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/m²)
- Timber: Truss: 310 m³, Deck: 560 m³
- Steel: 250 ton
- Year of construction: October 2011 - June 2012, 9 months
Tretten

- A village located about 30 km north of Lillehammer, 200 km north of Oslo
- Population: 900
- Main industry: farming, forestry, tourism
Old bridge

- 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
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
- diagonals in same direction amplifies asymmetry
- "tunnel" effect reduced by short wind-truss area
Truss, crossbeams and windtruss
Crossection
Traffic loads

- Driving lanes:

- V1:

- V2:

- Sidewalk: 4 kN/m³
Structural challenges

- stability in upper chord outside wind truss areas
- large moments at connection between cross beam and vertical
- u-frames individually designed to optimize the stabilization of the upper chord
Structural challenges

- large axial forces at pointy ends (east)
Structural challenges

• large axial forces in wind truss transferred to main truss
• cross-beam in axis 1
• Detailing

• Steel profile as deck-support, previously timber profile

• Detail further developed to make inspection of joint easier

• Beams for sidewalk
Detailing

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

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

<table>
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<th>Year</th>
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<th>Area [m²]</th>
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- reduction in connections between steel and timber might be an explanation
Concluding remarks

- Several recommendations 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
Thank you for your attention

Questions?