G’day Australia!
We are FiberCore Europe

Martijn Veltkamp  Structural Engineer
Jan Kroon        General Manager
Netherlands = living with water

25% of country below sea level
We make FRP bridges

- Started in 2007, now > 800 bridges in the Netherlands, Europe and worldwide (UK, USA, China, ...)
- Fibre Reinforced Polymer is meanwhile an accepted construction material
- Our FRP products are sustainable in many ways
- We intend to use 40 % of recycled materials in our structures by 2021
- We have our unique InfraCore® Inside technology – distinctive in FRP!
- We have international partners and projects
We are connecting people with our bridges,
and also in Rotterdam.
Summary of the presentation / main topics

- Explanation of the unique InfraCore® technology
- Engineering according to the Eurocode, standards, CUR 96
- Why is the city of Rotterdam going green on designing their bridges?
- Examples:
  - standard and variations on a theme
  - bespoke
Steel beam
Loaded in three-point bending
Steel beam
Loaded in three-point bending

Glass fibre fabric beam
Loaded in three-point bending
Steel beam
Loaded in three-point bending

Glass fibre fabric beam
Loaded in three-point bending

Glass fibre fabric box plate
Flanges, connected by webs
Steel beam
Loaded in three-point bending

Glass fibre fabric beam
Loaded in three-point bending

Glass fibre box plate
Flanges, connected by webs

InfraCore Inside
No sandwich > no delamination
InfraCore® Inside

Tested and proven on strength in combination with fatigue and damage
Proven technology
Engineering of FRP structures
Material properties

- **Steel**:
  - Stress: 360 MPa
  - Strain: 0.2%
  - Modulus of Elasticity: 210 GPa
  - Used in FRP bridge

- **Composite 0/90°, 75/25%**
  - Stress: 600 MPa
  - Strain: 2%
  - Modulus of Elasticity: 34 GPa
  - Used in FRP bridge

**With FRP:**
- Stiffness-dominated design
- Low utilisation ratio in ultimate limit state

**Resistant against:**
- UV-radiation
- Water
- No rot or corrosion

**Consider creep in the design!**
Standards and design guidance (1)

- Experiences from the energy and aviation industry + generic FRP design guidance + academic sources

- CUR96: Fibre-reinforced polymers in buildings and civil engineering structures
  - Specific to civil engineering and limit-state design
  - Published in 2003, revised in 2017, in English in 2019

- UK: CIRIA, fibre-reinforced polymer bridges - guidance for designers
  - Practical and qualitative considerations on FRP-design
# Standards and design guidance (2)

## Eurocodes
- Design loadings: independent of the material
- Checking of the material:

<table>
<thead>
<tr>
<th>Step 1:</th>
<th>2018</th>
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<tbody>
<tr>
<td>Preparation and publication of a “Science and Policy Report”, subject to agreement of CEN/TC250.</td>
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<th>Step 2:</th>
<th>2022</th>
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<tr>
<td>After agreement of CEN/TC250, preparation and publication of CEN Technical Specifications (TS, previously known as ENV).</td>
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<th>Step 3:</th>
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<td>After a period for trial use and commenting, CEN/TC250 will decide whether the CEN Technical Specifications should be converted into Eurocodes.</td>
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## Australia
- Loadings fully compliant with AS 5100
- Design criteria for comfort very stringent
- Unlike conventional materials: discomfort ≠ danger
Why is Rotterdam going green with beautiful composite constructions?
Way of thinking / acting in Rotterdam

- Cost of maintenance in the future > economic reason for low-maintenance
- Possibility for a second life elsewhere when urban grid changes
- Good figures at sustainability indicators such as LCA, LCC, MCI, CO₂
- Reliable constructions, offsite-construction, long lifespan
- Low impact on environment at installation; less traffic movements, WH&S
Which bridge are you thinking of now?
Building the future

FiberCore®

Building the future

Thanks for your attention

Jan Kroon | Martijn Veltkamp