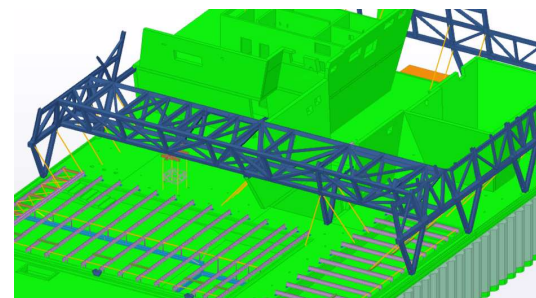
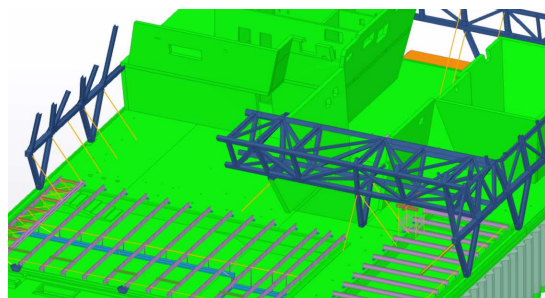
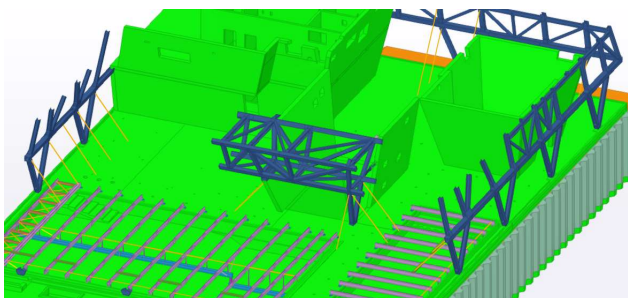
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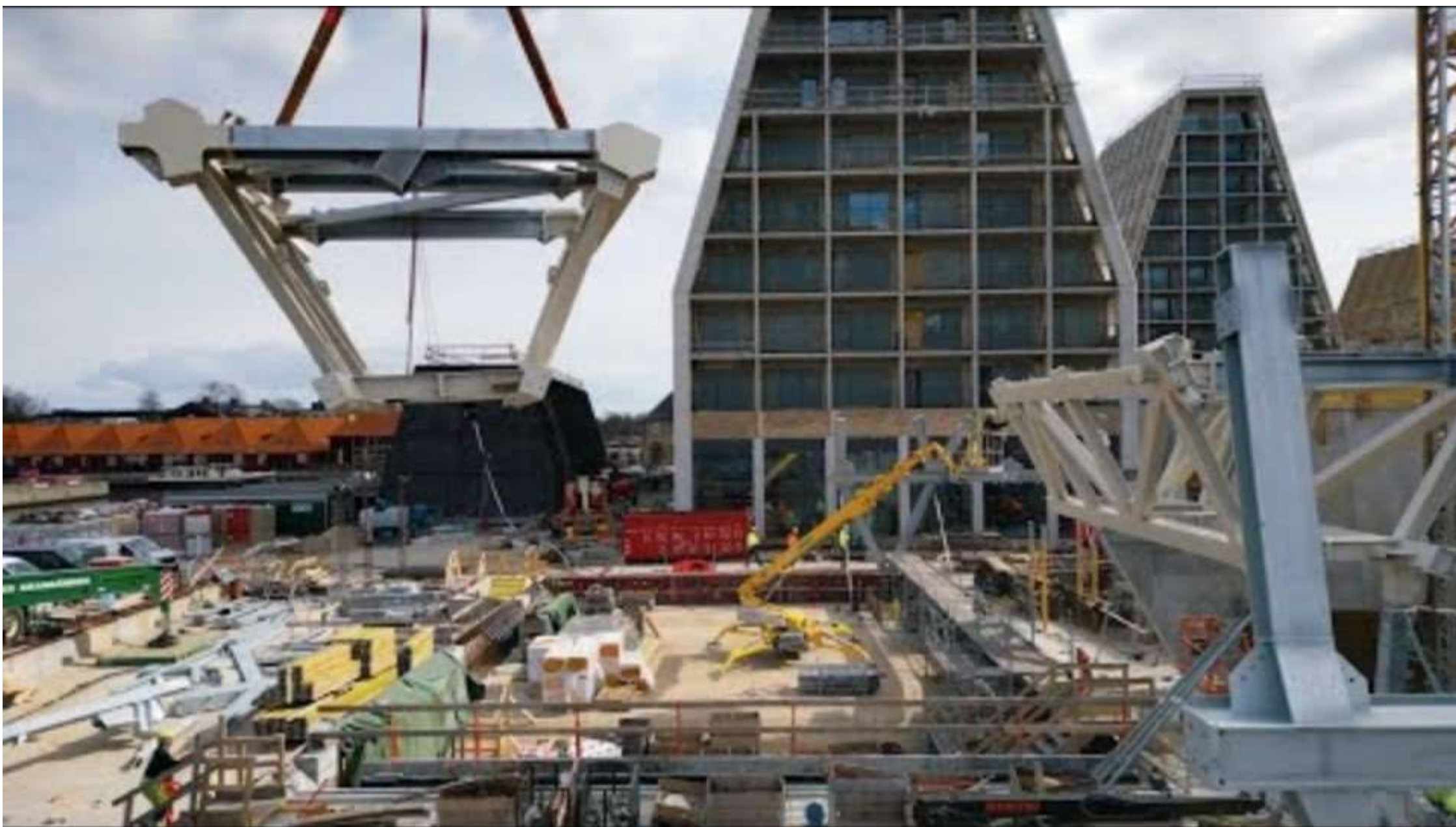


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Statics: NOT OK	Statics: OK	Statics: OK
Function: OK	Function: NOT OK	Function: OK



ERECTION SEQUENCE







THANK YOU FOR LISTENING!

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