Atriumtrappen i The Stamp

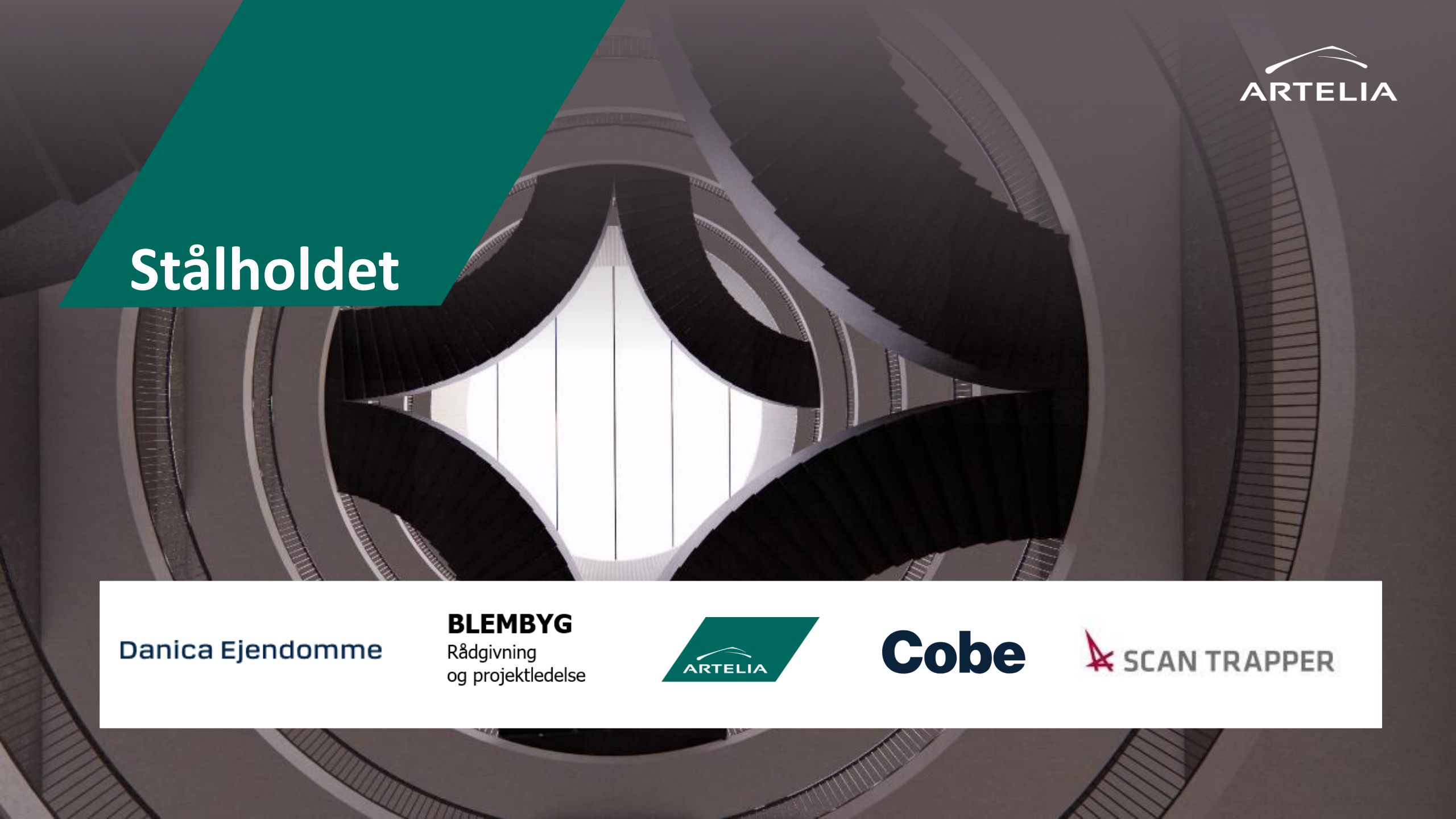
Den Europæiske Stålpris 2026

Dansk Ståldag



Peter Madsen Nordestgaard

Stålholdet



Danica Ejendomme

BLEMBYG
Rådgivning
og projektledelse

ARTELIA

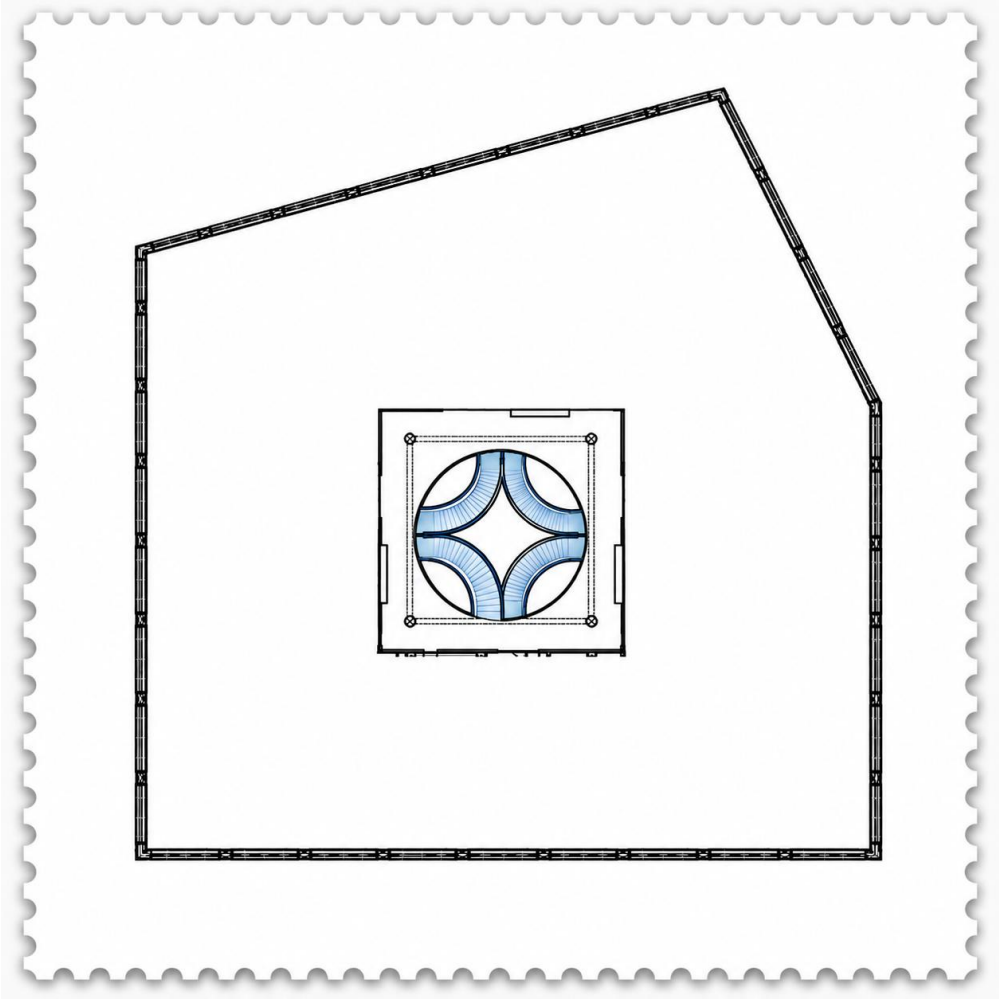
Cobe

SCAN TRAPPER


Lad stålhistorien begynde…

Atriumtrappen

Stempel på bygningen





Det geometriske princip - Kvartcirkler definerer atriets udtryk

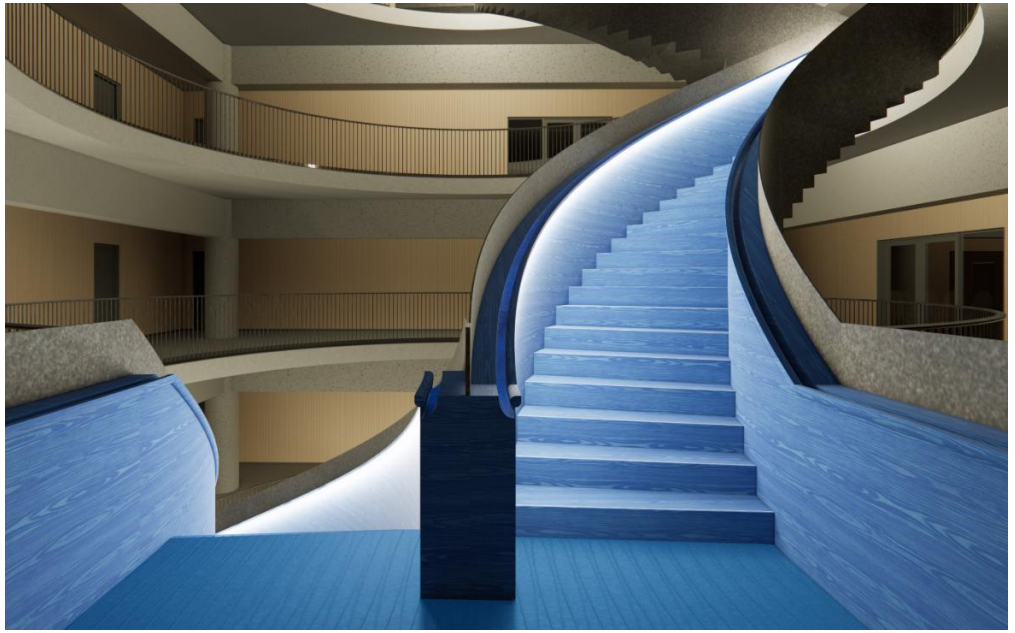








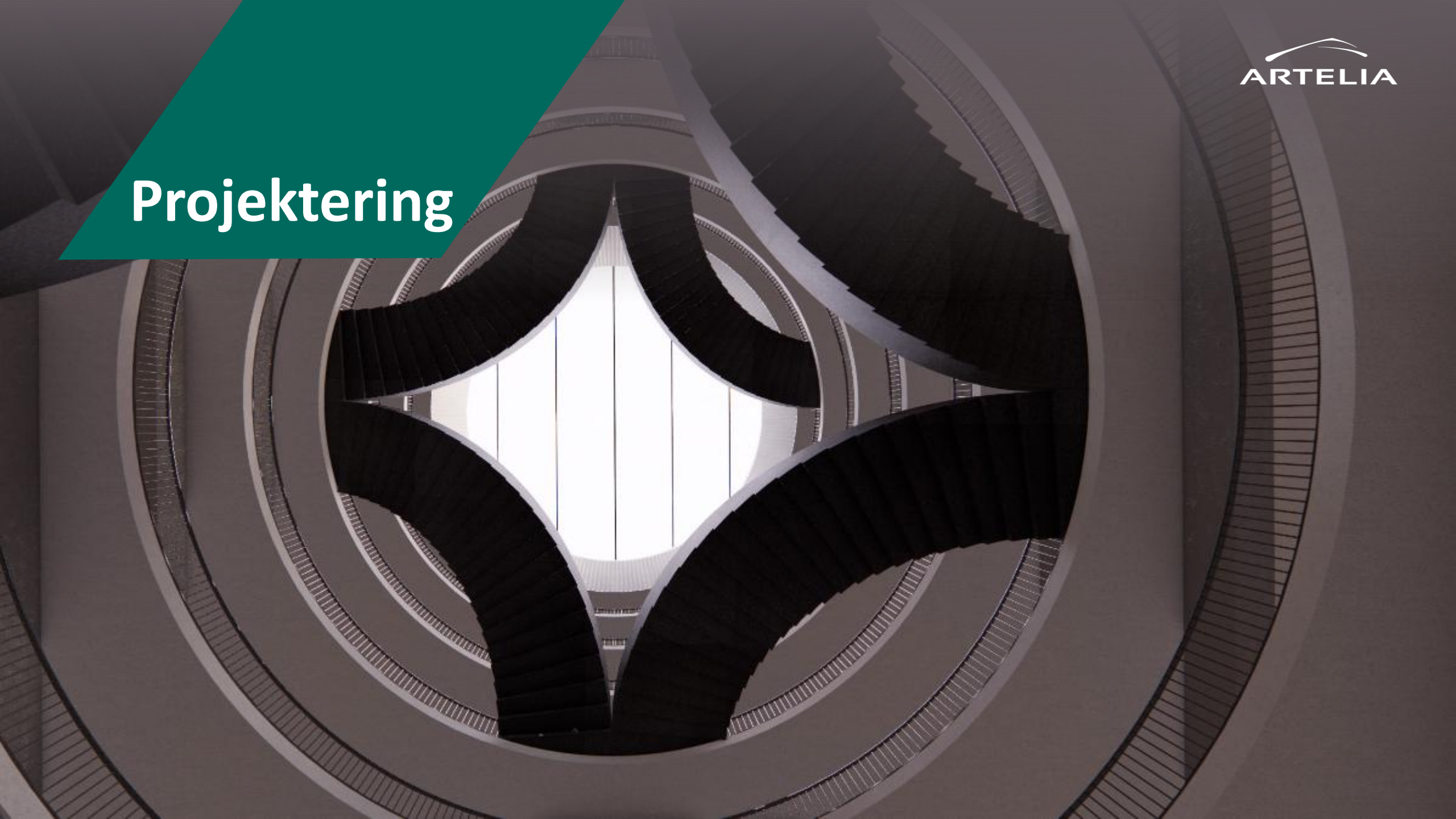




Arkitektonisk prosa - Kunst

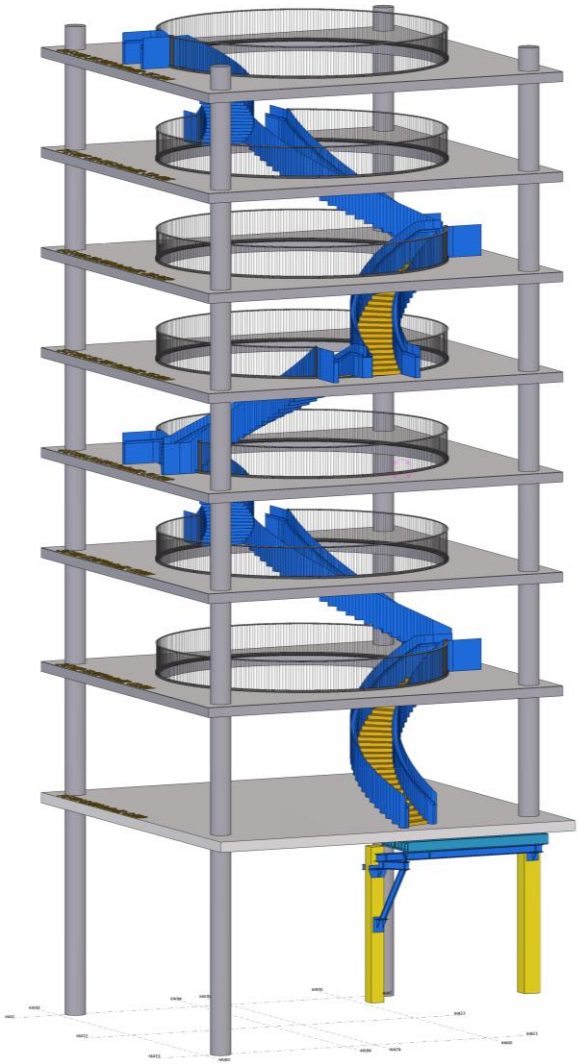
Udgangspunktet for designet er det rationelle, naturlige forløb i et cirkulært rum, hvor geometrien følger cirkelslagets periferi. Forestillingen om ét kontinuerligt trappeforløb rundt i periferien danner grundlag for designets udvikling. Det rene, spiralerende trappeløb deles i plan i fire kvarter, hvor hver kvarte del udgør trappeløb for én etage. De **kvarte løb roteres 90 grader** og sender hvert enkelt **bueslag ud i atriet**, istedet for langs periferien. Således gøres nye etagereposer unødvendige - og de eksisterende, generøse gangforløb omkring atriet udnyttes hertil. Hvert enkelt trappeløb lægges nænsomt ovenpå etagedækkene. Dækforkanter fremstår urørte og trappen optræder skulpturelt med respekt for de rene cirkler. I rumlige perspektiver opleves trappen næsten flydende, mens den stramme, geometriske præcision samler sig omkring den vertikale centerakse.

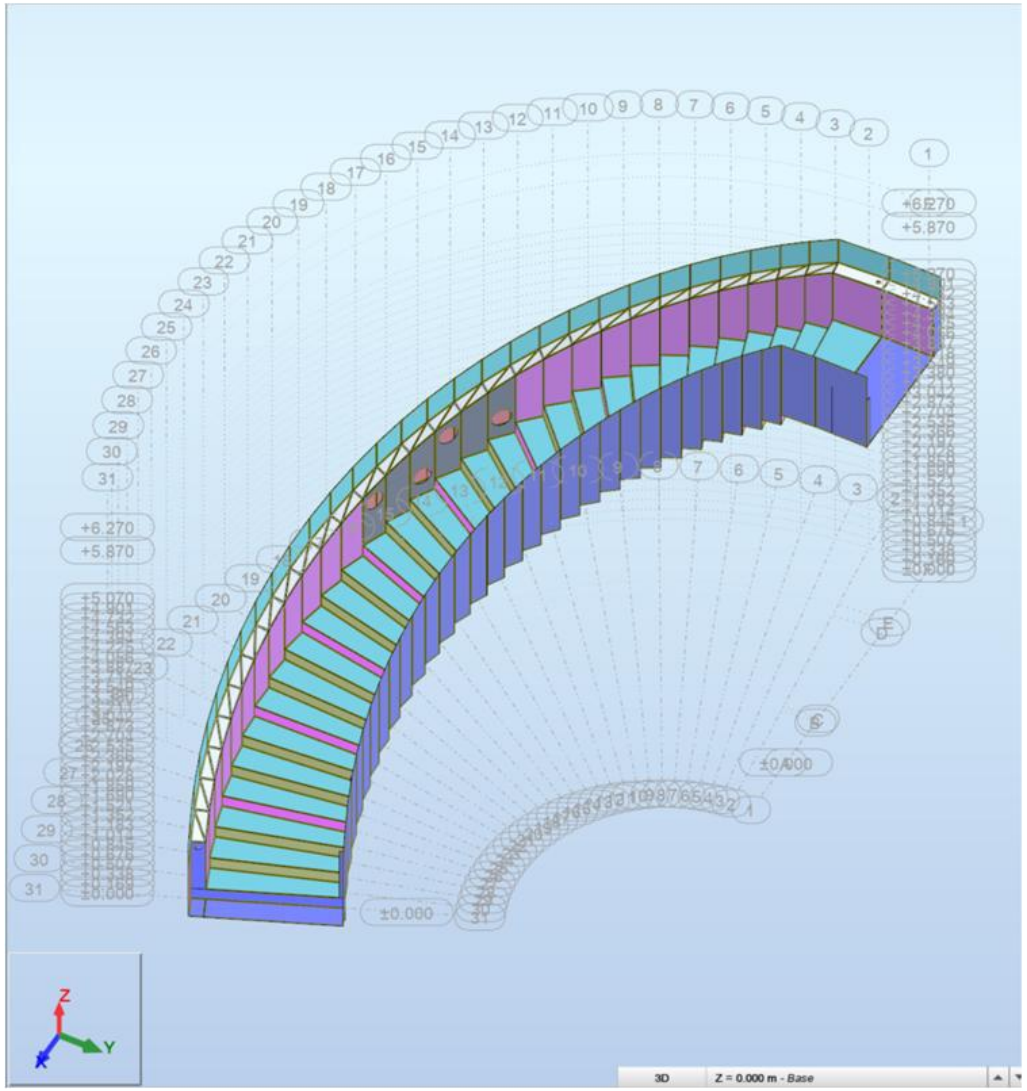
Projektering



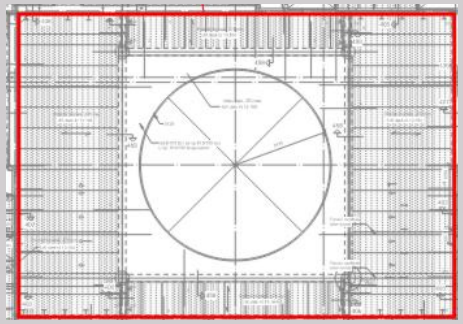
Design - Fra geometri til konstruktion

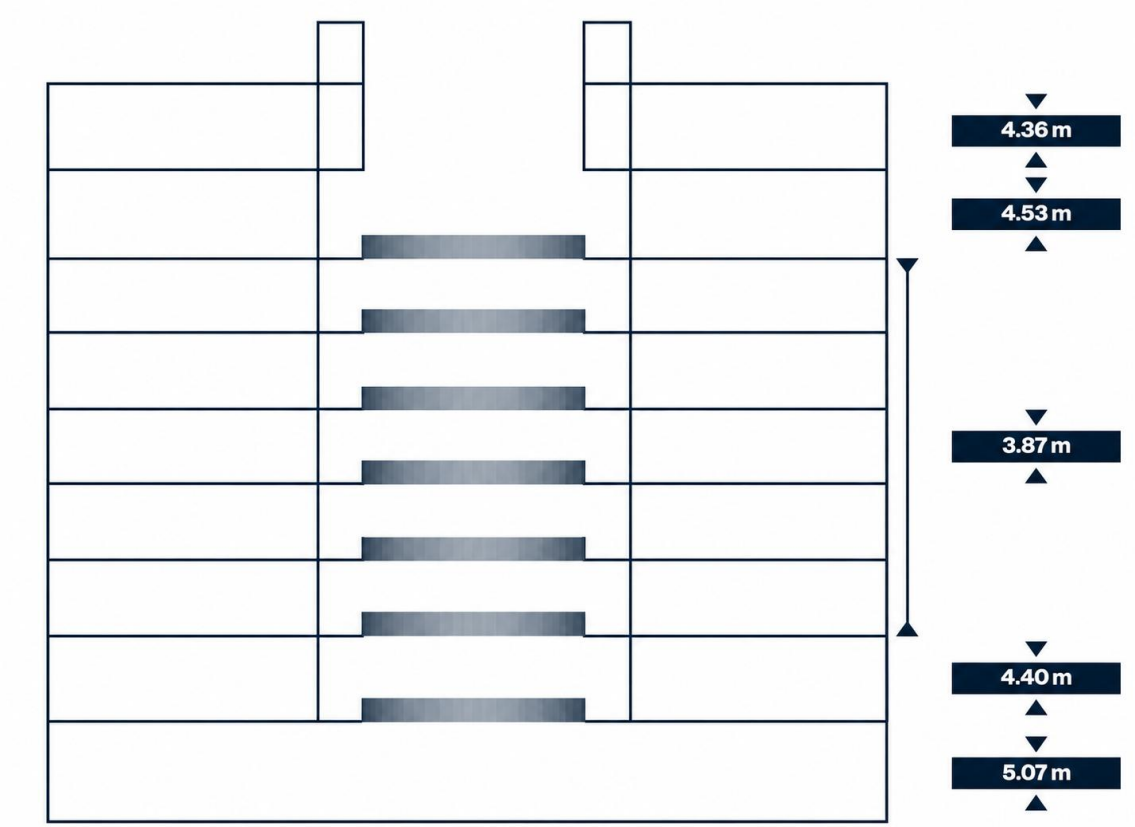
- Understøtninger
- Vanger
- Tværstabilitet
- Svejsninger
- Optimering
- Komfort



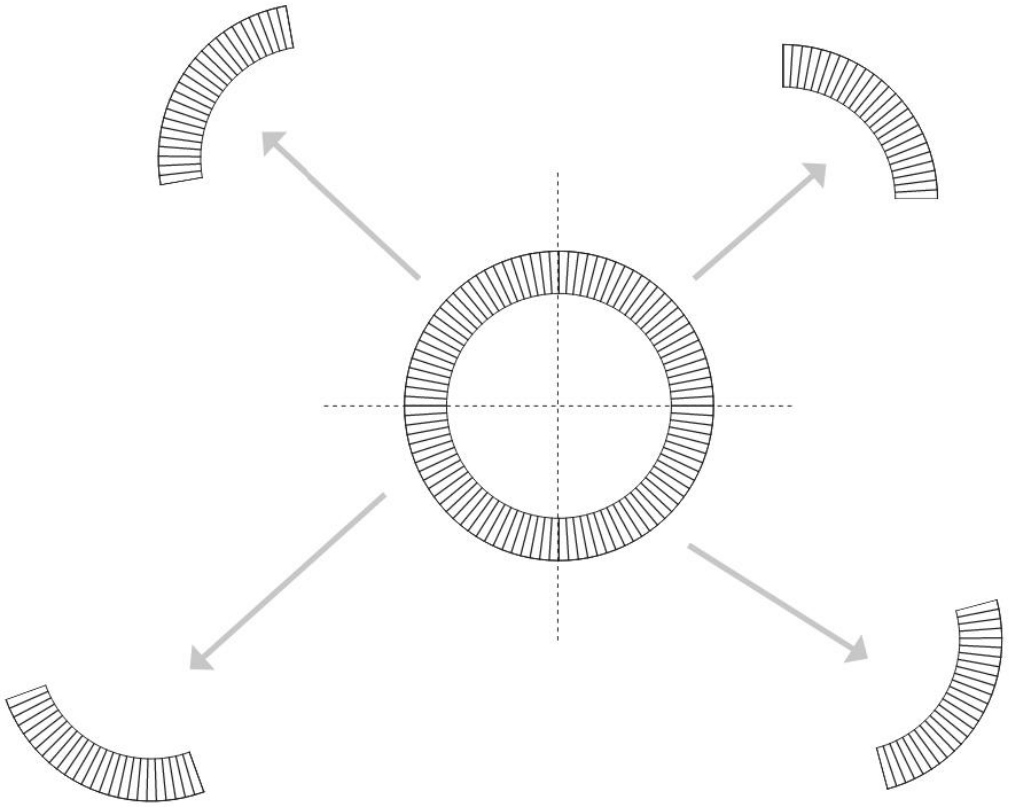


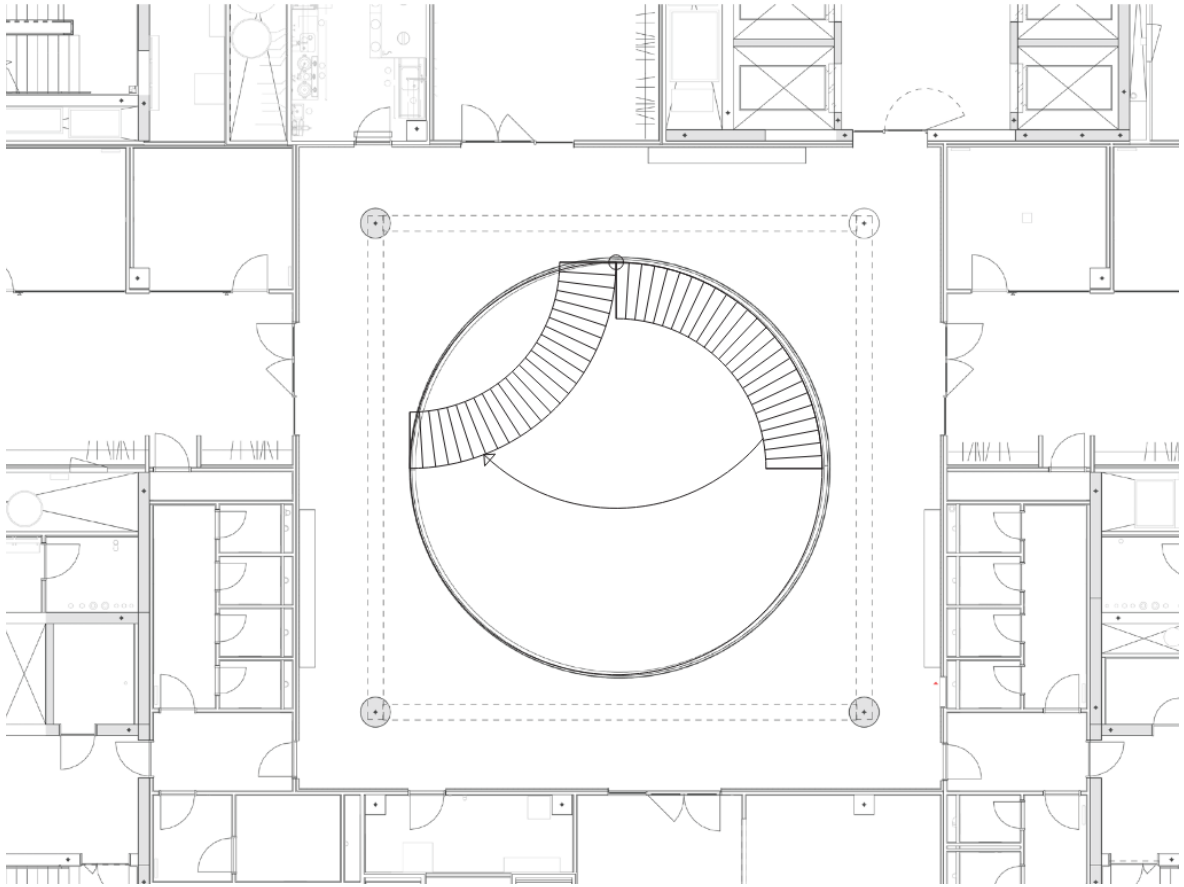
Eksisterende konstruktioner



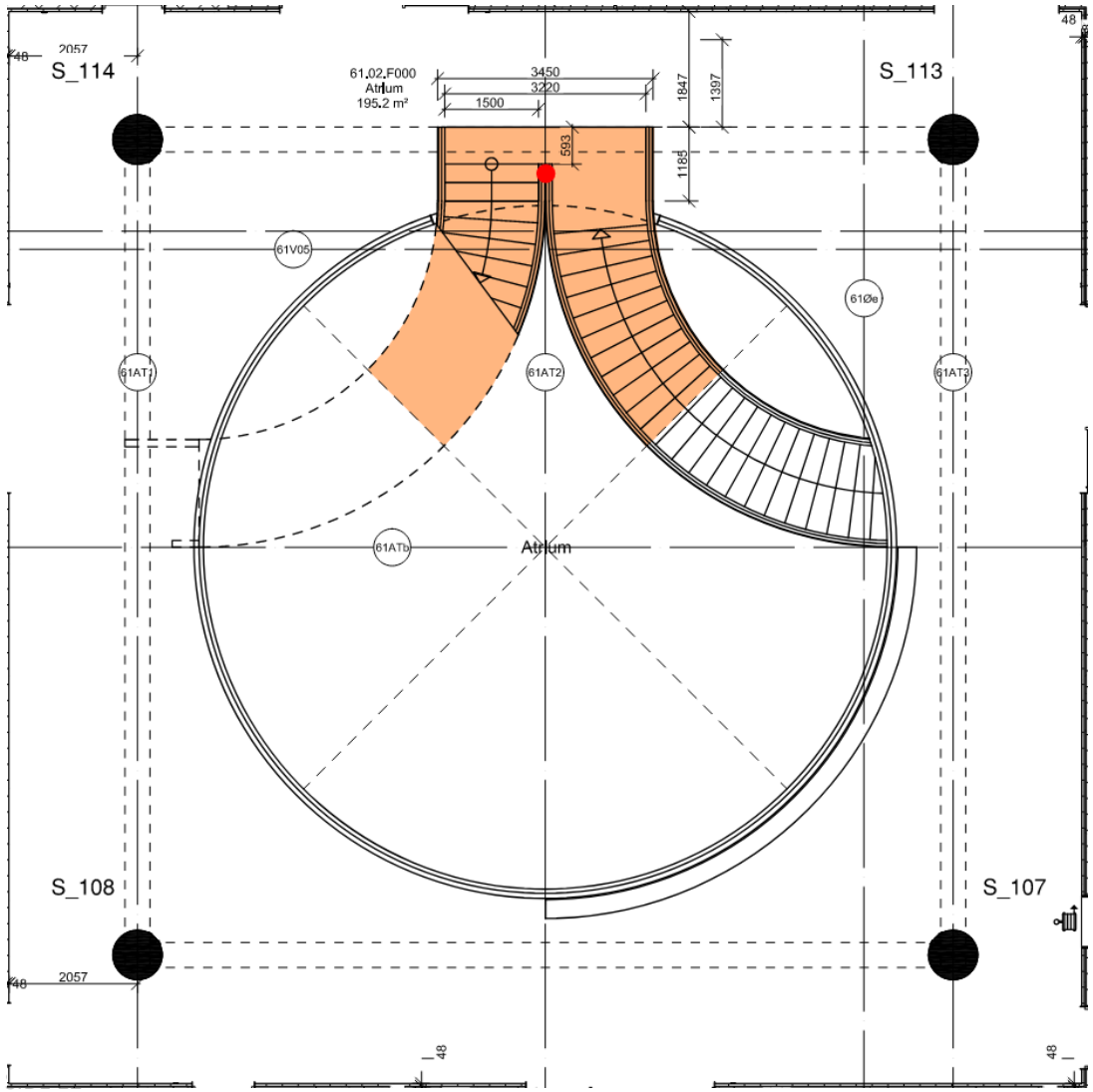


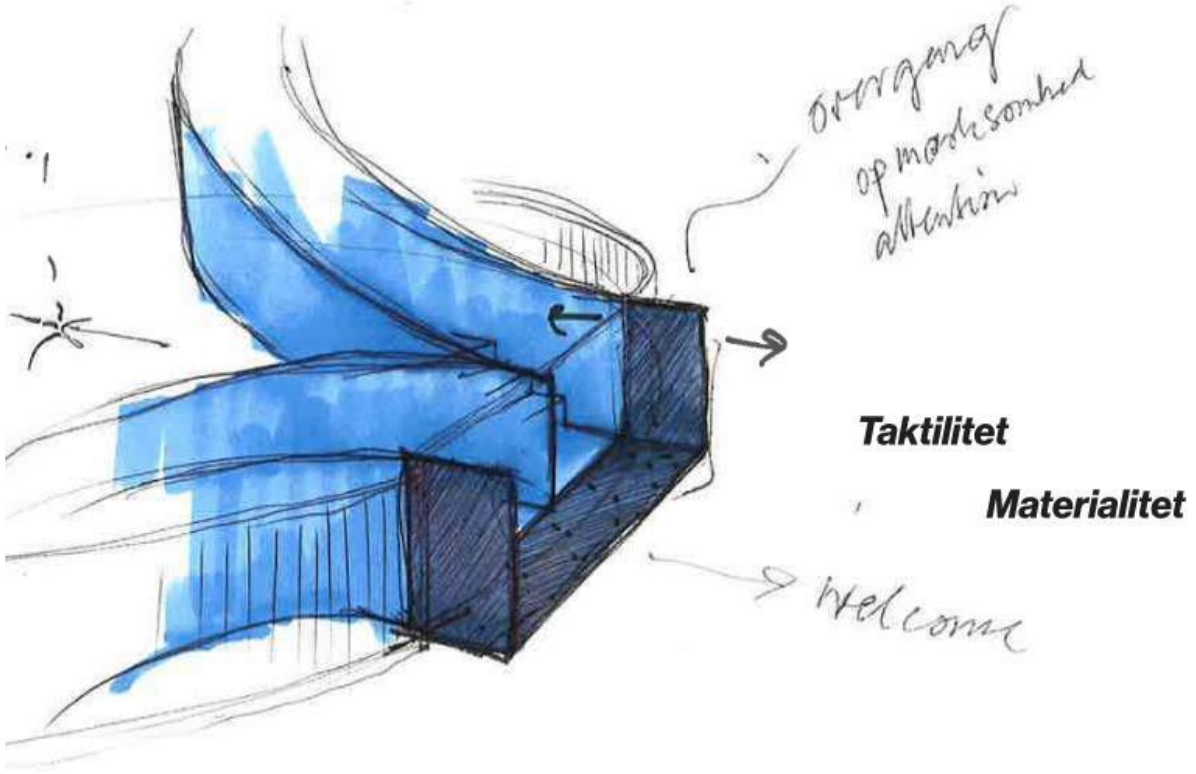
Klassisk spiraltrappe brudt op i stykker og sammensat på ny





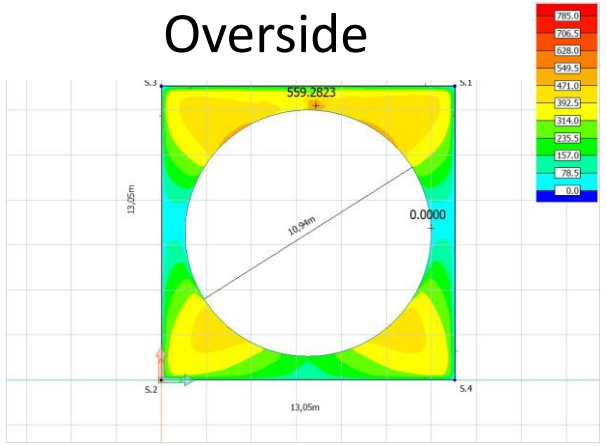
Samling ind ovenpå eksisterende dæk



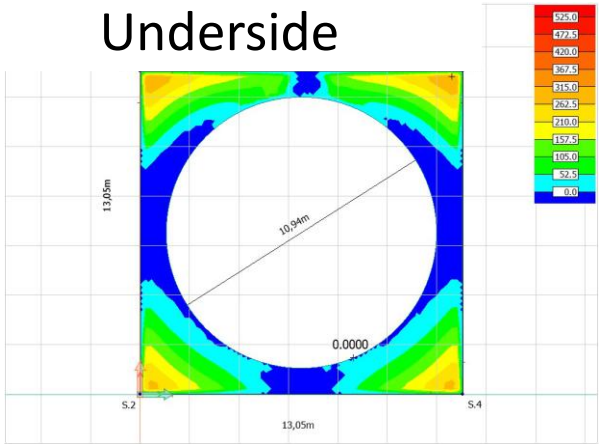


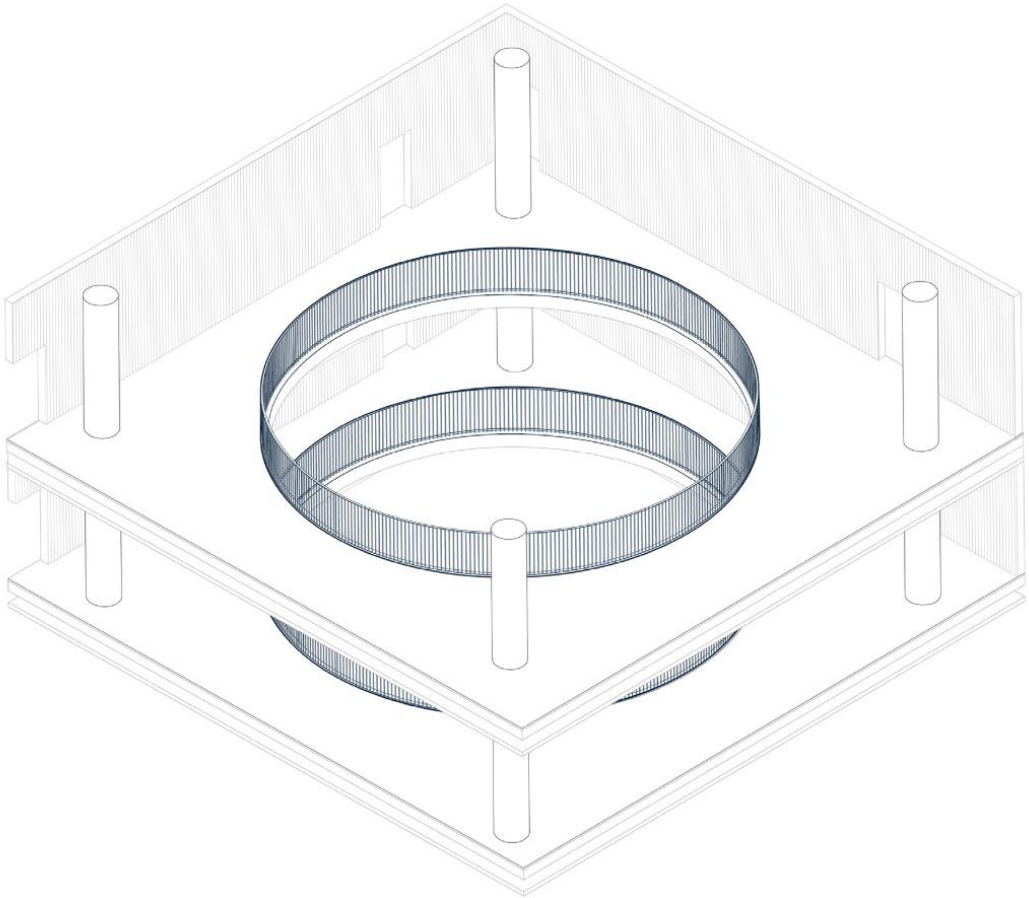
Eksisterende betonkonstruktion

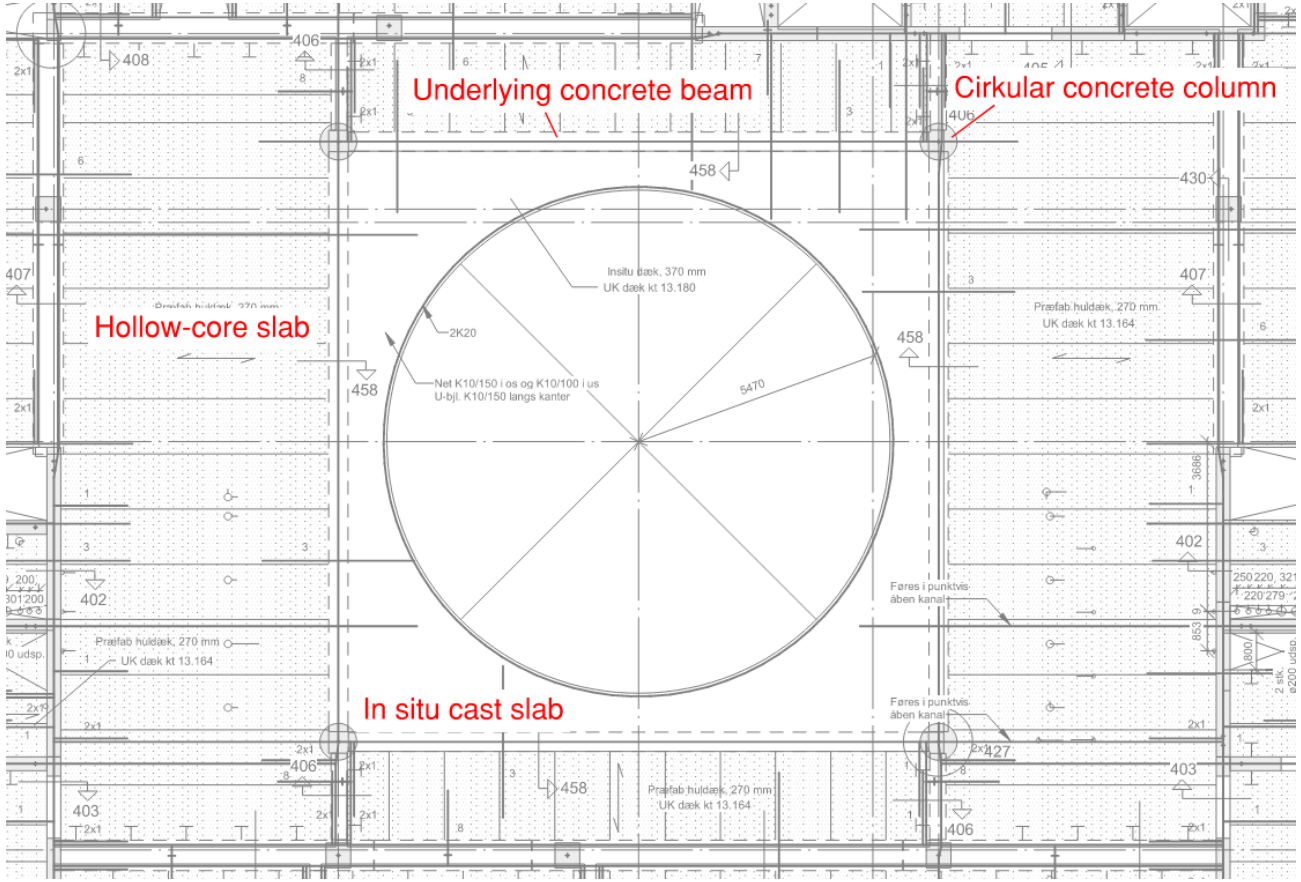
Overside



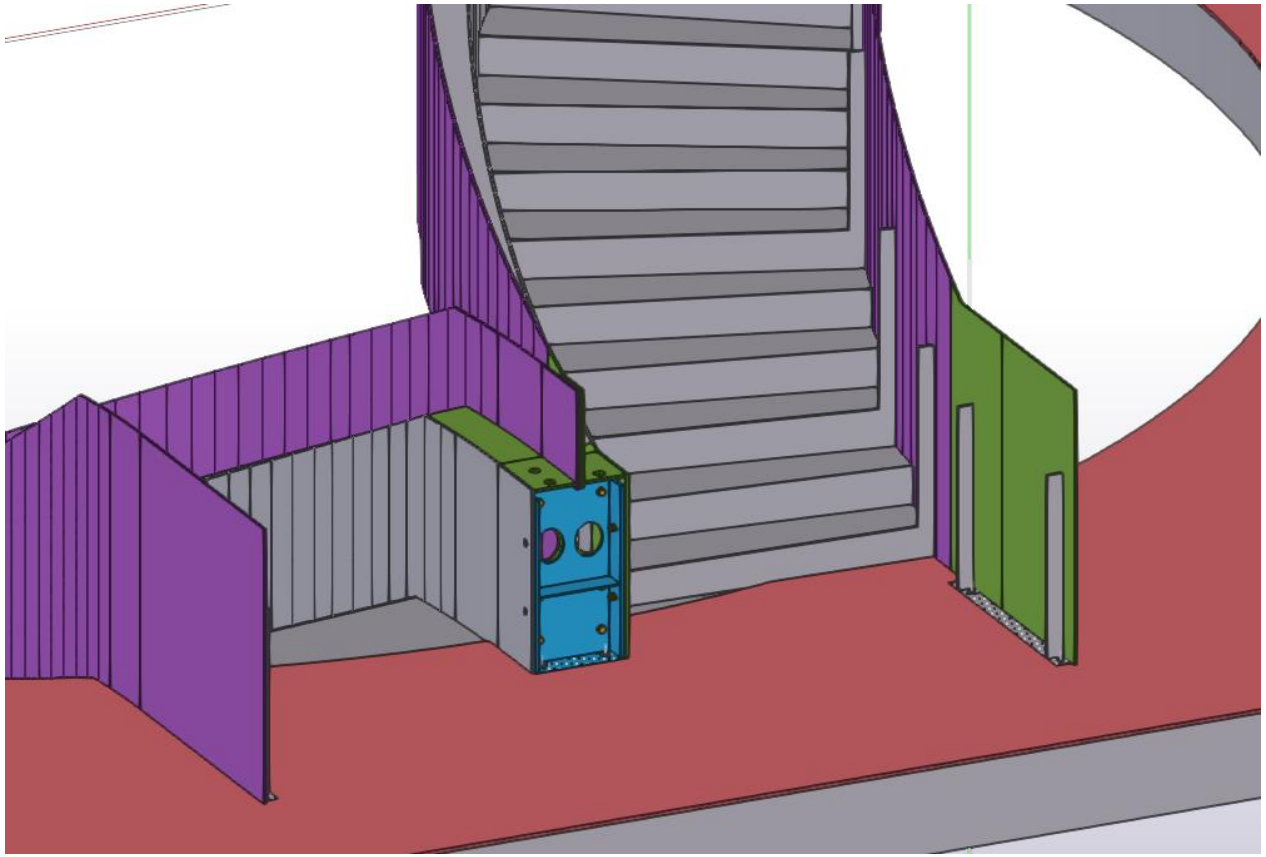
Underside







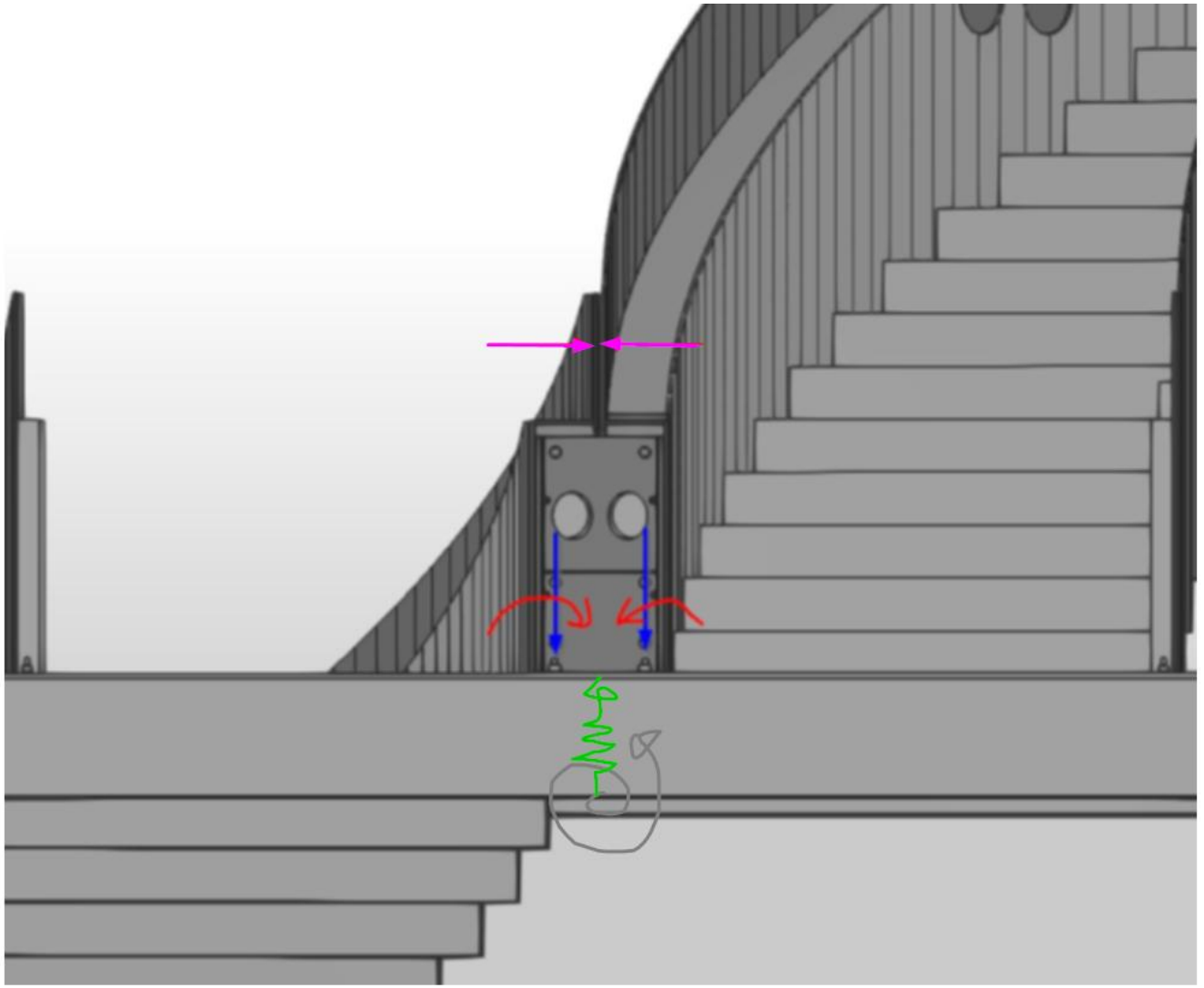
Repos samlet via UNP-profi





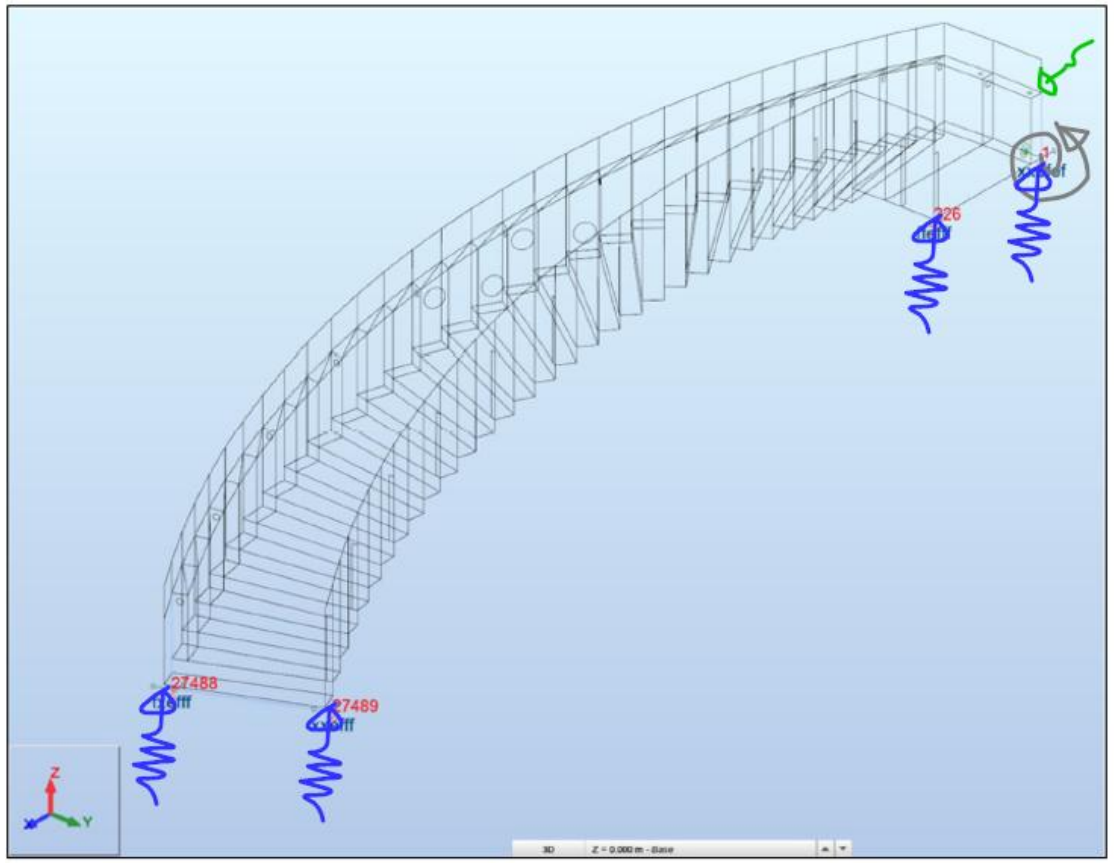
Trapper samlet i et punkt – Udførelse og Kapacitet



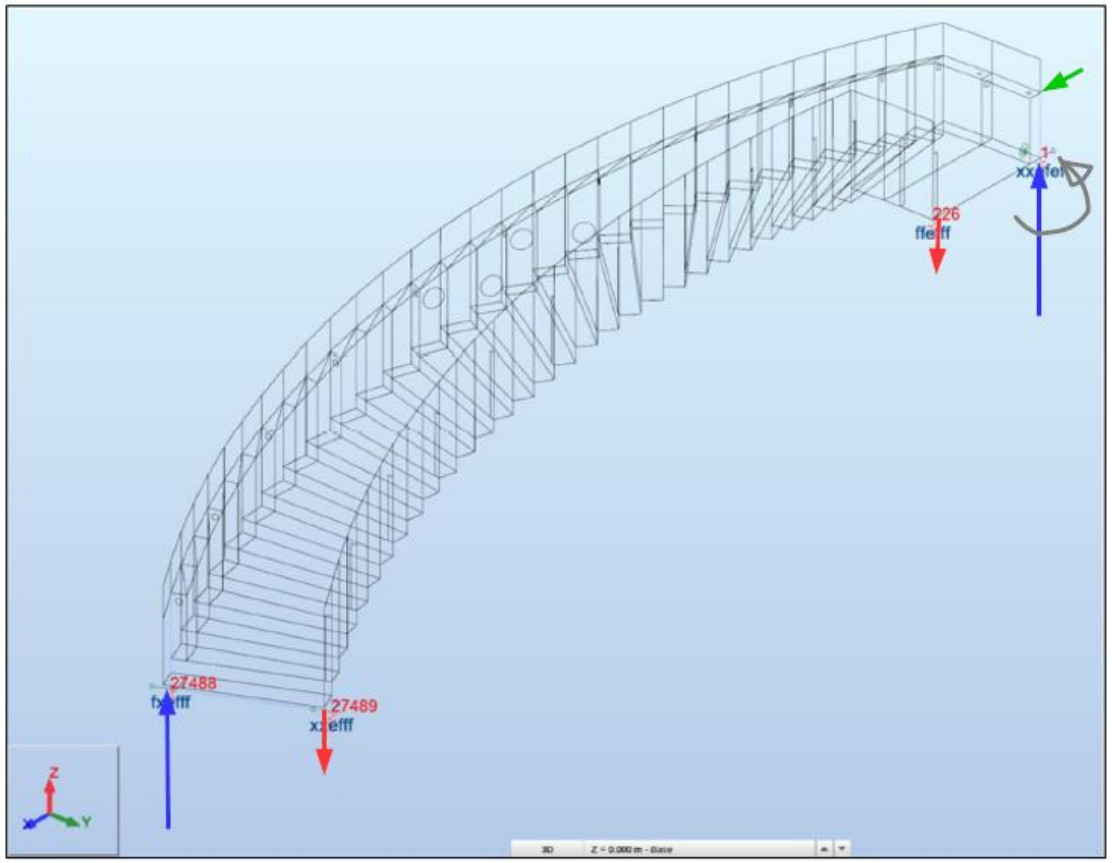


Understøtninger

Fjederunderstøtninger

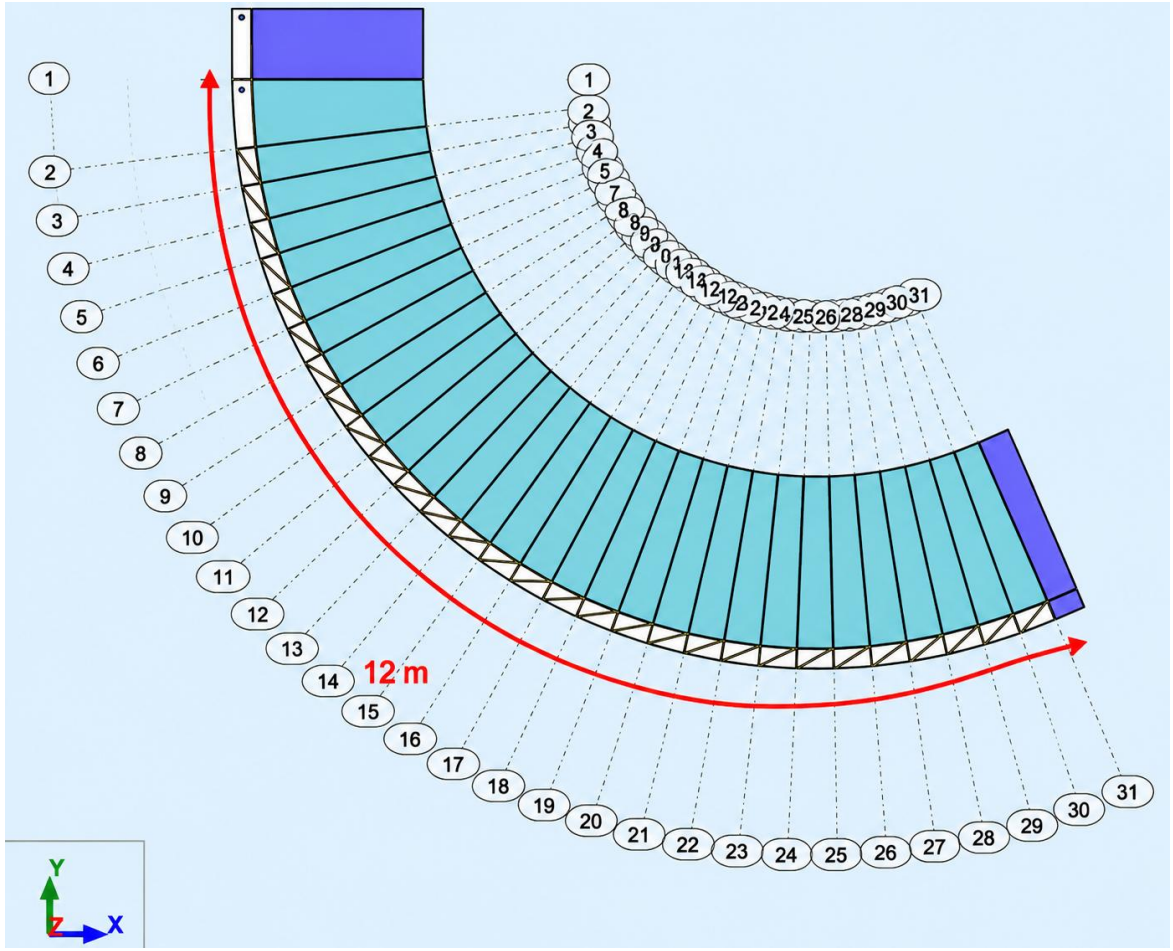


Reaktioner

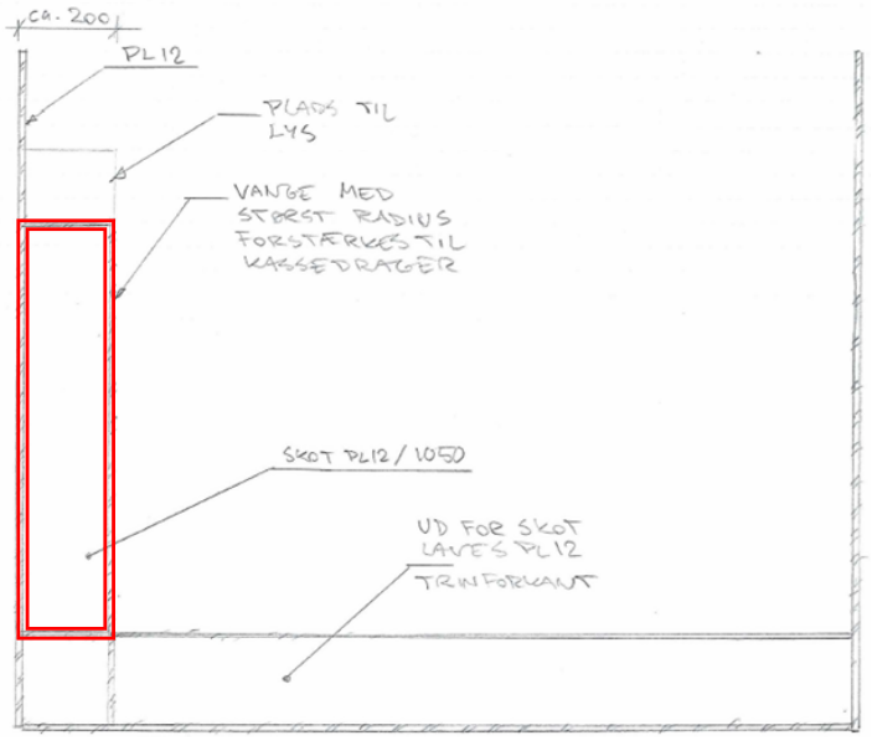


12 m spænd uden mellemunderstøtninger

Kasseprofil som i brodragere

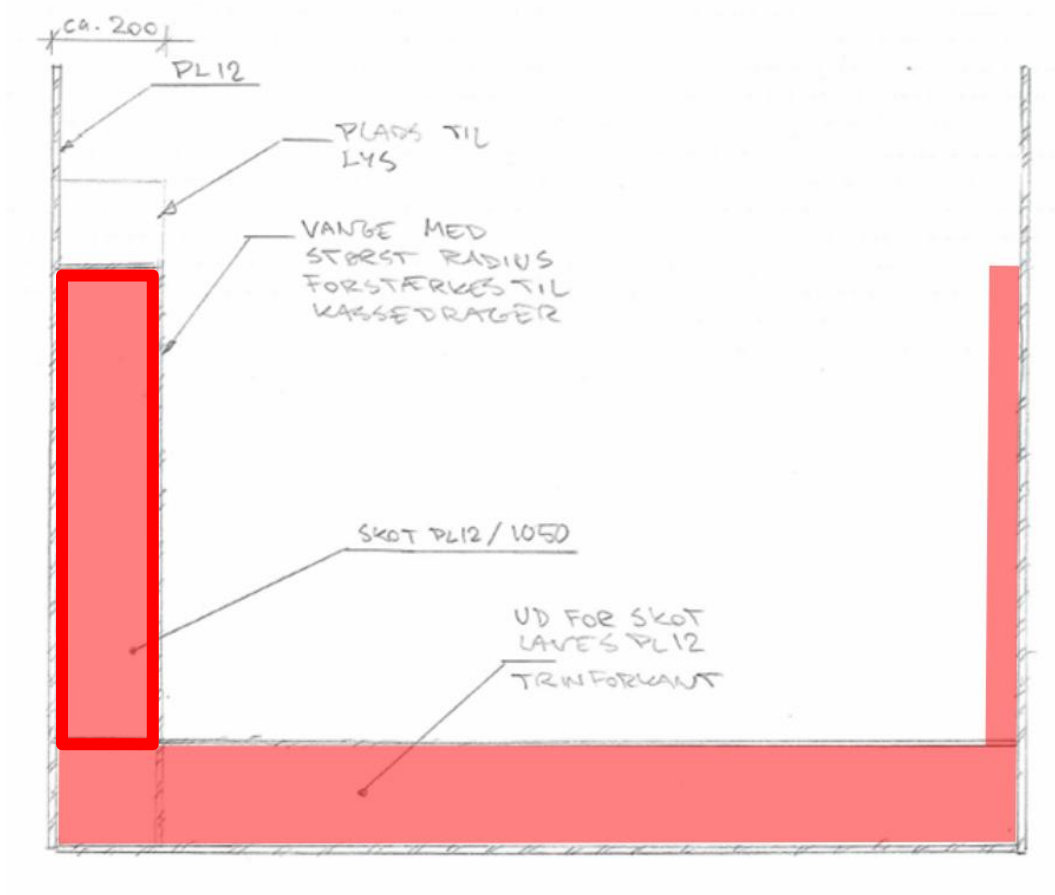


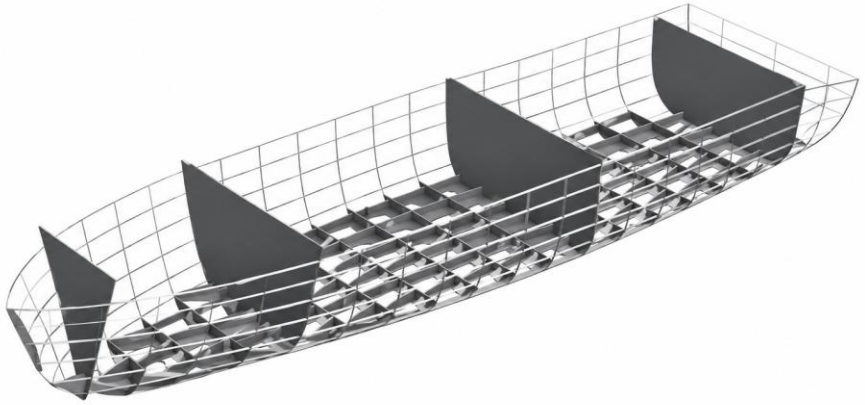


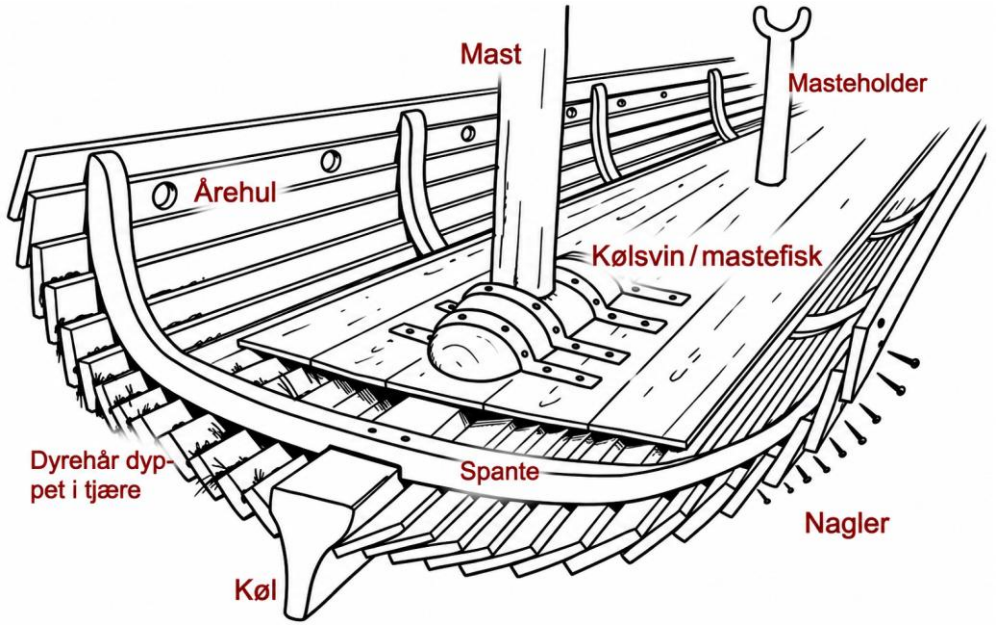


Tværstabilitet skal sikres pga. krumning

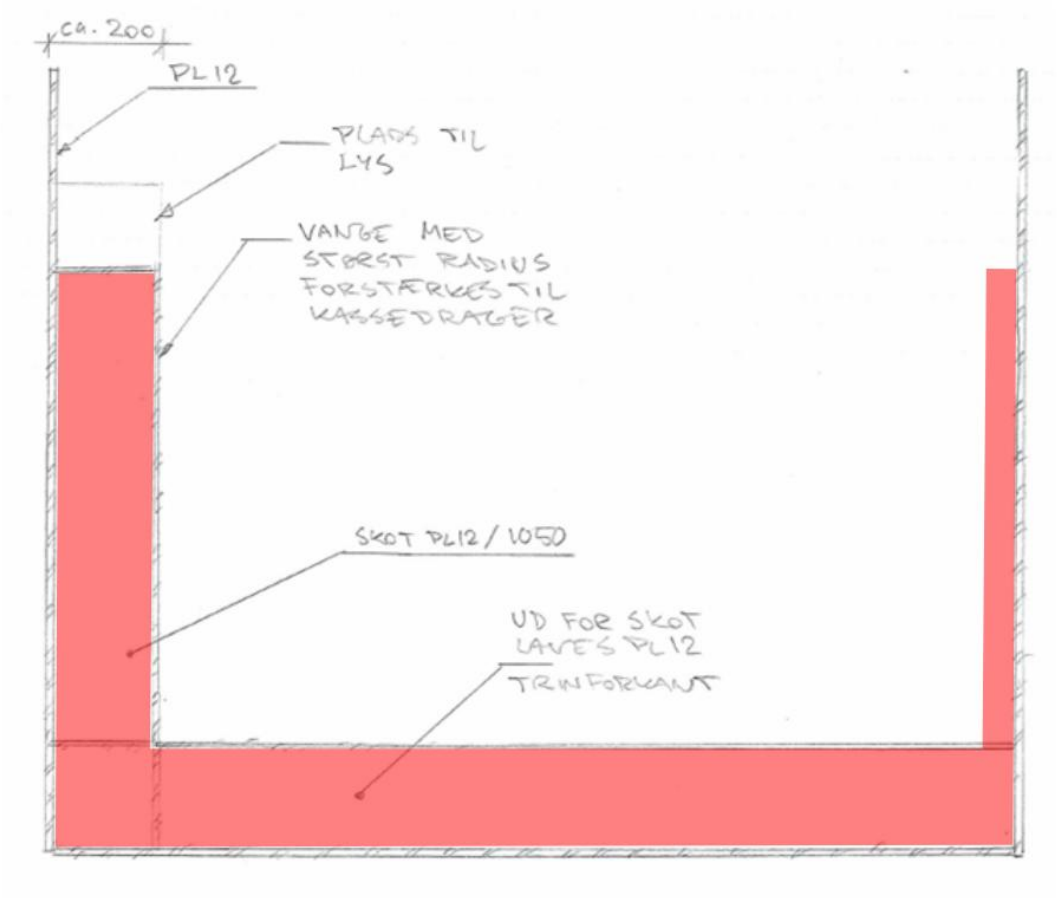
Skot + Spanter som i skibe

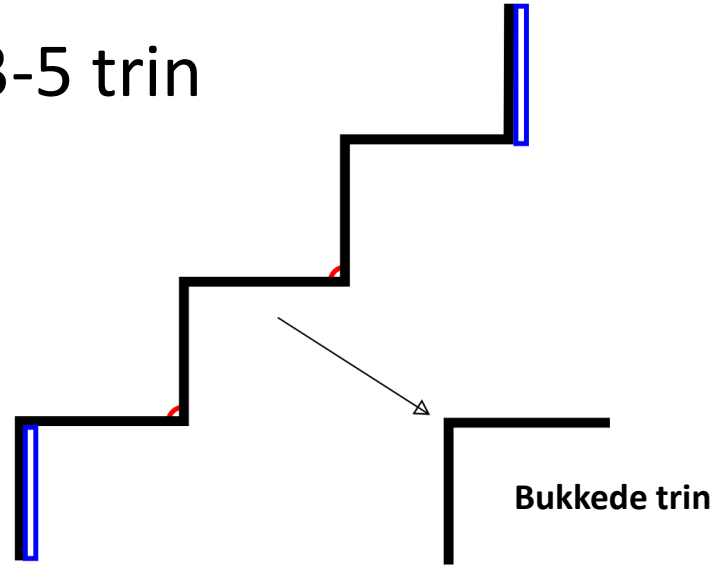


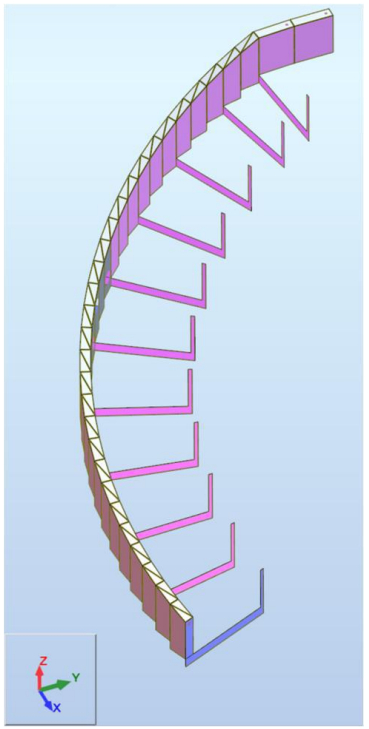


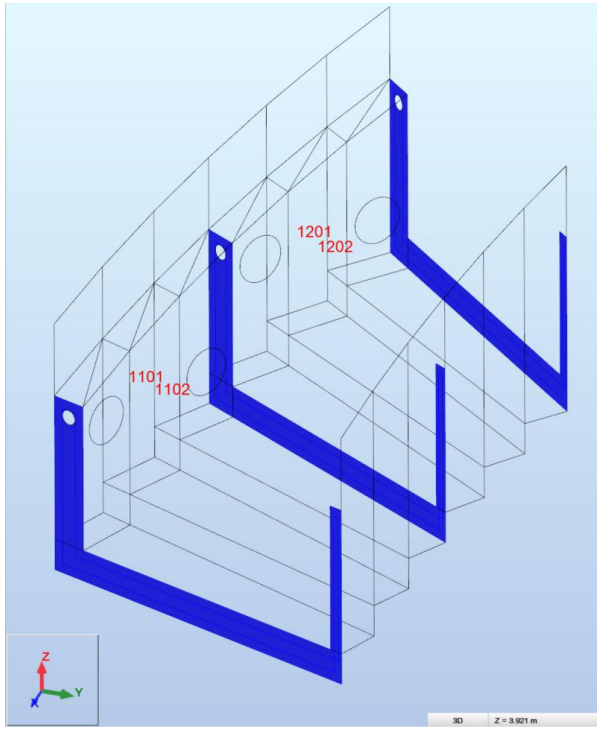


Differentiering af trin: Skot/Spanter hvert 3-5 trin

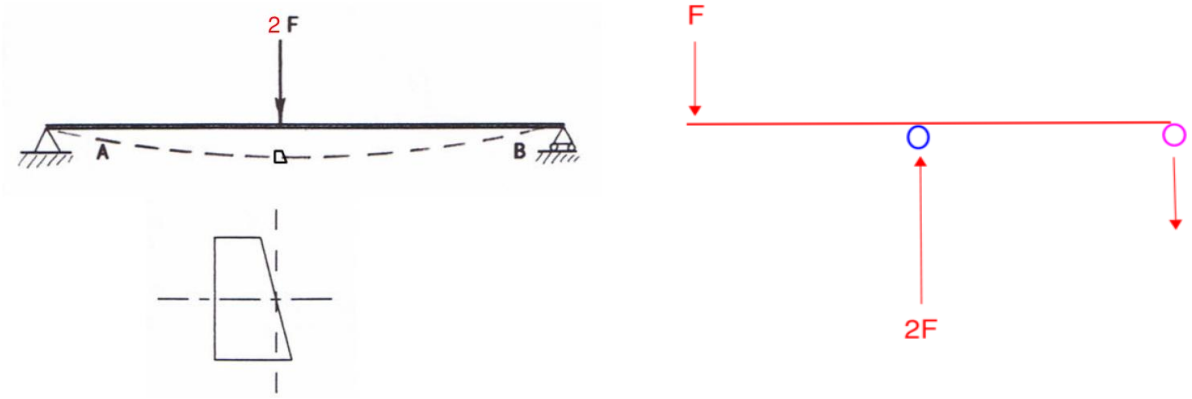


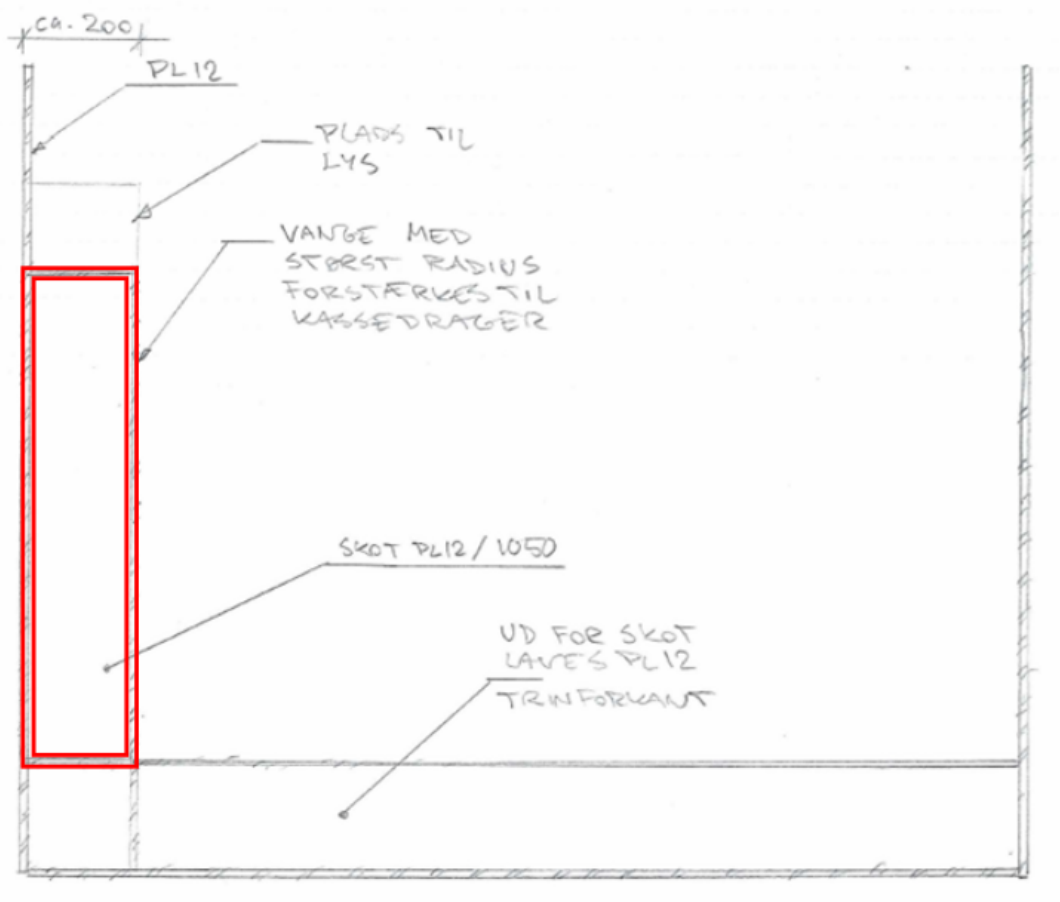


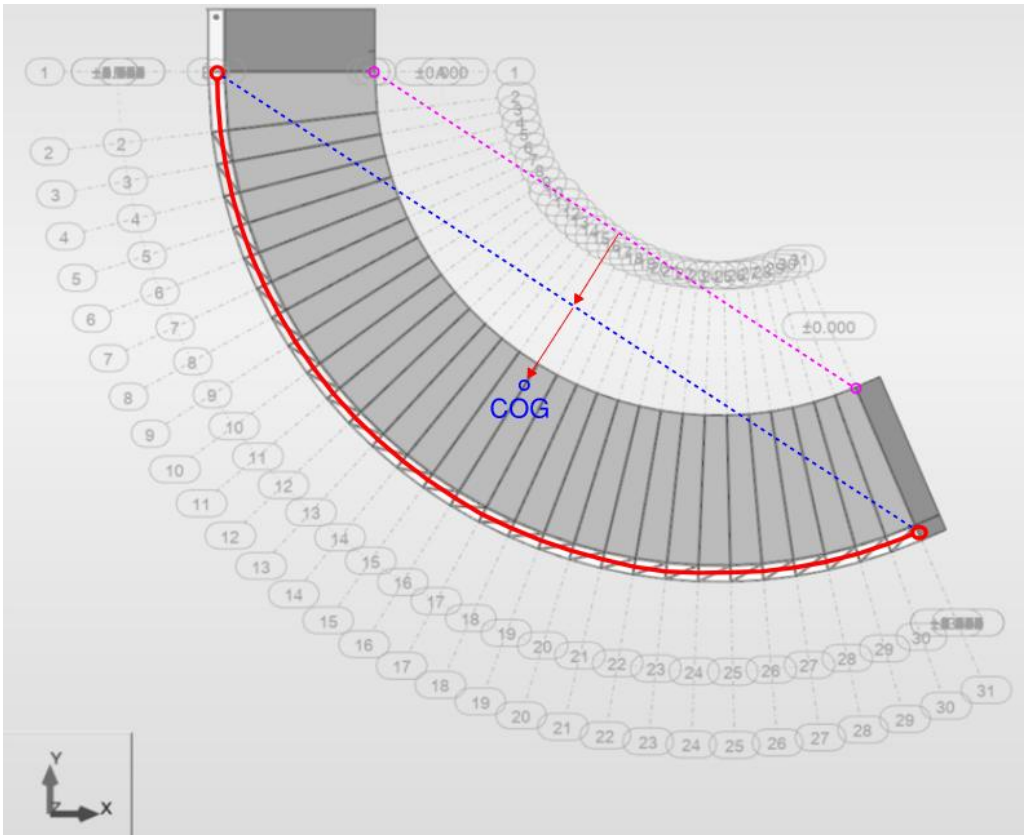




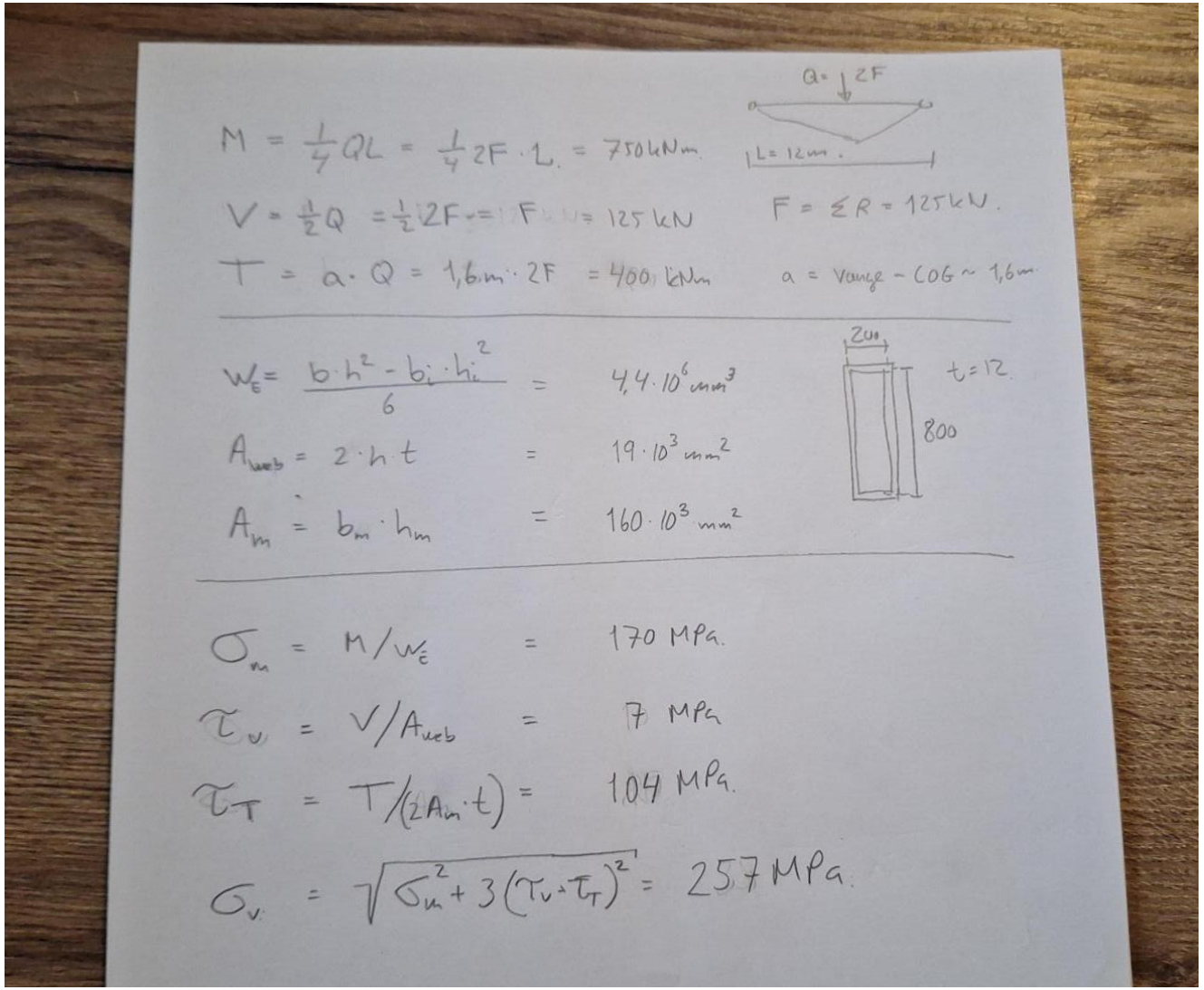
Vridning / Excentricitet



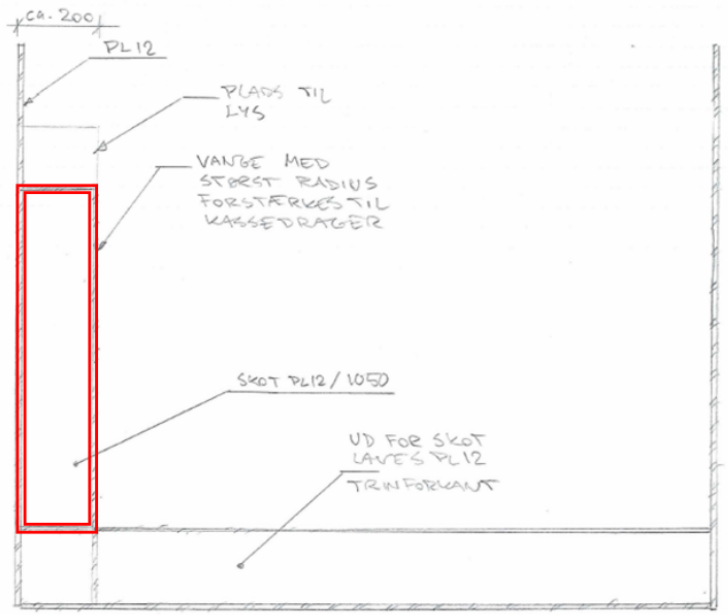




Design → Overslag → Optimering

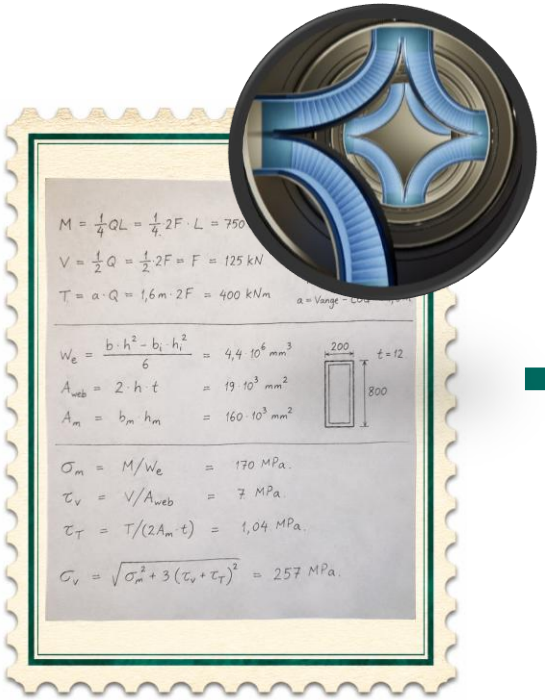


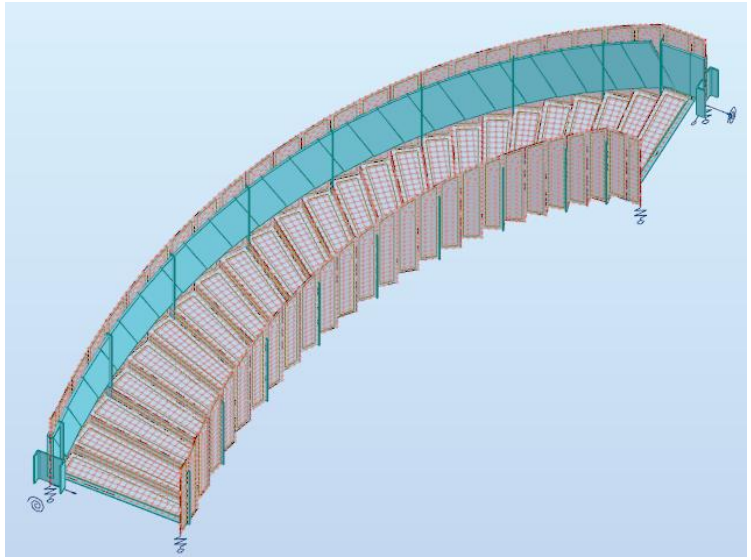


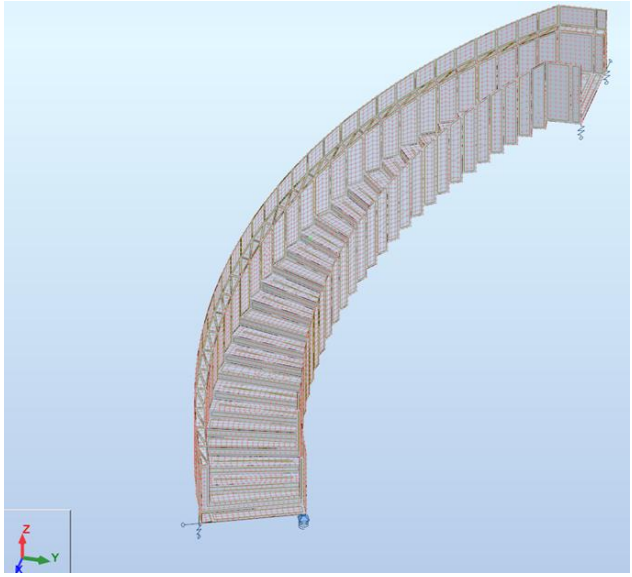


Detailprojektering og Optimering

Håndberegning → Bjælkemode → ”Helt krum” skalmodel





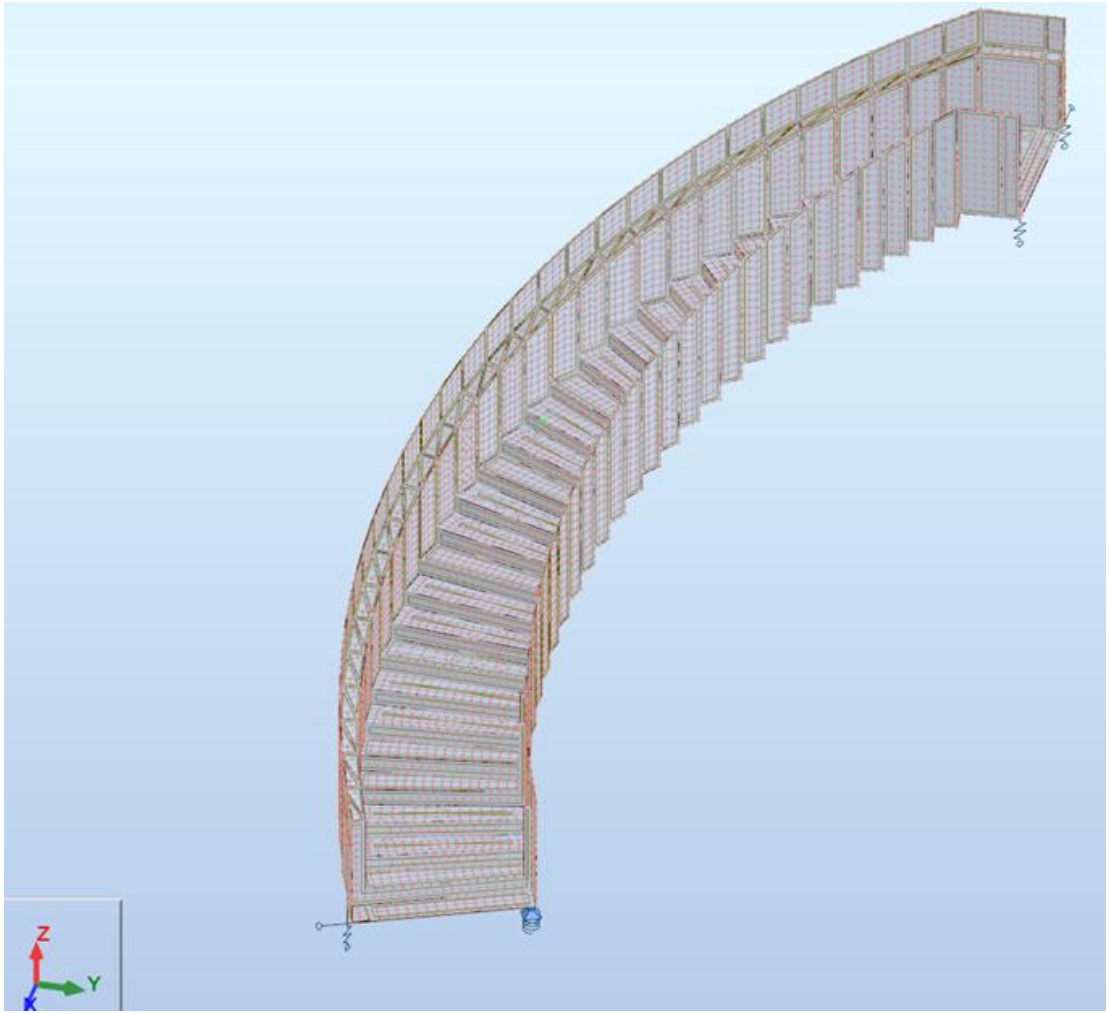


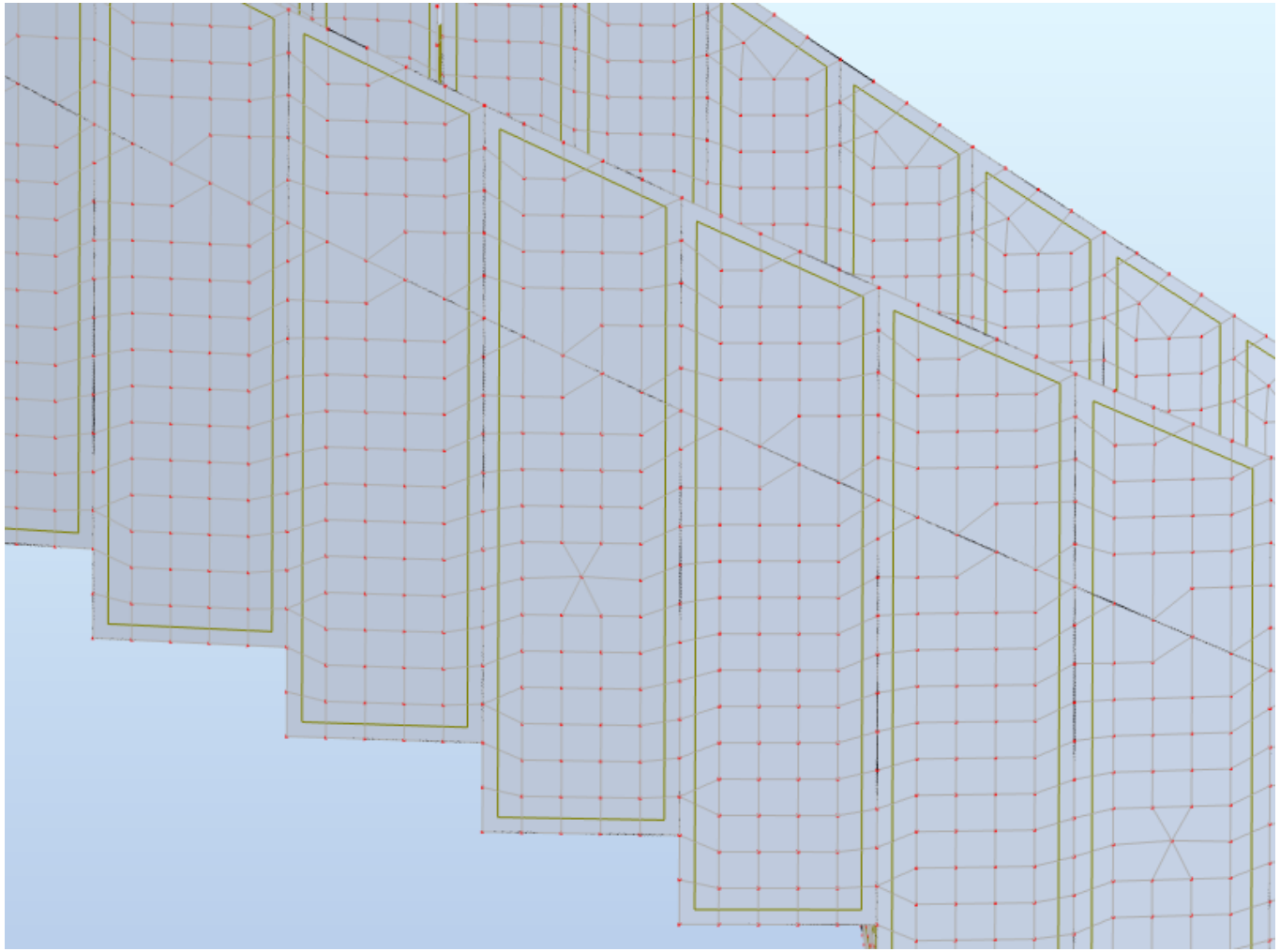
- Understøtninger
- Pladetykkelser
- Svejsninger
- Komfort

FE-skalmodel

Robot 3D-modellering

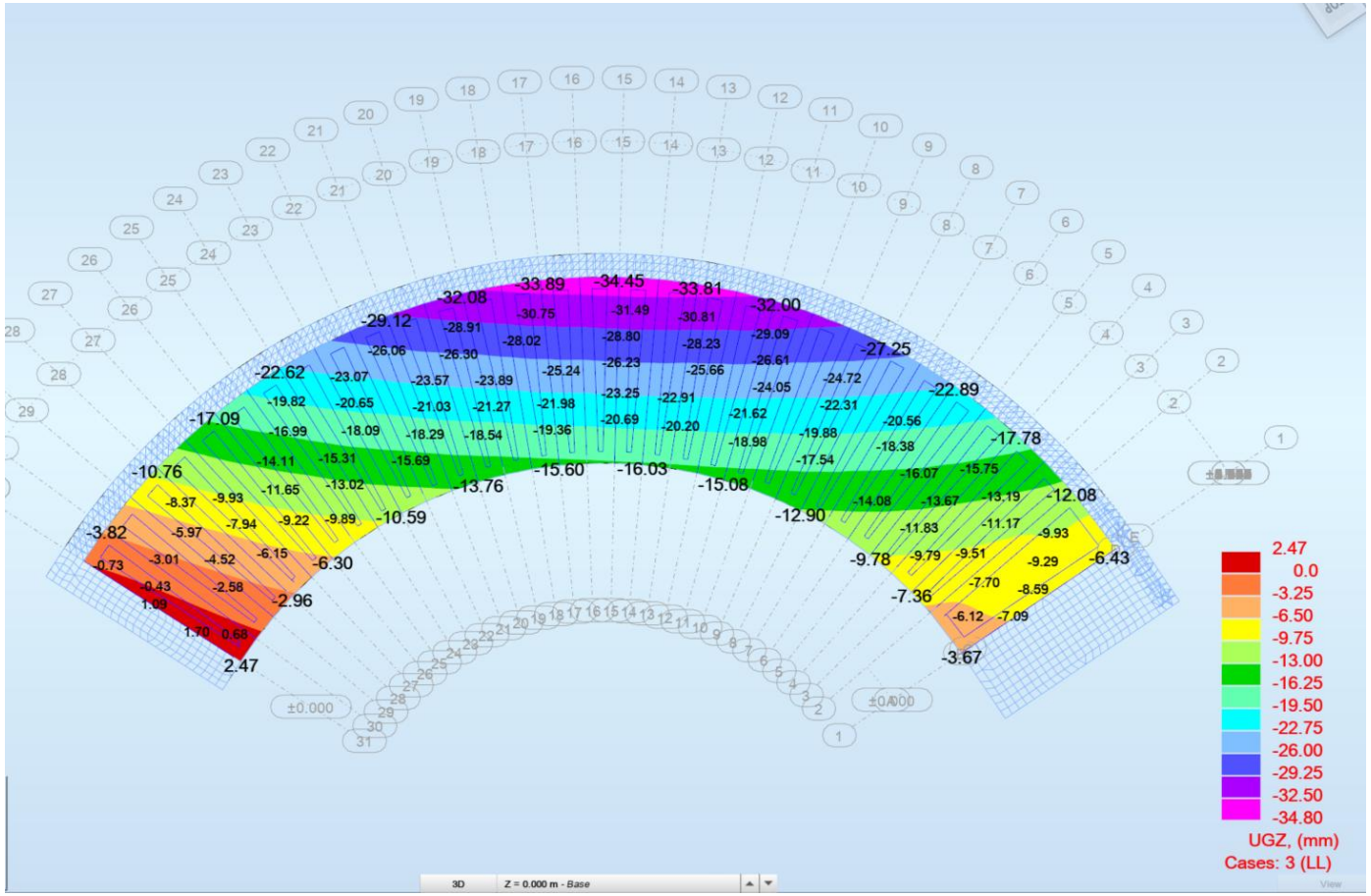
Autodesk Robot 2026

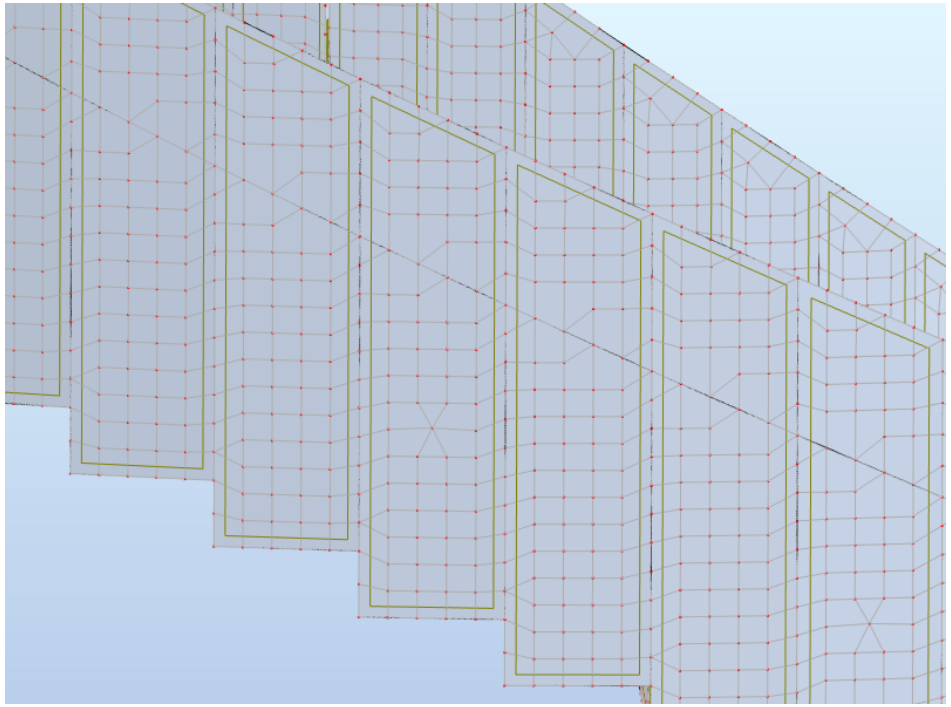


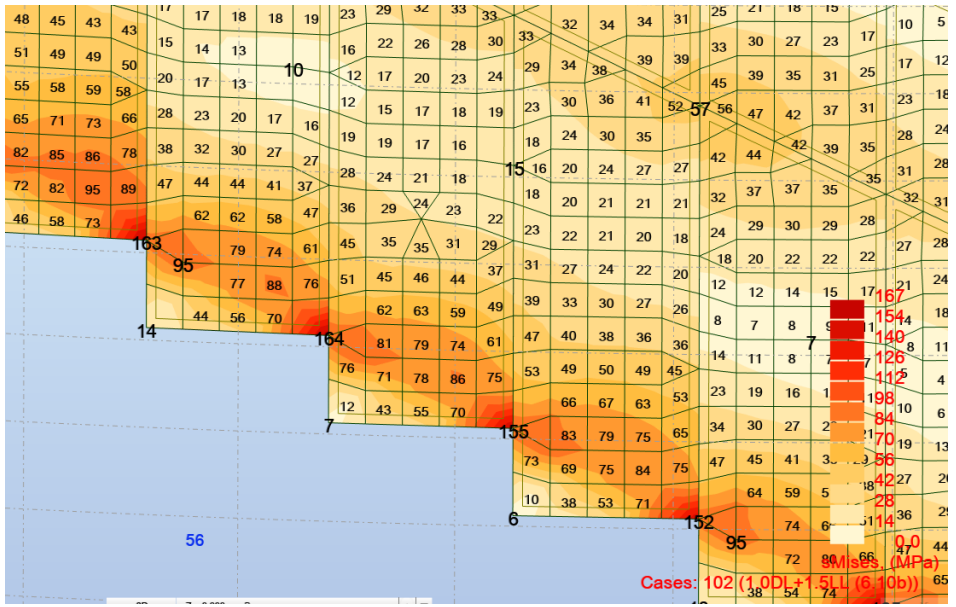


Skalmodel

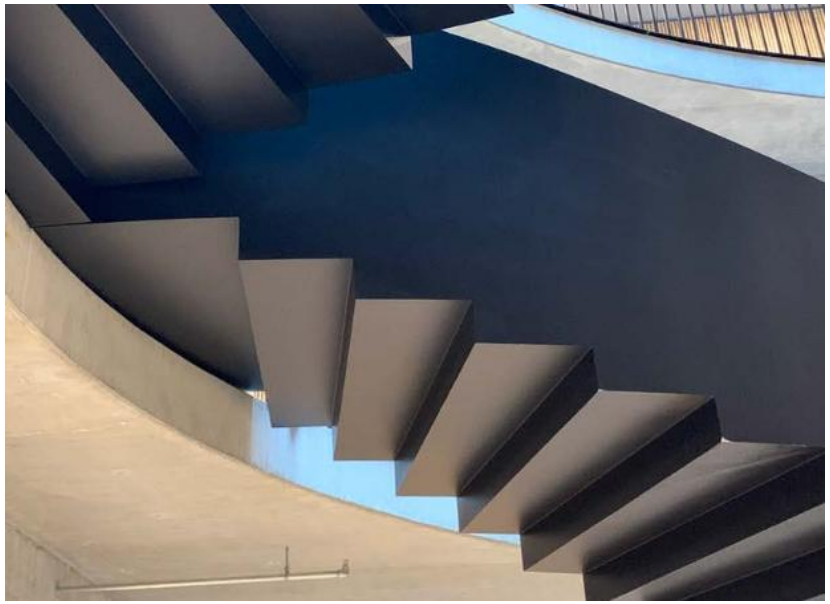
Spændinger, deformationer og komfort

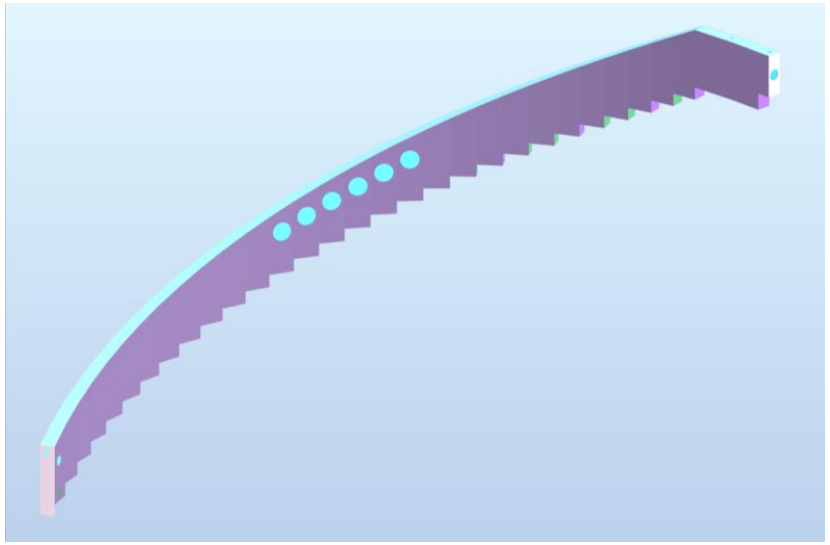


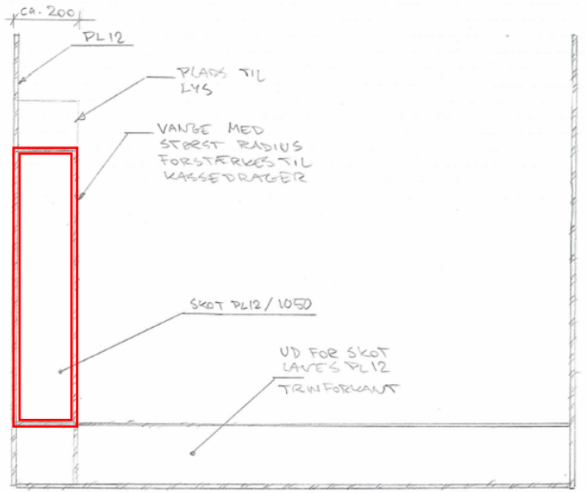


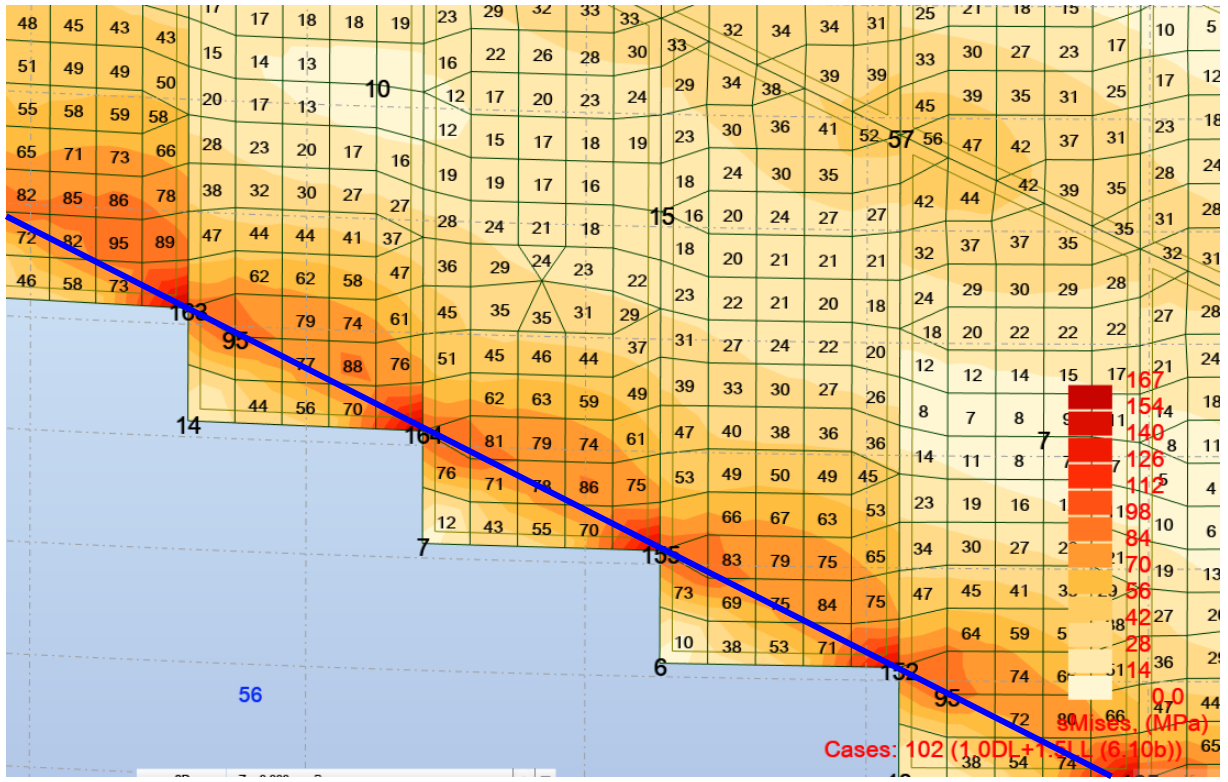


Spændinger ved takket underside

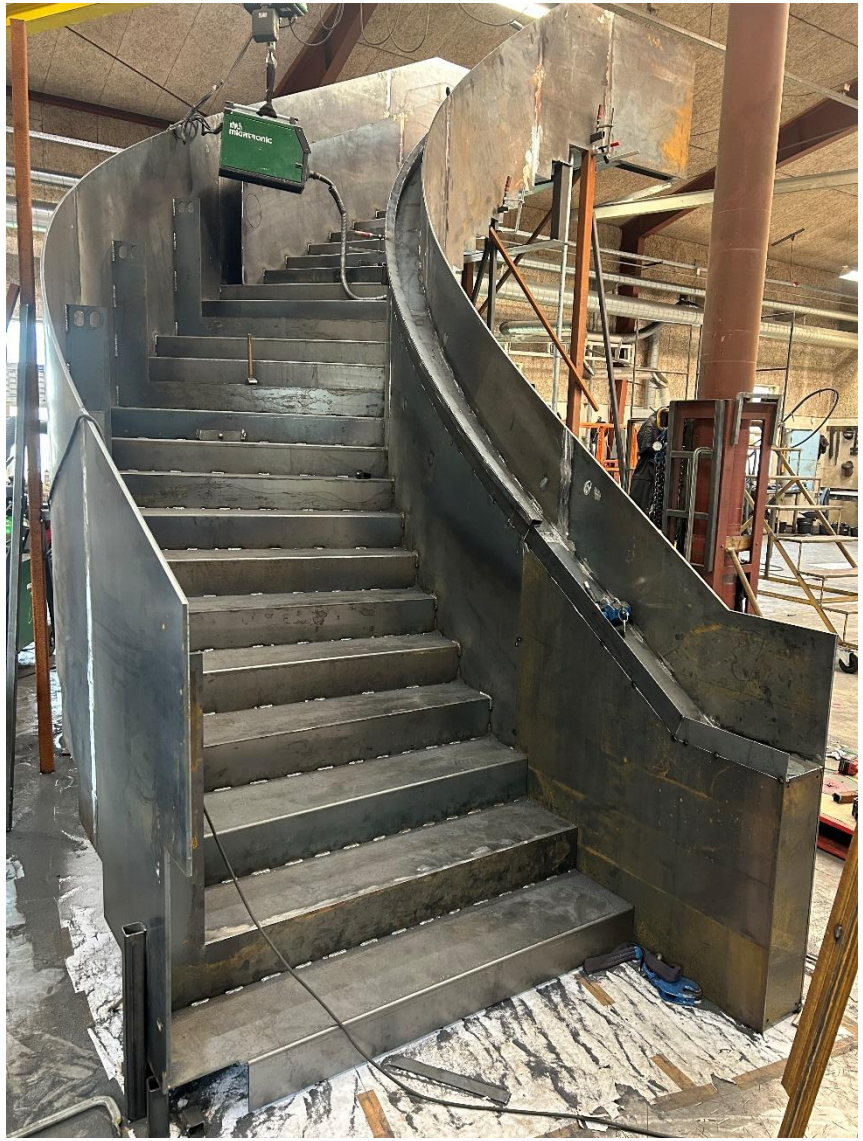








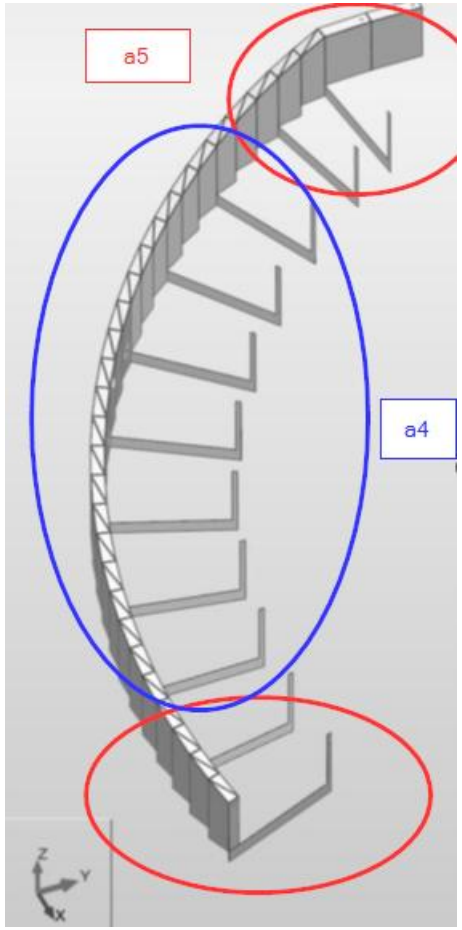
Svejsearbejde under udførelse

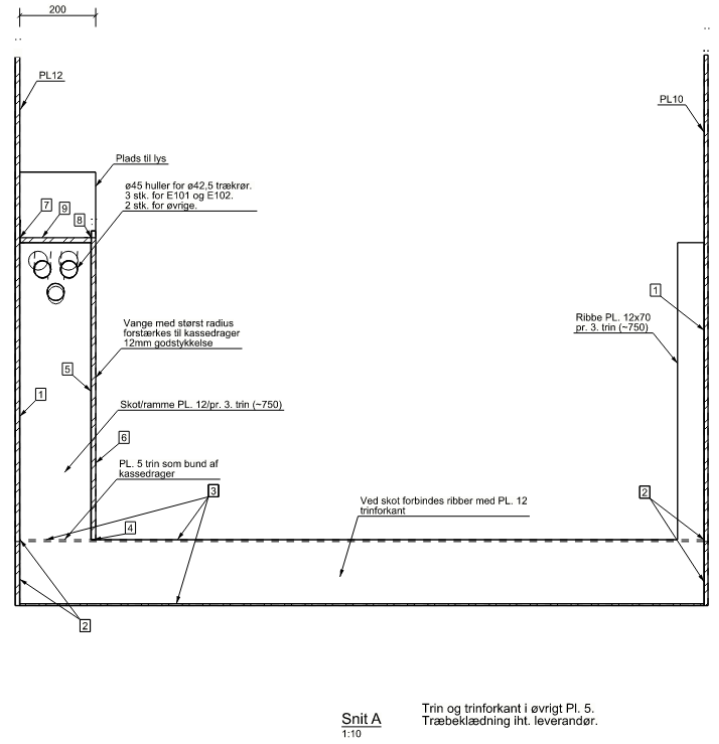




Som udgangspunkt a4 med a5 ved understøtninge

Kontinuerte → Afbrudte





Eventuelle stød i vanger forudsættes fuldsvejste V-sømme, hvor accepteret af arkitekt.

1. U-ramme til vanger:
   a5 kontinuert for nederste 2 U-rammer og øverste 2 U-rammer, alternativt a5 100 mm skiftevis hver side
   a4 100/100 for øvrige.

2. Trin til vanger:
   a4 50/50 lodret og vandret fortsat rundt om hjørner
   a4 kontinuert ved nederste 3 trin og øverste 3 trin.

3. Trin-Trin/U-ramme:
   Trinforkant er bukket, hvor der ikke er U-ramme
   a4 100/100 ved U-rammer, dog kontinuert min 250 mm ved hvert rammeben
   a4 100/100 ved nederste 3 trin og øverste 3 trin
   a4 50/100 ved trin-trin ud for massedæmpere, a4 50/150 ved trin-trin øvrige steder.
   Dog altid Y4 kontinuert ved synlige områder mellem vange og gulvtæppe. Det afklares med arkitekt om synlige Y4-sømme skal slibes. Der spartles på bagside. Om U-rammers forkant under gulvtæppe skal afrundes afklares med arkitekt.

4. Vange til Trin:
   Y4 50/50 vandret og lodret, dog kontinuert ved nedeste 3 trin og øverste 3 trin.

5. U-ramme til vange:
   a5 100 mm skiftevis hver side indtil 500 mm fra top ved kontinuert vange.

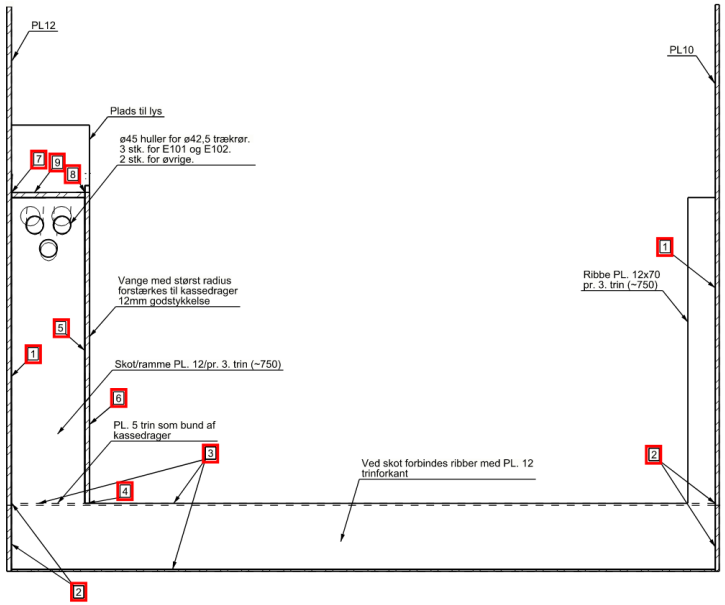
6. Vange til U-ramme:
   II-søm fuldsvejst på nederste del ved kontinuerte vanger, hvor skiftet er fra foregående svejsning
   II-søm fuldsvejst kontinuert ved afbrudt vange. Udfyldningssømmes bredde 6-8 mm, dybde lig fuld pladetykkelse på 12 mm. Skal slibes til plan overflade.

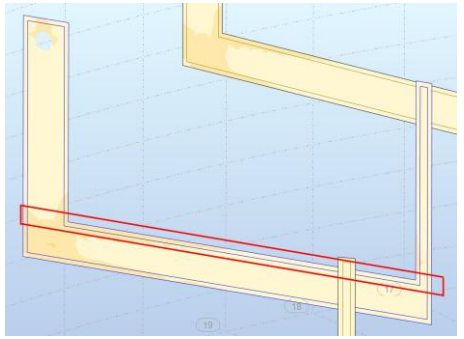
7. Topplade til vange:
   Y5 50/100, dog kontinuert til 2-uramme fra top og bund.

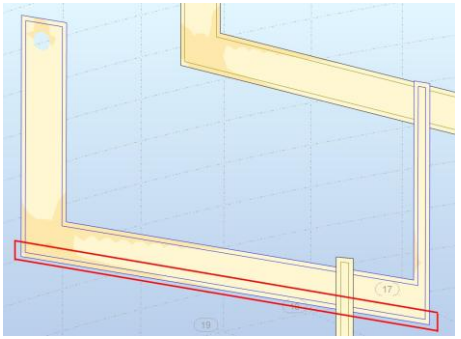
8. Topplade til vange:
   a5 50/100, dog kontinuert til 2-uramme fra top og bund.

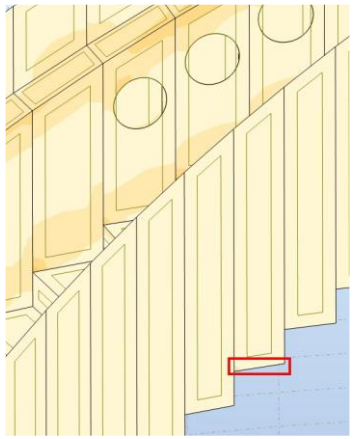
9. Topplade til U-ramme:
   II-søm fuldsvejst 2*50 mm ved kontinuerte topplade
   II-søm fuldsvejst kontinuert ved stød i topplader.
   Udfyldningssømmes bredde 6-8 mm, dybde lig fuld pladetykkelse på 12 mm. Skal slibes til plan overflade.

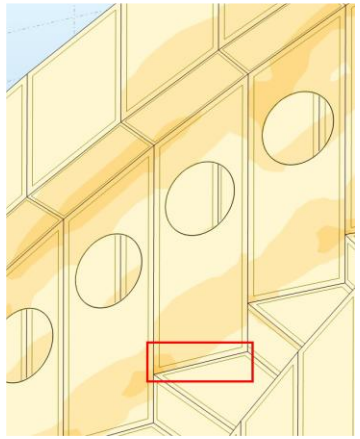
Differentiering af svejsninger

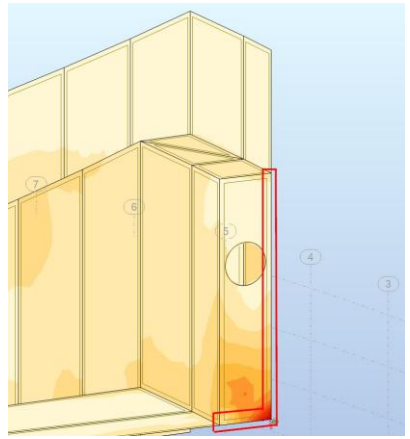


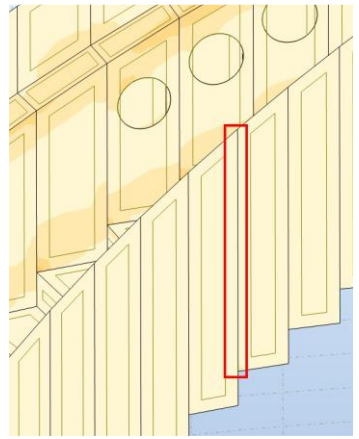


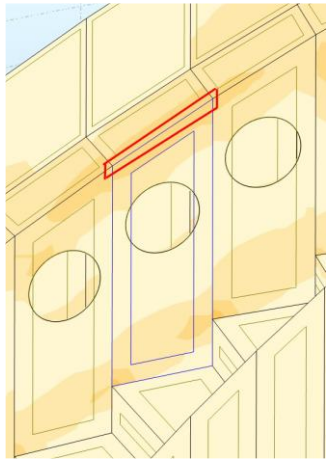


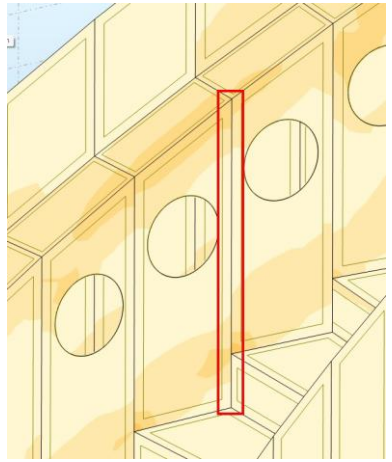


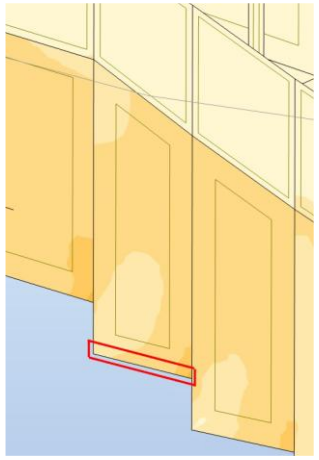


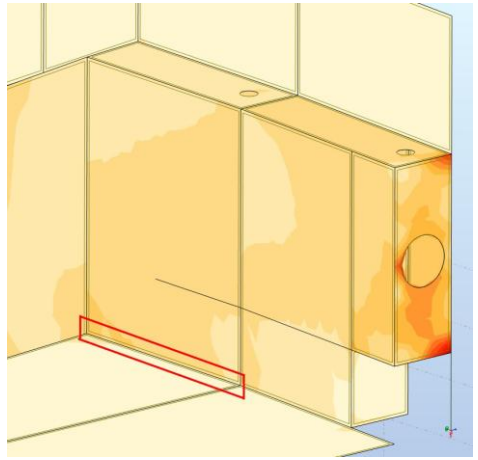




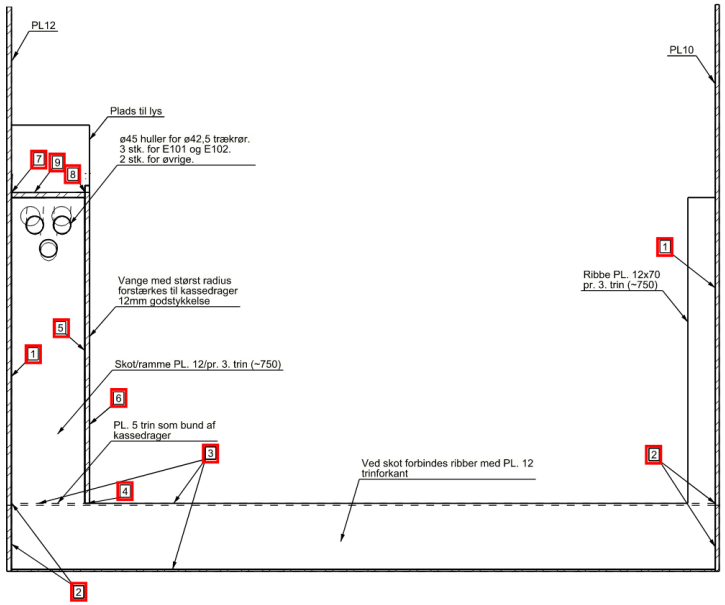








Optimering af svejsninger – Tid, pris og bæredygtighed



Bæredygtighedsoptimering

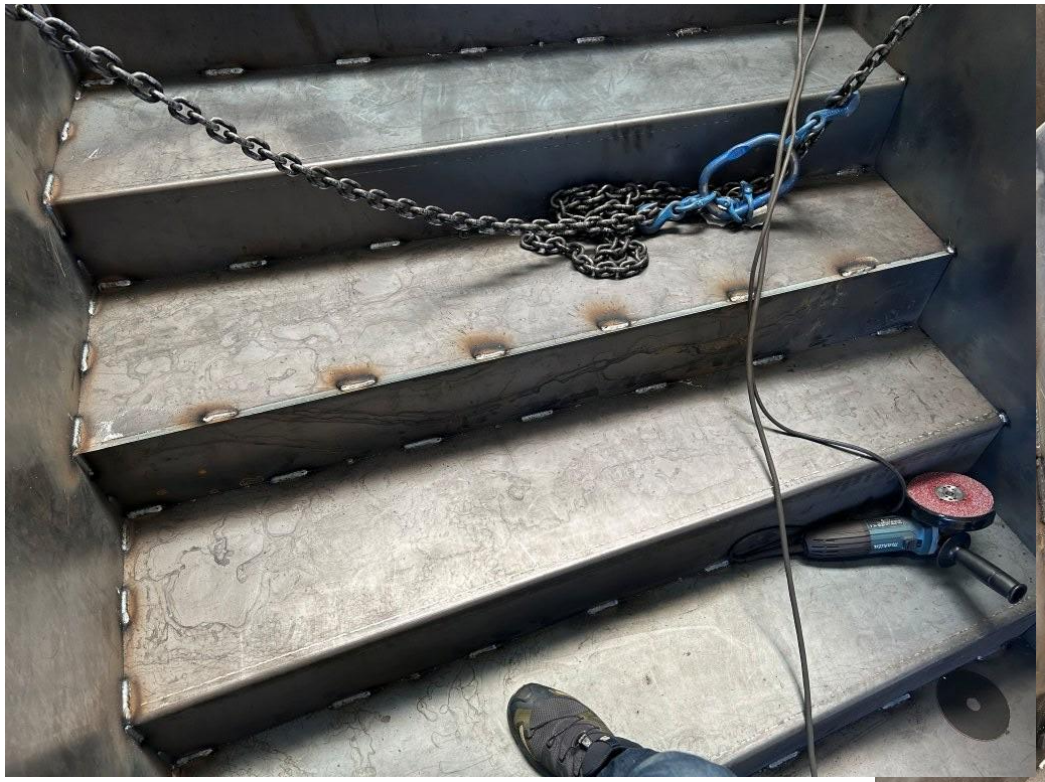
Svejsestørrelse	Kontinuerte	Længde [m]	Effektiv længde [m]	Estimat [kg CO_2e/m]	Forbrug [kg CO_2e]
a4	100 %	6.014	6.014	0,30	1.804
a5	100 %	1.504	1.504	0,45	677
I alt		**7.518**	**7.518**		**2.481**

Svejsestørrelse	Afbrudte	Længde [m]	Effektiv længde [m]	Estimat [kg CO_2e/m]	Forbrug [kg CO_2e]
a4	100 %	378	378	0,30	113
a4	50/50; 100/100	2.800	1.400	0,15	420
a4	50/100	1.400	467	0,10	140
a4	50/150	2.450	613	0,08	184
a4	Bukkede trin	420	105	0,00	0
a5	100 %	70	70	0,45	32
I alt		**7.518**	**3.032**		**889**

Besparelse	**4.486 m**	**1.592 kg CO_2e**	**64 %**

Ekskl. montagestød

Kommunikation ml. rådgiver og udførende - Optimering af svejsesøm





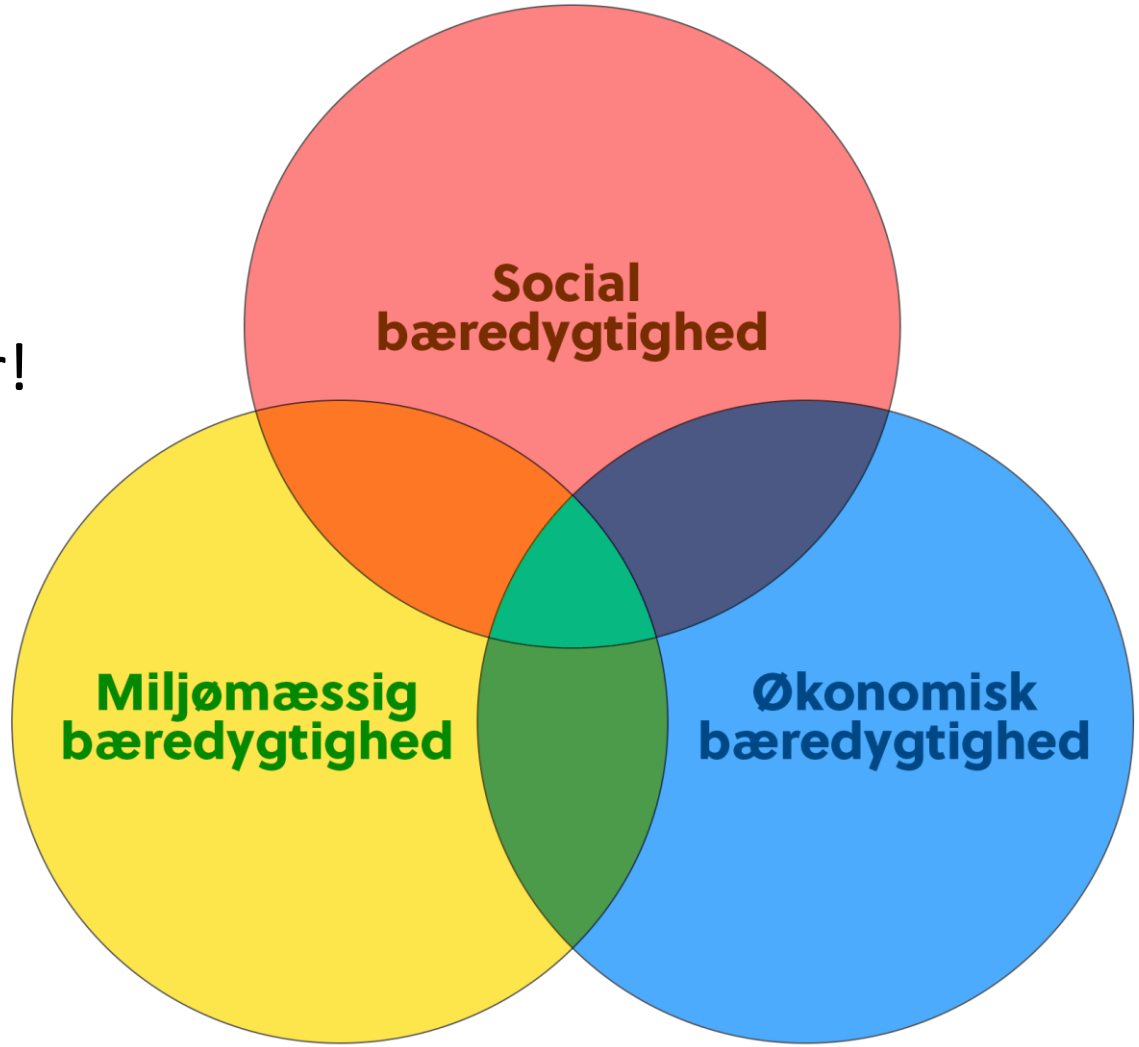


Sparede 4,5 km svejsninger og 1,6 tons CO_2e

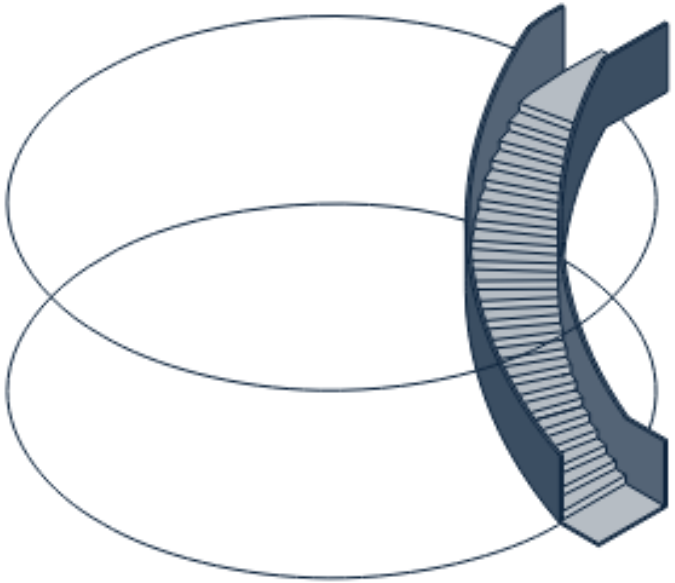
- Halvering af svejsemateriale
- Svarende til 1 persons CO_2-forbrug i 3 mdr.
- Det er bæredygtigt at optimere svejsninger!

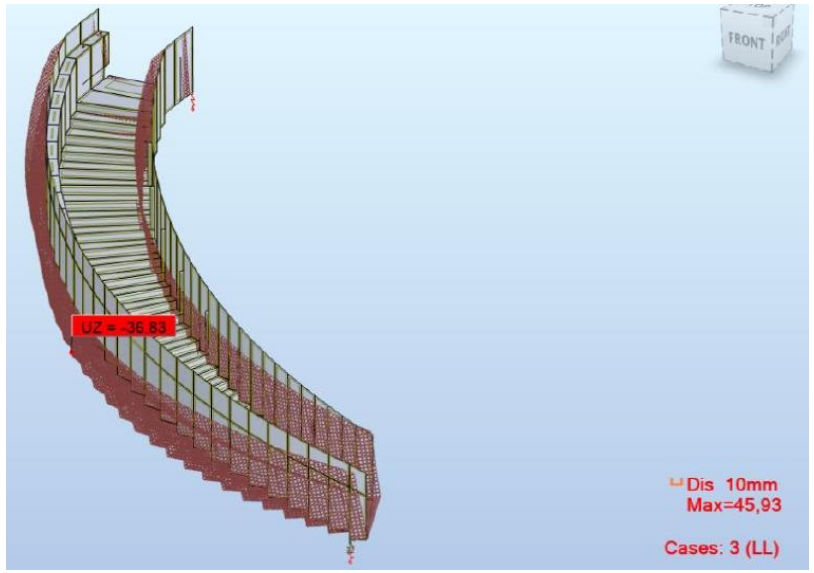


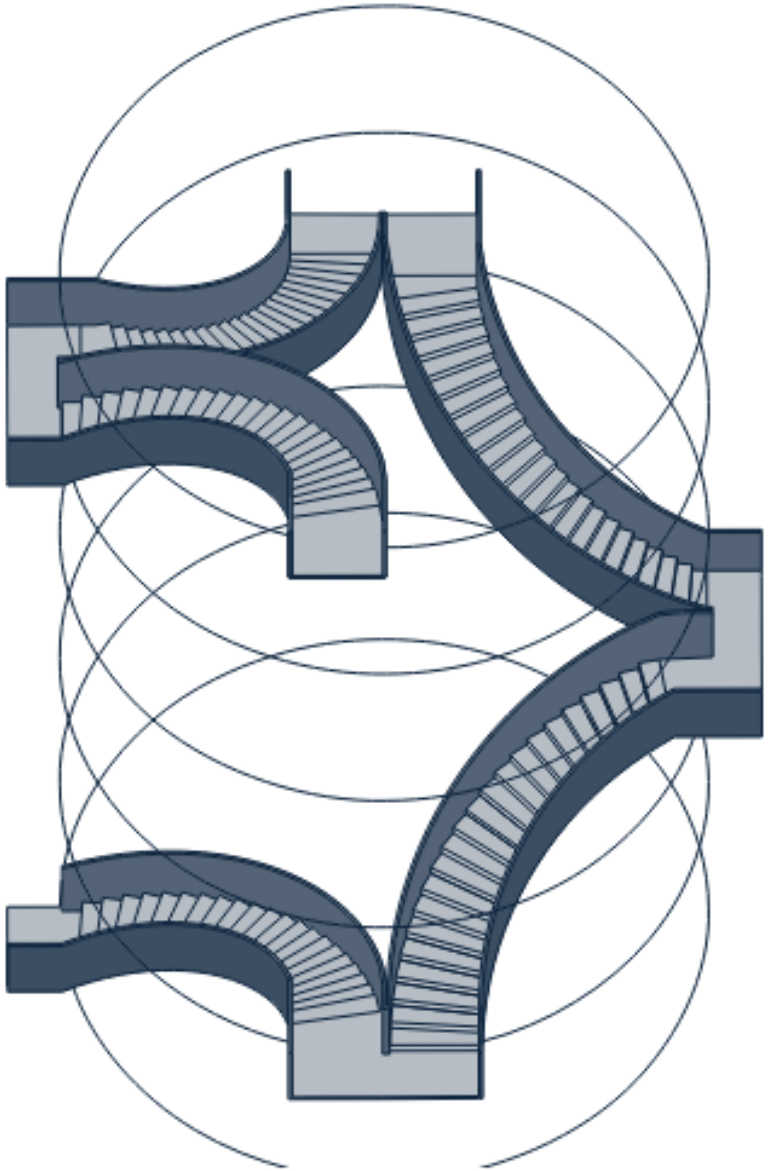
DANMARKS STATISTIK



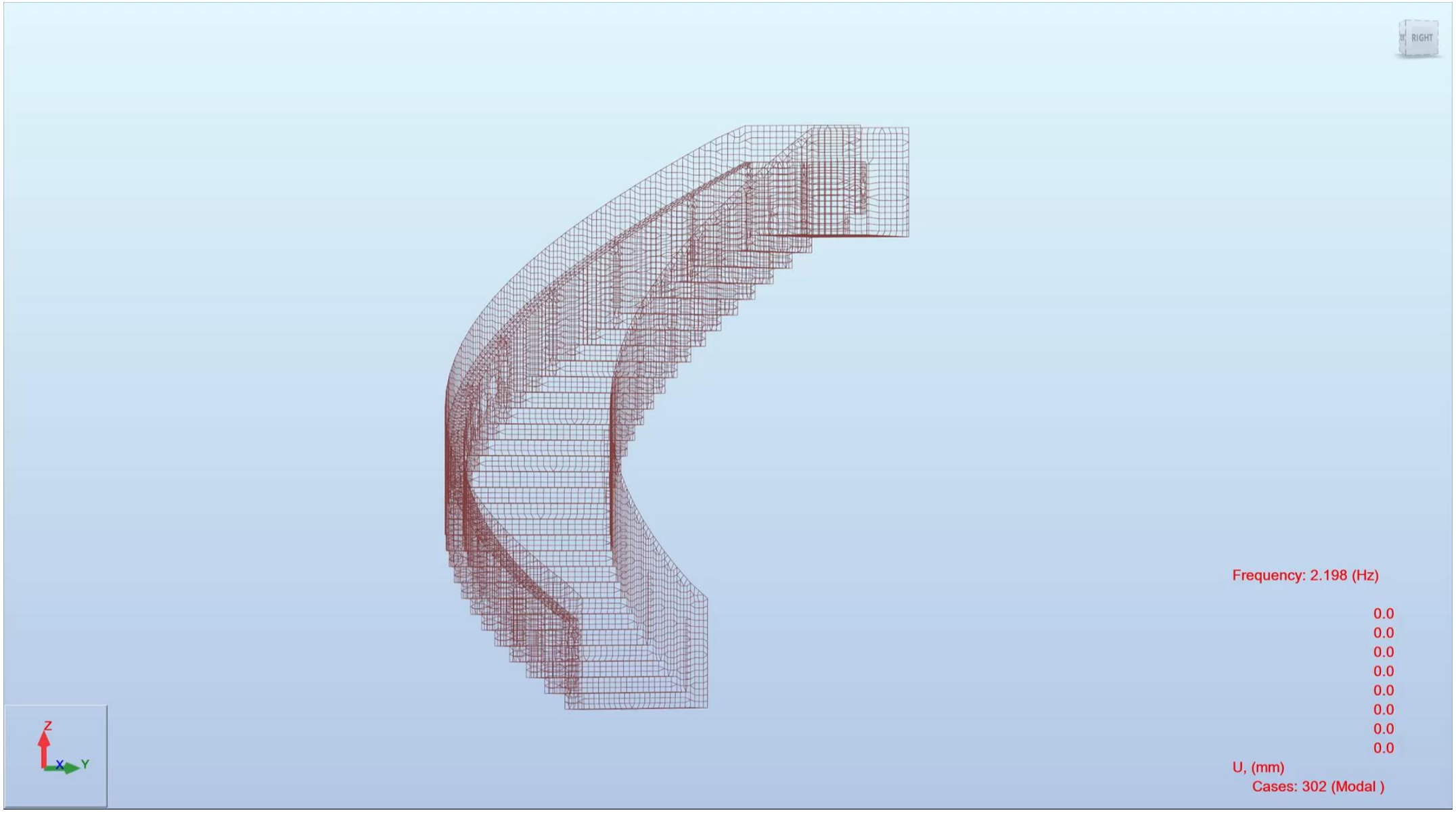
Comfort – 7 runways - 5 types







Eigen mode first runway



Lowest teoretical Eigen frequence 2,2 Hz

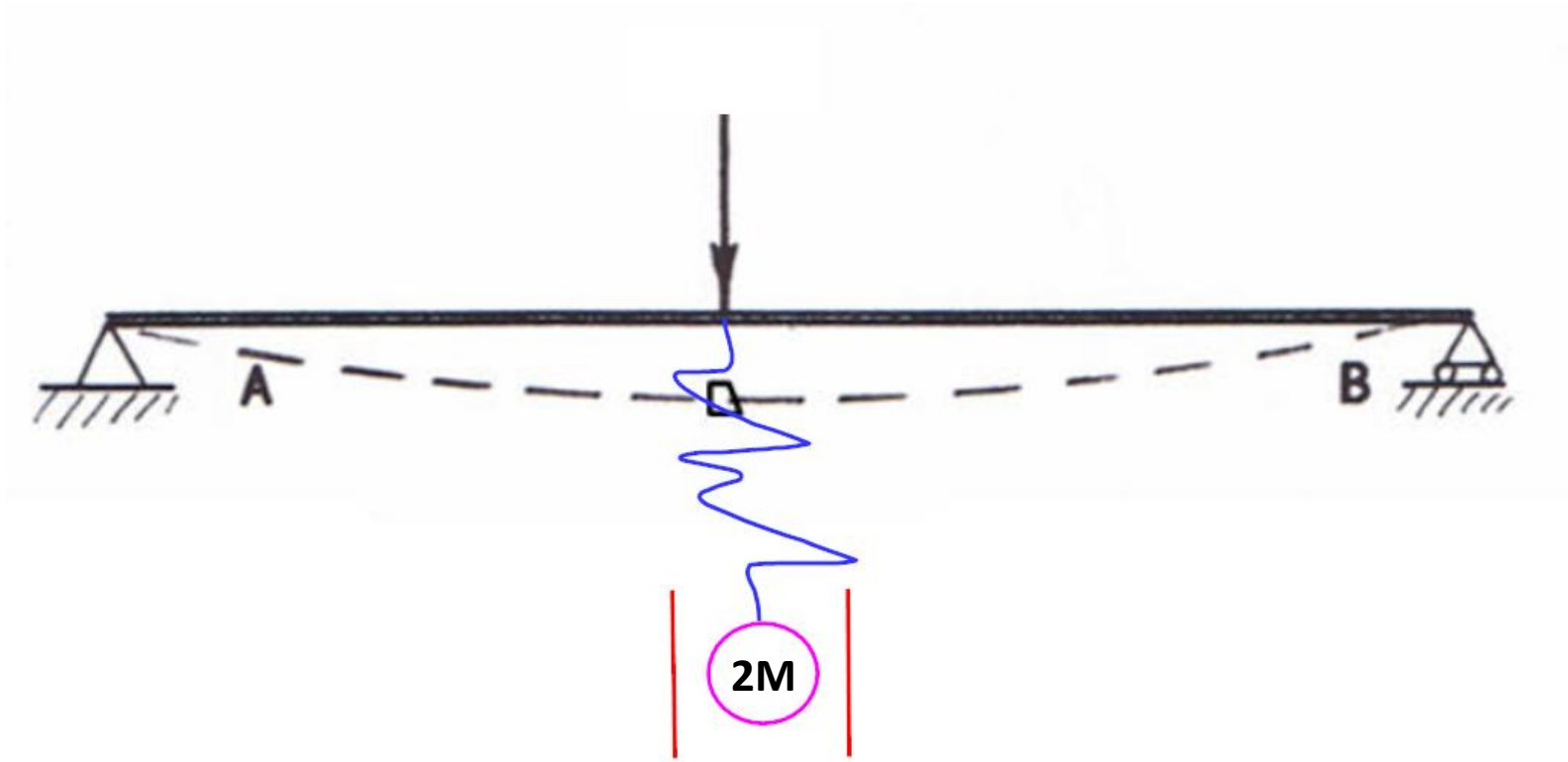
7 Summary

Summarised below are main results from modal and stiffness analysis of stair structure for stair E101.

- Total mass of stair structure, incl. timber finishing: m_{tot} = 5952 kg
- Frequency of fundamental vertical vibration mode: f = 2,23 Hz
- Modal mass in fundamental vertical vibration mode: m_z = 1849 kg
- Average vertical spring stiffness of supports for lower TMD: Kz_1 = 597 kN/m
- Average vertical spring stiffness of supports for upper TMD: Kz_2 = 567 kN/m

Damper from Christian Berner + GERB

Damping was achieved using a pair of two tuned mass dampers (TMD´s) by magnetic damping system

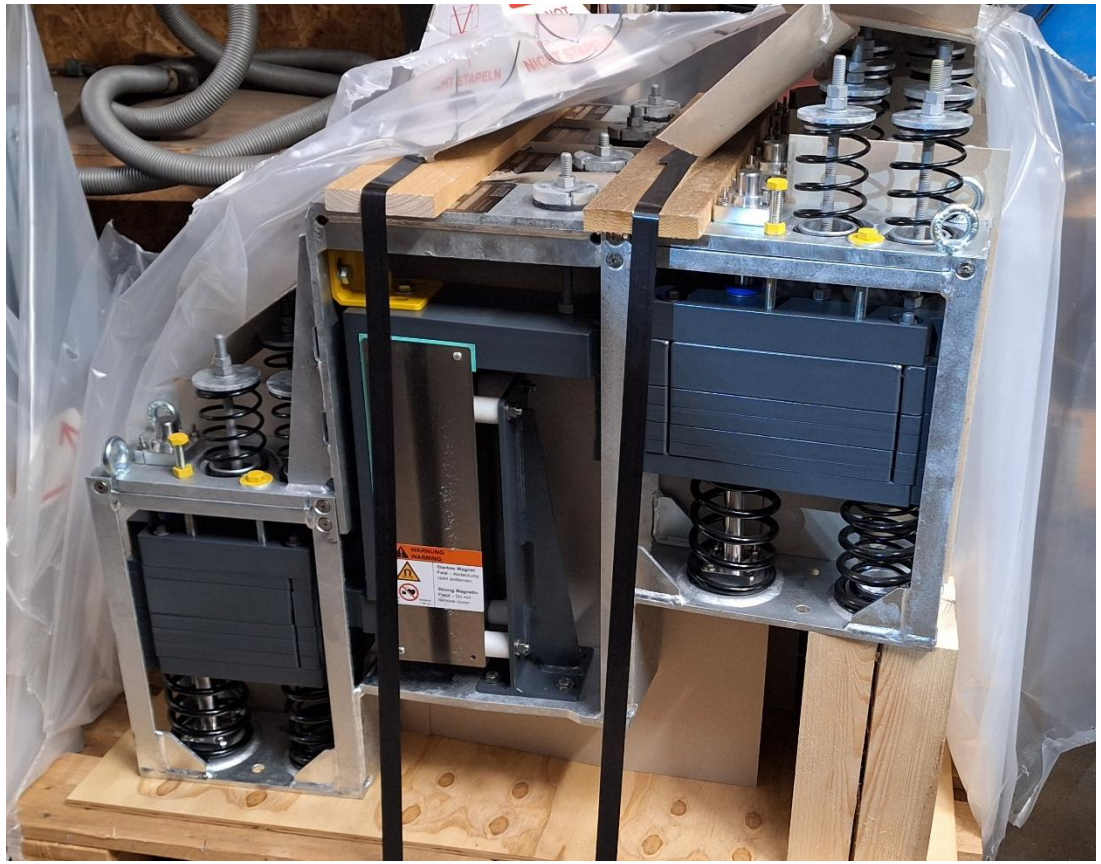


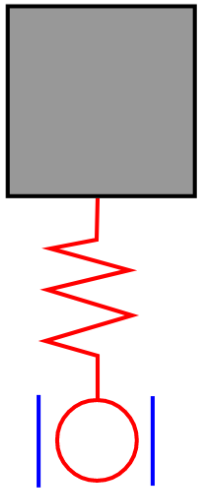
CHRISTIAN BERNER
Expect more

GERB
Vibration Control Systems

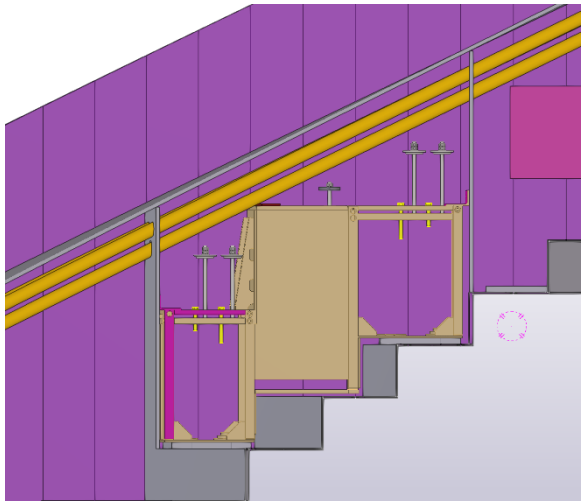
Magnetic Tuned Mass Damper

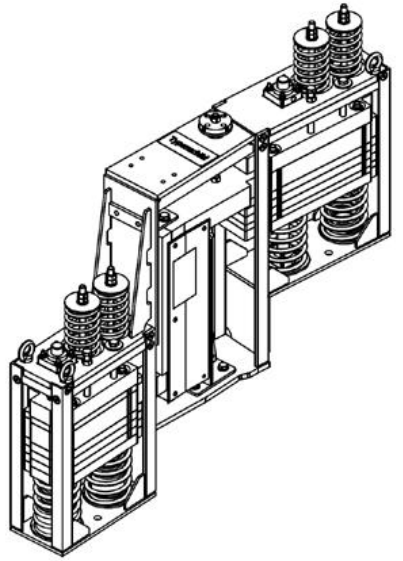
Securing the comfort by reducing response use of mass in spring damped with magnets









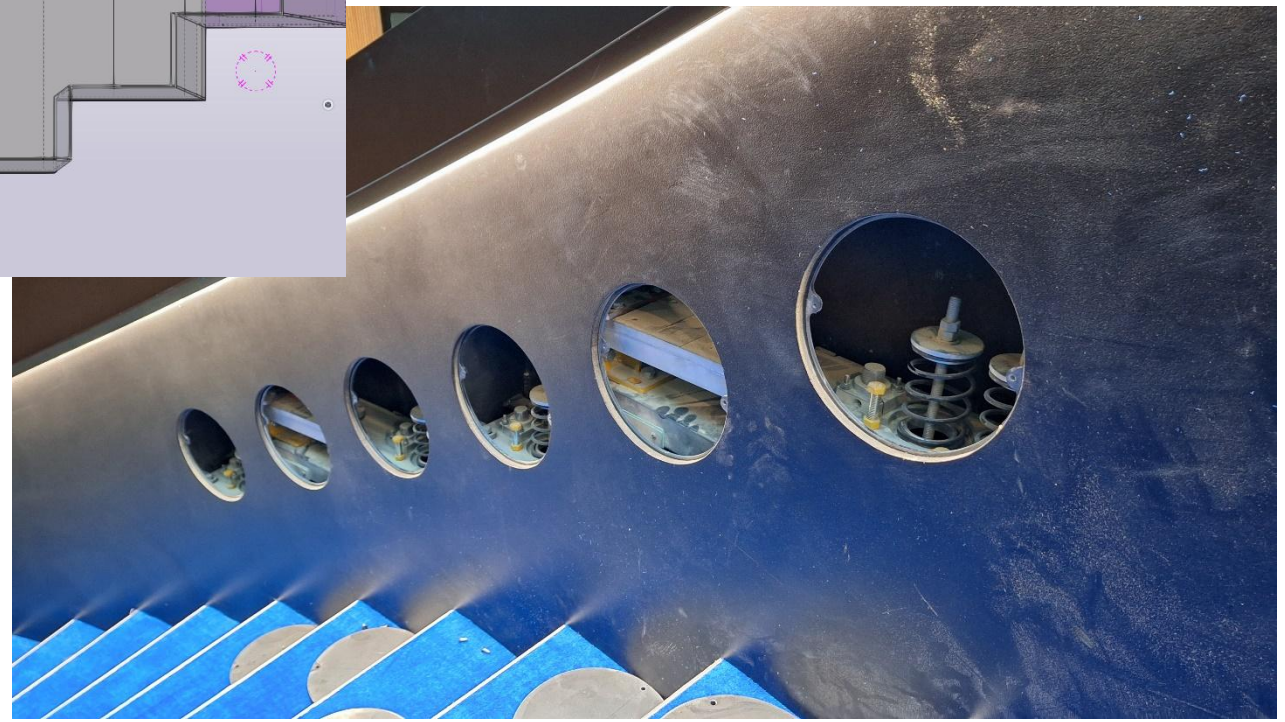


Magnetic Tuned Mass Damper

Hidden in the stringer



Placed in the stringer under fabrication and calibrated after erecting.





Results

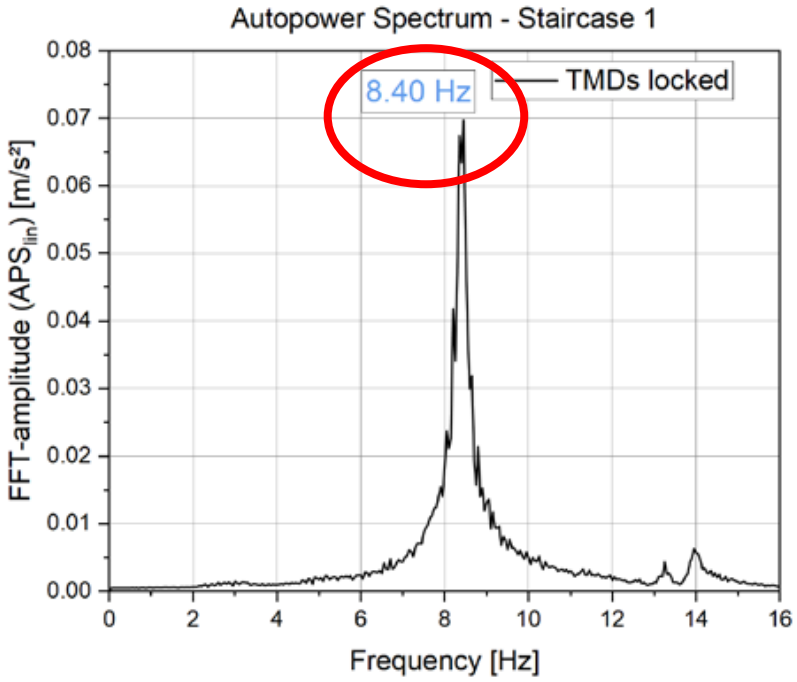
2.2 Hz vs. 8.4 to 11.3 Hz

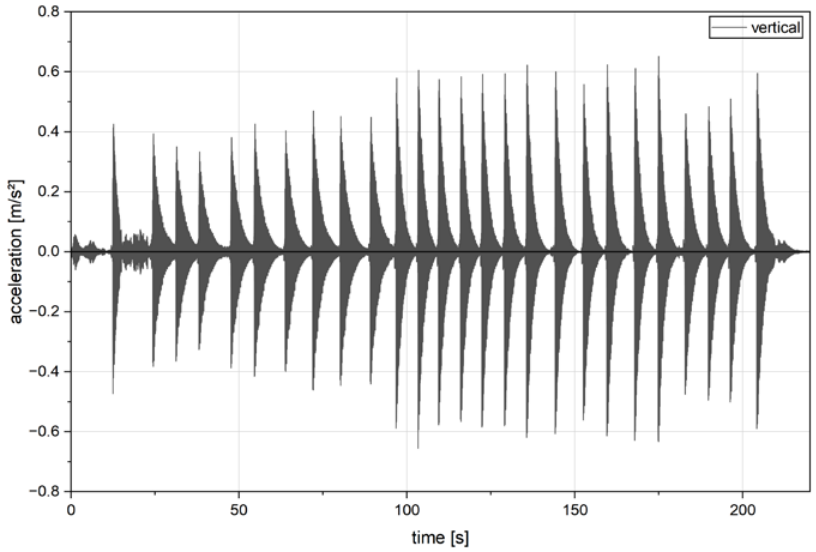
< 10 Hz and < 12 Hz

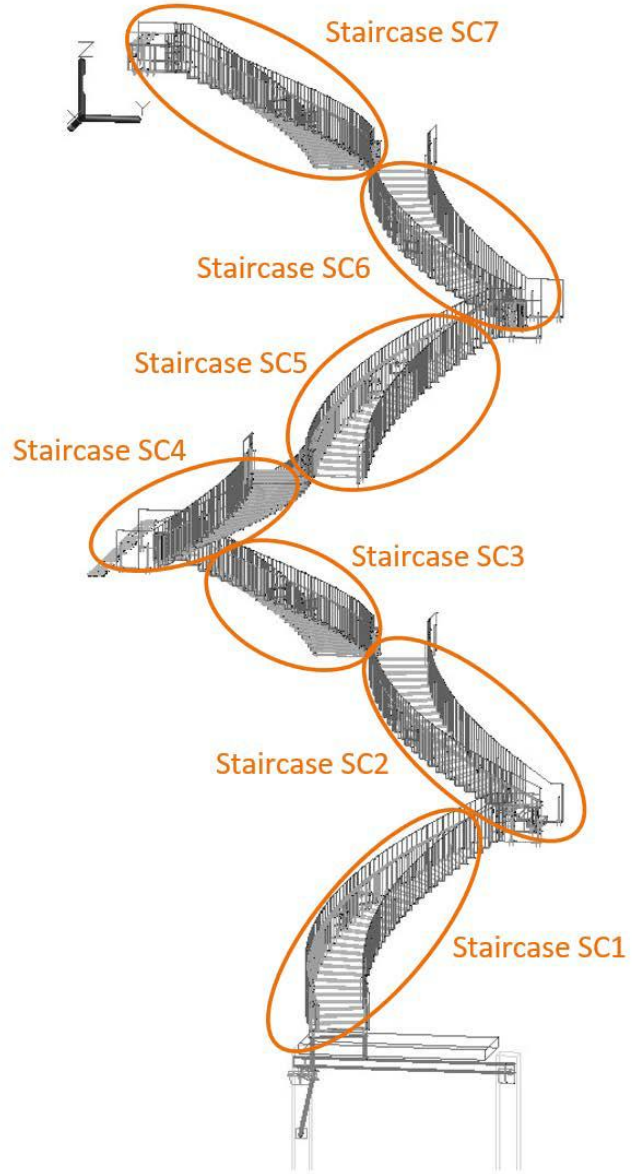
Locked TMD

Table 1 **Summary of identified dominant natural frequencies**

Staircase	Natural frequency	Damping ratio
SC1	8.40 Hz	1.3 %
SC2	8.45 Hz	0.6 %
SC3	11.20 Hz	0.8 %
SC4	11.20 Hz	1.0 %
SC5	11.20 Hz	1.9 %
SC6	10.90 Hz	1.4 %
SC7	11.30 Hz	1.4 %







Activated TMD

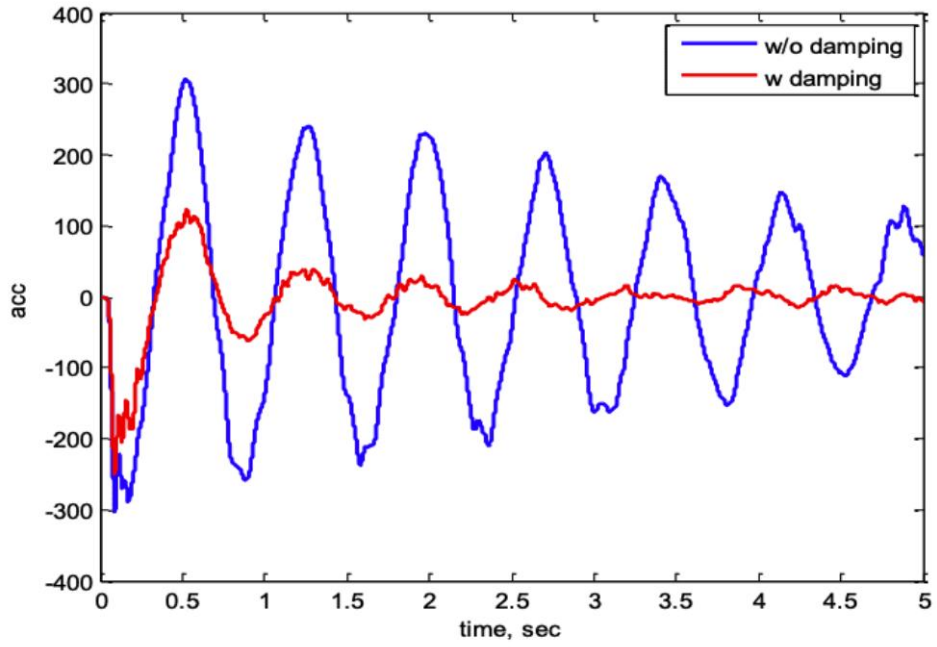
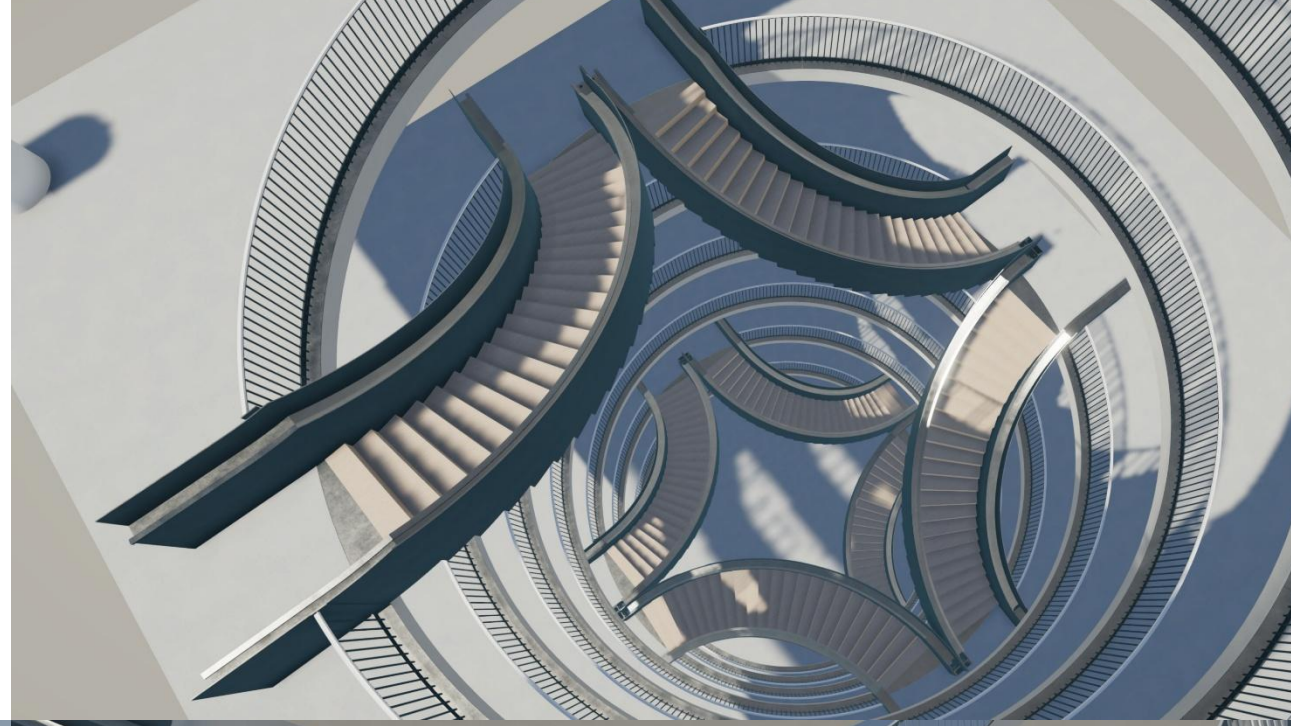


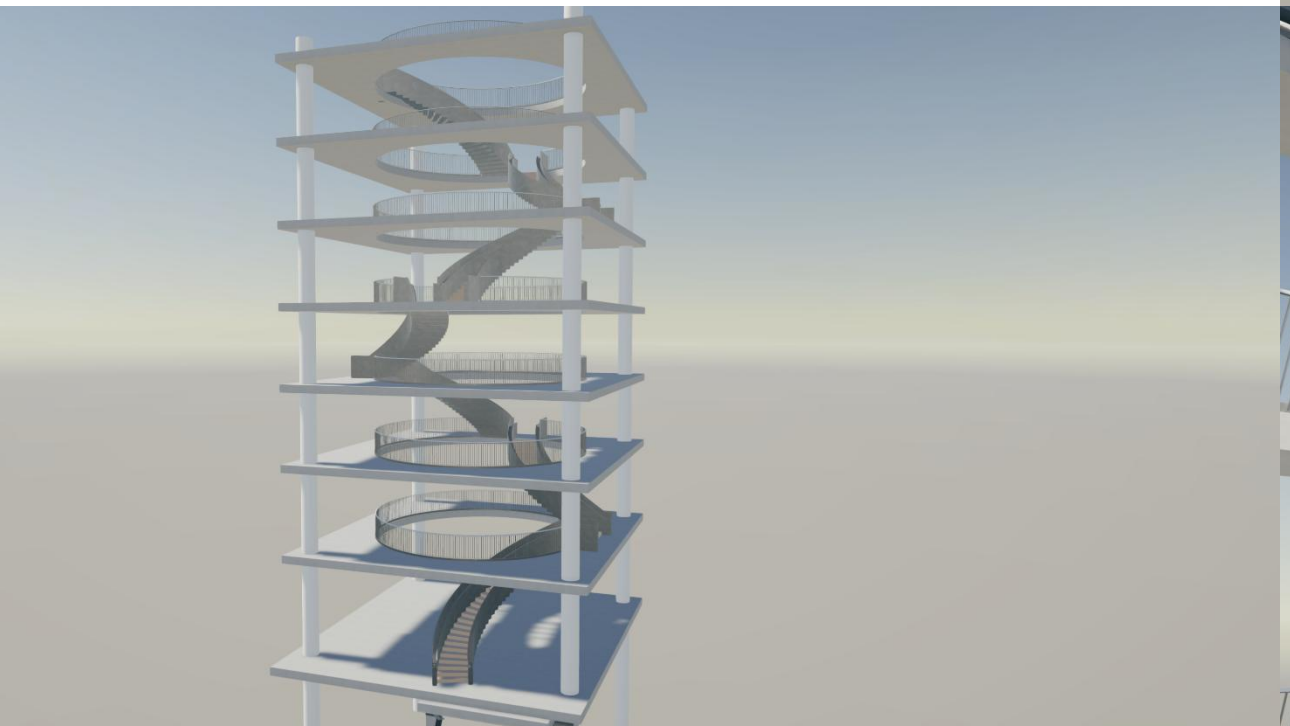
Figure 3 Accelearion responses of the TMD mass without and with damping control

Deviation on f_1

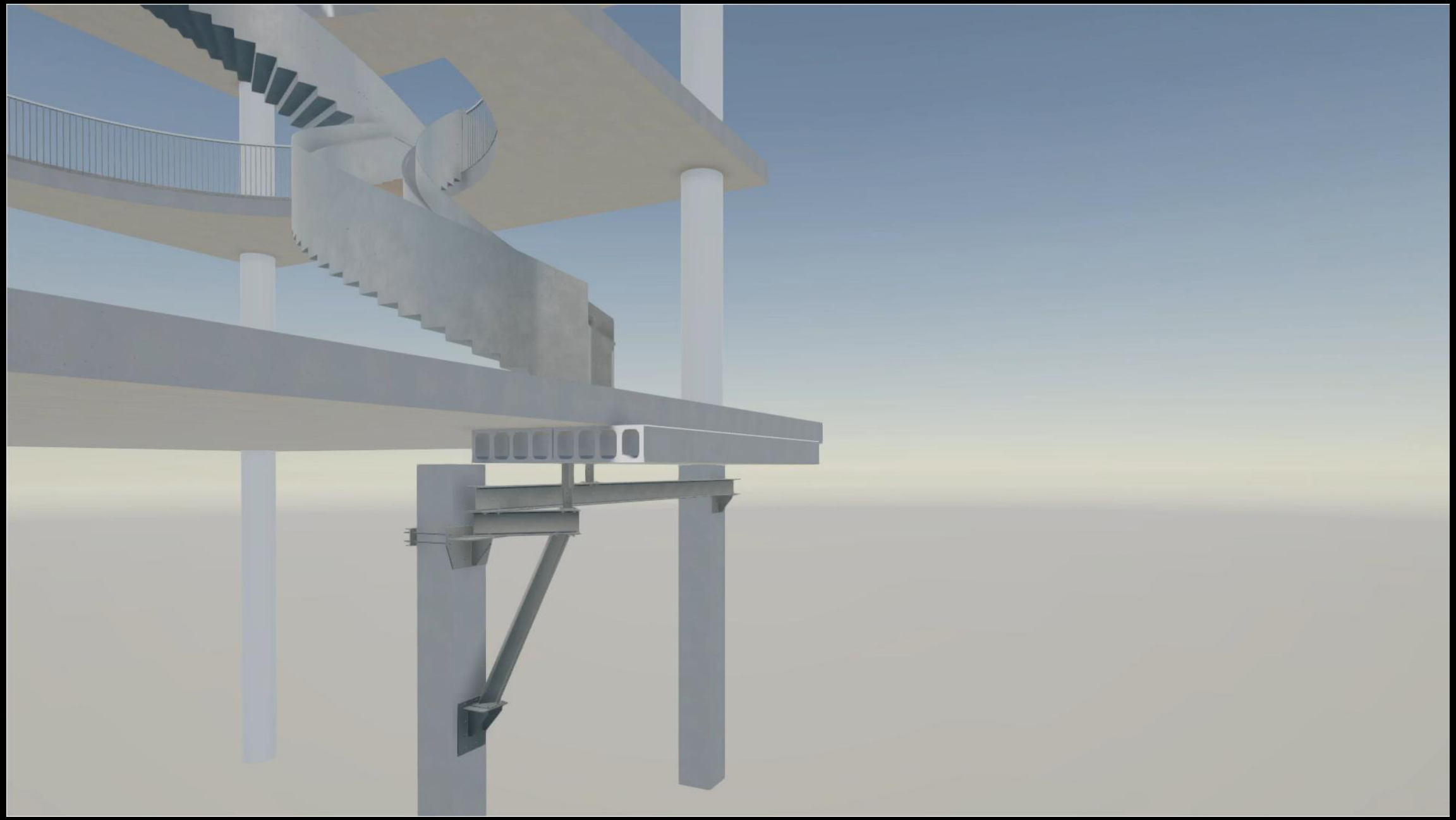
- Restrained by horizontal loads in practice
- Stiffer fixity at supports
- Restraint and mass from the neighbouring staircase
- In situ floor slab stiffness underestimated
- Additional bracing from secondary plates and cover
- Stiffness and damping of secondary timber flooring and cladding
- Lower self-weight
- Effect of welds/Connectons

Tekla Structures - Video



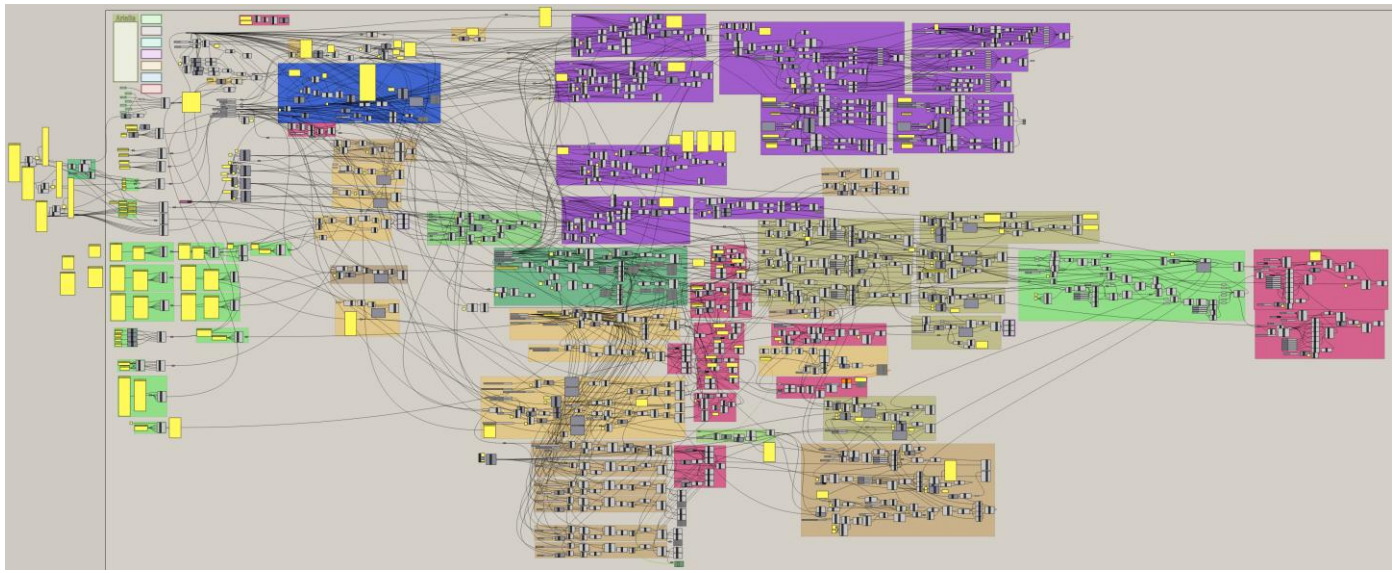


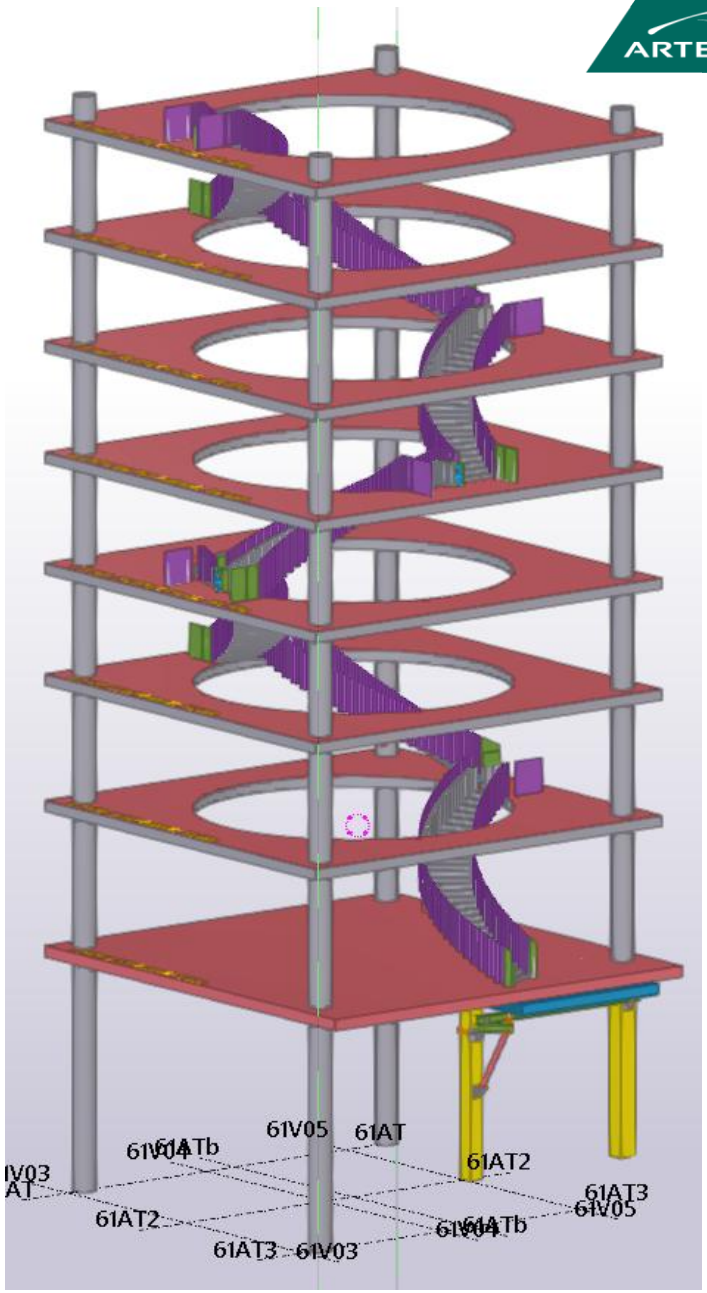


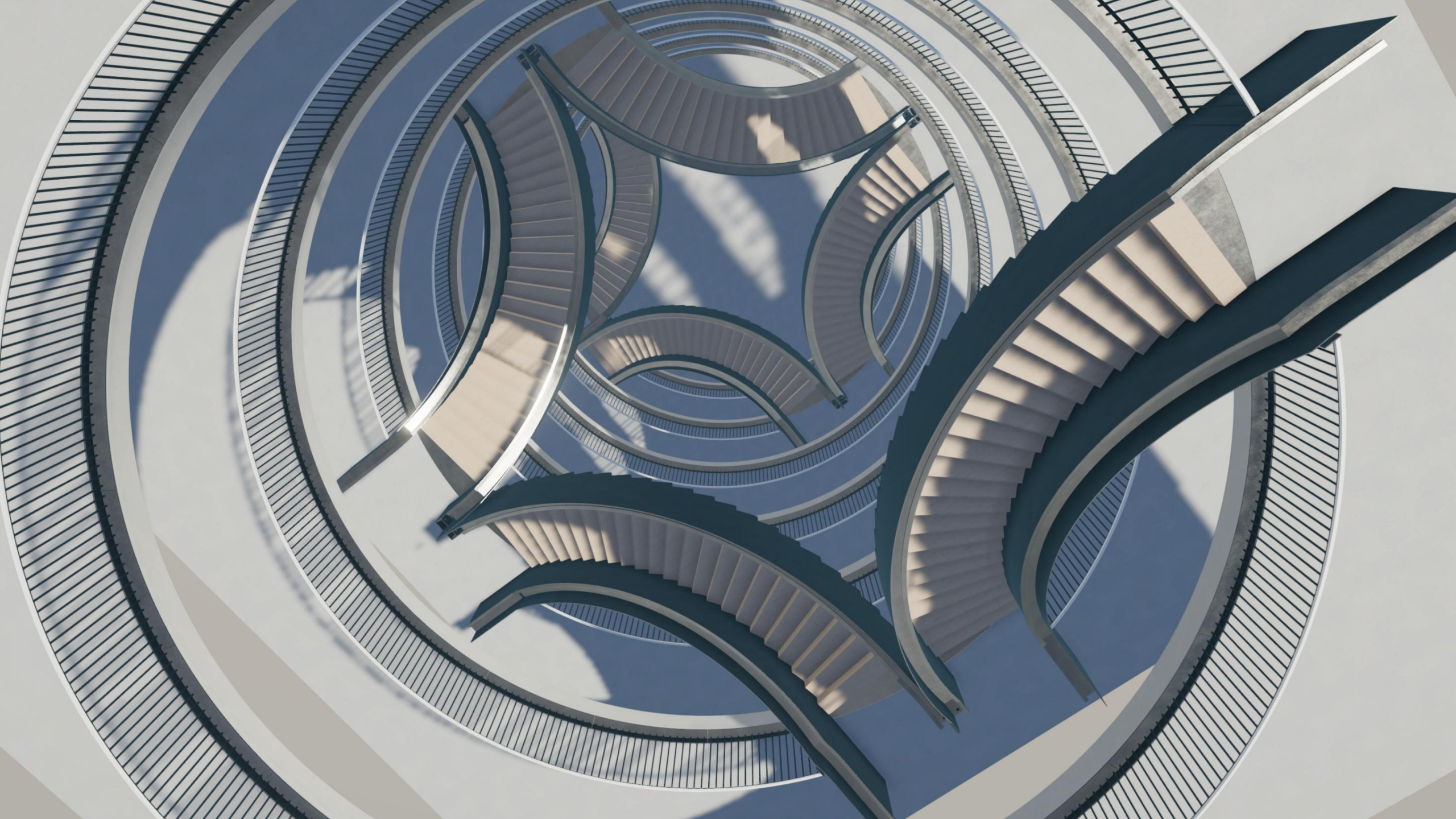


Tekla 3D-model

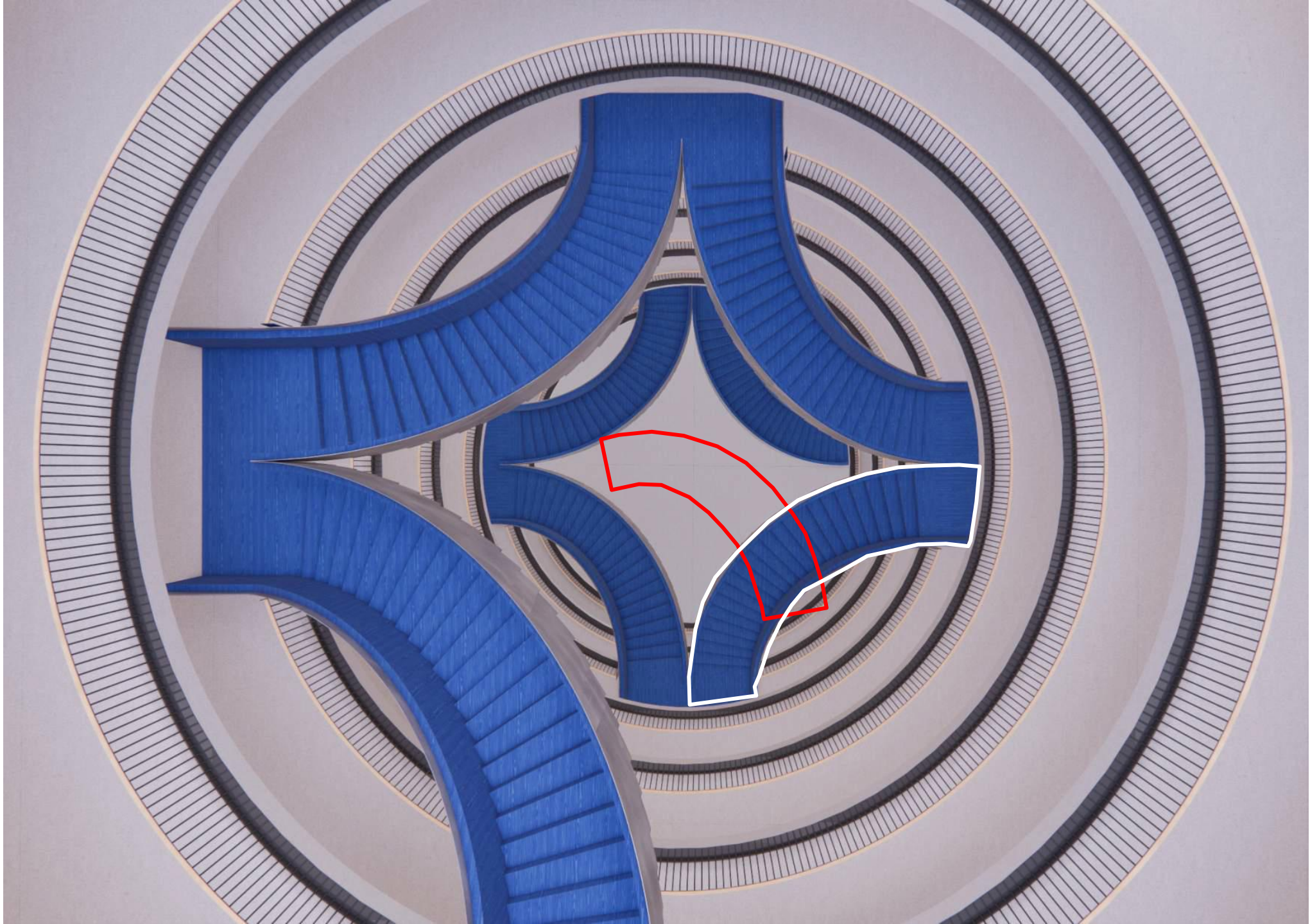
Modelleret via. Grasshopper







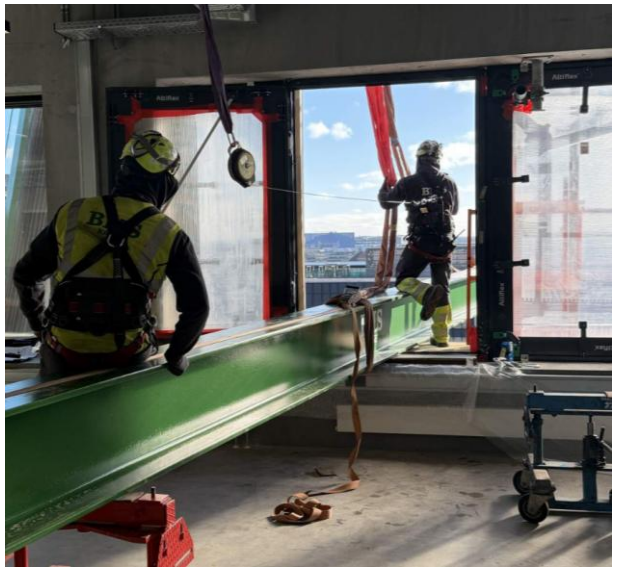
Montage x 7



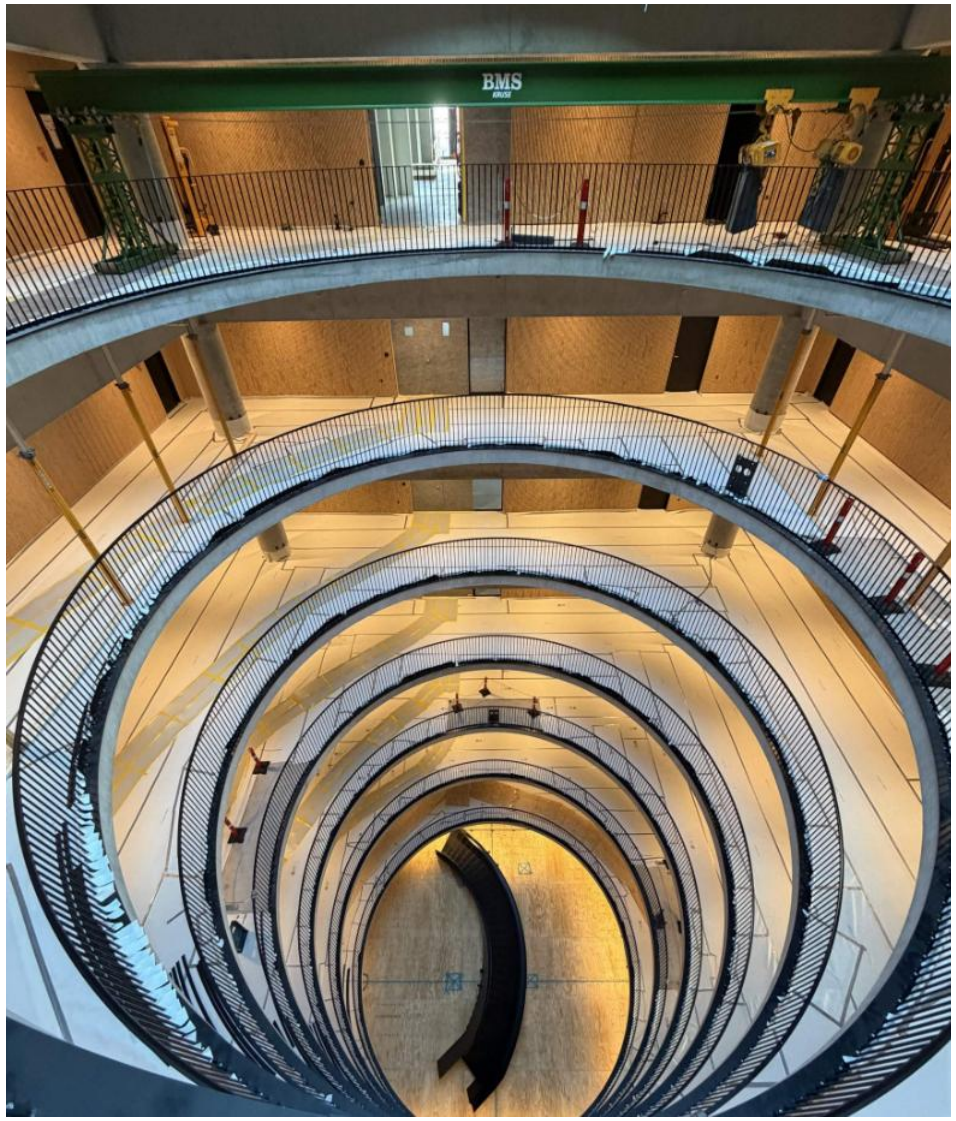
Udførelse

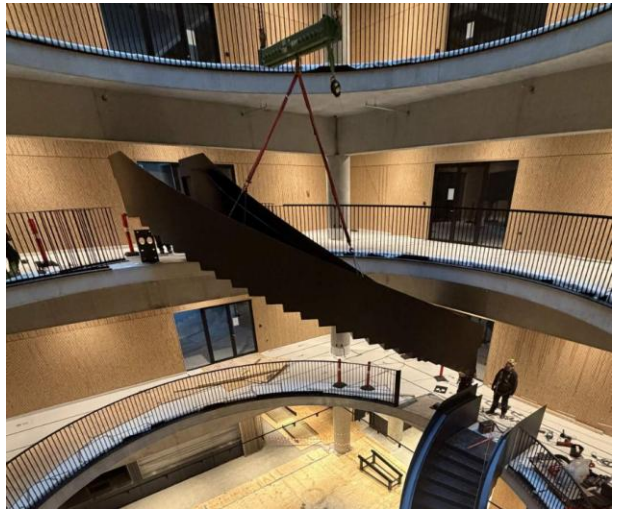
SCAN TRAPPER

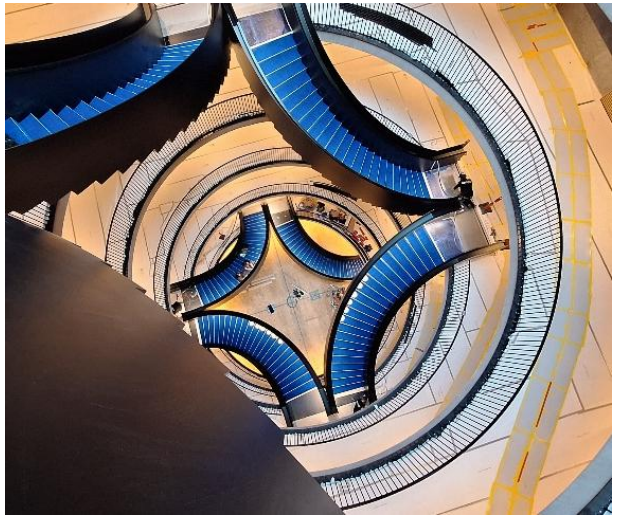
BMS





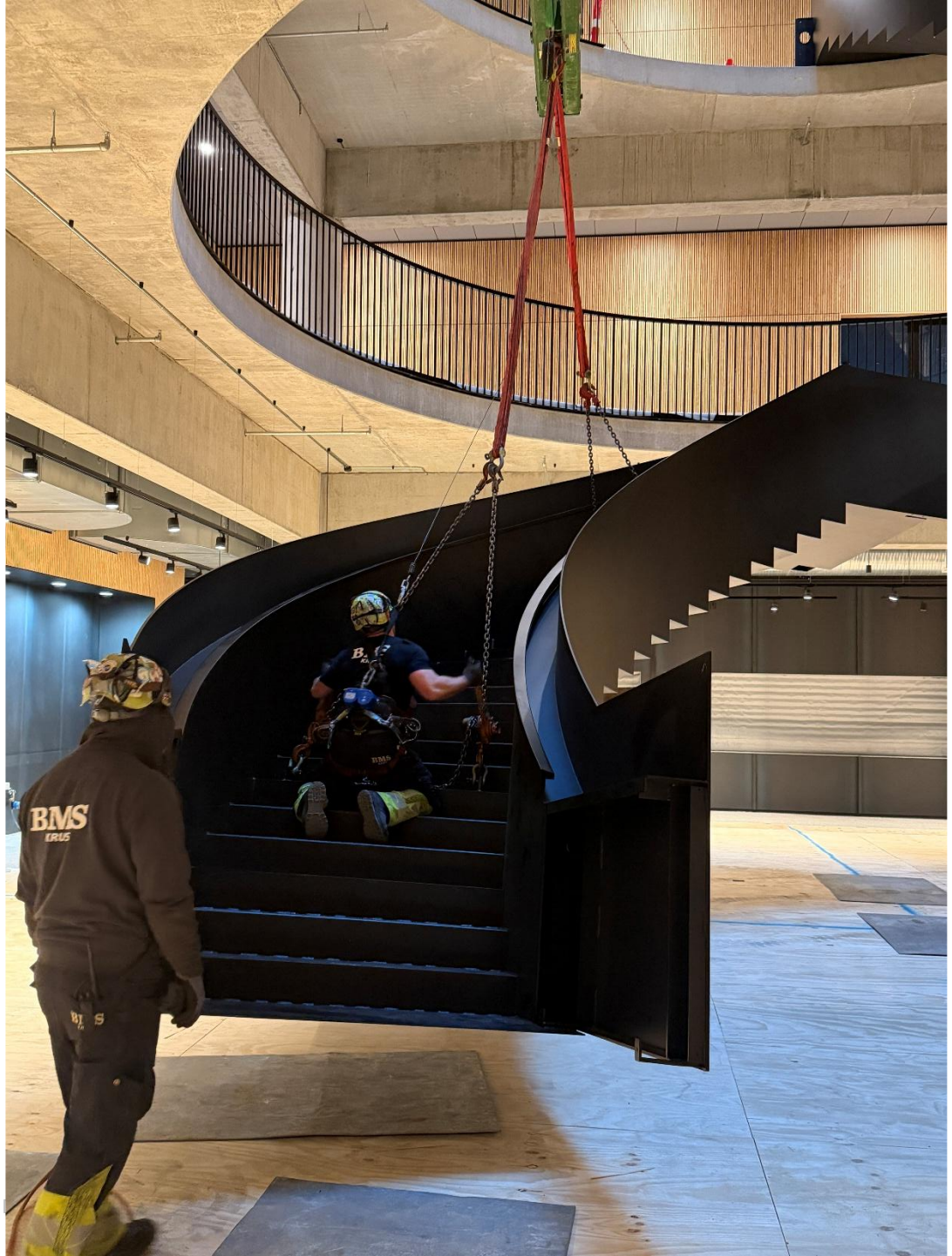


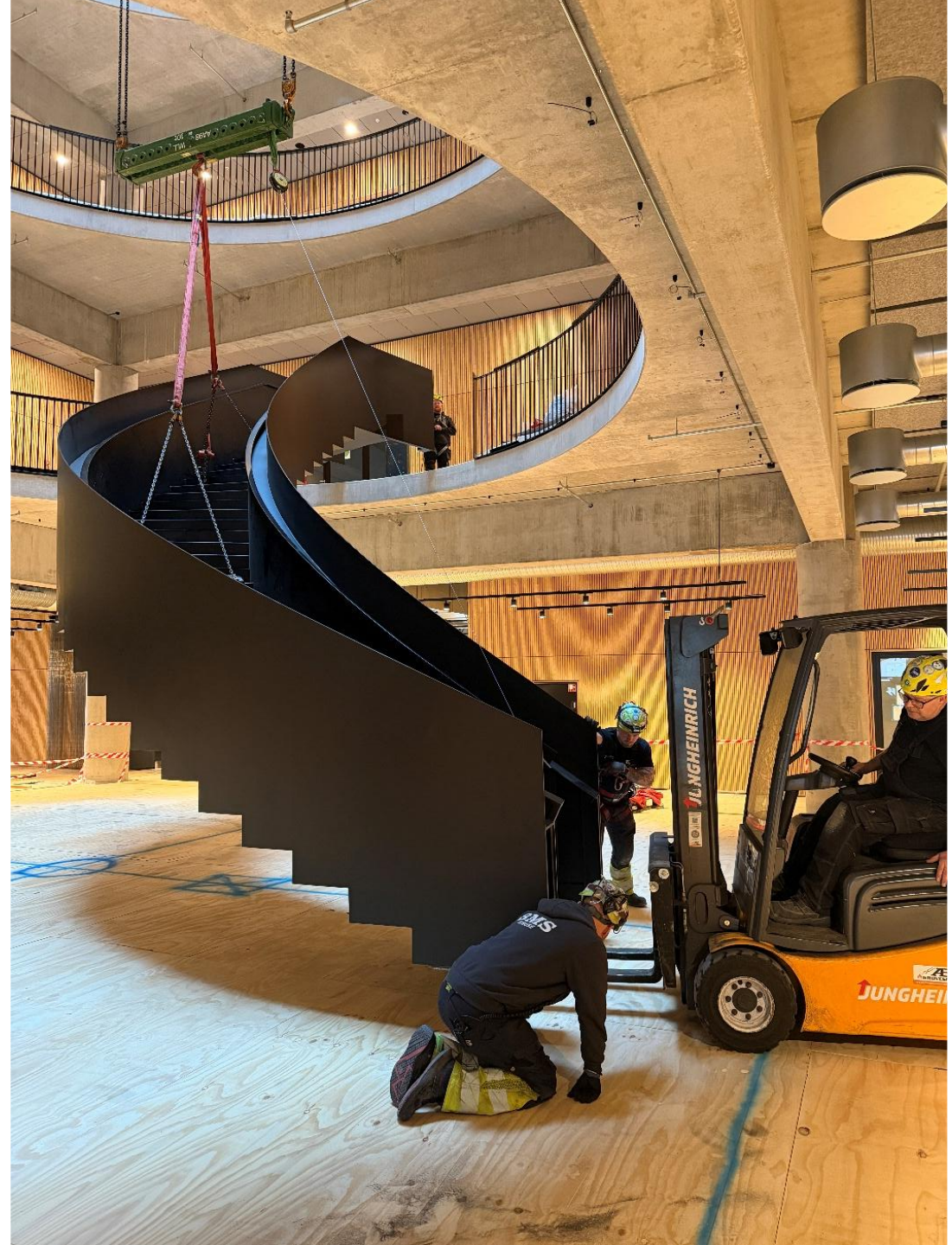


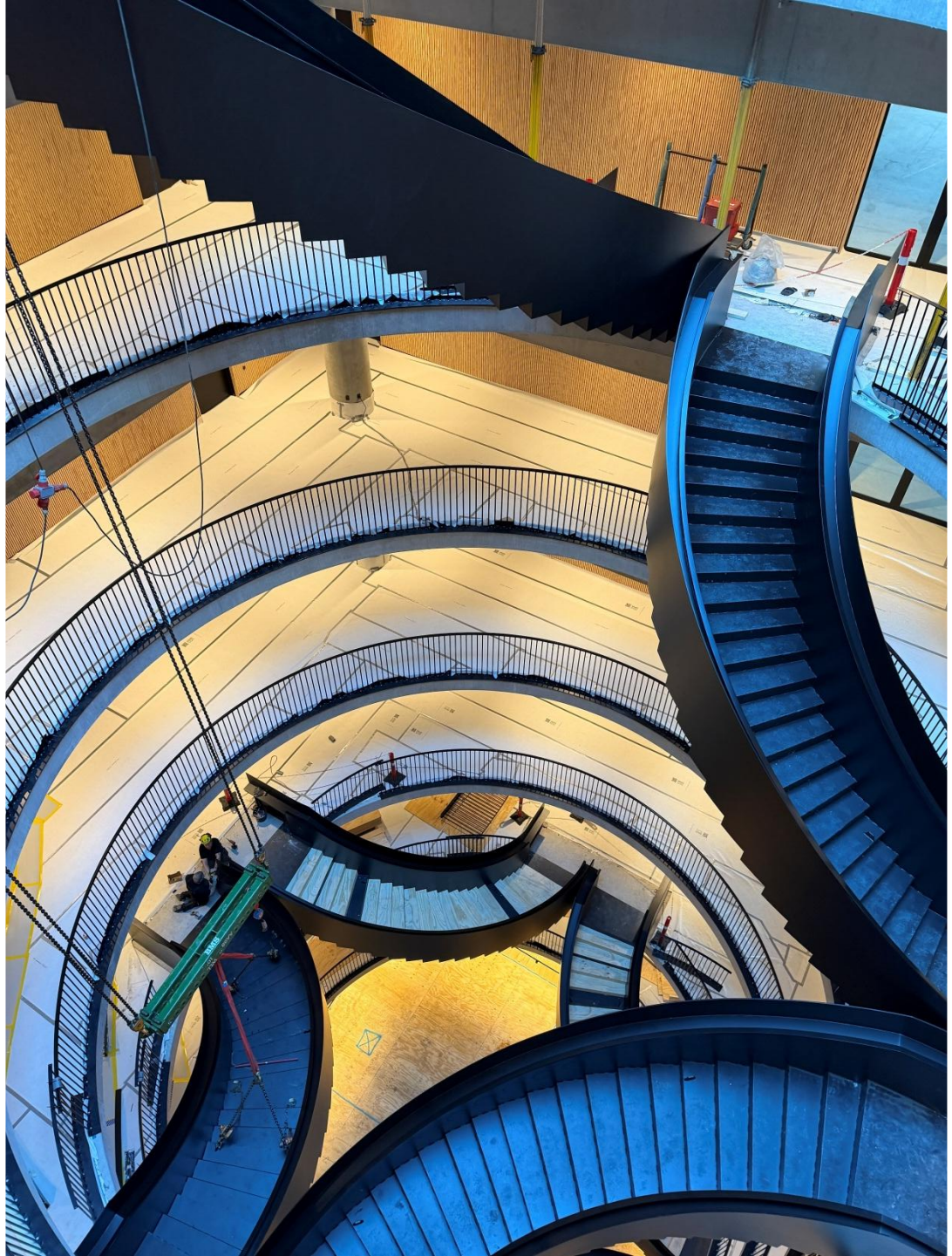



BMS
KRUSE



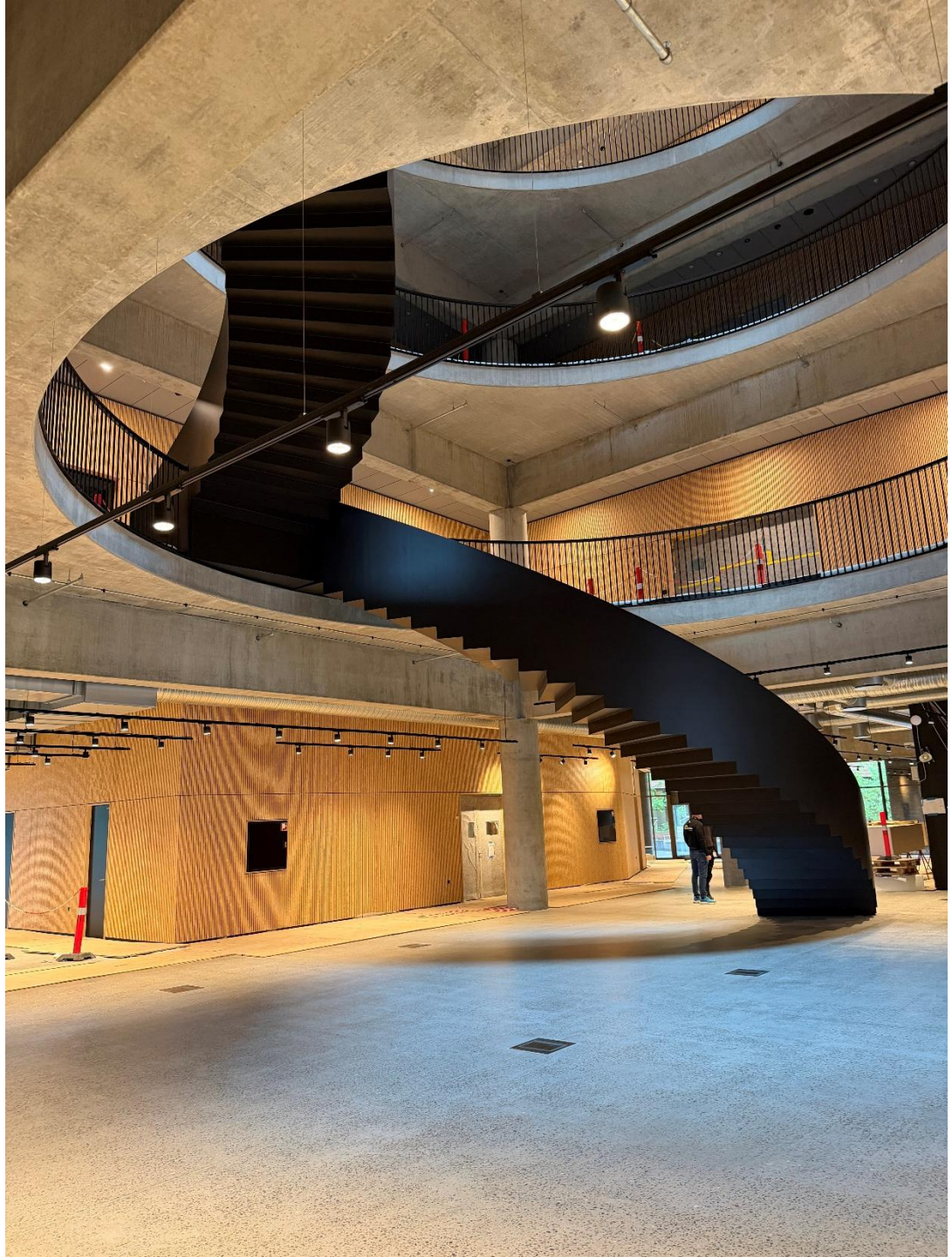

BMS

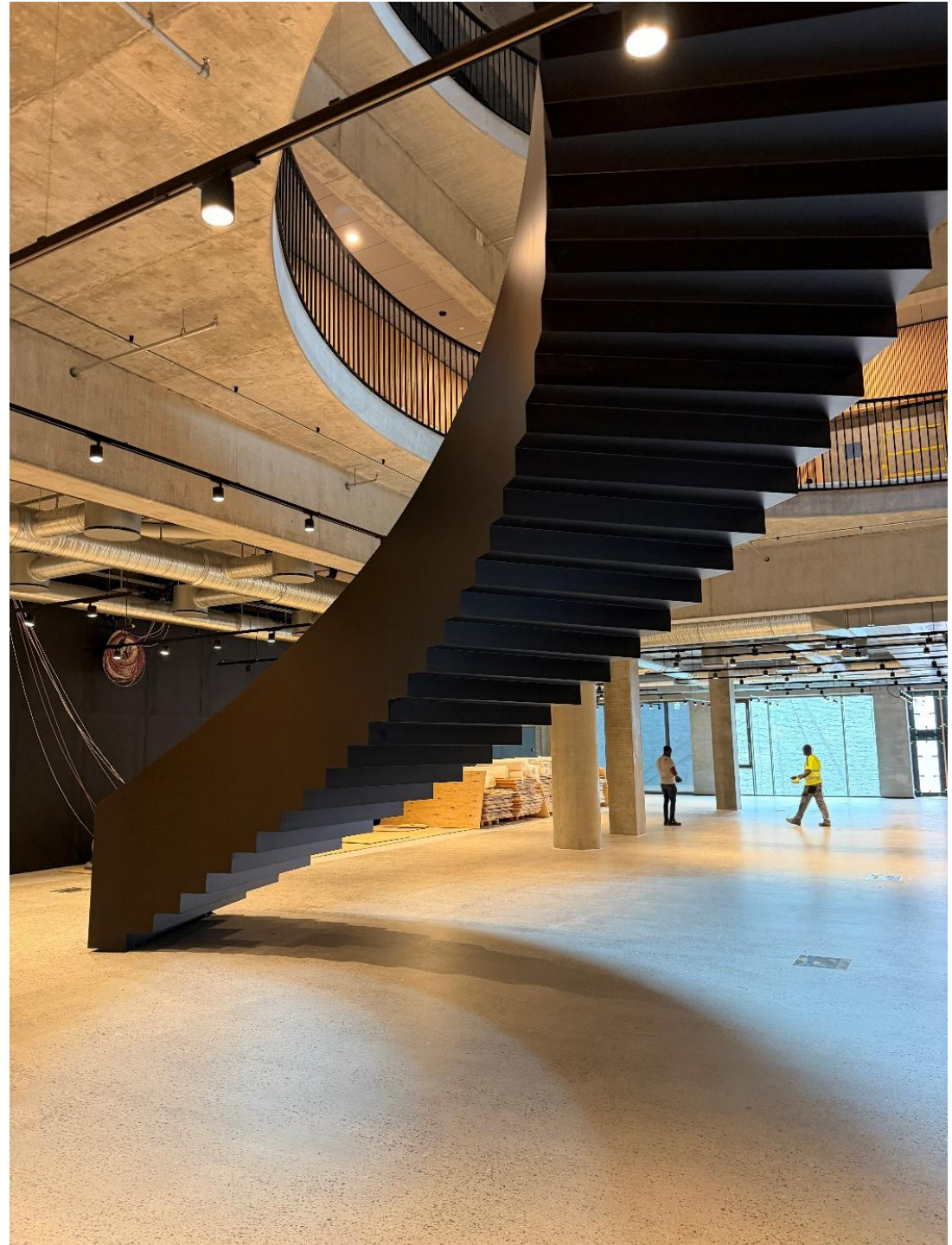

JUNGHEINRICH

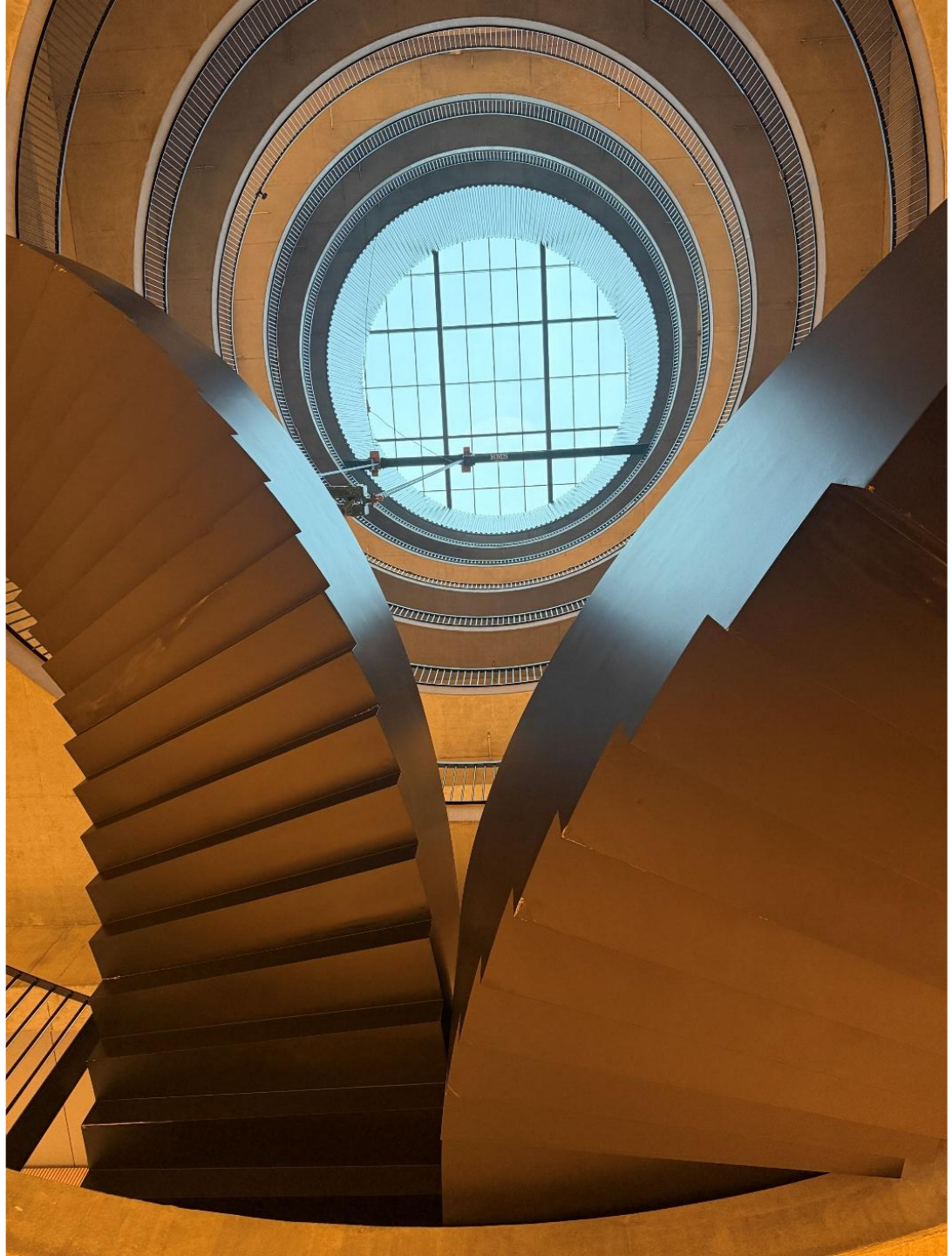


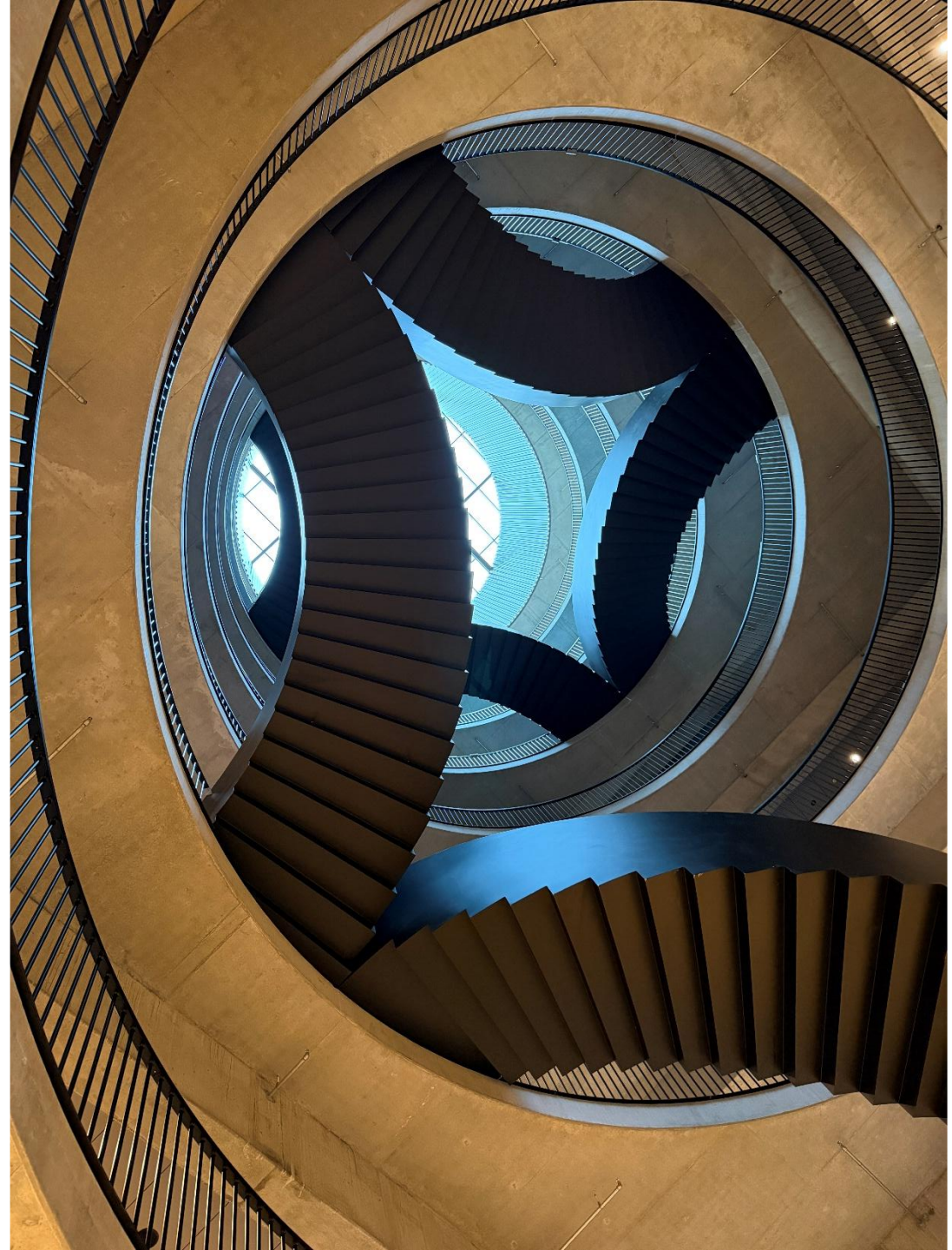


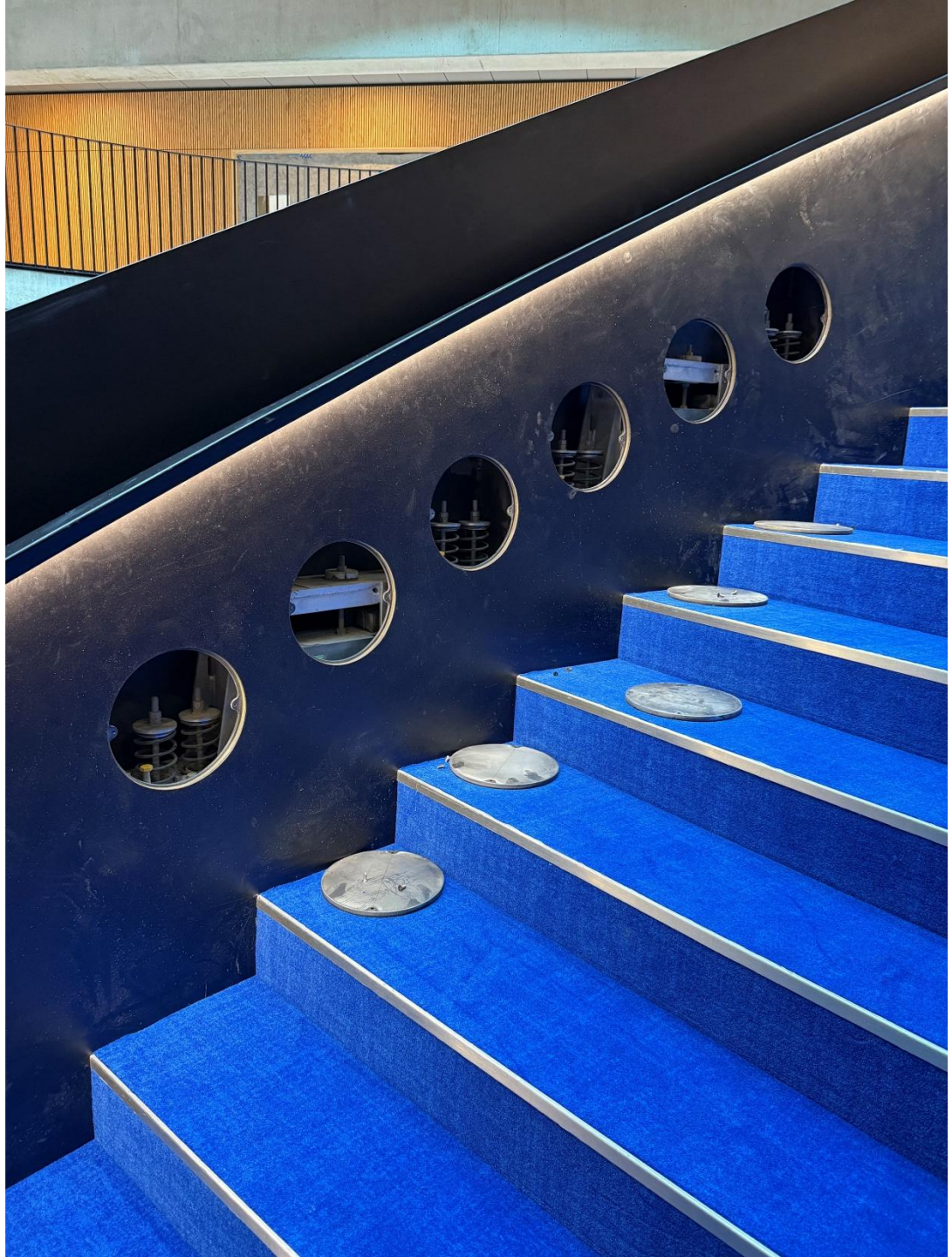


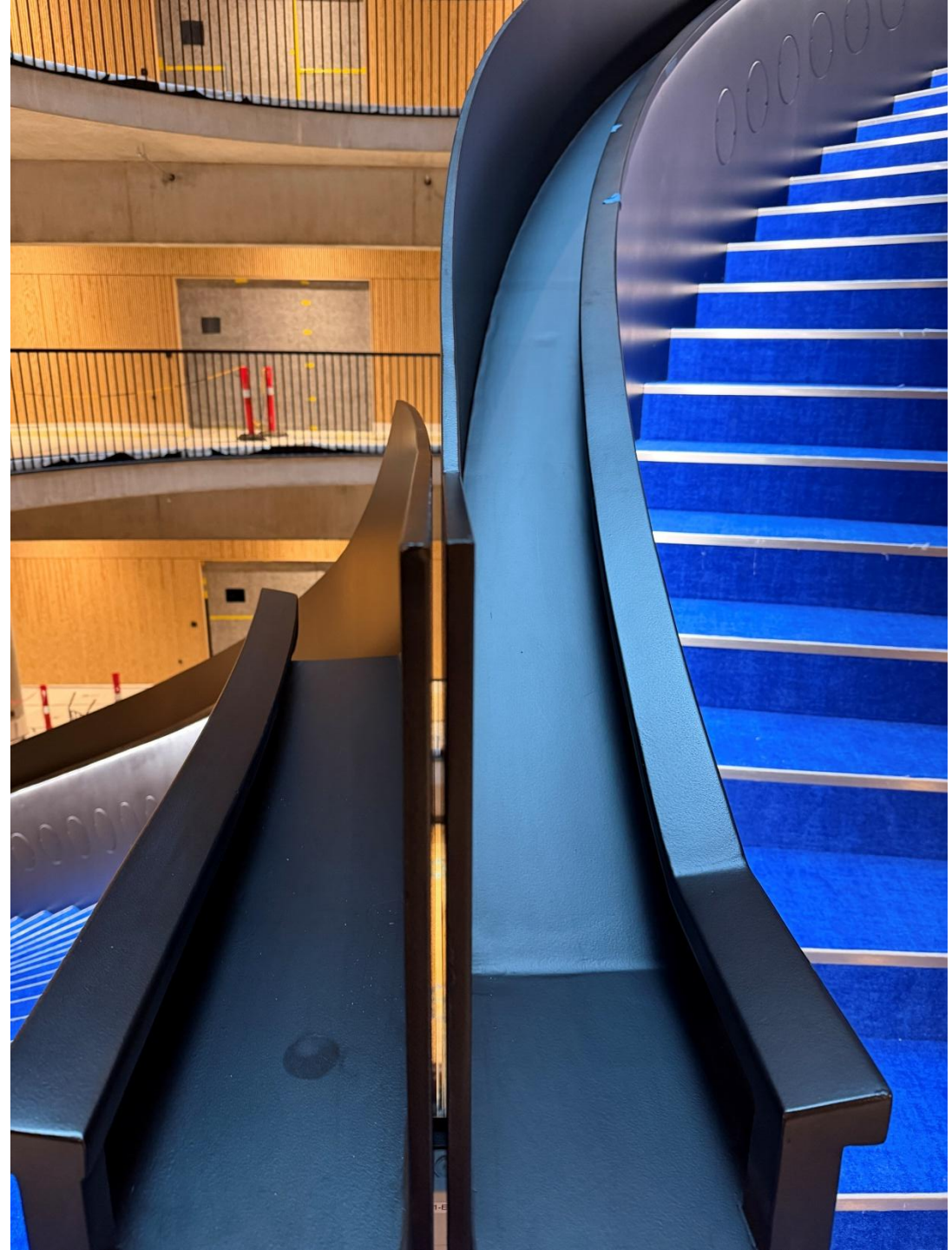


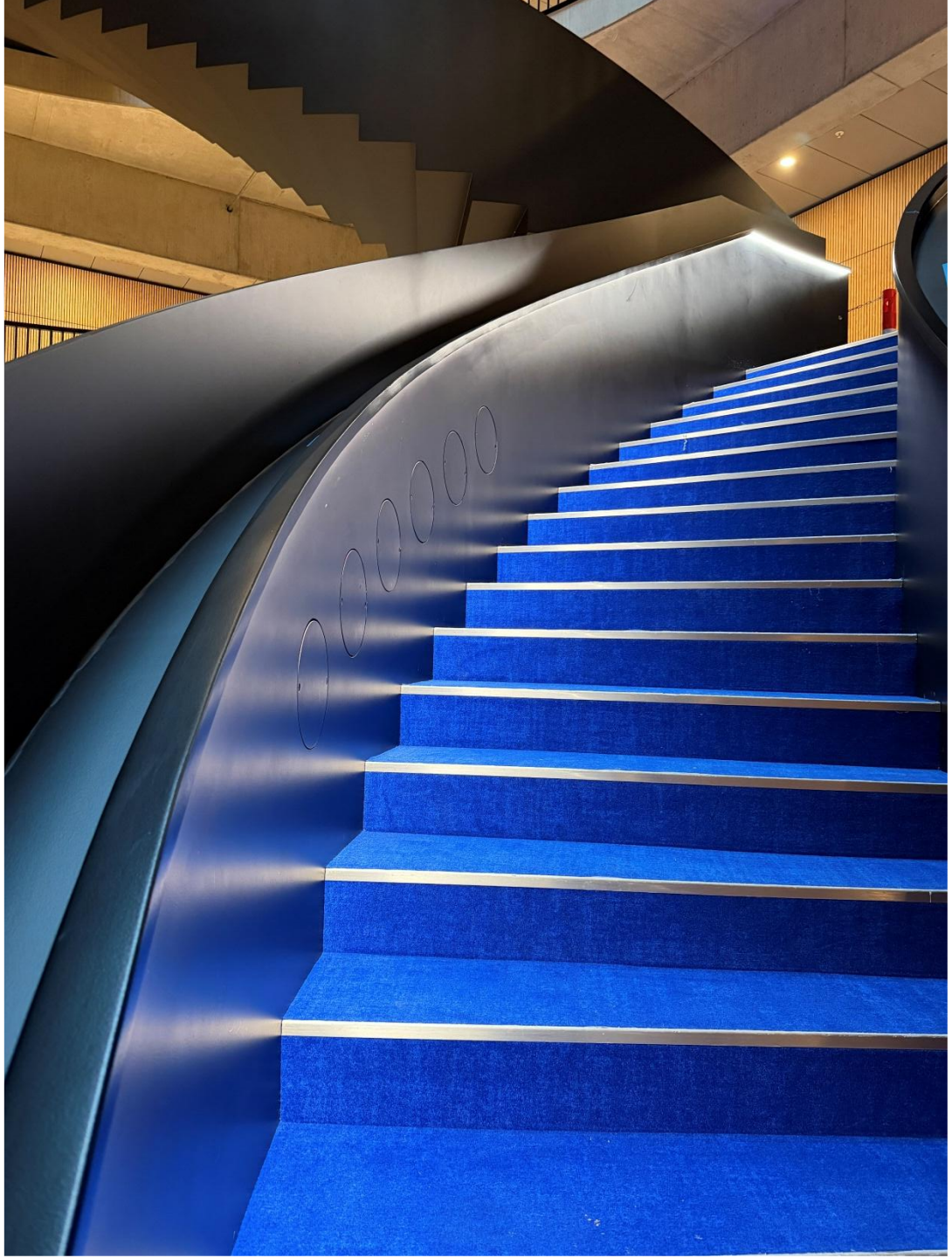


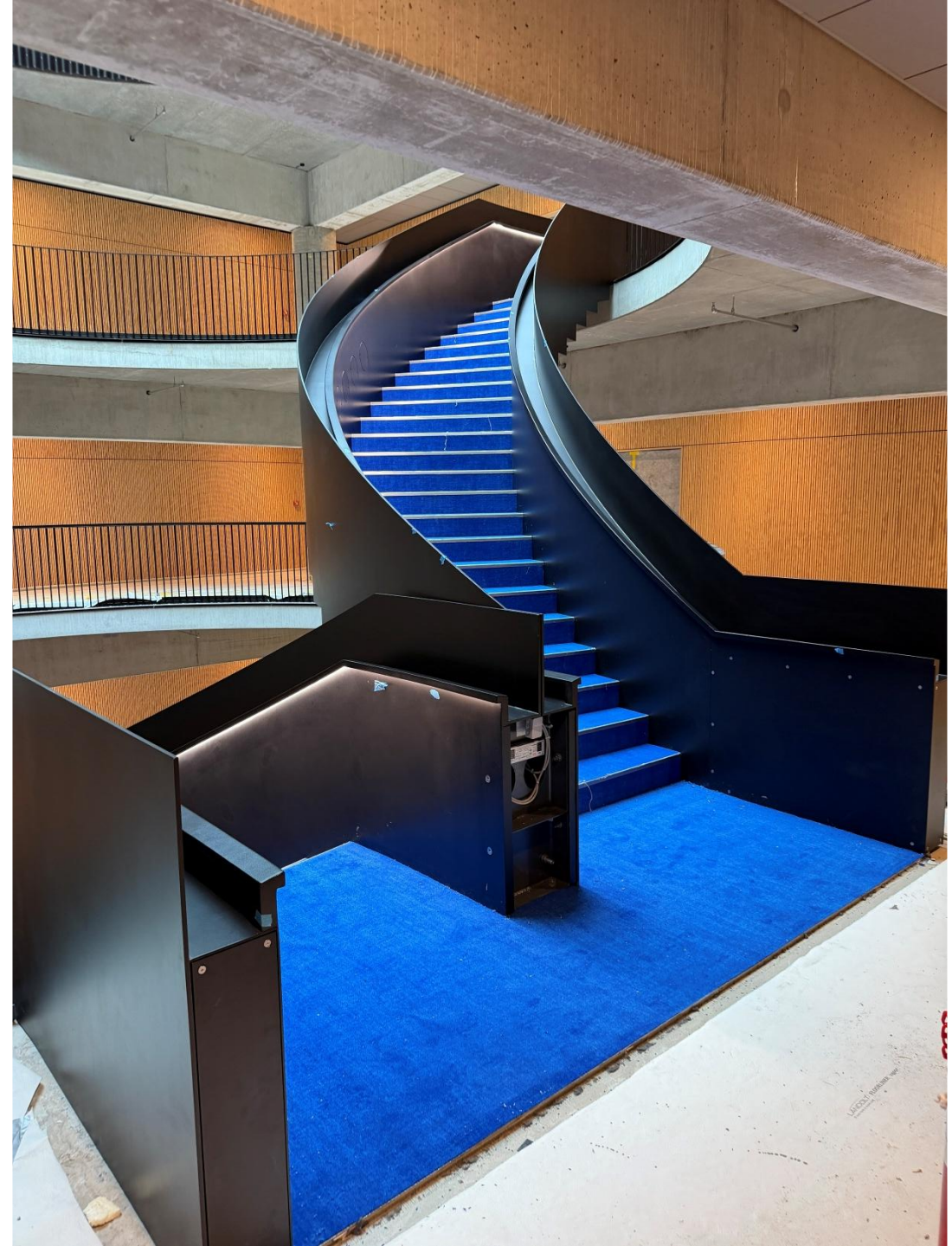


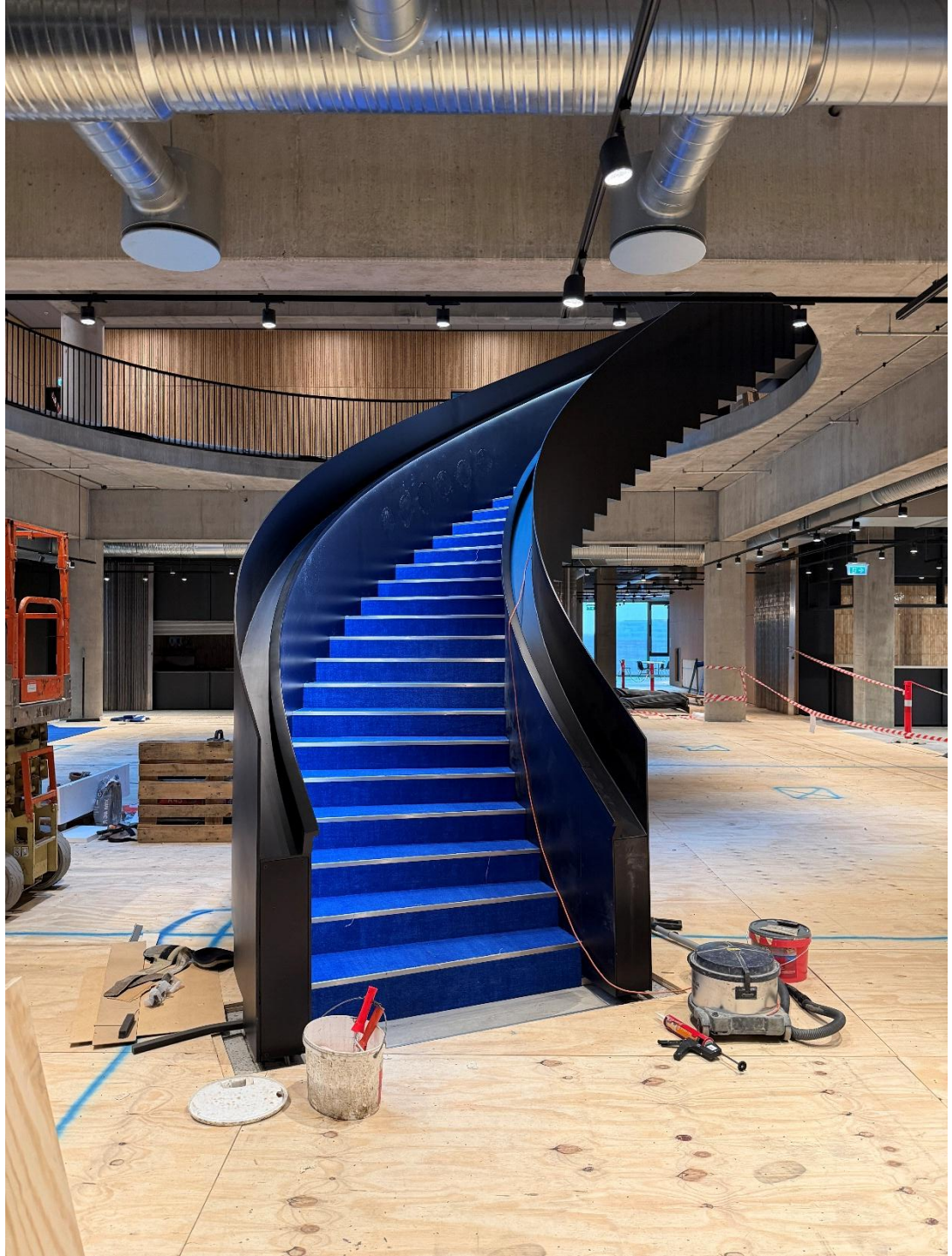


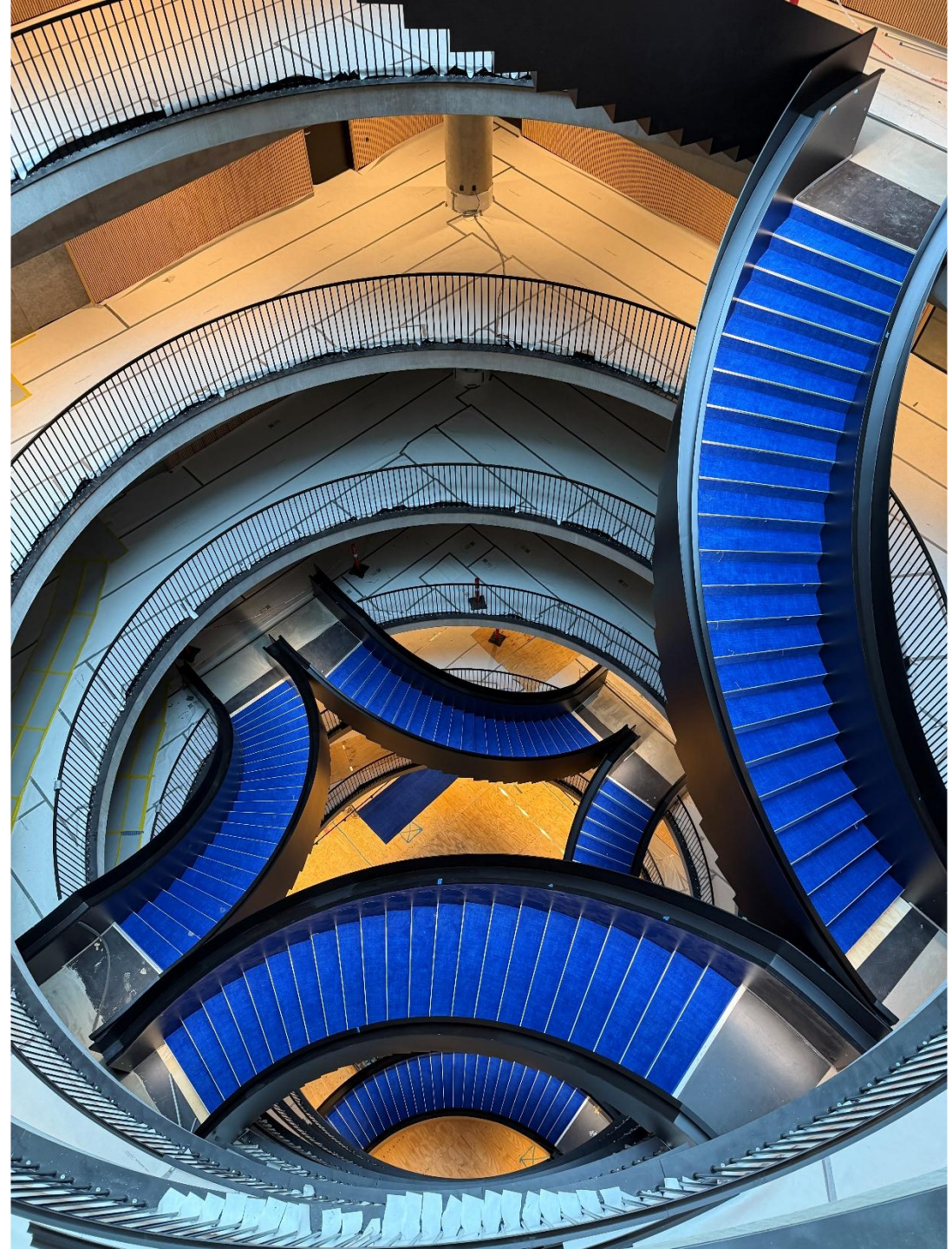












Dansk Design

Postkort fra Krakow



Vinder af Europæisk Stålpris 2026