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Tretten Bridge - Timber and Steel in Harmony

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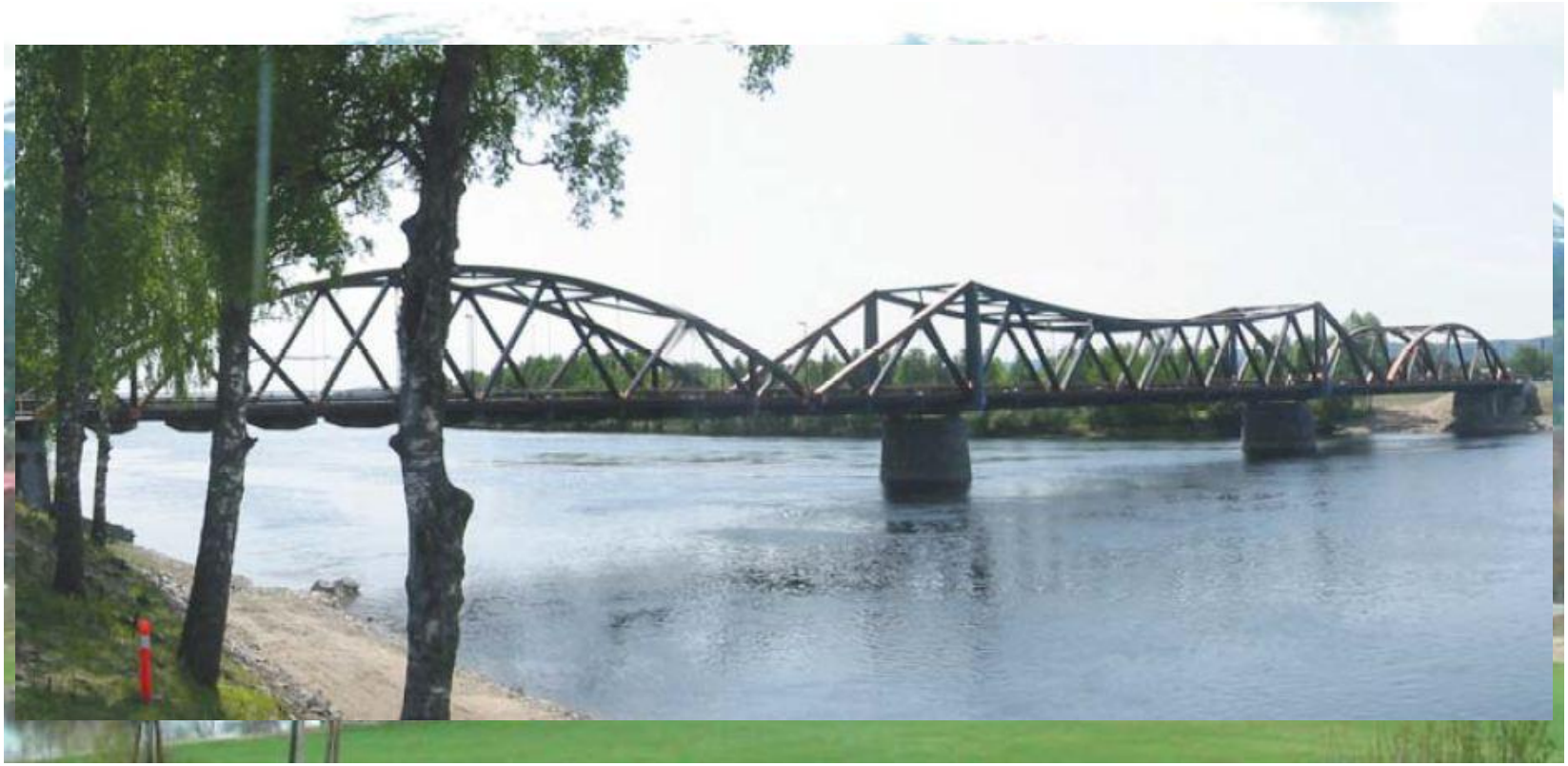
Previous projects

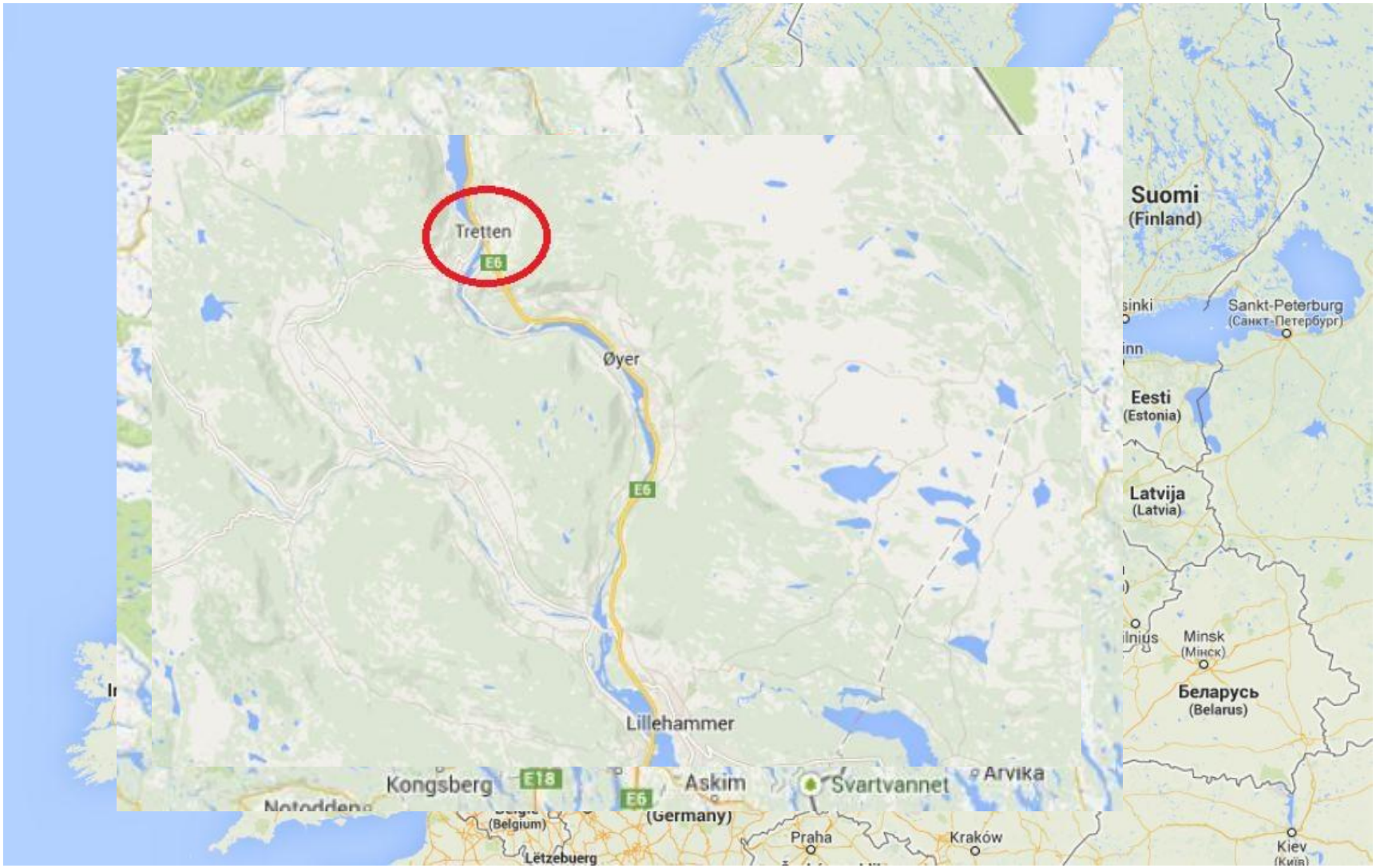
- Evenstad Bridge, 1996
- Tynset Bridge, 2001
- Flisa Bridge, 2003



Key numbers

- Owner: Norwegian Public Road Administration, NPRA
- Architect: PLAN Arkitekter, Yngve Aartun, Norway
- Designer: Norconsult AS, Norway
- Contractor: Contexo AS, Norway
- Contractor timber: Moelven Limtre AS, Norway
- Length: 148 m (41 m + 70,2 m + 36,8 m)
- Width: 10 m (3,75 m x 2 + 2,5 m)
- Cost: ca. 6,7 million USD. (4 500 USD/m^2)
- Timber: Truss: 310 m^3, Deck: 560 m^3
- Steel: 250 ton
- Year of construction: October 2011 - June 2012, 9 months

Tretten


Tretten
E6
Øyer
E6
Lillehammer
Kongsberg
E18
E6
Askim
Svartvannet
Arvika
(Belgium)
(Germany)
Letzebuerg
Praha
Kraków
Kiev
Suomi
(Finland)
Sankt-Peterburg
(Санкт-Петербург)
Eesti
(Estonia)
Latvija
(Latvia)
Minsk
(Мінск)
Беларусь
(Belarus)

Old bridge

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- built in 1894
- 120 m long, main span 80 m
- width: 3 m, 1 driving lane
- built on rock foundations
- steel trusses
- timber deck
- several modifications done in the 1980's

Old bridge

Pedestrian pathway

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Tendons

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Expansion

Recomendations

- pre-design phase started 2003
- timber was the desired material
- weathering steel unusual in Norway
- reuse of rock foundations
- restrictions regarding new foundations in the river
- high flood levels
- only minor adjustments to road geometry
- intersection east

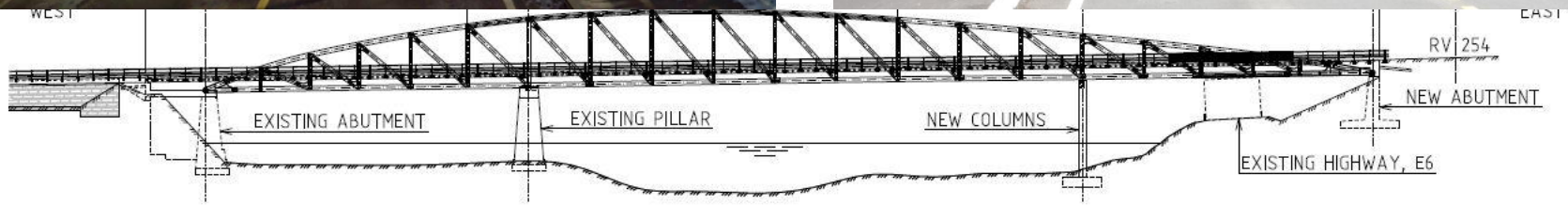
Early alternatives

Final shape of superstructure

- continuous truss
- existing foundations west, new foundations east
- prepared for potential expansion of E6
- low height in east favorable for road geometry

Architectural viewpoint

- asymmetric shape due to asymmetric foundations
- crossbeams "inside" the truss reducing the height



Truss, crossbeams and windtruss

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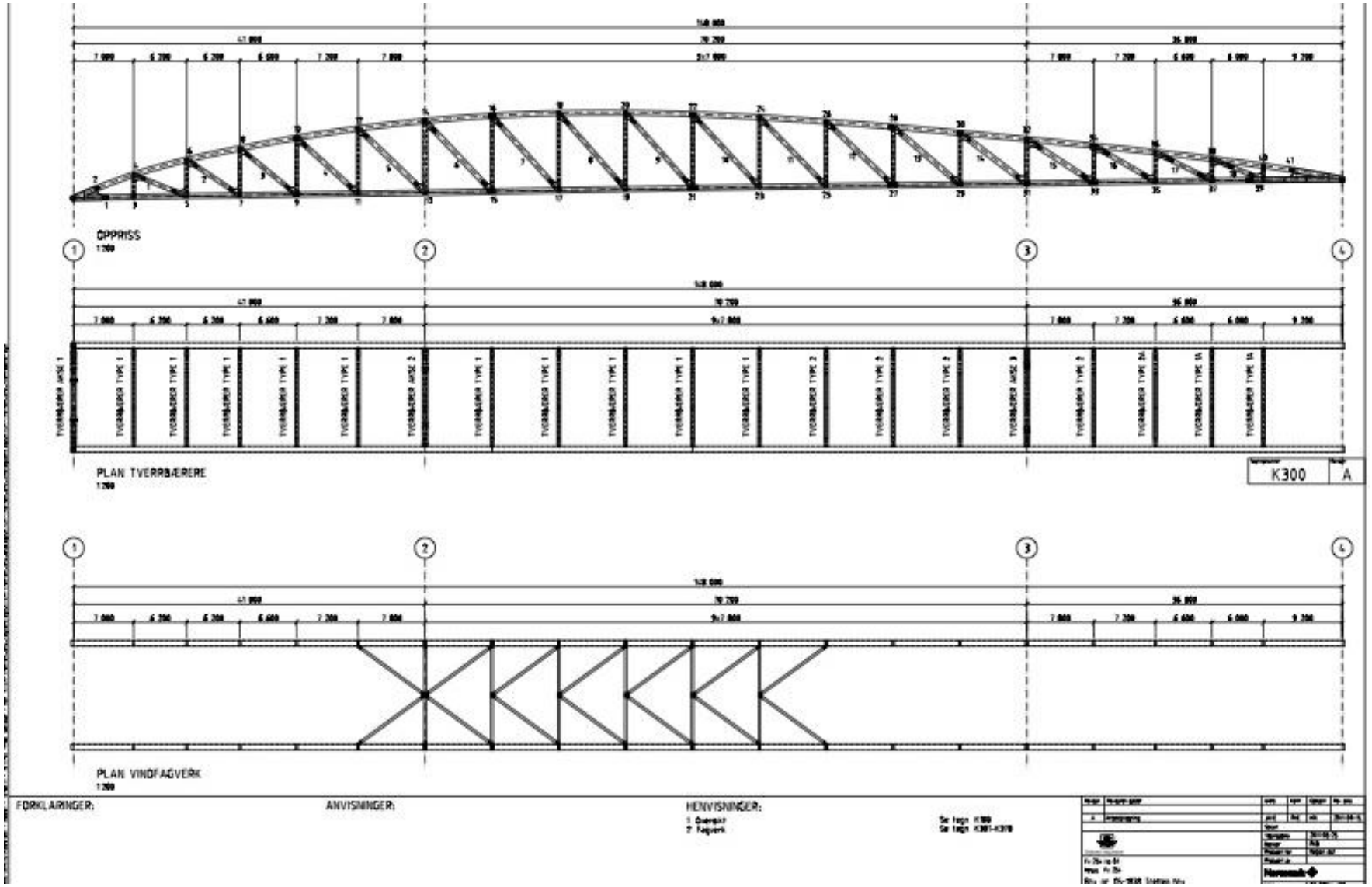

Part 1

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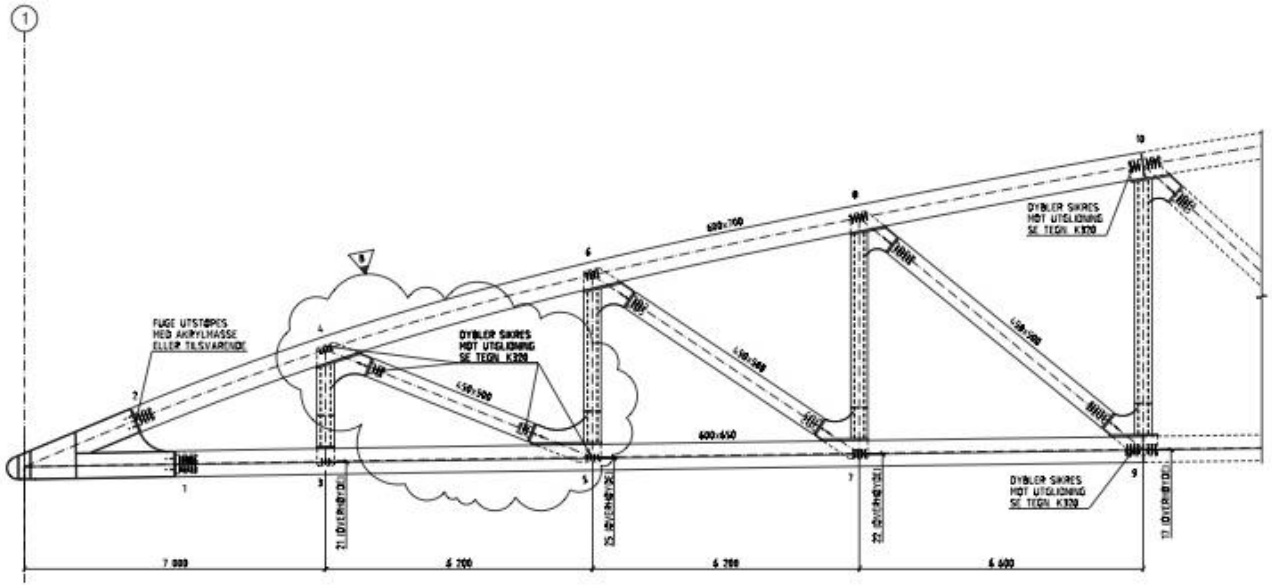

OPPRISS DEL 1
1:50

K310 | B

FORKLARINGER:
1 GL30: i alle tredeler hvis ikke annet er vist

ANVISNINGER:

HENVISNINGER:
1 Oversikt — Se tegn K100

Bru nr. 05-1838 Trettan bru

Crossection

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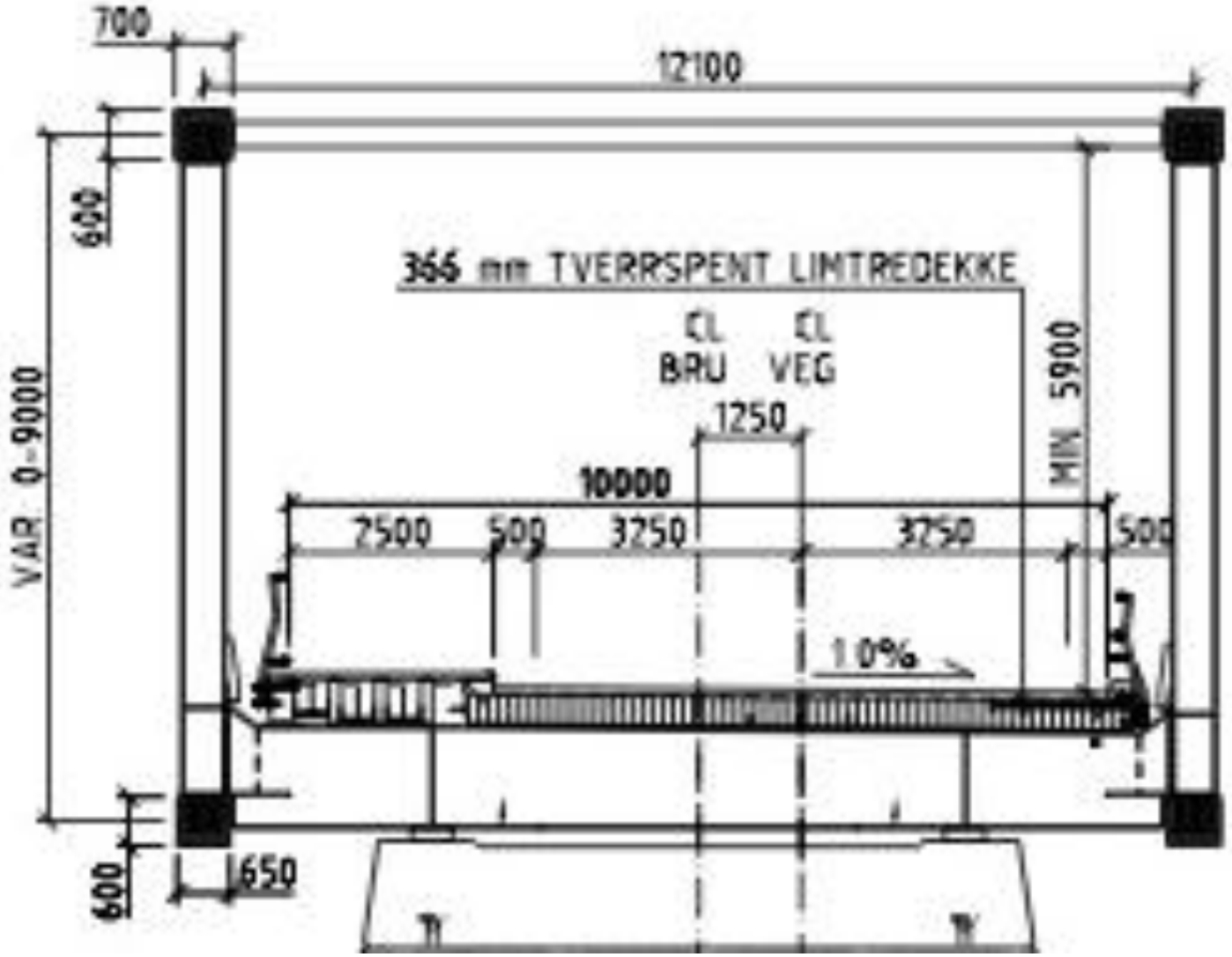
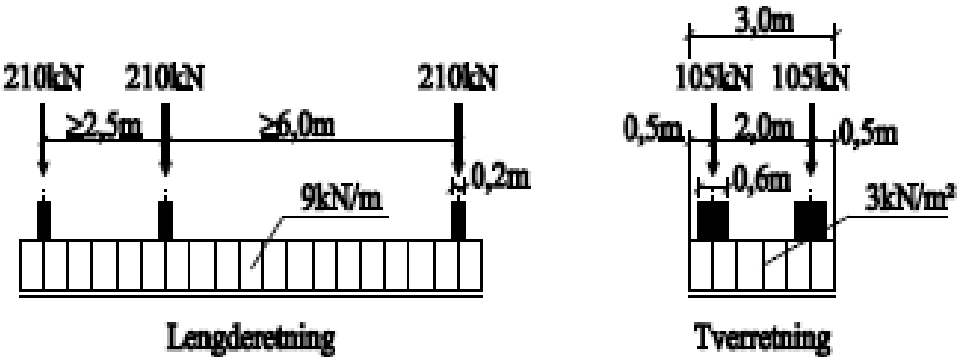
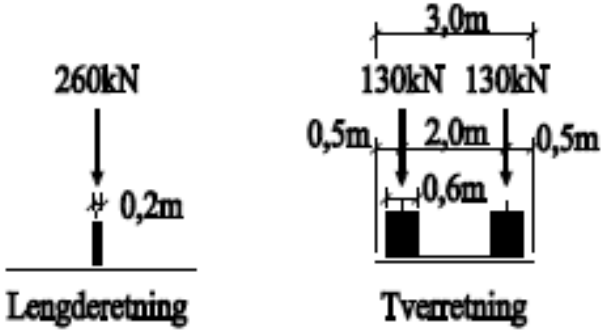


Traffic loads

- Driving lanes:
- V1:



- V2:



- Sidewalk: 4 kN/m³

Structural challenges

- stability in up as

- large momen beam and vertical
- u-frames indi stabilization of the upper ch ents

Structural challenges

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- large axial forces at pointy ends (east)

Structural challenges

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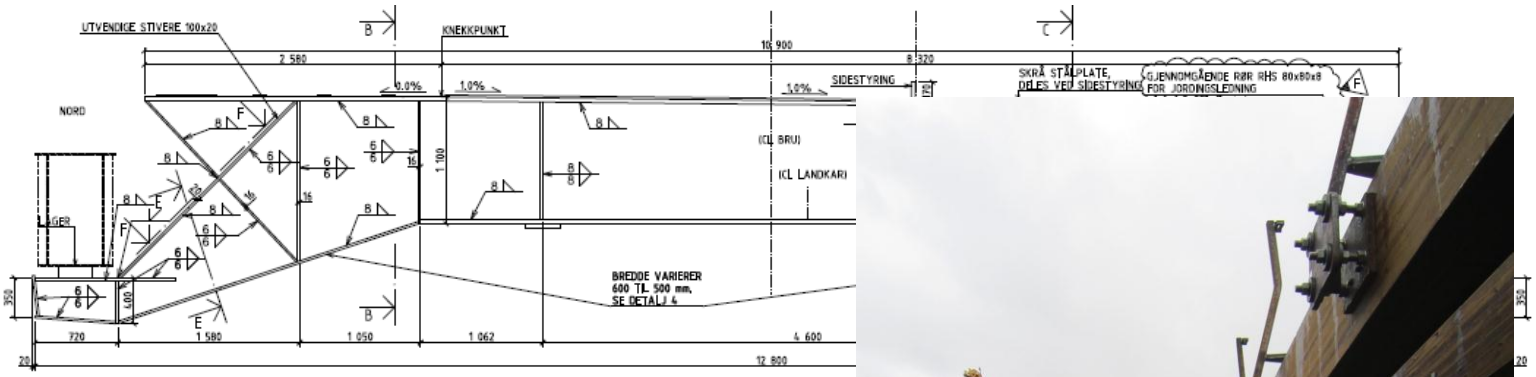
- large axial forces in wind truss transferred to main truss

Detailing

- cross-beam in axis 1



Detailing

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- detail further dev
- beams for sidew

Detailing

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- steel plates transferring lateral forces between bridge deck and cross-beams

Assembly

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Cost

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- no significant difference between Flisa and Tretten
- Rena designed for military vehicles
- timber truss bridges competitive in comparison to steel truss bridges

	Year	Length [m]	Width [m]	Area [m^2]	[NOK/m^2]
Evenstad	1996	180	6.5	1170	23 238
Flisa	2003	182	10,5	1911	26 297
Rena	2005	158	6,3	995	28 924
Tretten	2012	148	10.5	1554	26 810

- reduction in connections between steel and timber might be an explanation

Tretten Bridge

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Concluding remarks

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- Several recomandations decided the shape of the truss
- crossbeams inside the truss lead to verticals in steel
- low truss height improved conditions for intersection
- amount of steel did not influence the cost

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Thank you for your attention

Questions?