INFRASTAR

Innovation and Networking for Fatigue and Reliability Analysis of Structures – Training for Assessment of Risk

Fatigue of reinforced concrete structural element

Bartłomiej Sawicki

ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

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Fatigue of reinforced UHPFRC structural element

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Why the change?

- Emerging technology
- Use of UHPFRC:
  - Alone (not economical)
  - Prestresses (UHPFRC always in compression – endurance limit at 0.6 S)
  - Reinforced (R-UHPFRC – cooperation in tension)
- From RC: structural fatigue behaviour is not a sum of materials behaviour!
- Few fatigue tests R-UHPFRC!

Research questions

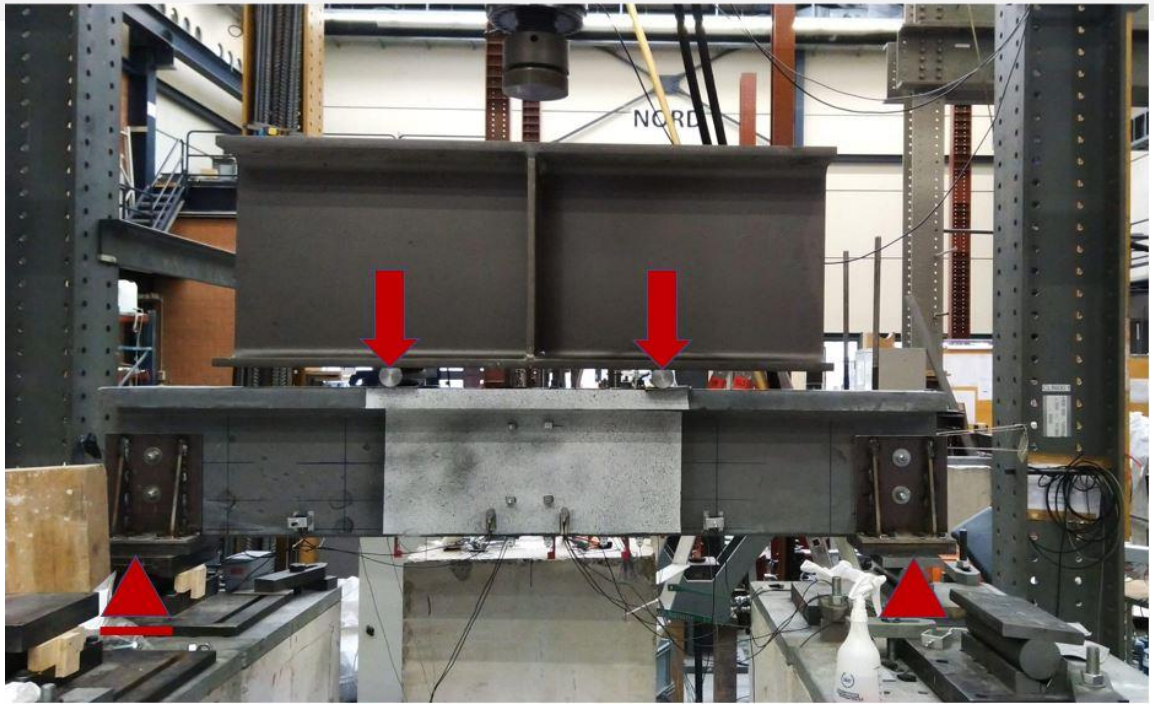
- Evolution of stress transfer (reinforcement and UHPFRC)
- Influence of reinforcement size

- **Is it enough to check the stresses in reinforcement? If so, how to calculate them?**

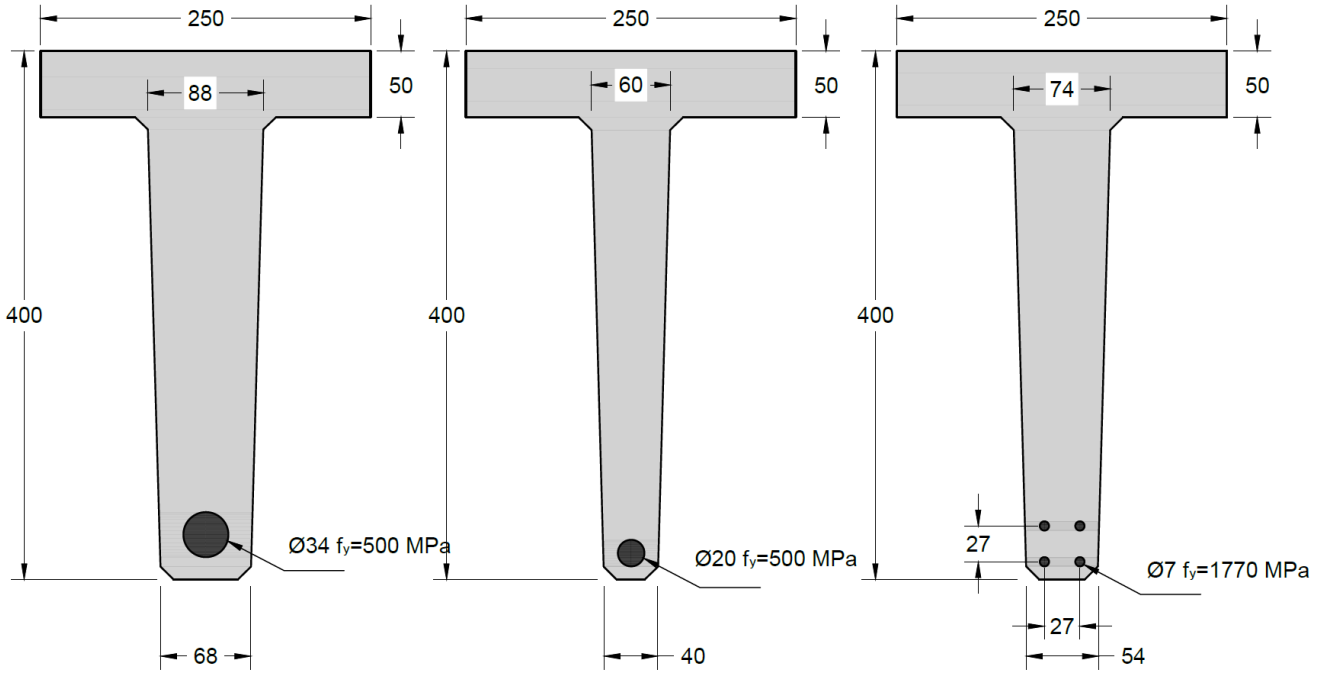
Experimental campaign

- Full size elements
- Direct strain measurements on rebars
- Looking for endurance

Experimental campaign



- 4P bending
- 3 types of cross-section
- Small cover (ϕ/2)
- Runout 10 mln



Instrumentation

- Strain gauges on rebars
- Extensometers on the beam
  - Strain profile
  - Chain (fatigue)
- DIC
  - Chain (static)
- Deflection (LVDTs)

Analysis of results

- Stresses in rebars and UHPFRC during fatigue from direct measurements
- Inverse analysis (FEM fitting) of static and fatigue tests results to link with material testing
- Comparison with probabilistic fatigue model from material testing

Ongoing research

- Preparation of experimental campaign – end of 2017
- Casting campaign – Summer/Autumn 2018
- Static tests – Autumn 2018
- Fatigue tests – Winter 2018 – Summer 2020
- First conclusions – Summer 2019
- Fatigue design guidelines for R-UHPFRC – Autumn 2020
- Direct application of results!

Thank you for your attention

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Stay tuned http://infrastar.eu

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