B[UILD] SMART!

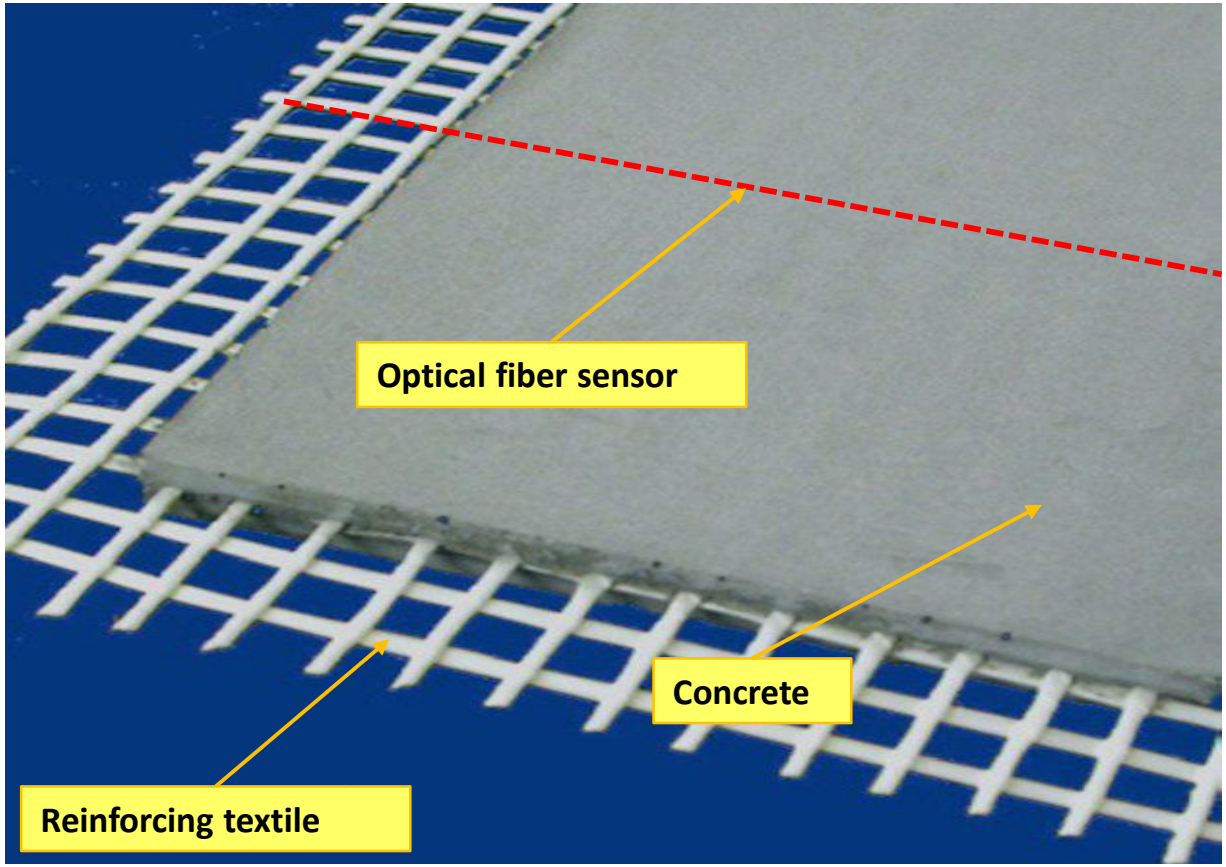
comfort, sicurezza, sostenibilità, innovazione

Paolo CORVAGLIA

Sviluppo di pannelli in calcestruzzo rinforzati con tessuto tecnico sensorizzato

Fiera Milano Rho, 13 | 16 marzo 2019

CONCEPT



CONCEPT

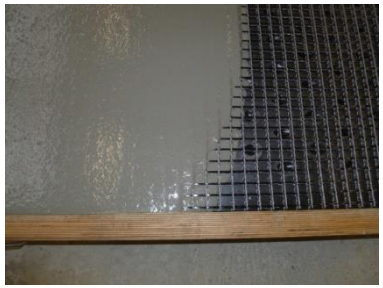
Textile Reinforced Concrete (TRC)

- High corrosion resistance of non-metallic fibres
- Enhanced crack control
- Low self-weight of textile fabrics

→ High durability
Lightweight, thinwalled elements

Possibility to align the yarns in the direction of expected tensile stresses

→ Increase in effectiveness and load-carrying capacity



Textile formability

→ Complex freeform geometries

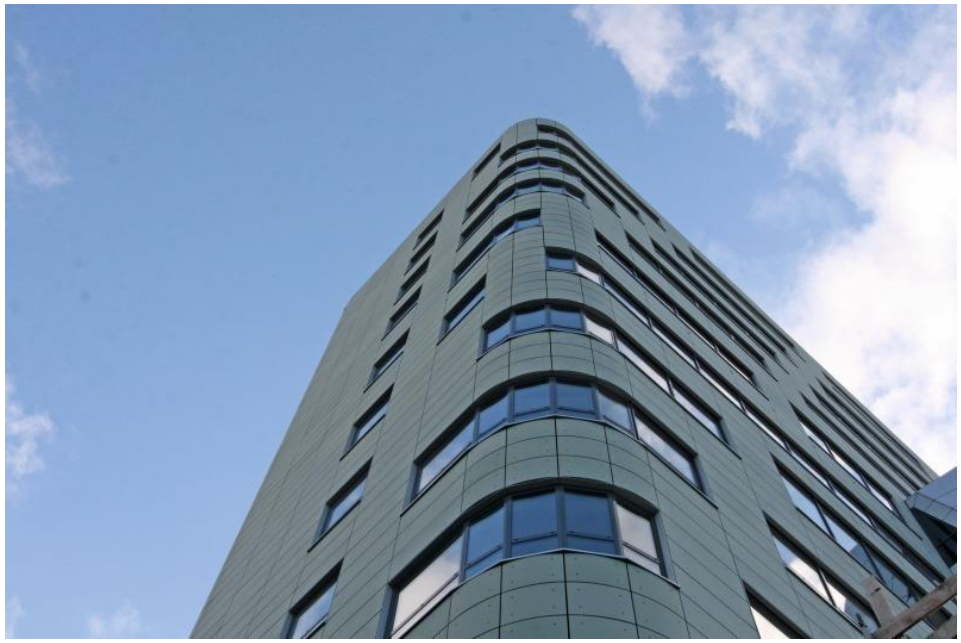
Textile sensorization

→ Structural monitoring capability

PILOT APPLICATIONS (not sensorized)

Footbridge in Oschatz, Saxony, Germany (2005)
Overall dimensions: 2.5 m in width × 8.6 m in span.
Components: 10 equal, 0.9 m long and only **3 cm thick** “U”-shaped units reinforced with textiles
Selfweight: 5 tons (5 times less in comparison to similar RC-bridge)
Bearing capacity: 3 times exceeded design values according to the German Codes

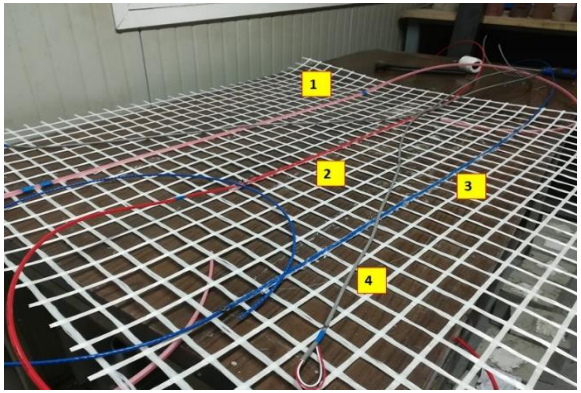
PILOT APPLICATIONS (not sensorized)



Ventilated facade of the Leiden Community College (2011)

10,000 m²
30 mm thick, textile-reinforced concrete panels
0.6x1.8 m each

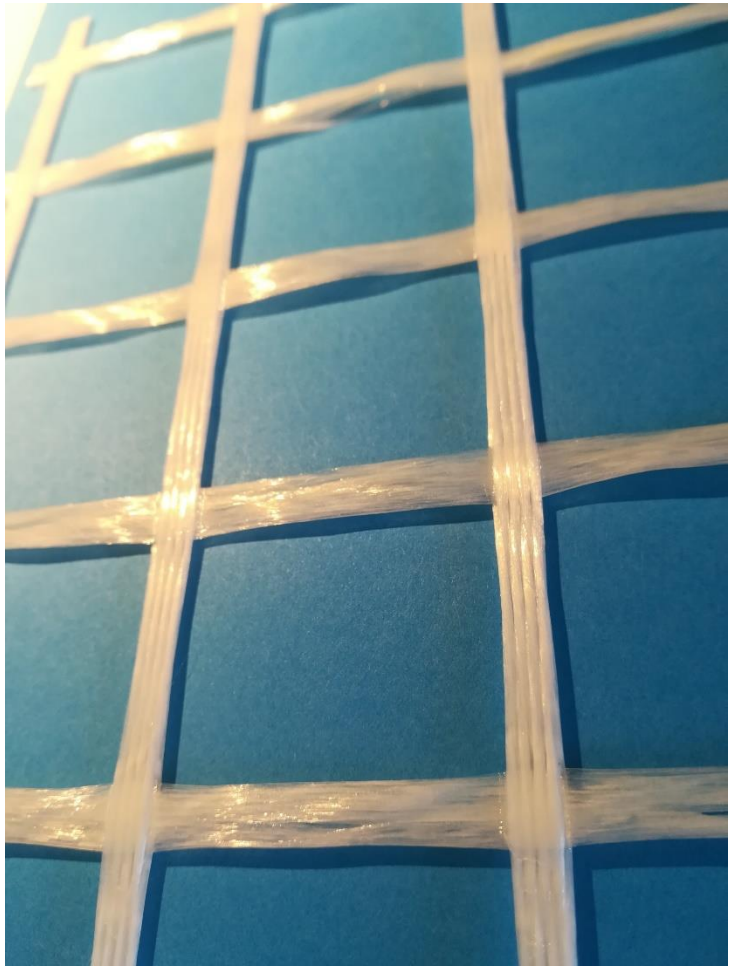
STEPS OF THE WORK



1) Design and development of the multifunctional reinforcing system

2) Integration of the multifunctional reinforcing system into the concrete component

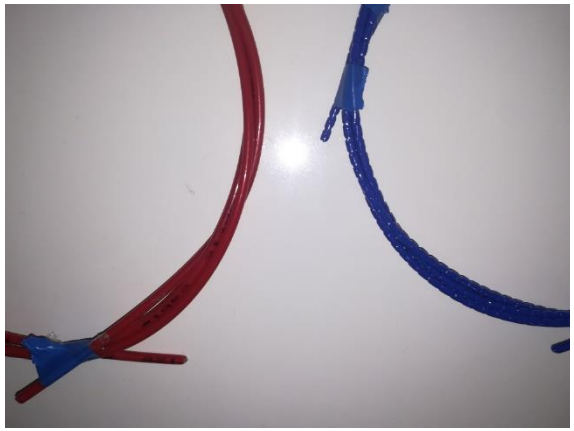
DESIGN AND DEVELOPMENT OF THE MULTIFUNCTIONAL REINFORCING SYSTEM

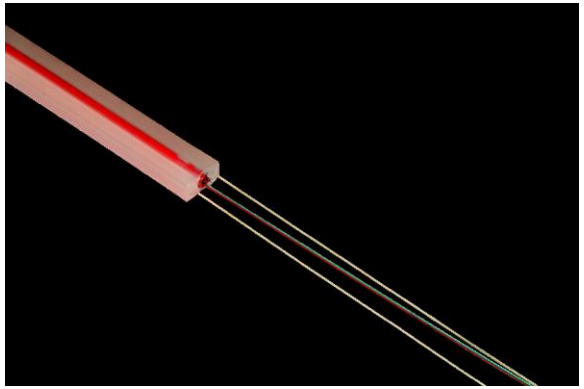


Textile specifications

- Fibers material: AR-glass
- Textile structure:
  - Leno woven fabrics, weft insertion warp-knitted
  - Mesh opening 3cm x 3cm
  - Polymeric coating

DESIGN AND DEVELOPMENT OF THE MULTIFUNCTIONAL REINFORCING SYSTEM

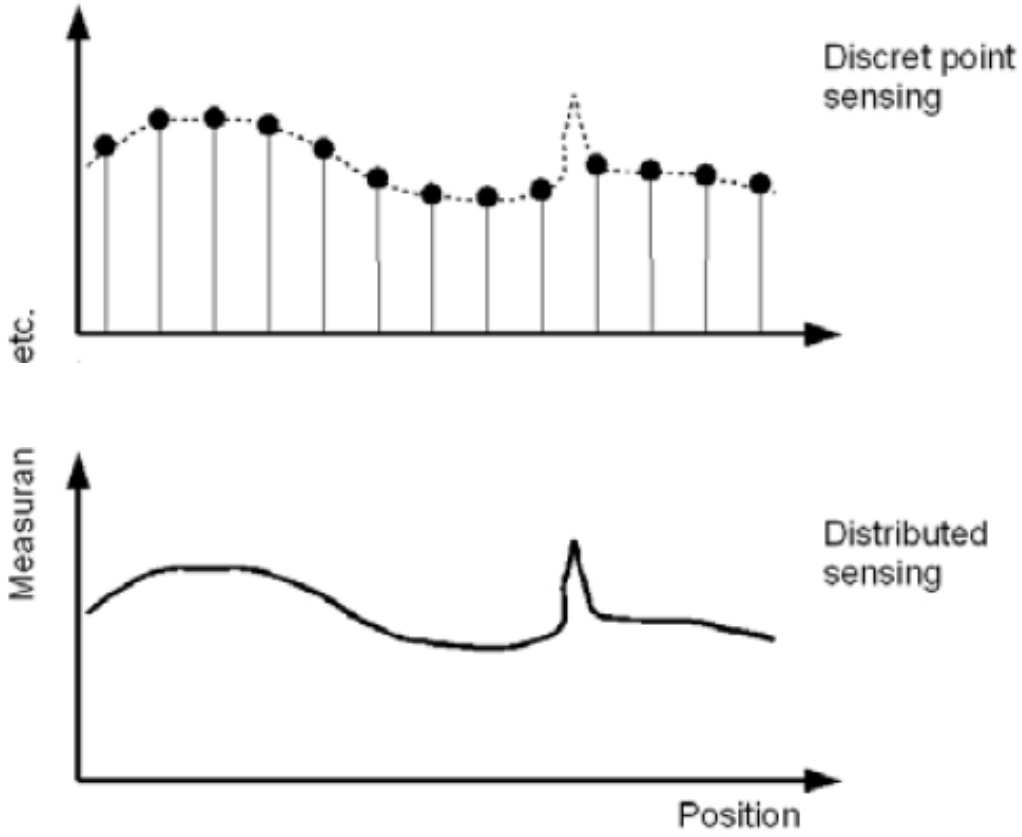




Sensors specifications

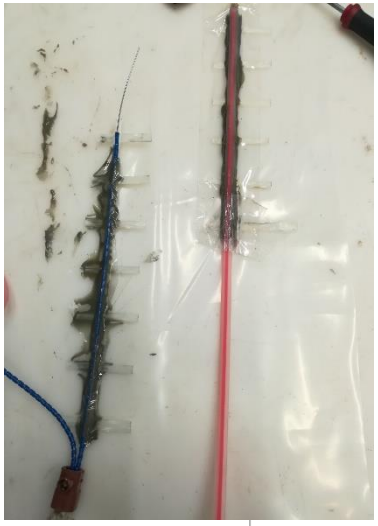
- Fiber Optics Sensor
- gage length: truly distributed
- working principle: Brillouin scattering
- metrological performances (accuracy, resolution, sensitivity, interrogation frequency),
- dimensions and robustness
- Thermal compensation

DESIGN AND DEVELOPMENT OF THE MULTIFUNCTIONAL REINFORCING SYSTEM



DESIGN AND DEVELOPMENT OF THE MULTIFUNCTIONAL REINFORCING SYSTEM

post-production stitching



post-production gluing

Integration strategies

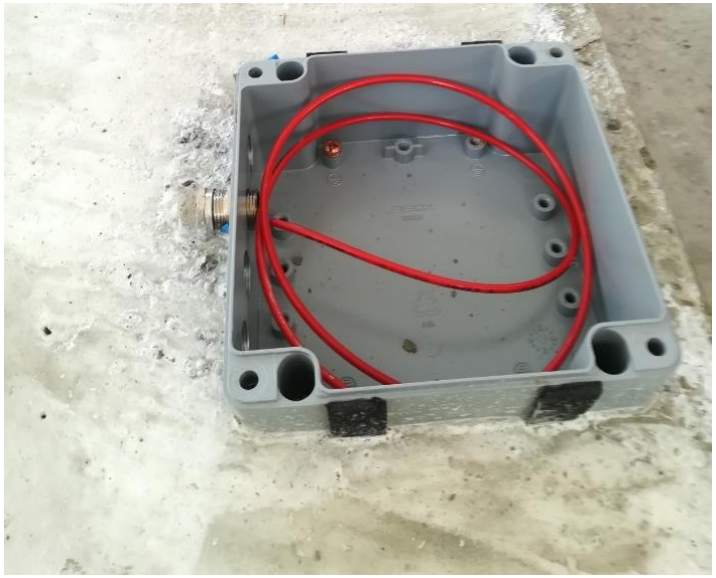
~~Insertion during grid production (unfeasible!)~~

INTEGRATION OF THE MULTIFUNCTIONAL REINFORCING SYSTEM INTO THE CONCRETE COMPONENT

Sensors fixing

INTEGRATION OF THE MULTIFUNCTIONAL REINFORCING SYSTEM INTO THE CONCRETE COMPONENT

Sensor cables protection



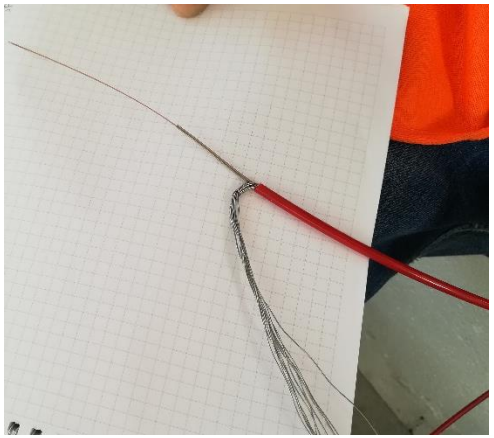
INTEGRATION OF THE MULTIFUNCTIONAL REINFORCING SYSTEM INTO THE CONCRETE COMPONENT

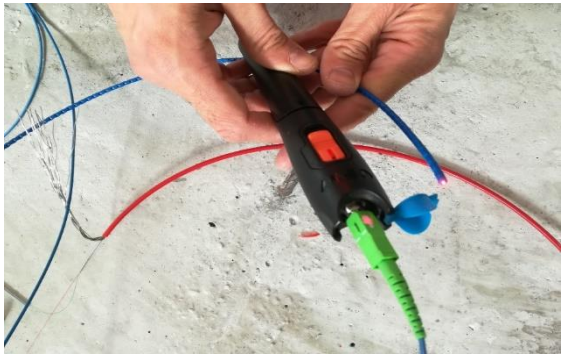
Mould preparation

INTEGRATION OF THE MULTIFUNCTIONAL REINFORCING SYSTEM INTO THE CONCRETE COMPONENT

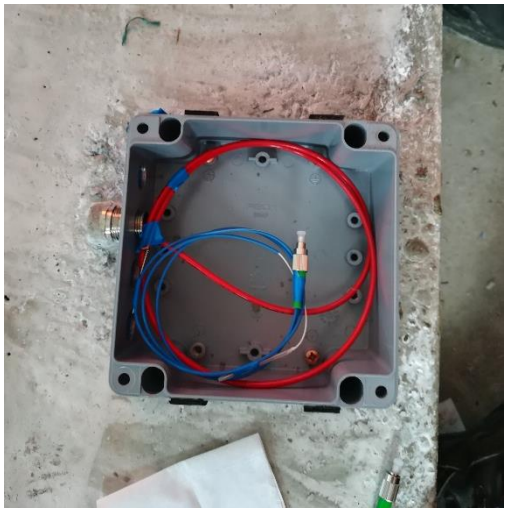
Concrete casting, vibration and demoulding

INTEGRATION OF THE MULTIFUNCTIONAL REINFORCING SYSTEM INTO THE CONCRETE COMPONENT



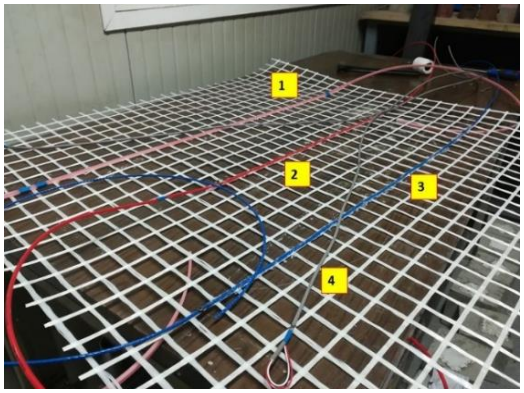


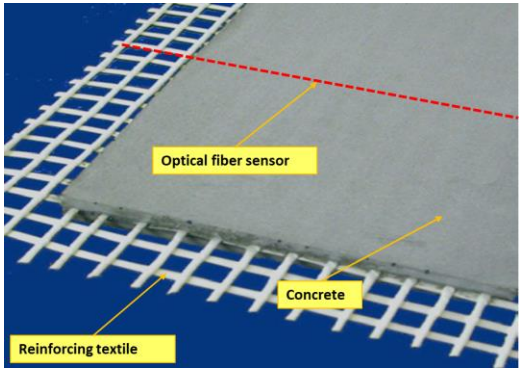
Sensors connection and testing



All connections successfully tested!

CONCLUSIONS AND NEXT STEPS





- ✓ Development of an innovative precast solution, based on the replacement of steel rebars with sensorized textile reinforcement
- ✓ High durability, lightweight, thinwalled elements
- ✓ Increase in effectiveness and load-carrying capacity
- ✓ Complex freeform geometries
- ✓ **Structural monitoring capability**

Next step: calibration testing

The ENDURCRETE Project, leading to the described application, has received funding from the EU's H2020 Programme, under G.A. n. 760639

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Fiera Milano Rho, 13 | 16 marzo 2019

Padiglione 4
B[UILD] SMART! INVOLUCRO

Padiglione 10
B[UILD] SMART! COSTRUZIONI

GRAZIE PER L'ATTENZIONE

MADE EXPO

agorà