

Lanseringsbruer

Betongkveld – Kristiansand 18. november 2021



Lanseringsbruene

Involverte

- Nye Veier, byggherre
- AF total entreprenør
- NO prosjektering, rådgiver for AF
- KSE UE av AF, bygger konstruksjoner
- BBR UE av KSE, lansering
- Spenneteknikk UE av KSE, spennarmering
- LENTAS lanseringskonsulent for KSE
- MC 3. parts kontroll prosjektering
- +++

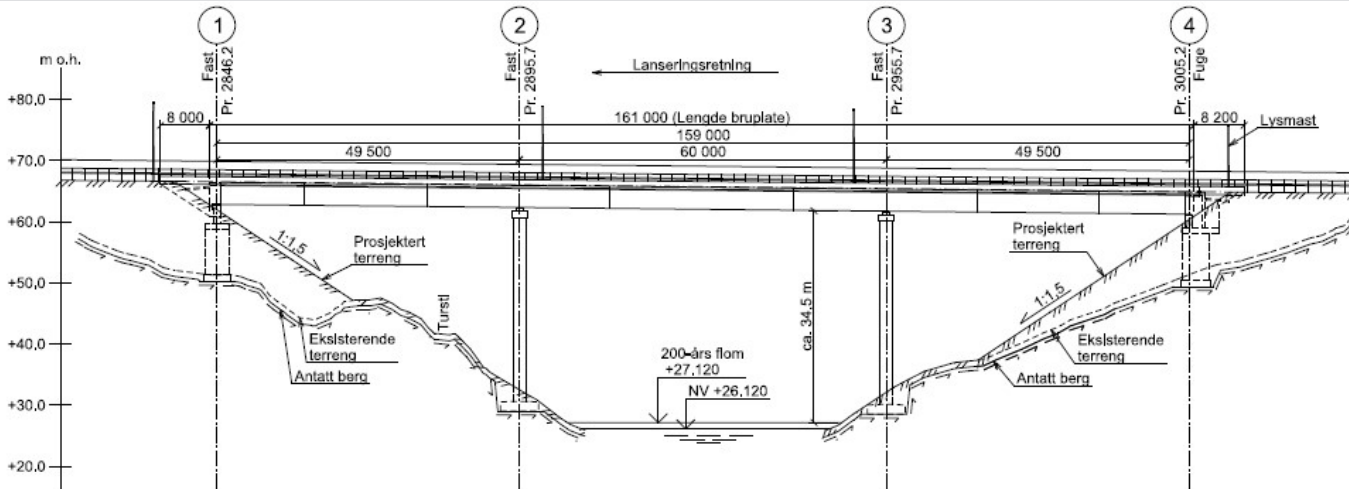
Lanseringsbruene

Dette har jeg
aldri gjort før,
så det klarer jeg
sikkert.

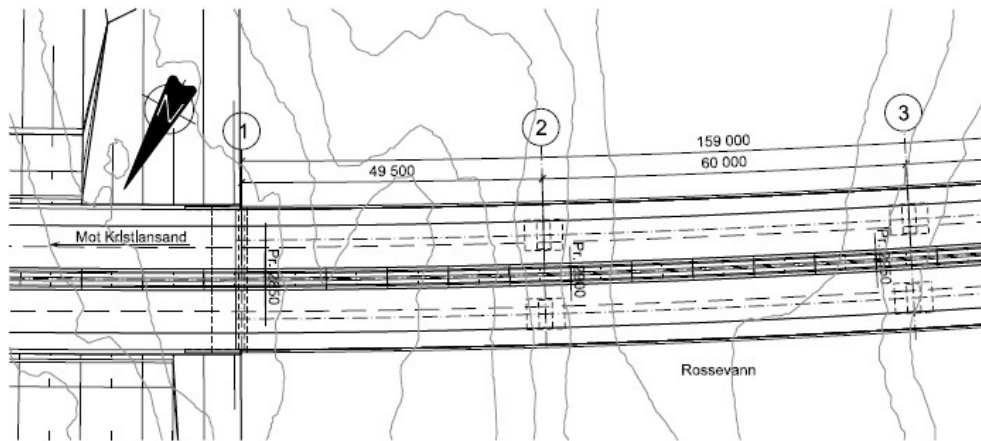


Spire Gro

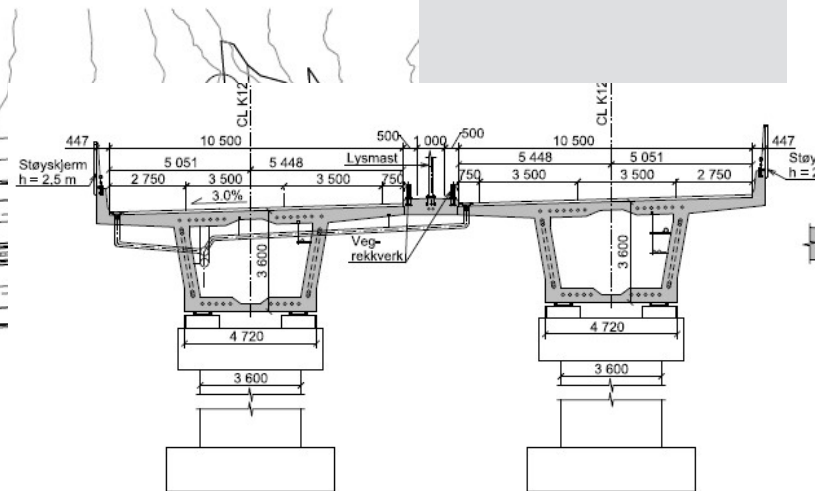
Rossevann



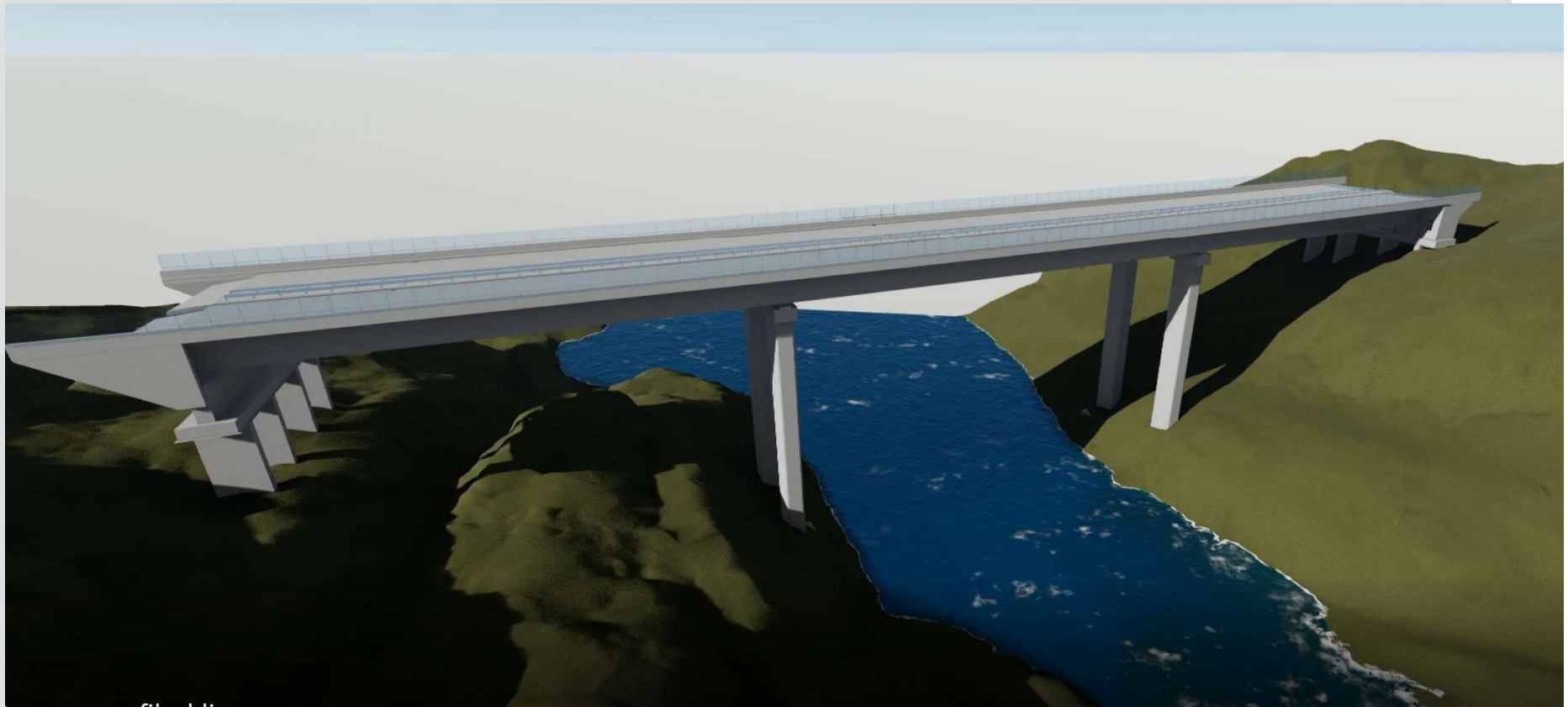
OPPRISS
1:500



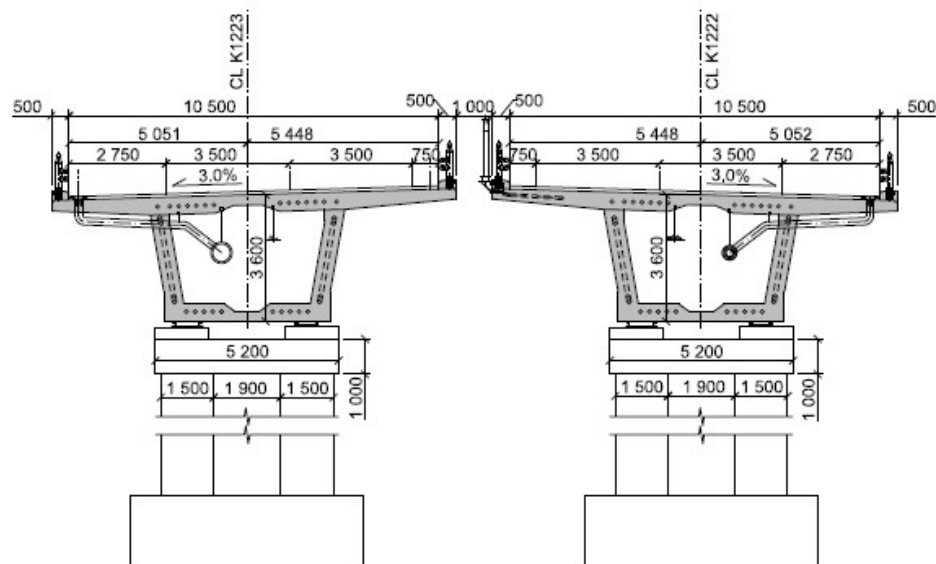
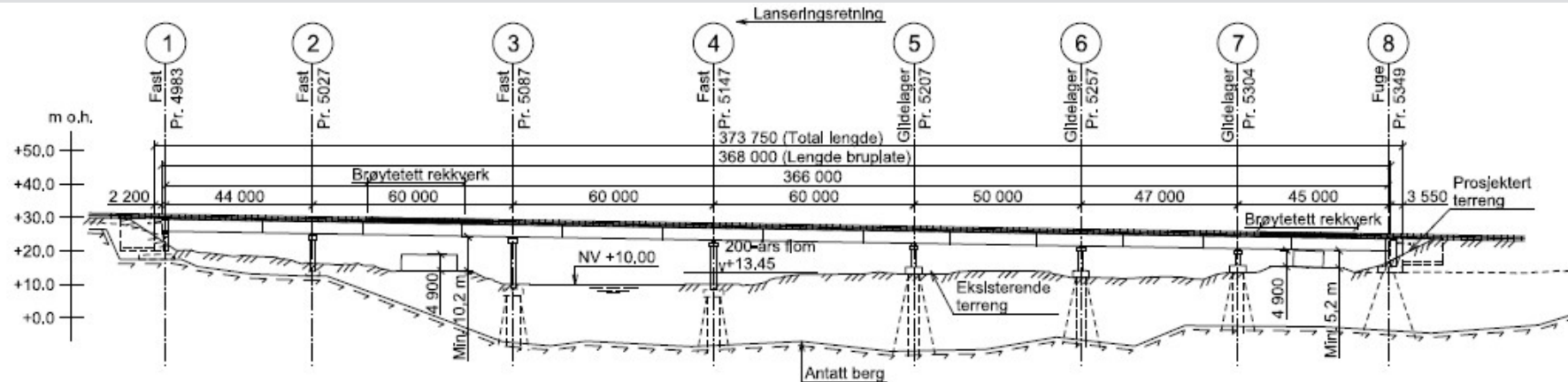
PLAN
1:500



Rossevann



Monan

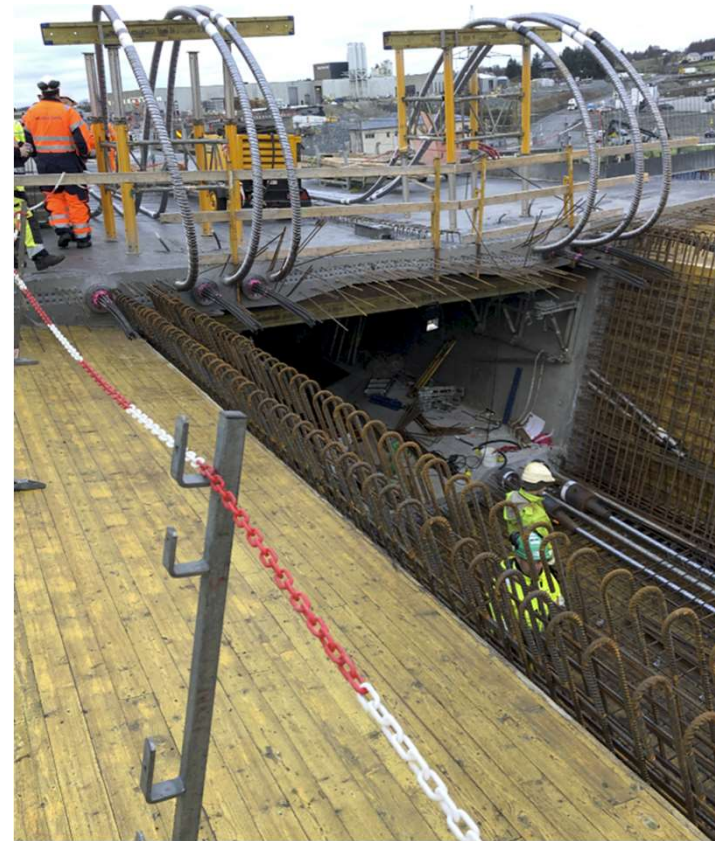
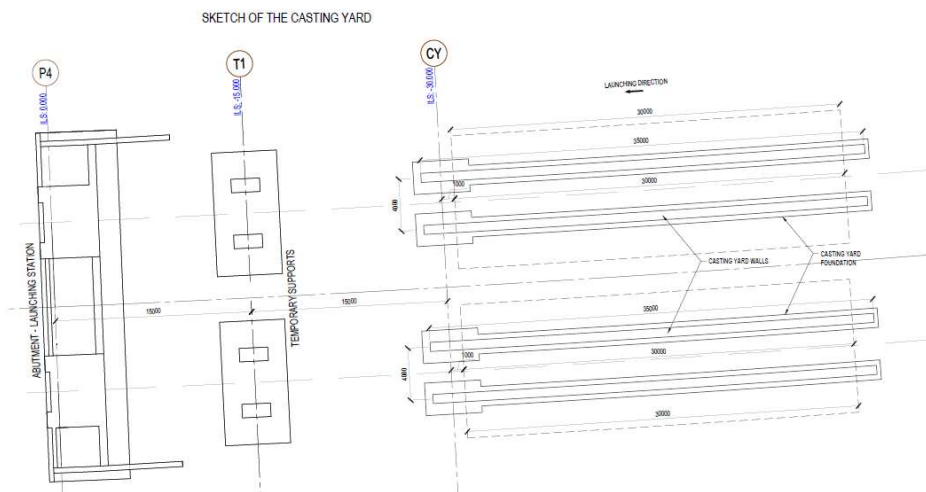


Monan



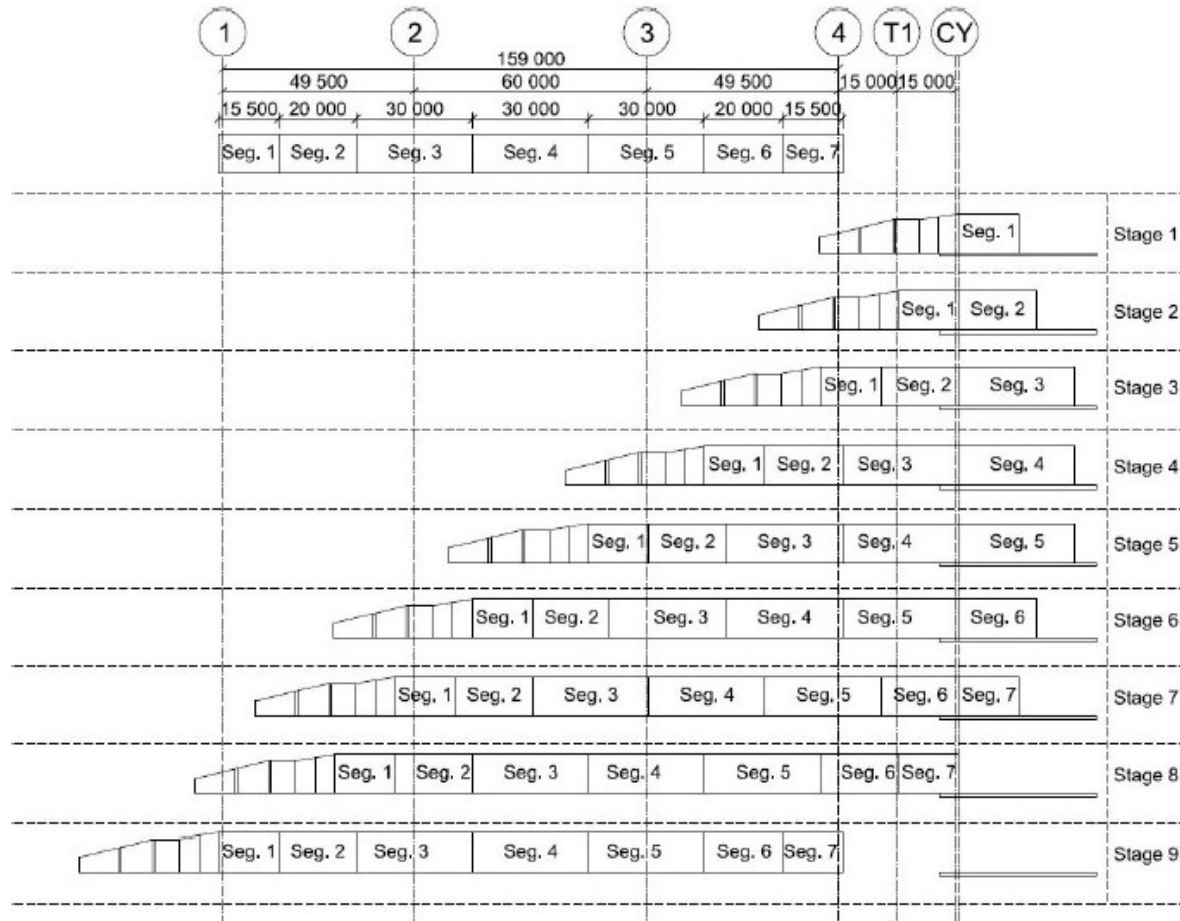
Segmenter

- 30 m lange segmenter, ca 0,5* spennvidde
- Fabrikken bygges ca 1 segmentlengde bak lanseringsakse



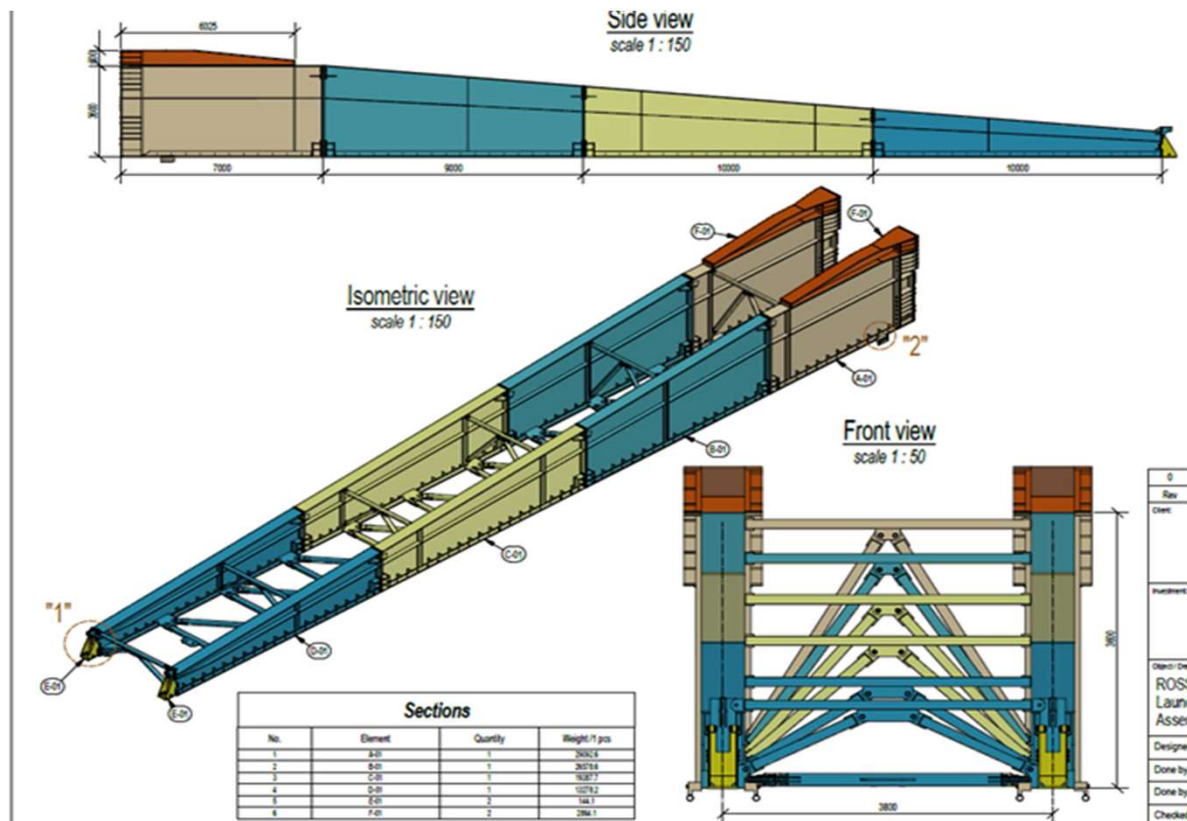
Rossevann

- Lanseringstrinn



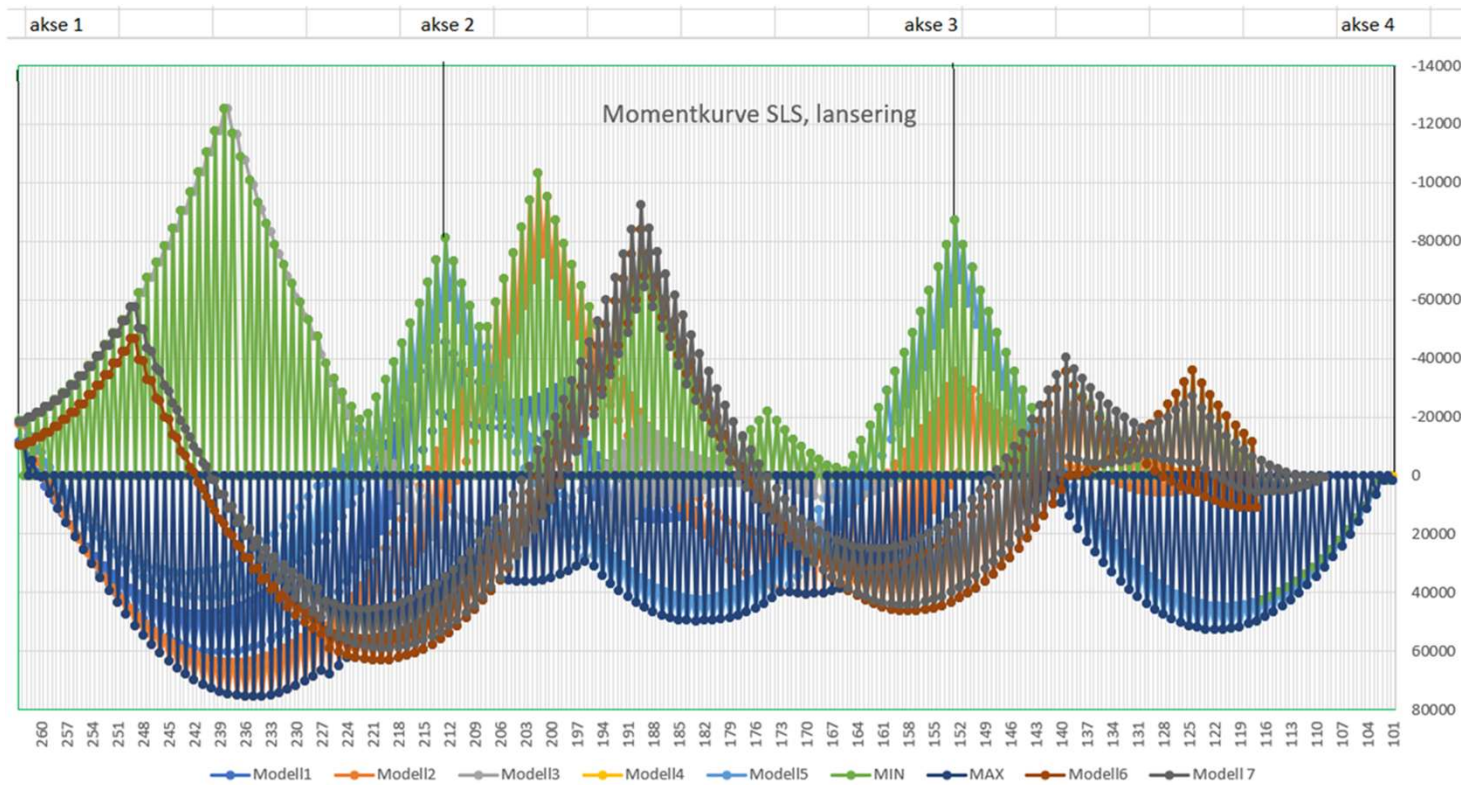
Lanseringsnesa

- $L_{nesa} \sim 0,6 * \text{spennvidde} = 36 \text{ m}$, 90 tonn; $g = 25 \text{ kN/m}$ (bru $g = 240 \text{ kN/m}$)



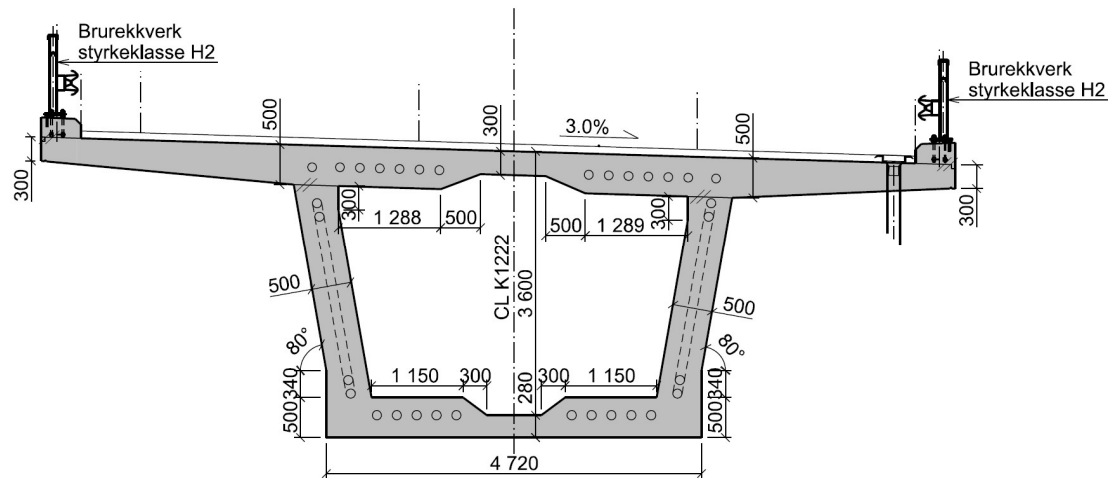
Rossevann

- Moment omhylningskurve



Lanseringsbruene

- Valg av tverrsnittet



- Sentrisk spennarmering (tvangsmoment = 0)
- Høyde $H = L/15$; $H = 0,94 + L/22,7 = 3,58 \text{ m} \sim 3,6 \text{ m}$.
- Tykkelse av bunnplate og bruplate
- Tykkelse av steget

Lanseringsbruene

Forutsetningene:

- Bruene dimensjoneres i byggefase:
 - ULS, SLS tilnærmet permanent ingen opprissing, dvs.

$$\sigma_{\max} = M/W \leq \sigma_{td} = 2,3 \text{ MPa}$$

- Laster i byggefase:
 - Egenvekt nesa og konstruksjon x1,1
 - Forspenning med korttidstap
 - Temperaturlaster
 - Ujevn høyde av midlertidige opplegg (10 mm)
 - Jekking av brua ved lansering og lagerbytte
 - Friksjon midl. lagre (5%)

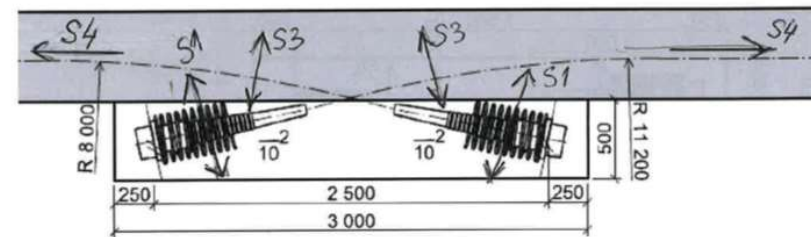
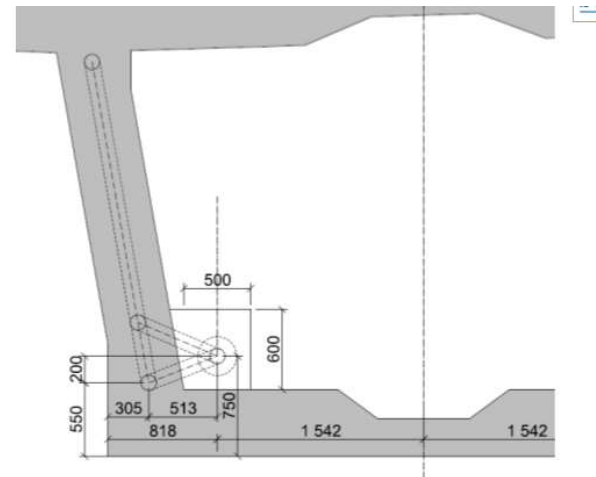
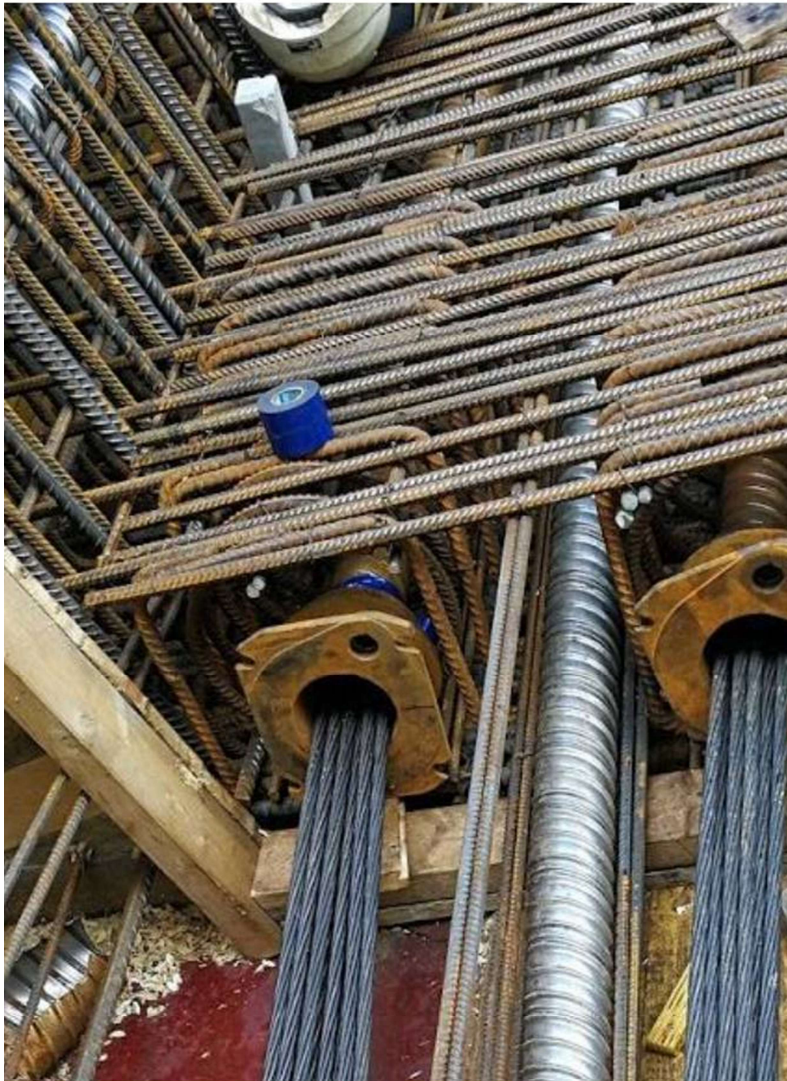
Lanseringsbruene

Spennarmering

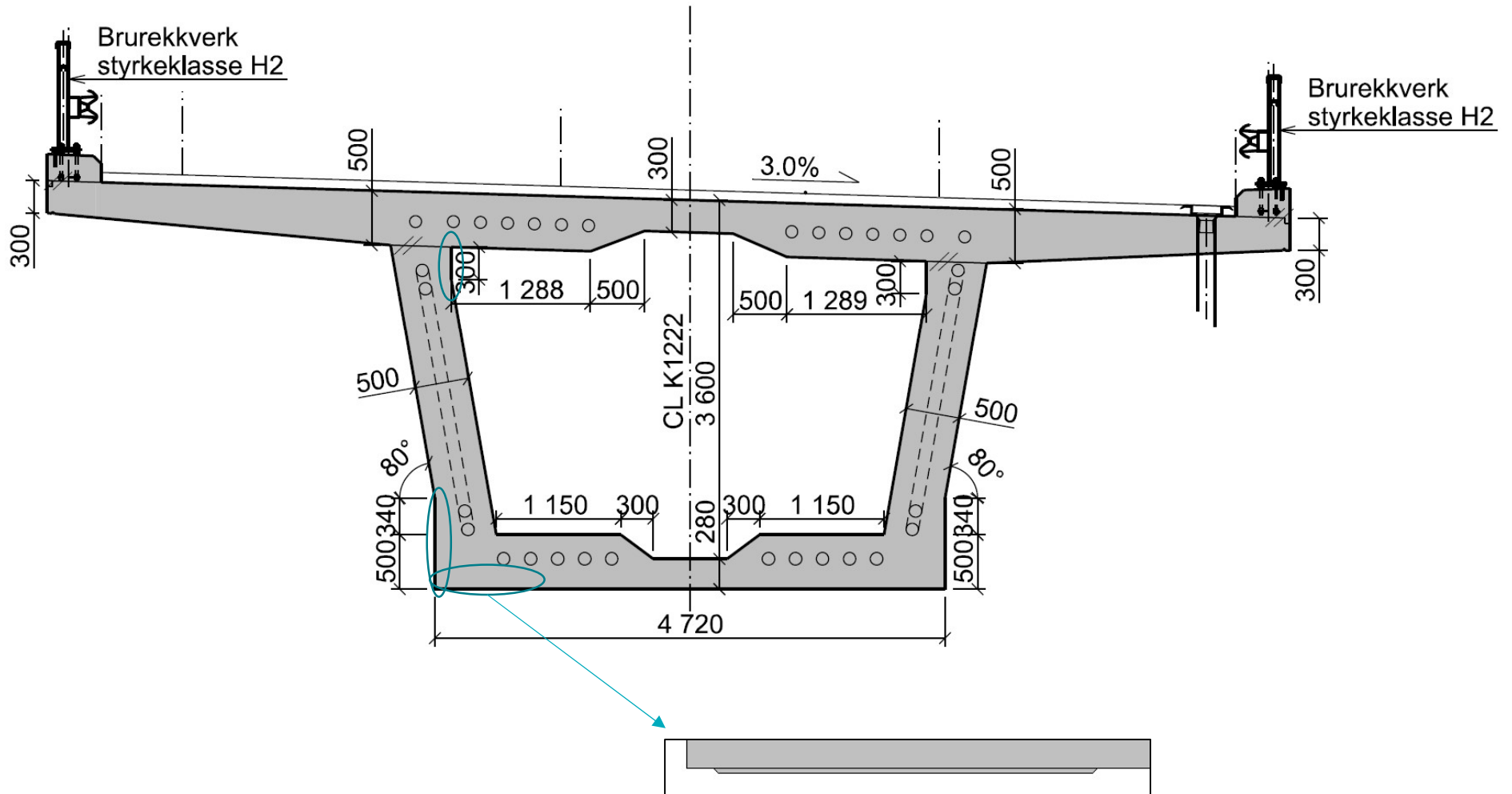
- Skjøtekoblinger i plater, konsoller i steget



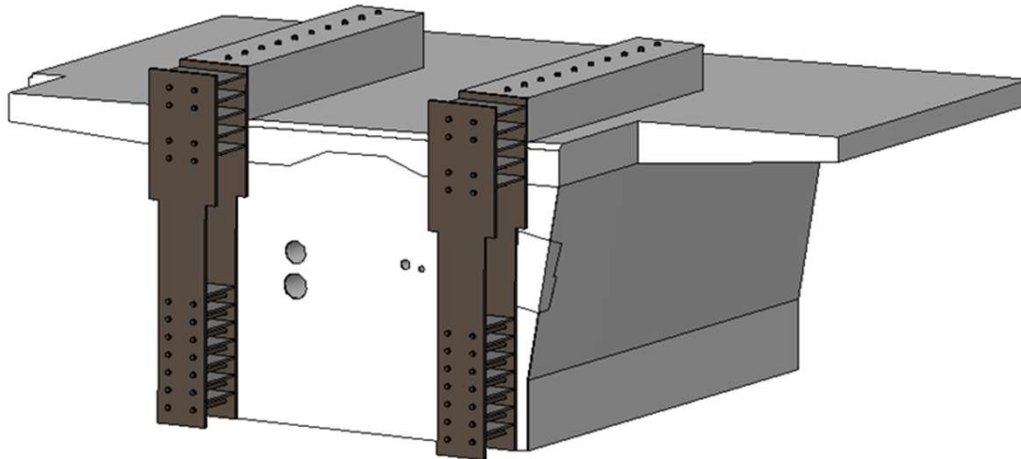
Lanseringsbruene



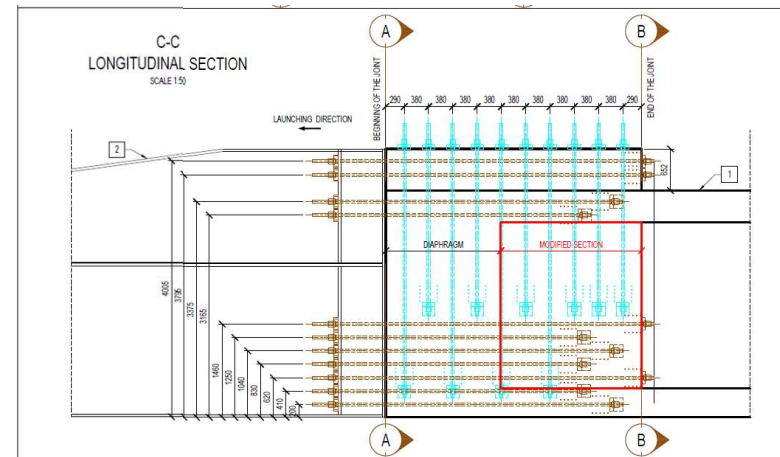
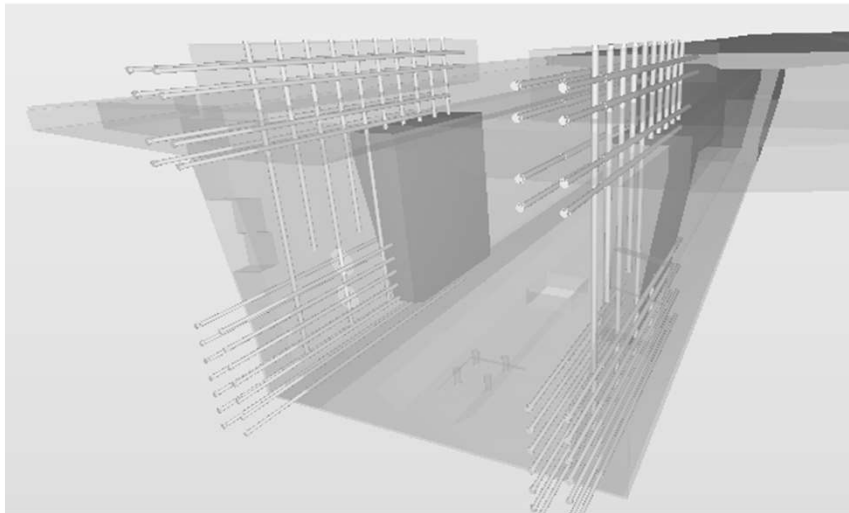
Tverrsnitt – Spesielle forhold



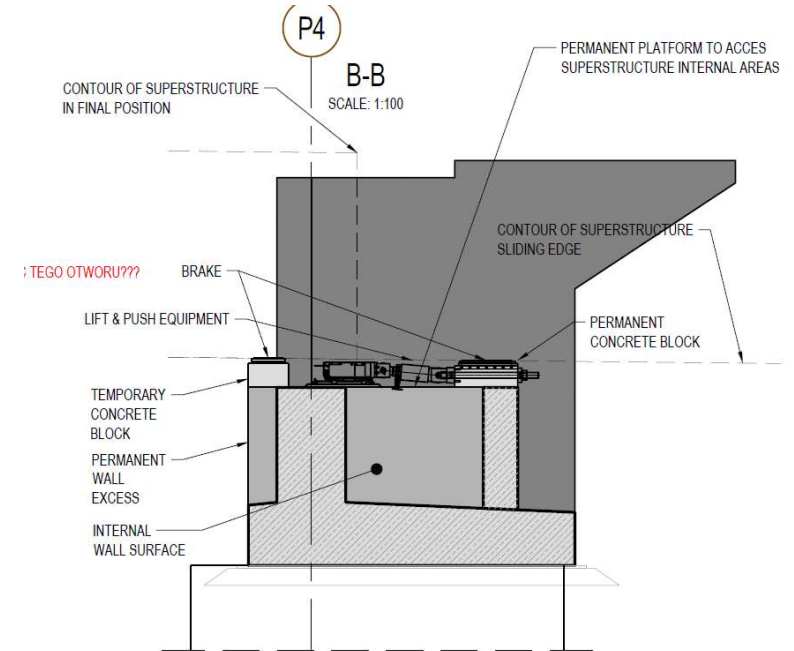
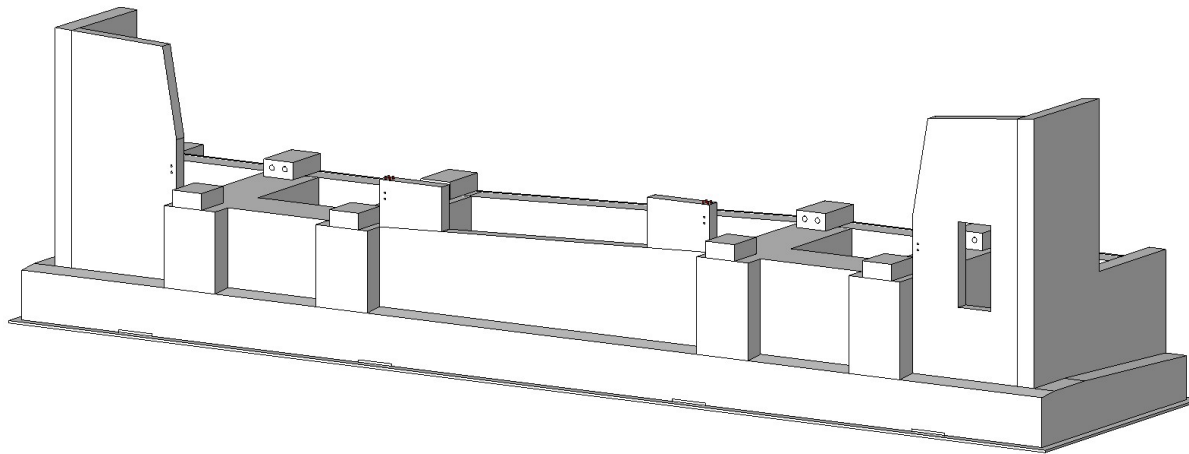
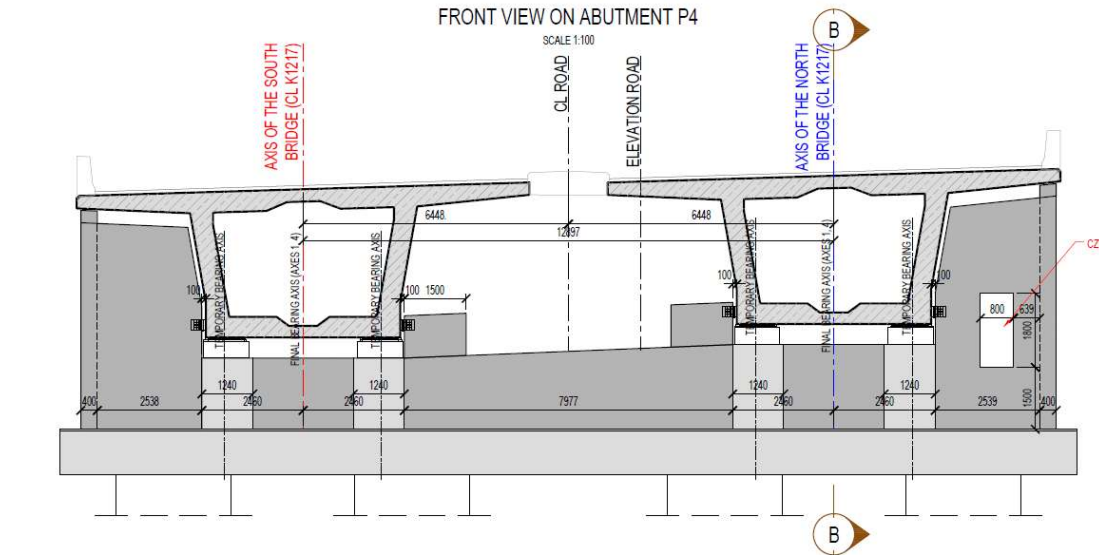
Innfesting av lanseringsnese



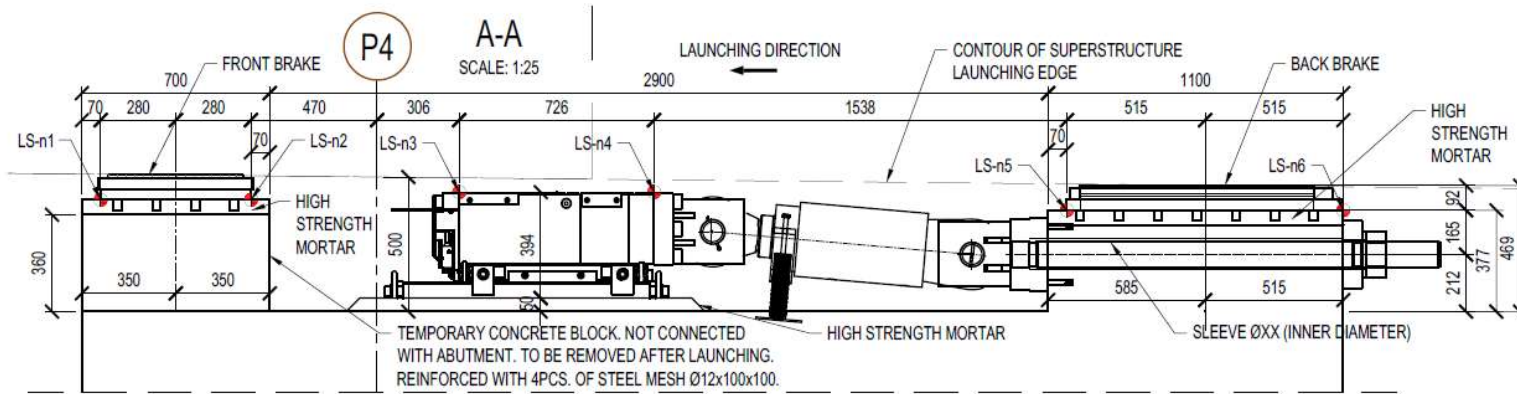
44 horisontale stag Ø47 mm
20 vertikale stag Ø47 mm



Lanseringstasjon (landkar)

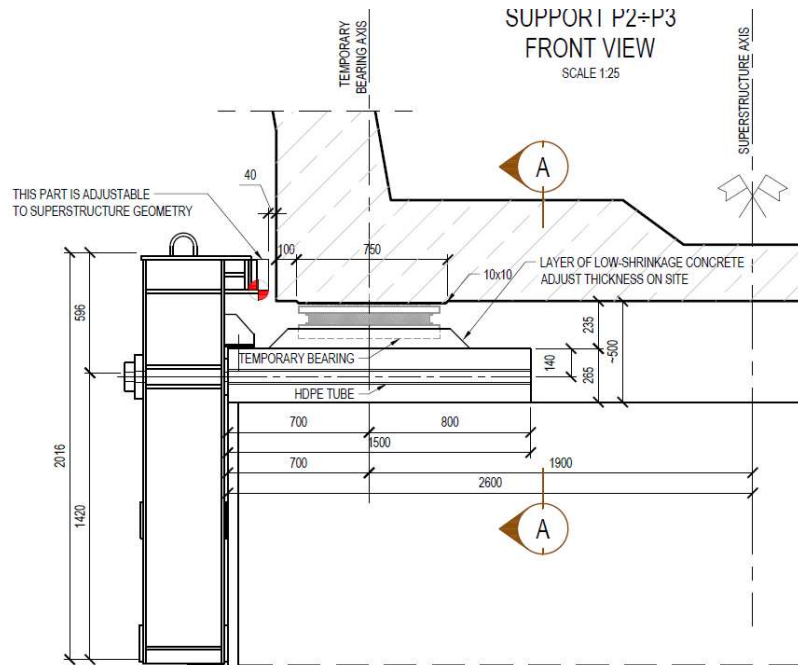


Lanseringsjeker

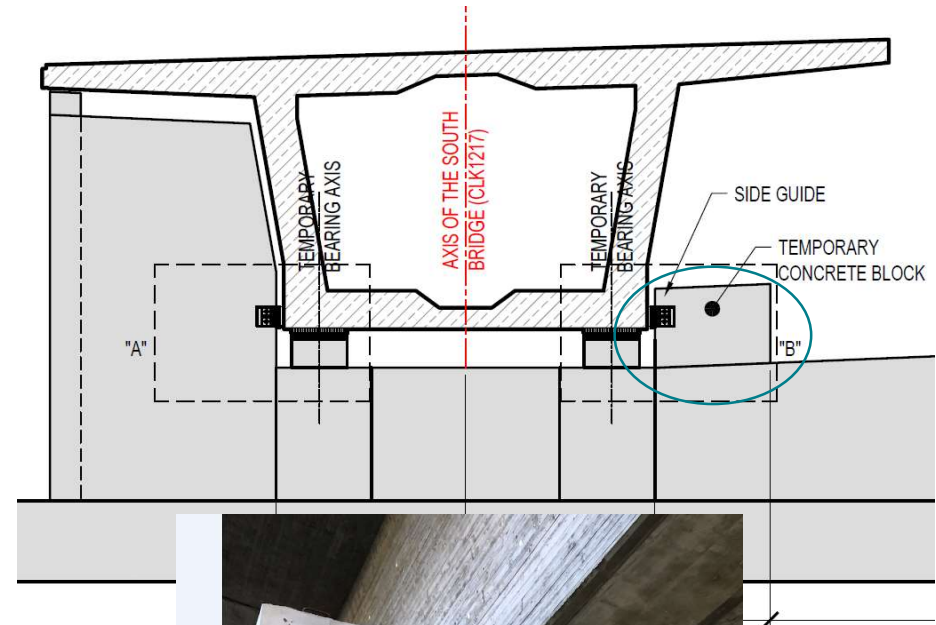


Sidestyring

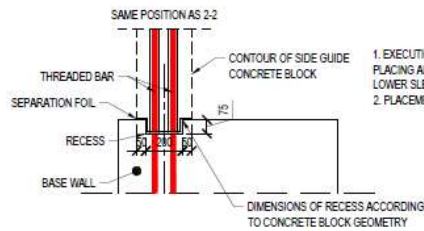
På søyler:



På landkar:



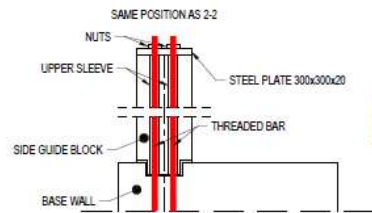
Sidestyring



PHASE 1

SCALE 1:25

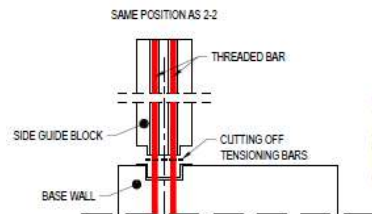
1. EXECUTION OF BASE WALL WITH RECESS FOR THE SIDE GUIDE BLOCK, PLACING ANCHORAGE THREADED BARS AND LOWER SLEEVES FOR SHEAR CONNECTION BARS.
2. PLACEMENT OF SEPARATION FOIL.



PHASE 2

SCALE 1:25

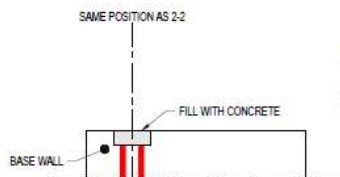
1. MOUNTING SHEAR CONNECTION BARS AND UPPER SLEEVES.
2. POURING SIDE GUIDE BLOCK.
3. MOUNTING STEEL PLATE.
4. POST TENSIONING THREADED BARS WITH MINIMAL FORCE $F_{min}=10kN$.



PHASE 3

SCALE 1:25

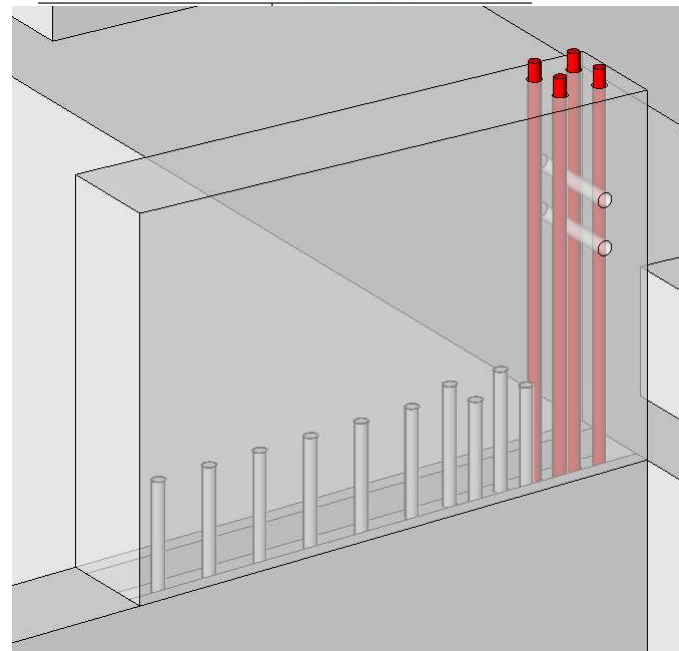
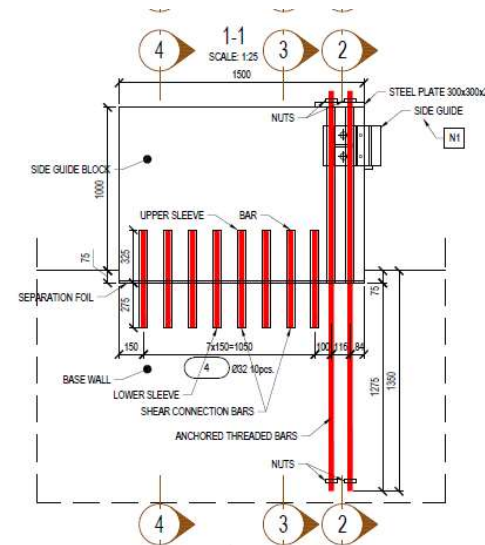
1. DISMOUNTING STEEL PLATE AFTER LAUNCHING THE SUPERSTRUCTURE.
2. LIFTING UP THE SIDE GUIDE BLOCK TO THE HEIGHT THAT PROVIDES ACCESS TO THREADED BARS.
3. CUTTING OFF THREADED BARS AND REMOVING SIDE GUIDE BLOCK FROM BASE WALL.



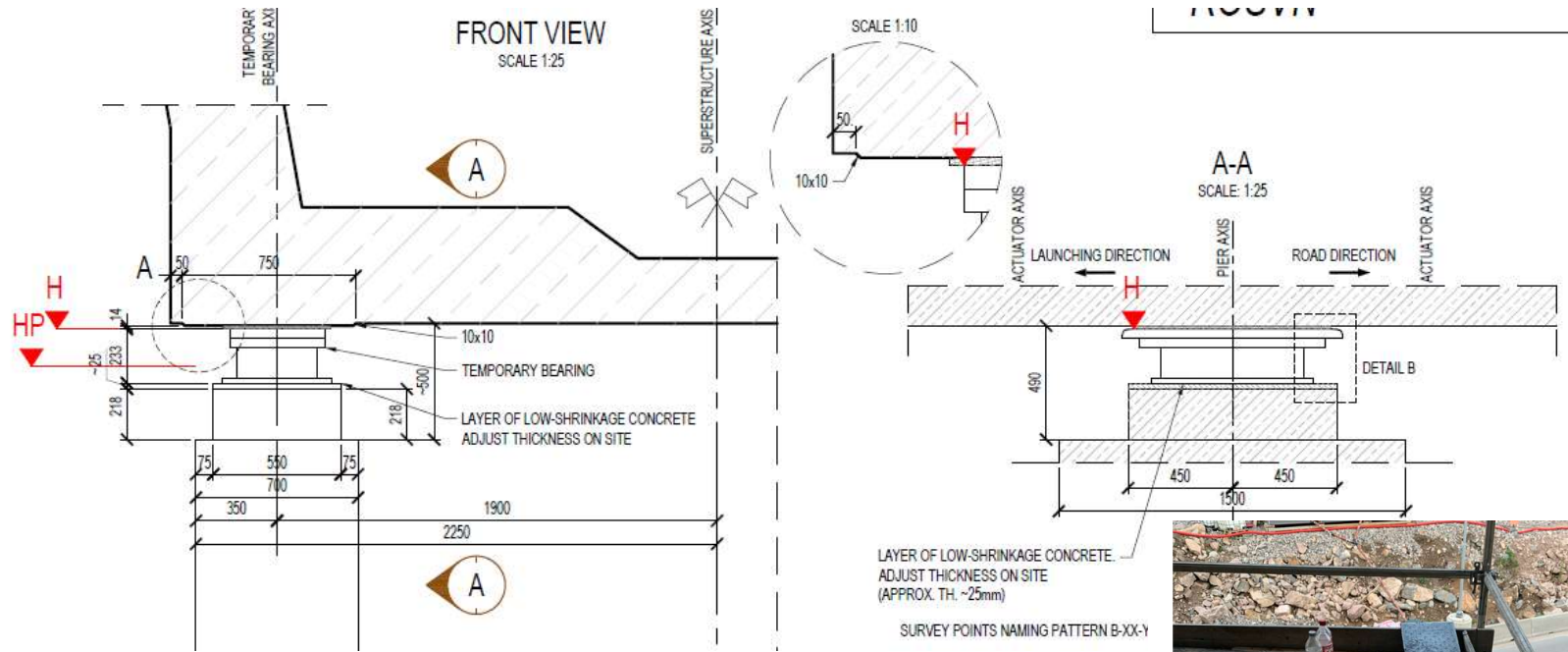
PHASE 4

SCALE 1:25

1. REMOVING SEPARATION FOIL.
2. CUTTING OFF THREADED BARS AS CLOSE TO BASE WALL SURFACE AS POSSIBLE.
3. FULFILL OF RECESS WITH CONCRETE.

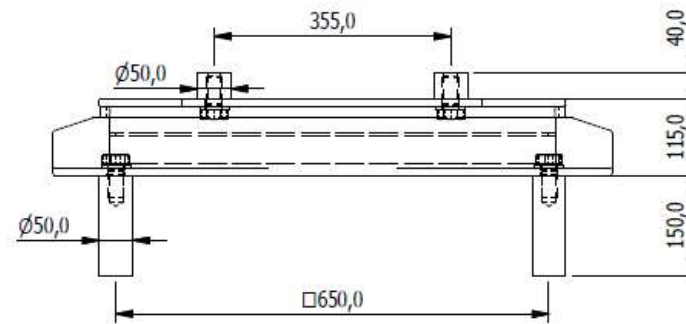


Midlertidige lagre

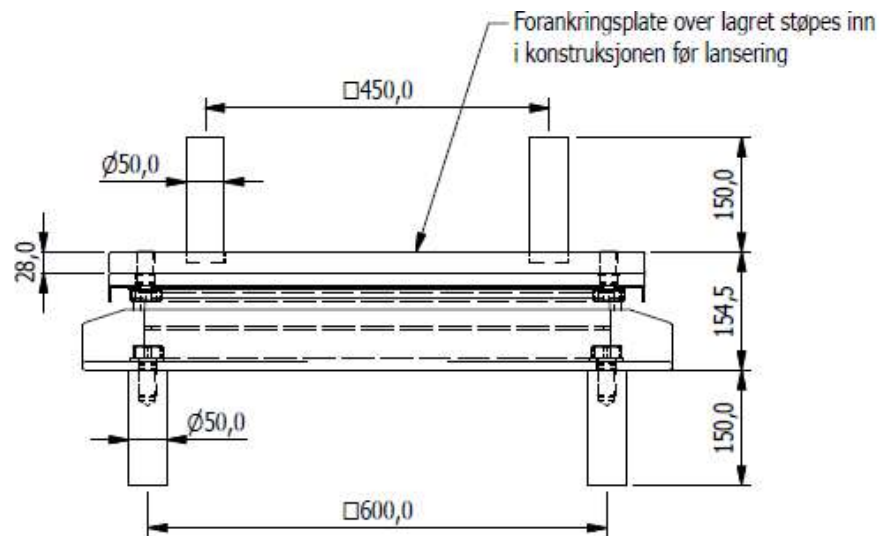


Permanente lagre

Permanente lagre i søyleaksene uten lagerbolter opp i overbygning



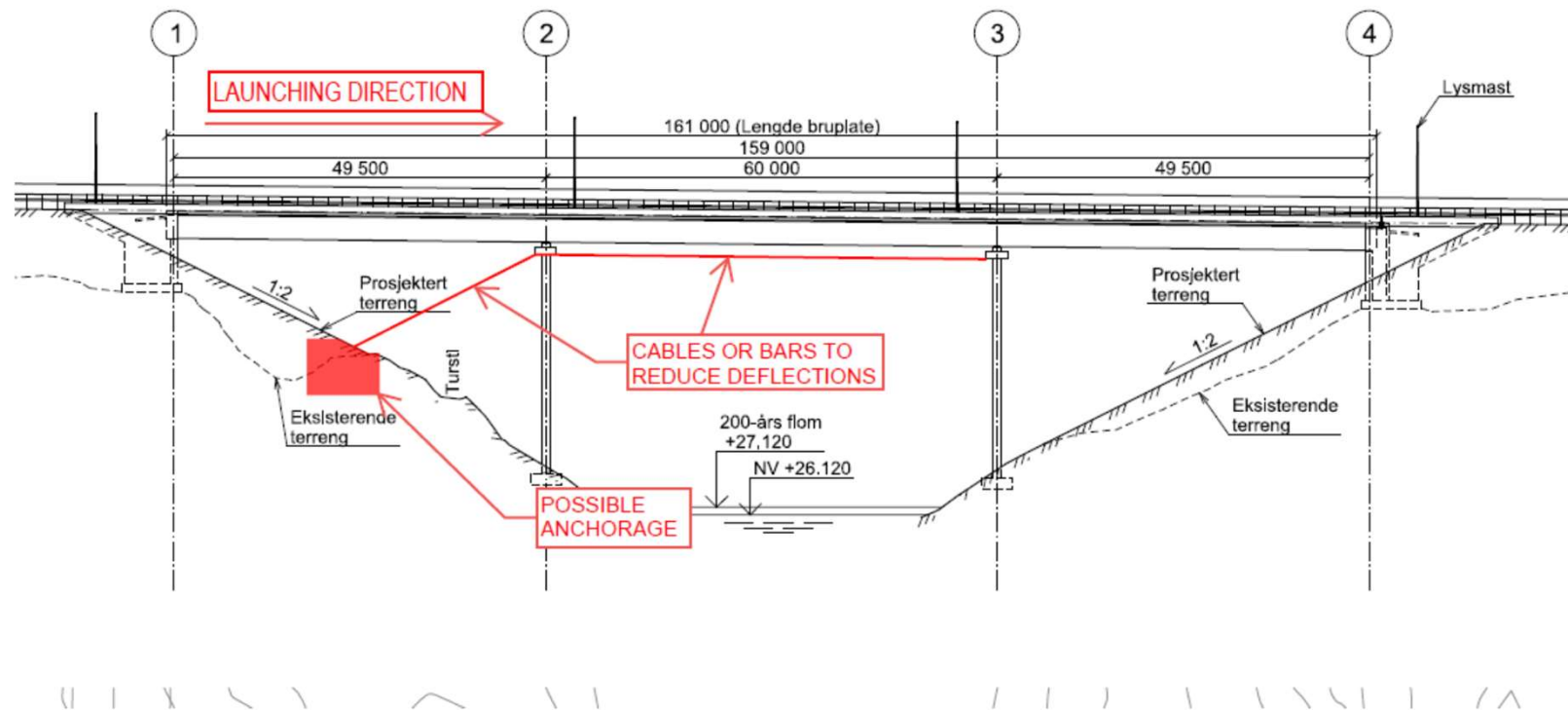
Permanente lagre i endeaksene med lagerbolter opp i overbygning



Rossevann

Underbygning

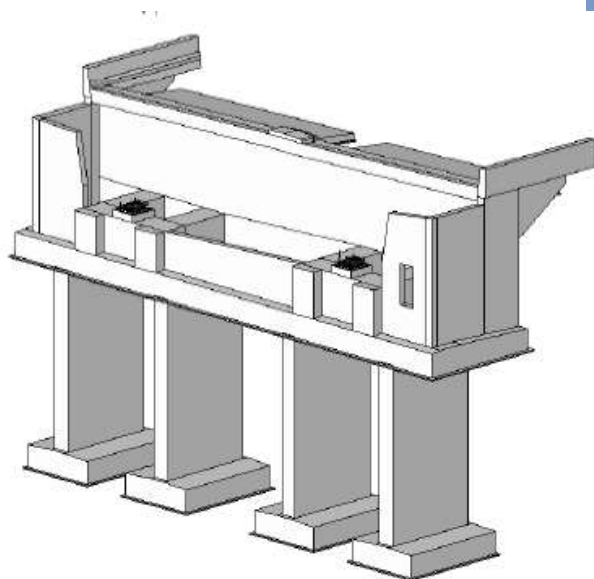
- Oppdimensjonering eller avstivning?



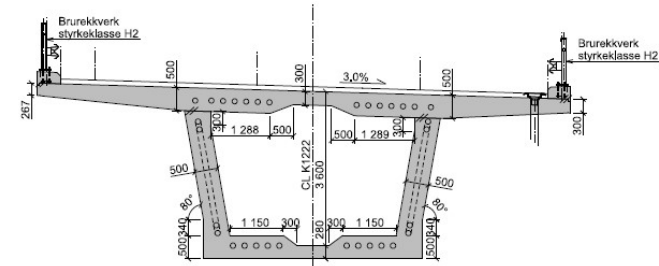
Rossevann



Landkar fundamentering

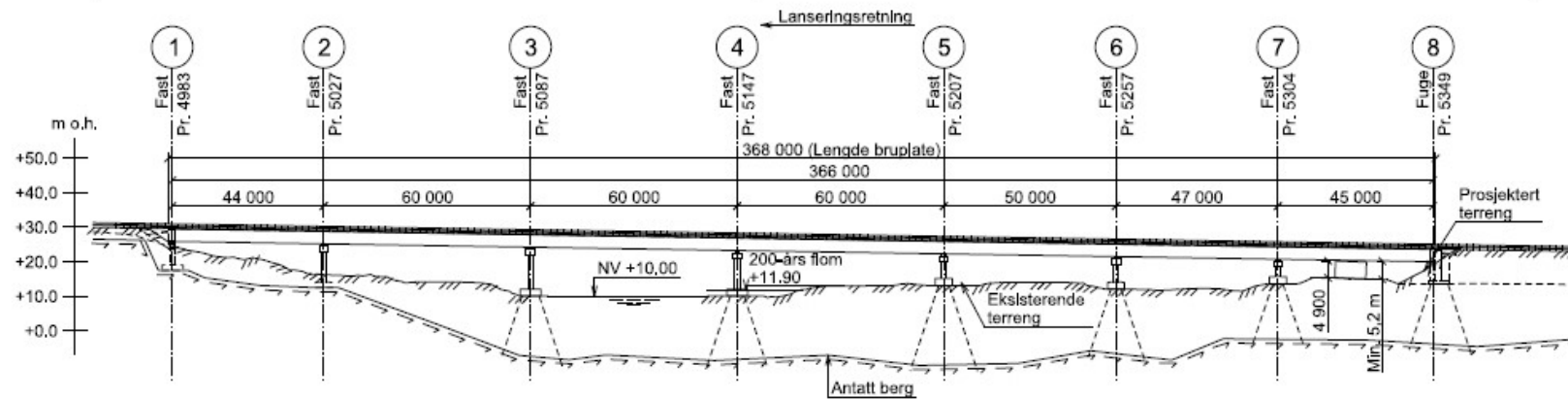


Lanseringslandkar



TVERRSNITT K1222

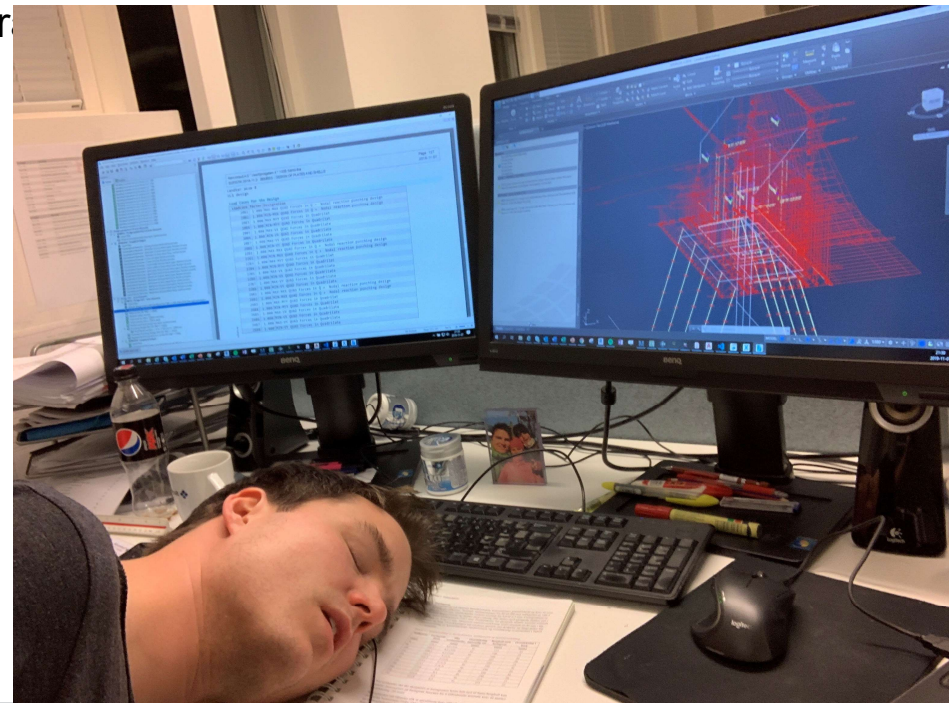
Profilnr.	4980	5000	5020	5040	5060	5080	5100	5120	5140	5160	5180	5200	5220	5240	5260	5280	5300	5320	5340	5360	5380
Profilhøyde	29.584	29.262	28.941	28.619	28.298	27.976	27.654	27.333	27.011	26.690	26.368	26.047	25.725	25.403	25.082	24.760	24.439	24.117	23.795	23.474	23.152
Vertikalkurvatur	-1.61 %																				
Horisontalkurvatur	R = ∞																				
Breddeutvidelse	-																				
Tverrfall	3,0 % ensidig fall mot venstre																				



OPPRISS

Lanseringslandkar

- Rammer
 - Landkaret må pelefunderes
 - 20 m til berg
 - Ikke strekk i bruksgrense karakteristisk
 - Stor horisontalkraft i forhold til vertikalkraft
 - Maks helning 3:1
 - Maks forskyvning ved jekk – 10 mm
 - Permanent fase
 - Jordtrykk
 - Jordskjelv
 - Løsning?



Lanseringslandkar

- Rammer

- Landkaret må pelefunderes

- 20 m til berg



- Peler

- Ikke strekk i bruksgrense karakteristisk

- Stor horisontalkraft i forhold til vertikalkraft



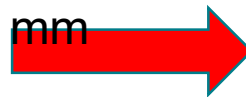
- Fyller opp med masser i byggefase

- Mottrykk (hviletrykk)

- Ballast

- Maks helning 3:1

- Maks forskyvning ved jekk – 10 mm



- Skrå peler

- Permanent fase

- Jordtrykk



- Kombinasjon stålkjernepeler og

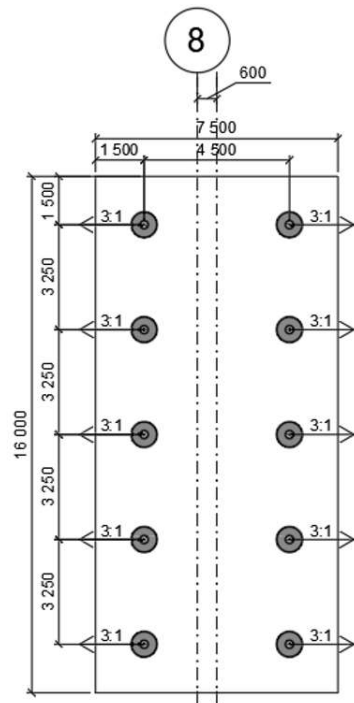
- stålrørspeler de øverste 10 m.

- Jordskjelv

- Løsning?

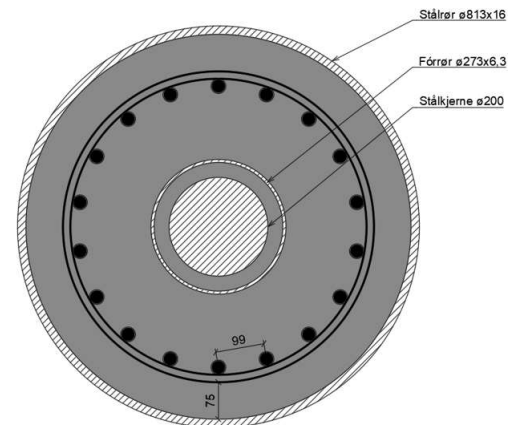
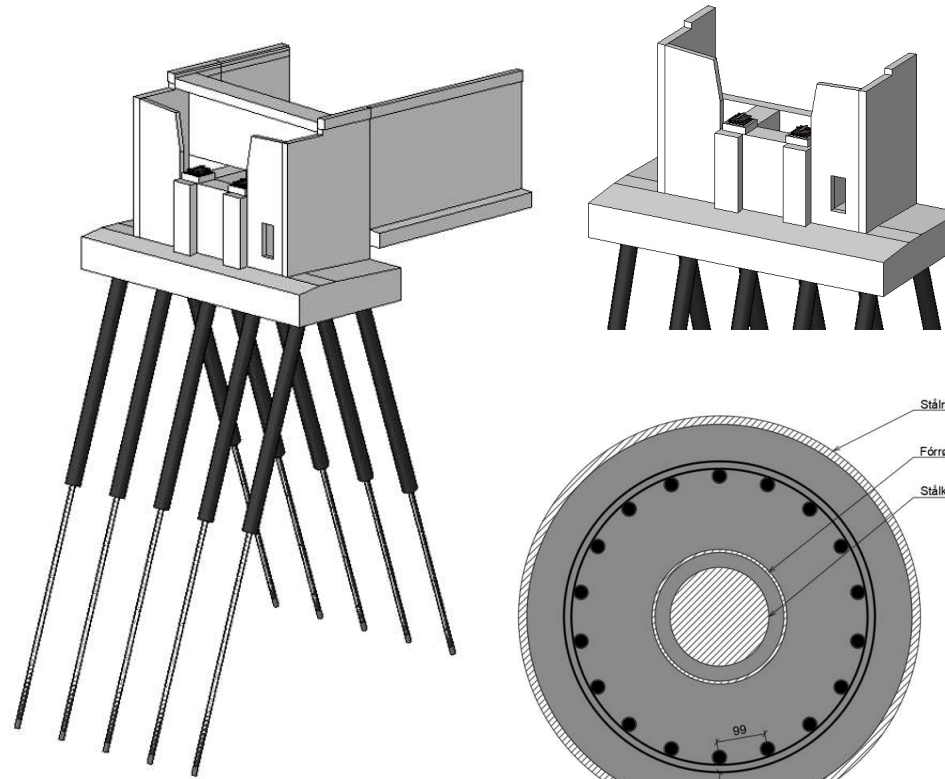
- Stålkjernepeler til berg.

Lanseringslandkar

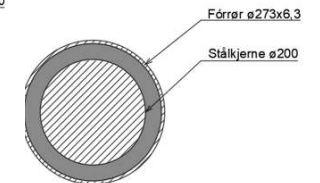


Figur 11-19 Pelekonfigurasjon i akse 8

Figur 11-15 Landkar akse 8



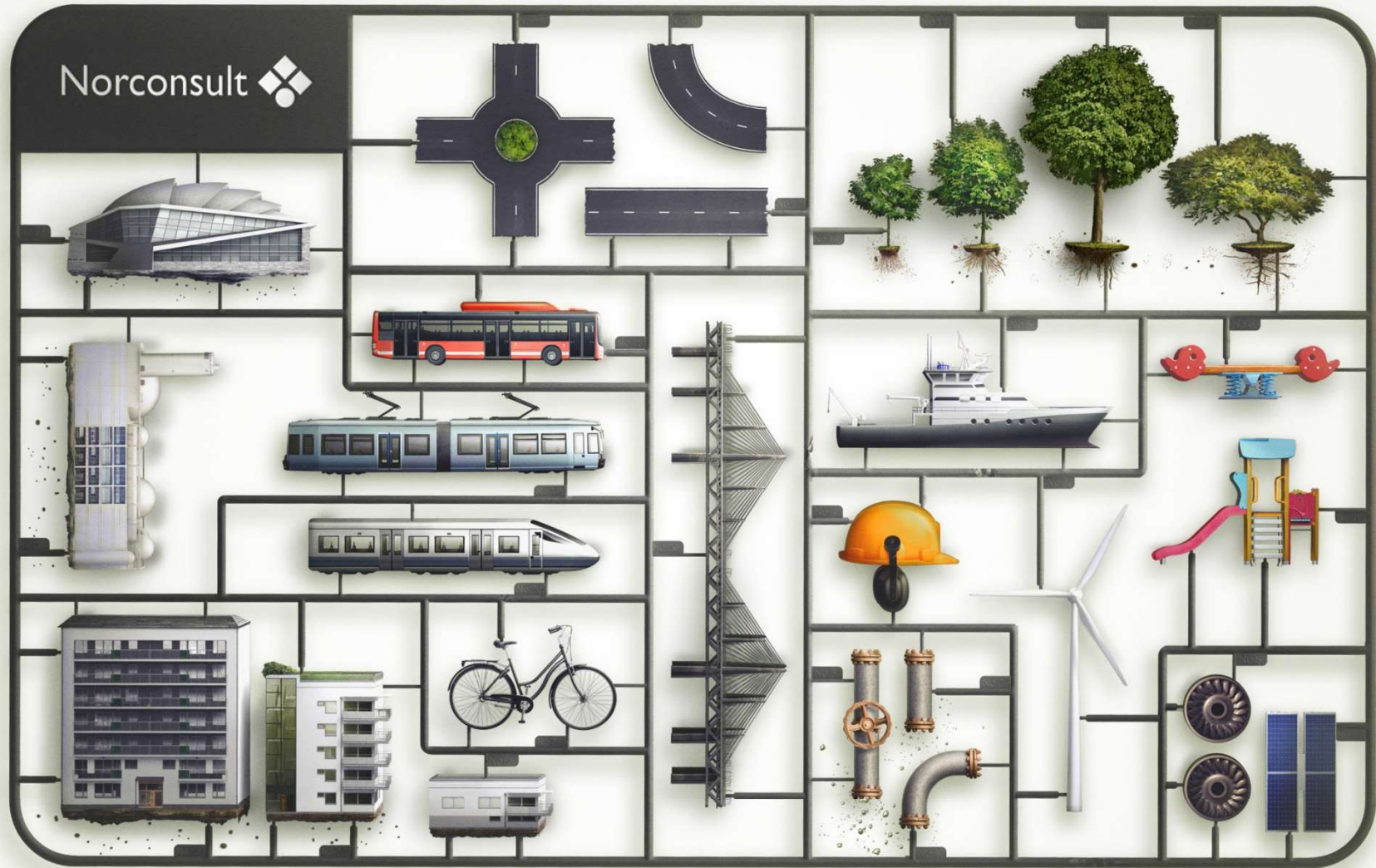
Figur 11-20 Peletversnitt 0 - 10 m



Figur 11-21 Peletversnitt 10 - 20 m

BIM





Takk