A timber bridge across Lake Mjøsa in Norway

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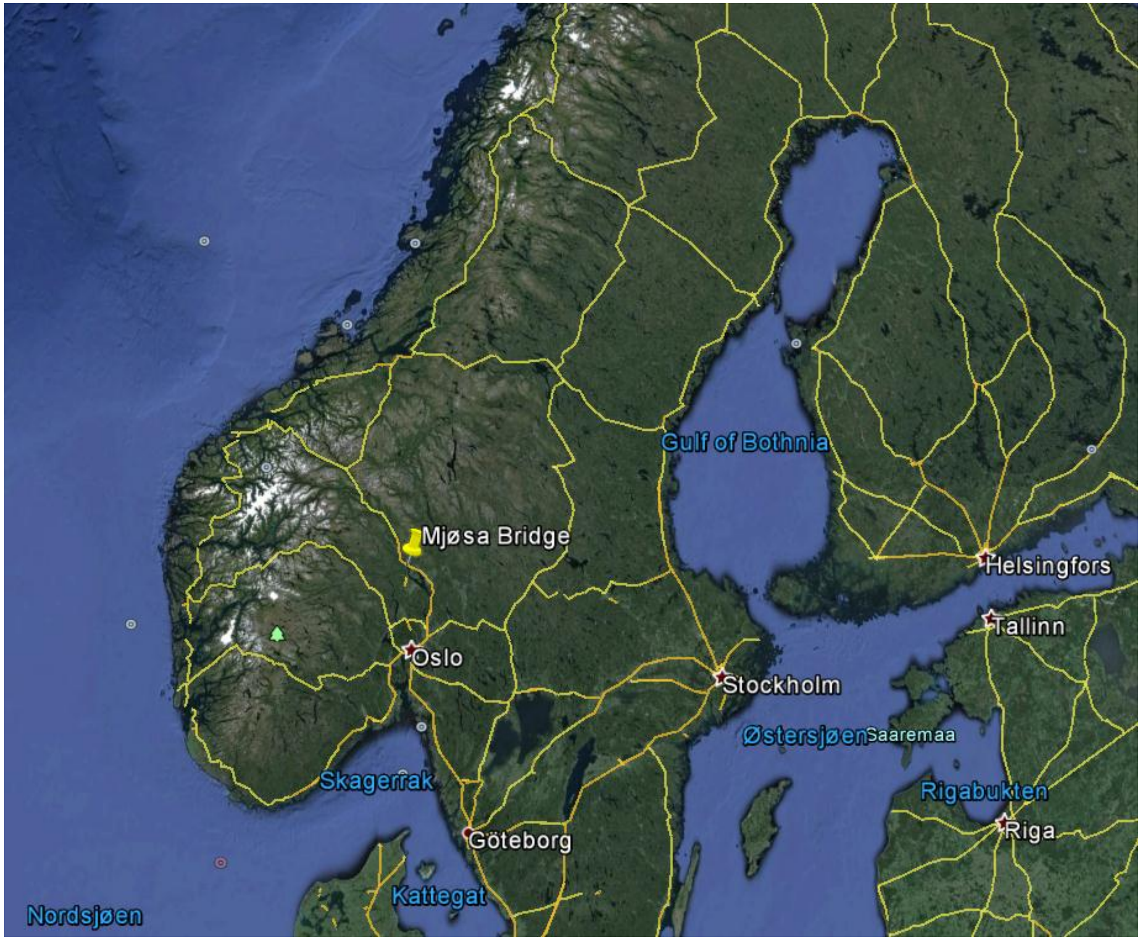
Content:

- History
- Conceptual design
- Technical chellenges
- Future development

Location



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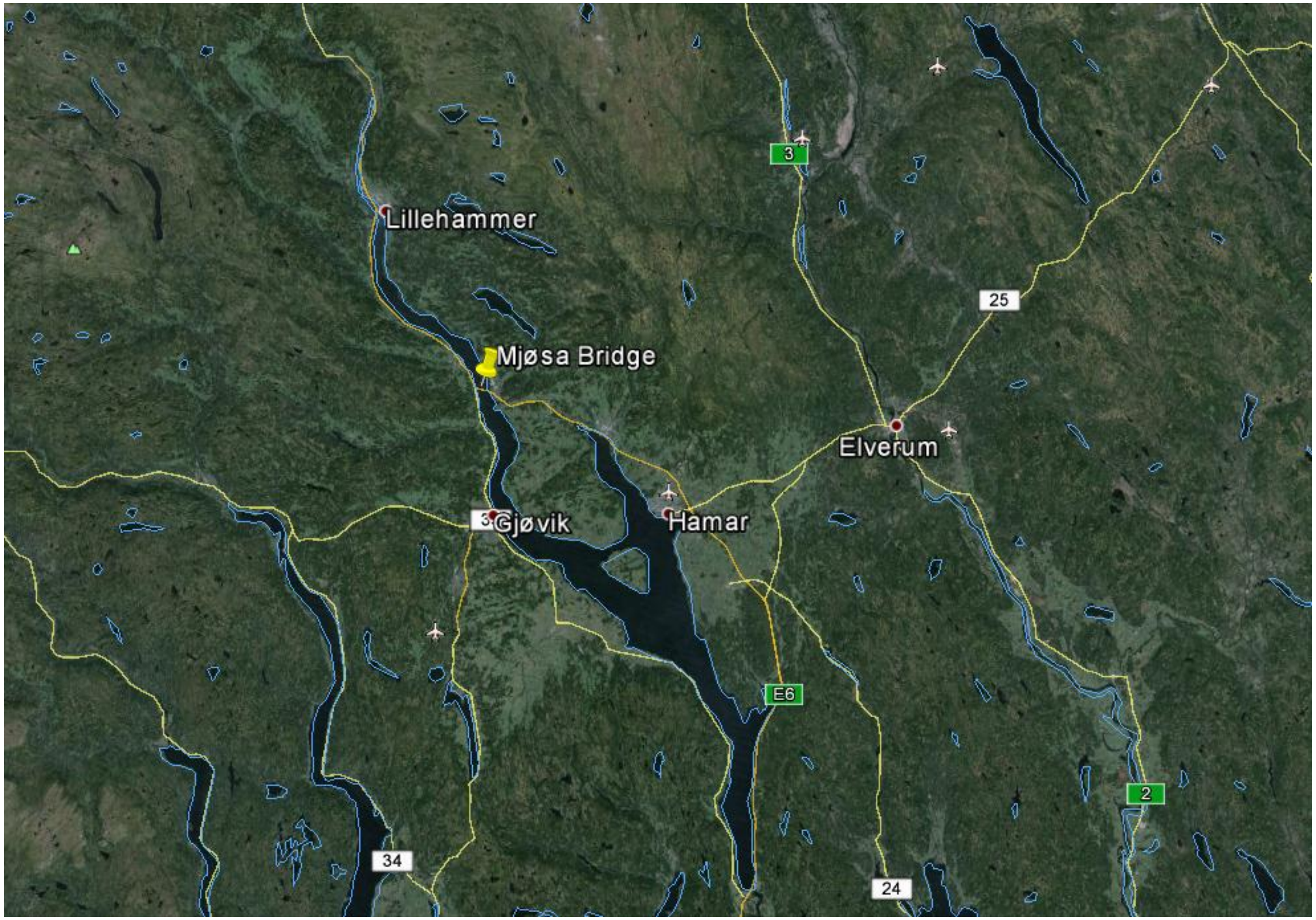
Location



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Existing bridge:

- Opened 1985
- Total length 1421m
- Concrete box girder
- Span width 69m
- Pile foundations
- 2 lanes + walkway/pavement

History:

- Existing bridge opened 1985
- Feasibility study for 2nd crossing 2006
- Feasibility seminar for timber bridge crossing 2010
- Conceptual design 2nd crossing 2012-13
- Launching of R&D timber bridge project 2013

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Feasibility study 2006:

- Building a 2nd bridge is feasible
- One possible placing of the bridge in vicinity of the exisisting bridge
- One possible placing of the bridge somewhat 1km south of the existion bridge involving deep sea foundations

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Feasibility seminar for timber bridge crossing 2010:

- 2 day seminar with a large number of bridge experts, architects and officials.
- Conclusion is that to build a timber bridge across Mjøsa is feasible
- 3 alternative solutions outlined.

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Conceptual design 2nd crossing 2012-13:

- Southern line preferrable
- Wide range of alternatives examined wrt. technical solution, construction, esthetics, environmental impact and costs
- Elimination method has revealed two alternatives:
  - Concrete bridge with extradozed main spans
  - Timber bridge

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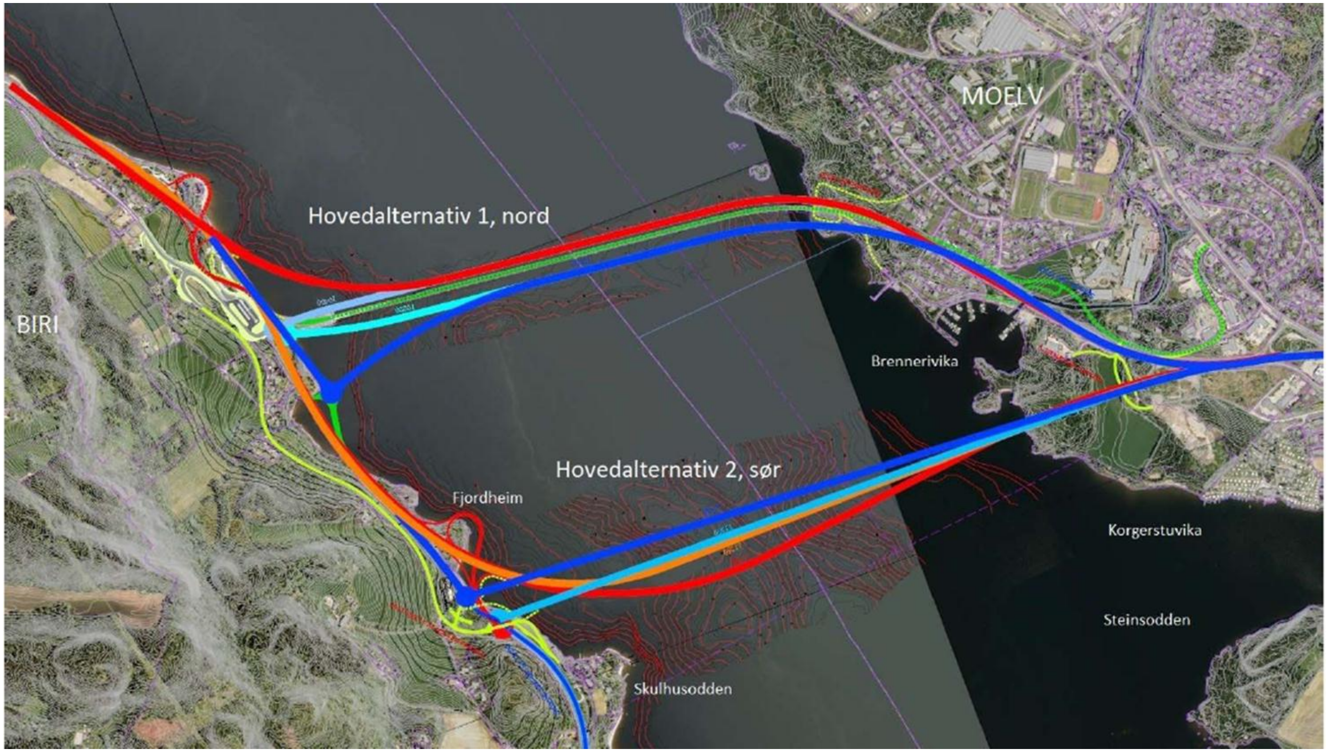

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Timber bridge development for 2nd Mjøsa bridge:

- Visibility
- Durability
- Constructionability

- Esthetics
- Costs
- State of the art elements

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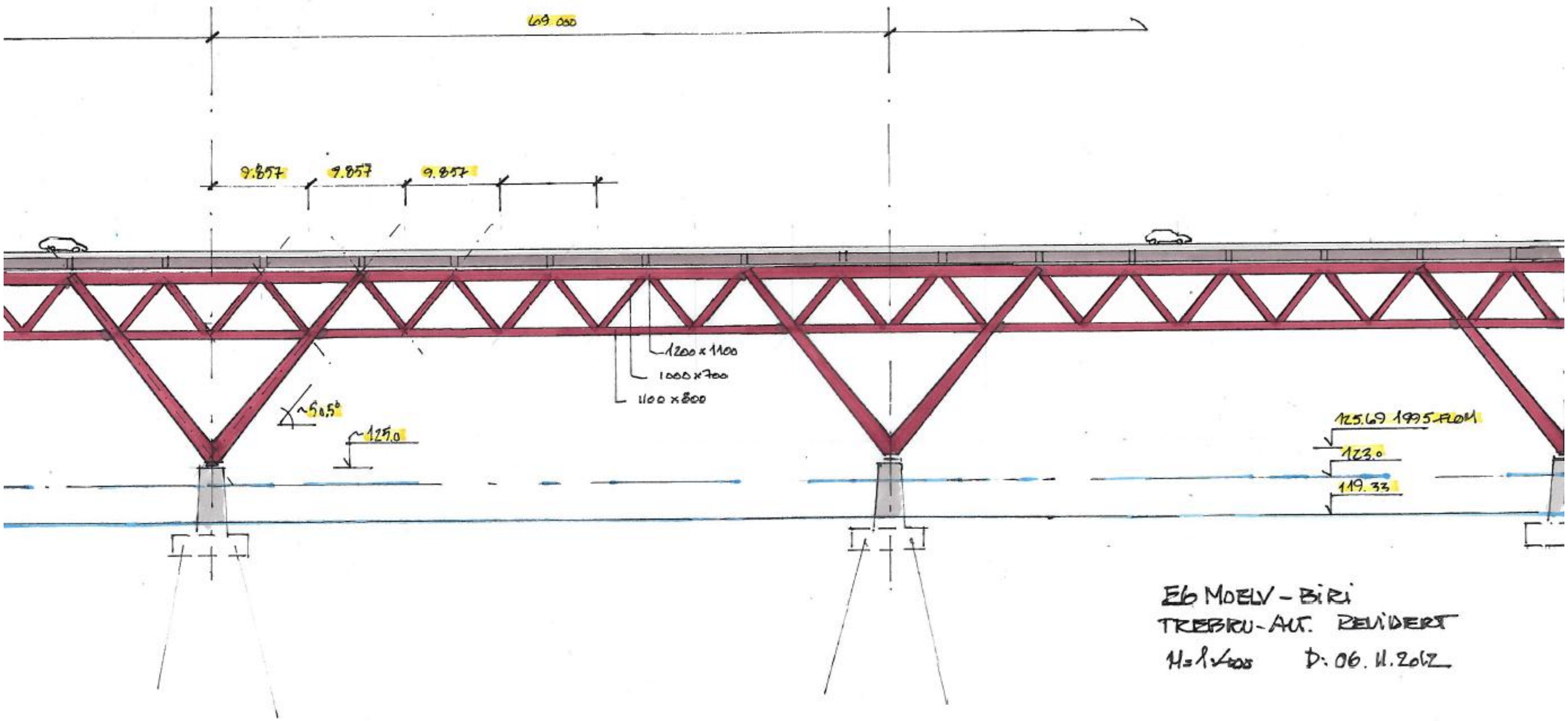

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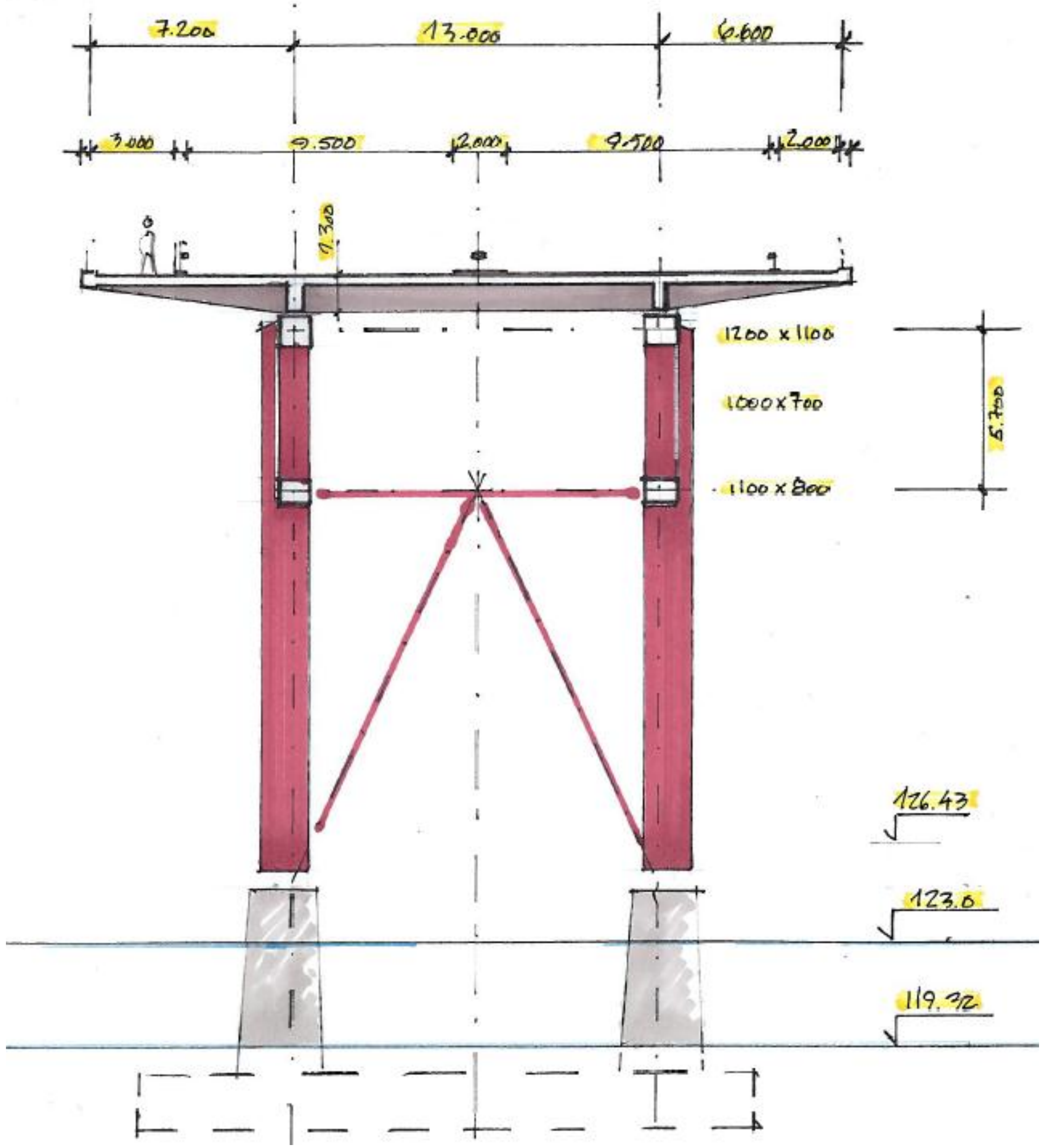

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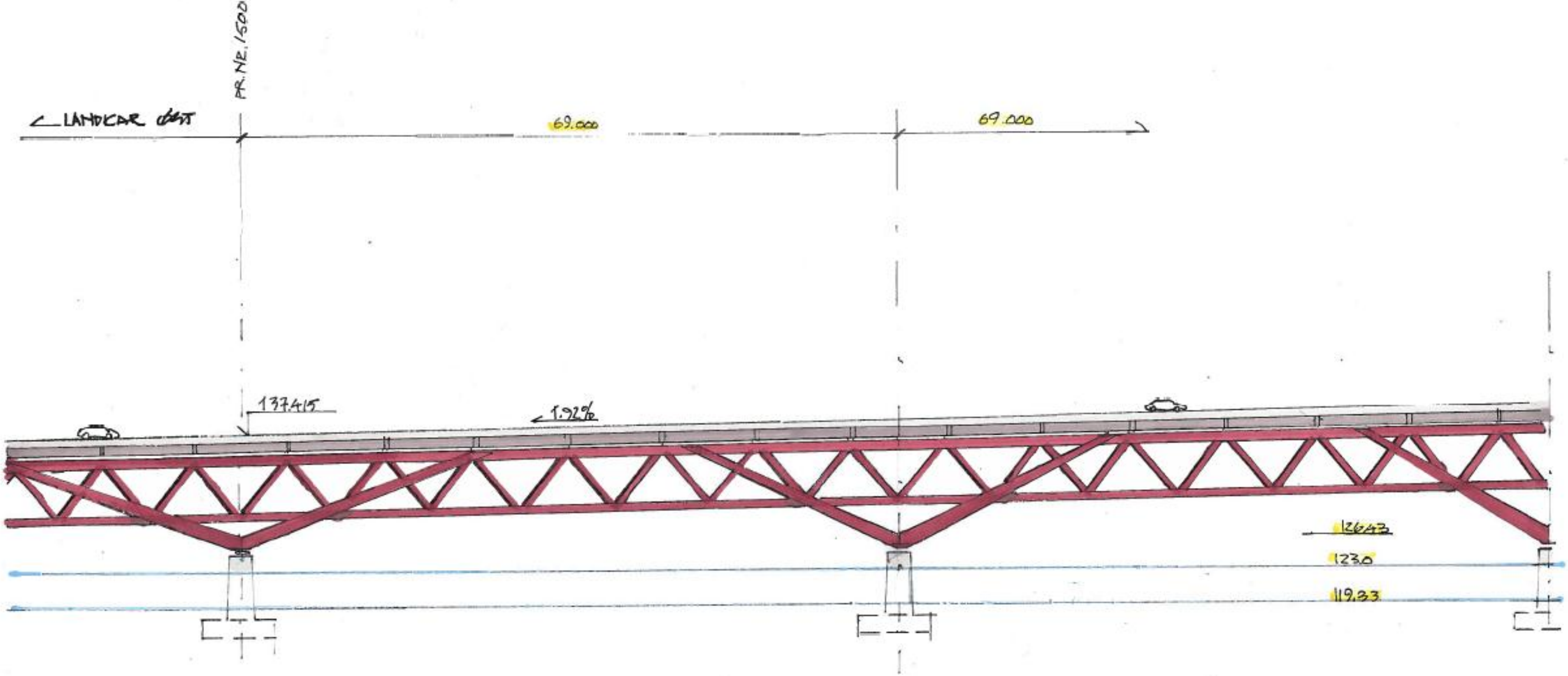

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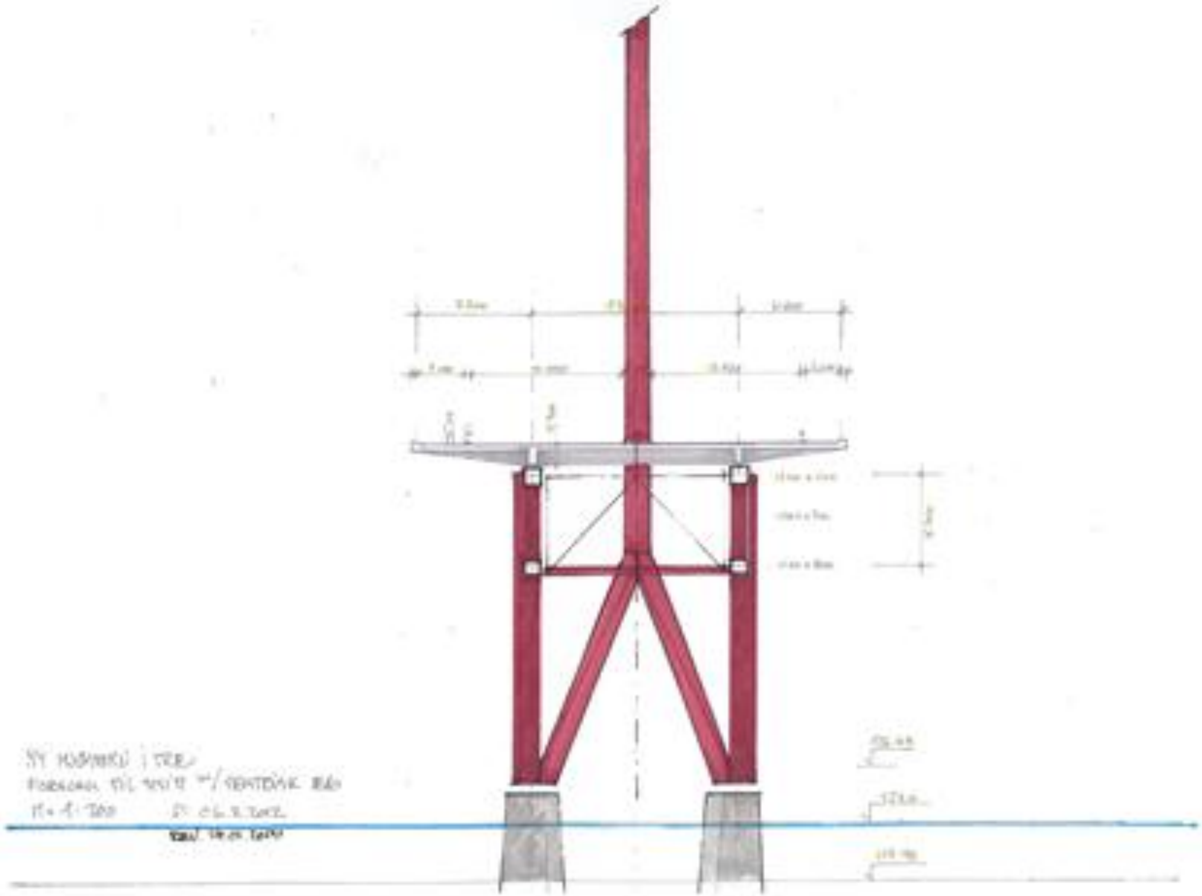

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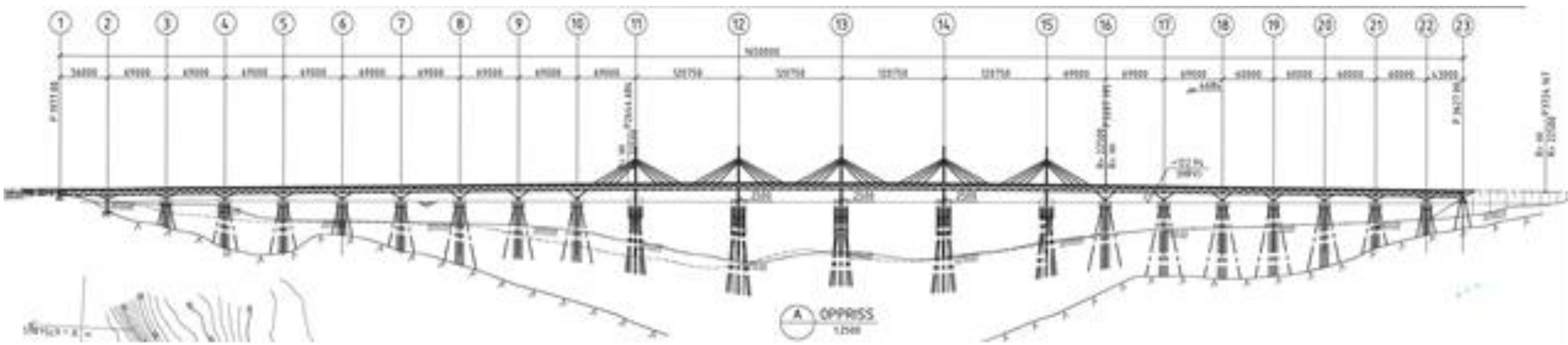
Vital figures:

- Total bridge length: 1650m
- Span widths: 56.0m + 9 x 69.0m + 4 x 120.75m + 4 x 69.0m + 3 x 56.0m + 46.0m
- Timber area: 8.05 m3/m



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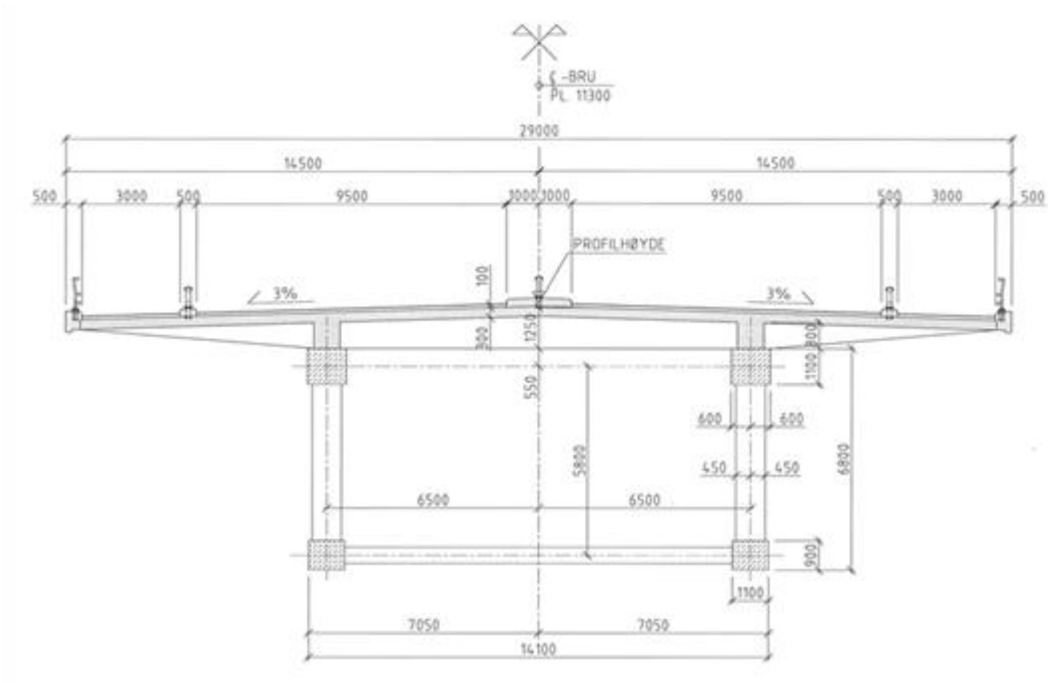

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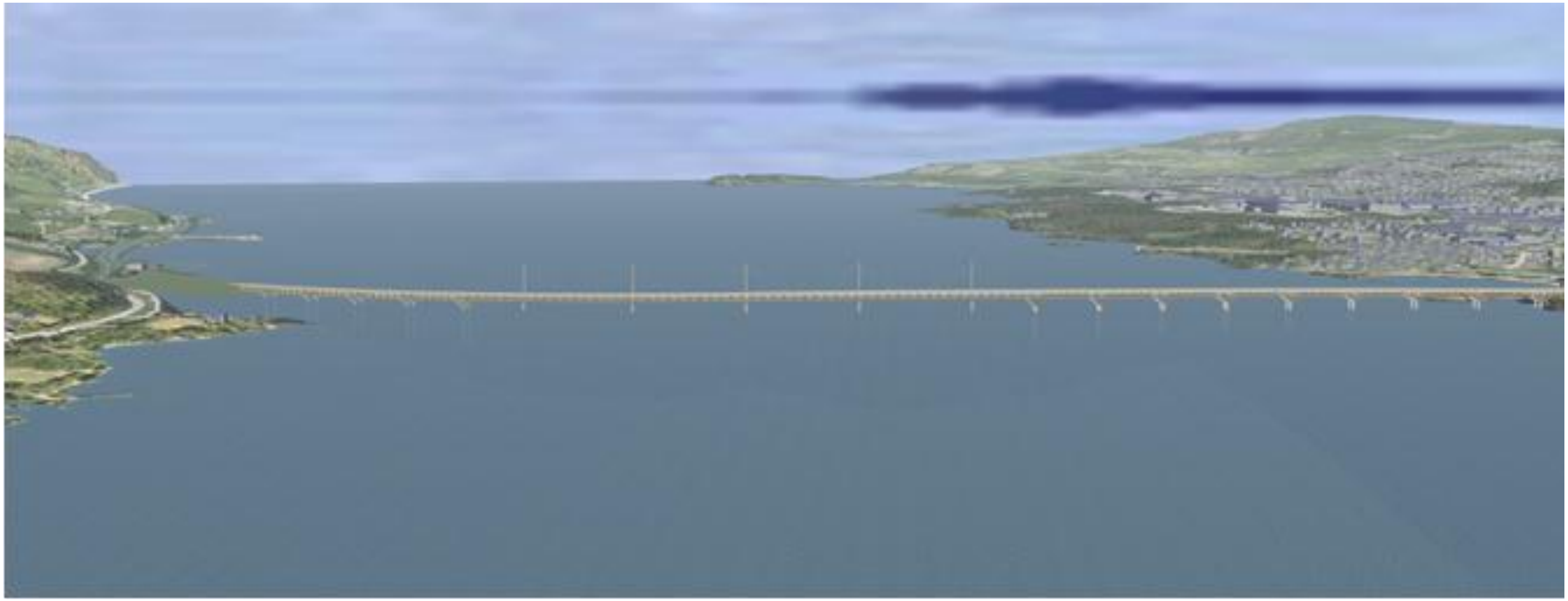

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Why composite structure timber-concrete?

- Big number of expension joints is not recommended due to maintainence costs
  - **At each supprt** **23 joints**
  - **At every other support** **12 joints**
  - **As existing bridge** **6 joints**
  - **At abutments** **2 joints**

- A floating concrete deck with only 2 joints will require a lot of sliding bearings
  - **Vertical supports every 10. m give 300 bearings**
  - **Horisontal supports at each columns give 42 additional bearings**

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Technical challenges

- Termal expension difference between timber and concrete
  - **Timber termal ecpension coefficient is about hlaf of concrete**
  - **Maximum contraction about 50 degrees celcius**
  - **This give an unconstrained movement difference if 190mm at each end of the bridge**

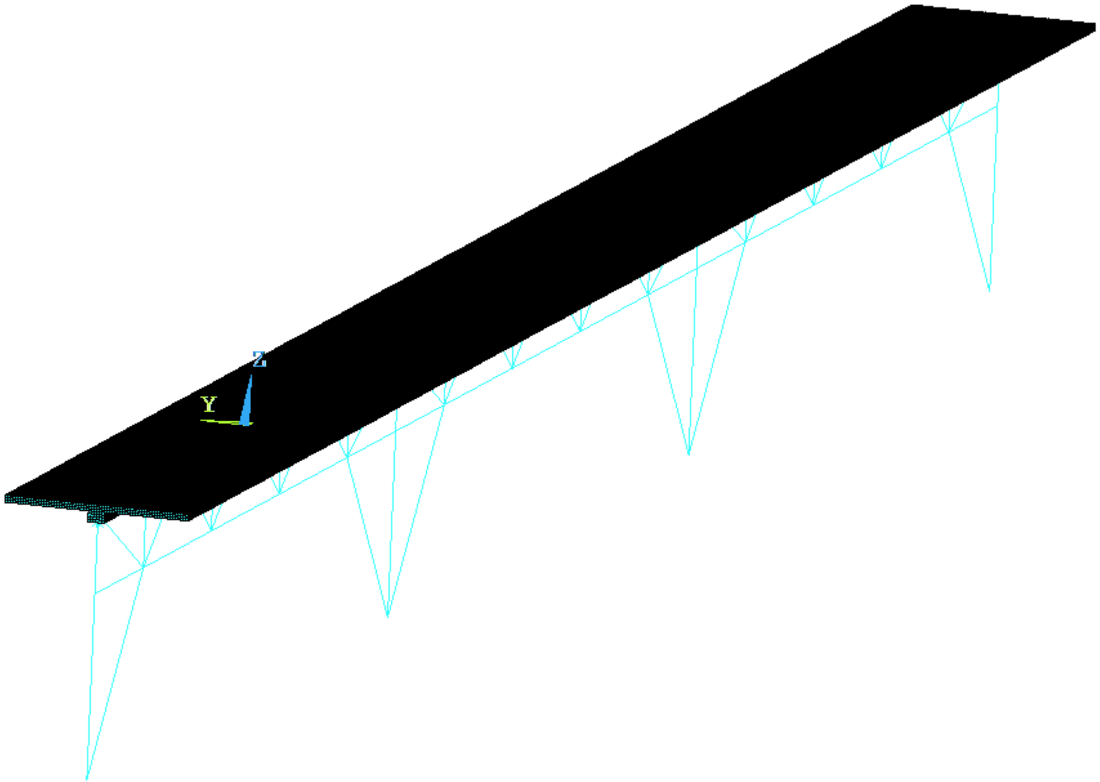
- Shrinkage of concrete
  - **Free shrinkage of app. 0,36 ‰.**

- Expension/contraction due to variation in humidity
  - **0,01 % per percent humidity content (fibre direction)**
  - **Variations up to 12-16% RH**
  - **Same direction as concrete shrinkage**

Finite element analysis of composite action

- Model of 3 spans
- Loading
  - **Dead weight**
  - **Traffic**
  - **Temperature**

- Dowel requirement
  - **13ø19 pr m**



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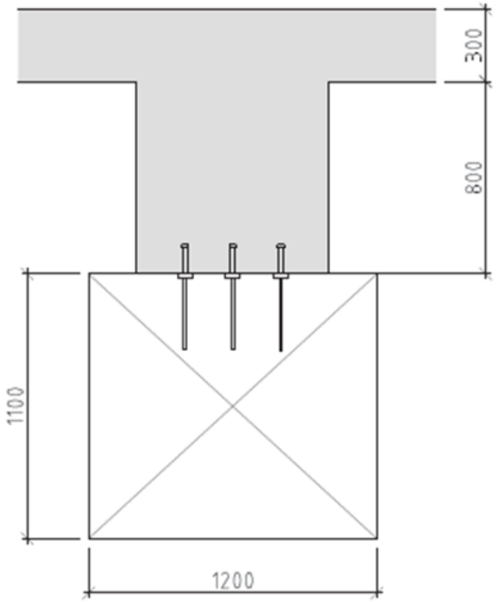
Alternative shear connection between timber and concrete

- Continous

- Nodal



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R&D Project:

- Not yet launched, but financial part fixed
- Duration 2 years
- Content not fixed, but could contain:
  - Large scale effects on timber bridges
  - Cable stay solutions on timber bridges
  - Large spans on timber bridges
  - Temperature effects on timber bridges
  - Material specifications on timber
  - Preservation of timber
  - Composite behaviour between timber and concrete

Thank you for your attention