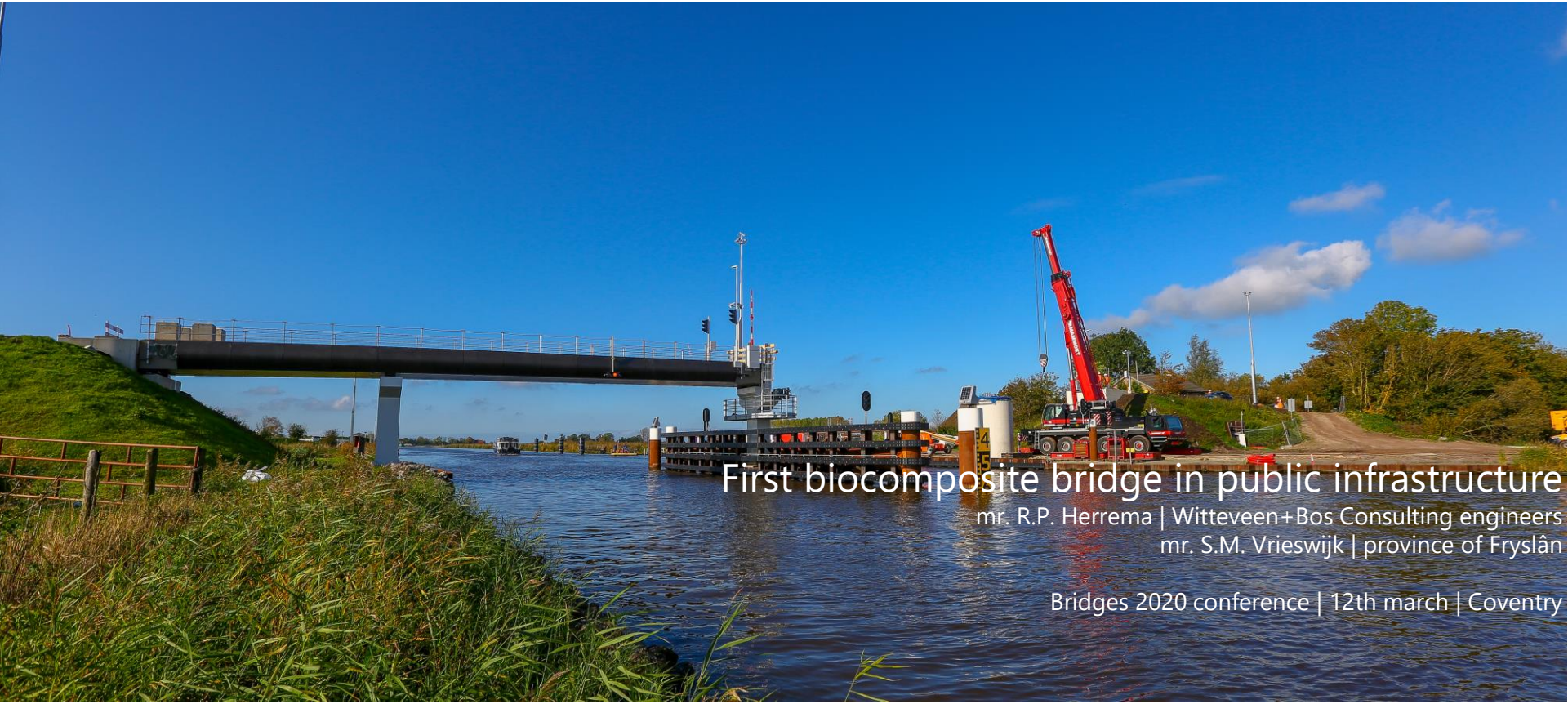


First biocomposite bridge in public infrastructure

mr. R.P. Herrema | Witteveen+Bos Consulting engineers
mr. S.M. Vrieswijk | province of Fryslân

Bridges 2020 conference | 12th march | Coventry

Sjoerd Vrieswijk

- civil servant at province of Fryslân since 20 years
- since 2019 general manager Provincial Water Authority
- responsible for daily exploitation and maintenance of waterways, bridges and locks

Province of Fryslân in metrics

- 5.749 km^2 surface
- 650.000 inhabitants
- 820 km waterways
- 123 fixed bridges
- 55 moveable bridges
- 6 aqueducts
- 19 locks

Sustainable and circulair ambitions Province Fryslân

- practice what we preach
- learning: increasing knowledge in own organisation
- storytelling: sharing best practices and inspiring examples

Challenge

- finishing a multi-milion infrastructural project with a “landmark”
- connect such a landmark to our circular ambition
- a drive to decrease our Carbonfootprint
- use new (building) materials?

and maybe start a change of a “movement”

key condition: cooperation with good partners

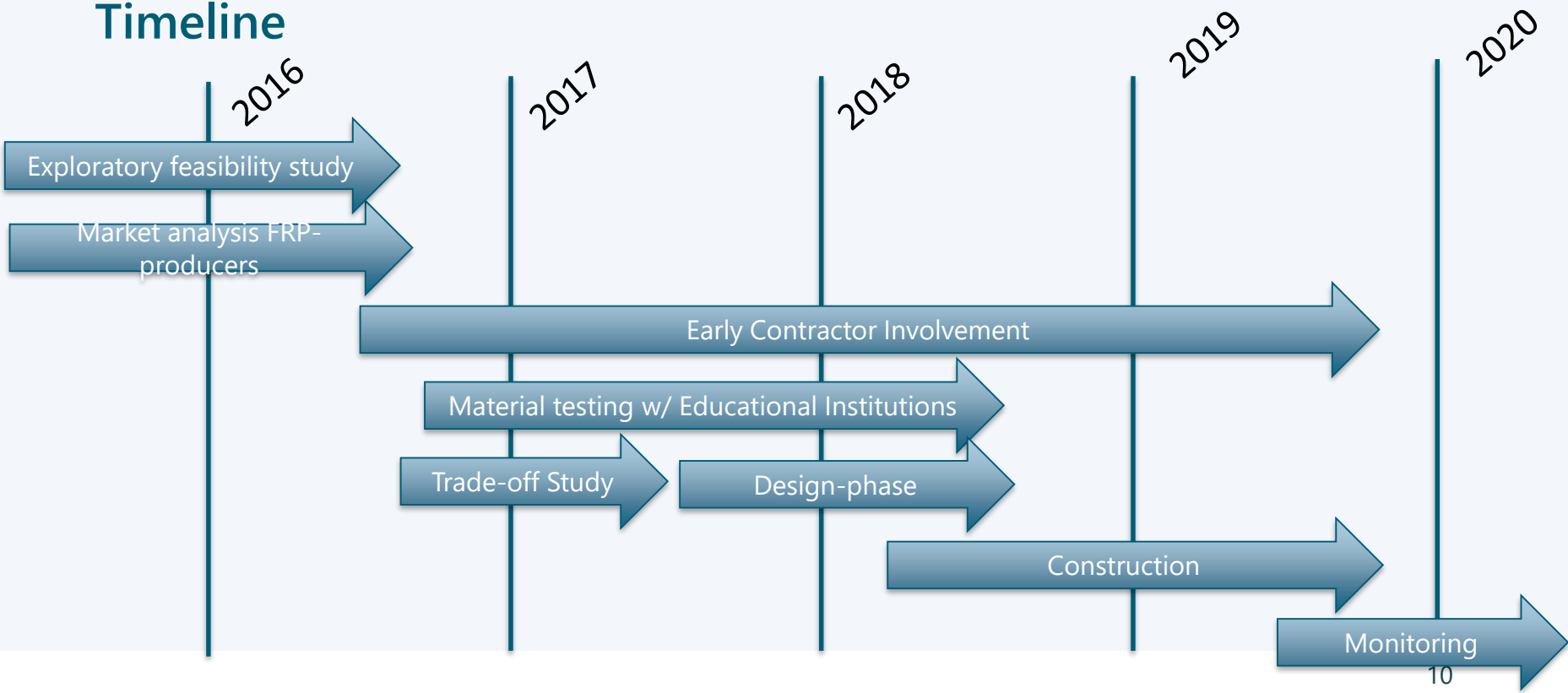
Rinze Herrema

- business unit manager Infrastructural Constructions at Witteveen+Bos
- Yorkshire Gateway Masterplan
- Hereford Walking and Cycling study
- ±1250 employees worldwide

The old situation

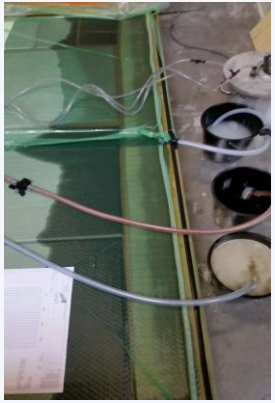
- build in 1960’s of steel (moveable deck) and concrete
- for motorized traffic;
- in 2010 downgraded to bicycle/pedestrian bridge

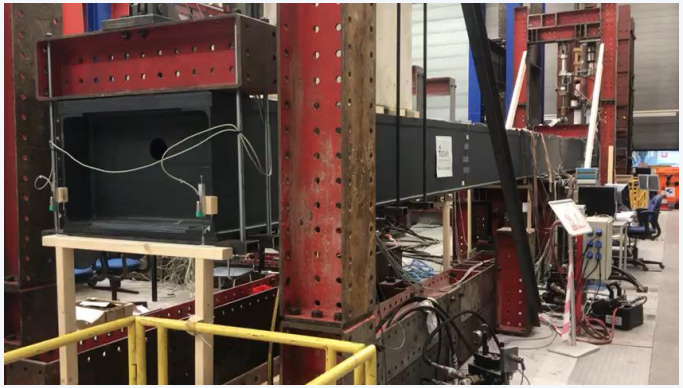
Timeline


2016
2017
2018
2019
2020
Exploratory feasibility study
Market analysis FRP-producers
Early Contractor Involvement
Material testing w/ Educational Institutions
Trade-off Study
Design-phase
Construction
Monitoring

Material testing

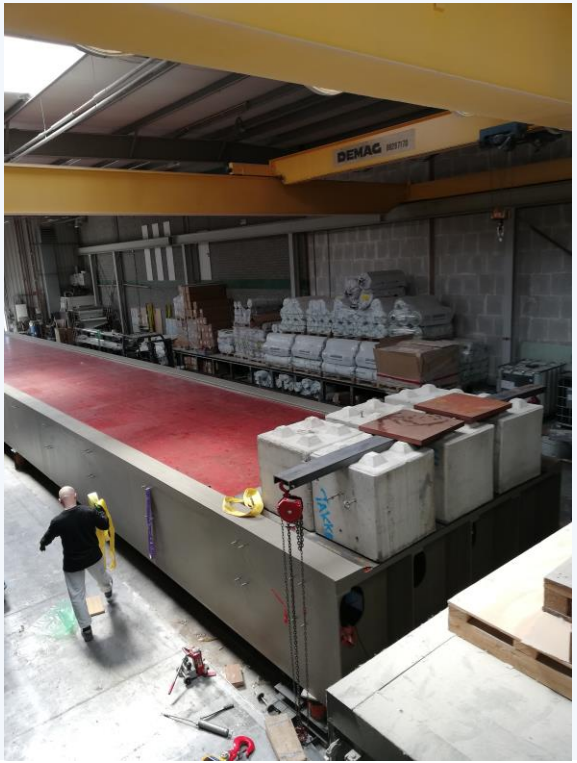
- fatigue
- expansion coefficient
- hot-wet testing
- pressure
- humidity
- creep



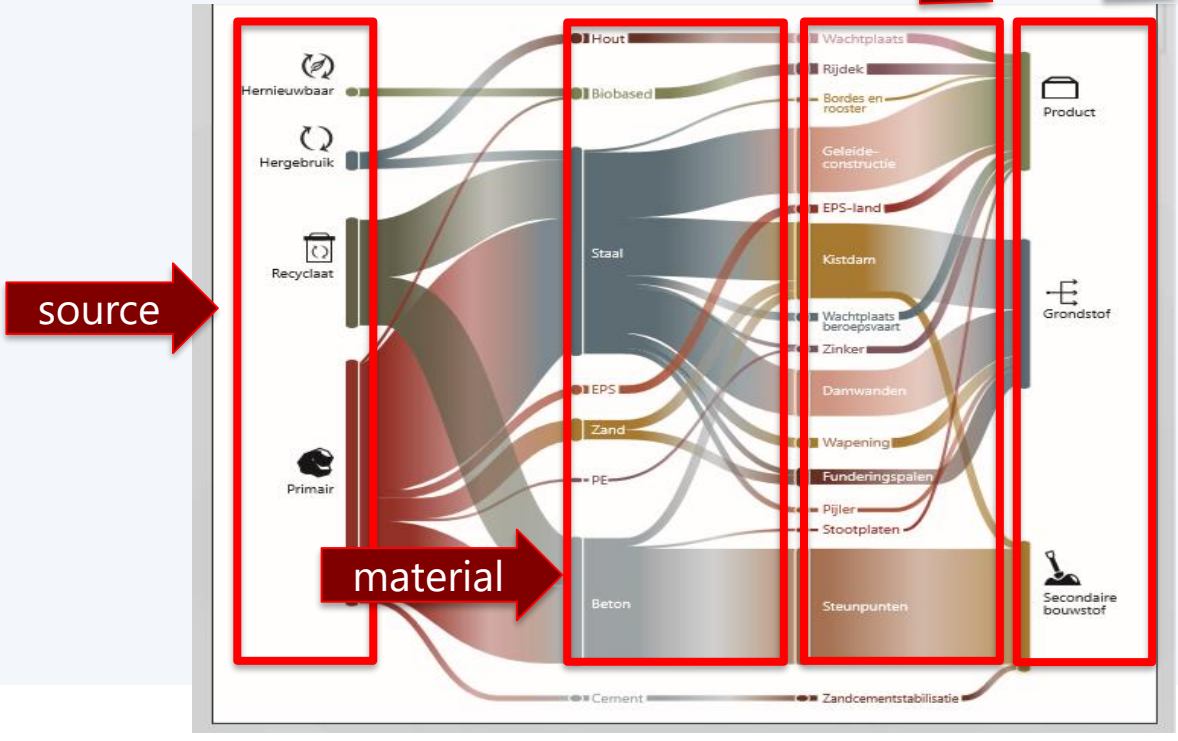


Result

- total span bio-composite– 66 m.
- free span 22 m bio-composite
- flax fiber 100% natural
- total bio-content of deck is 80%



Measuring bio-based composites



Monitoring

- SMART-bridge monitoring (moisture, creep, deformation, fatigue) to gain and share knowledge on biocomposites
- other data collection in scheme

Engineering monitoring plan

Data management

Acces of the information

Management and maintenance

Data driven workflow

RAW SENSOR DATA

Discrete en objective sensor data

INTELLIGENT MODELLING

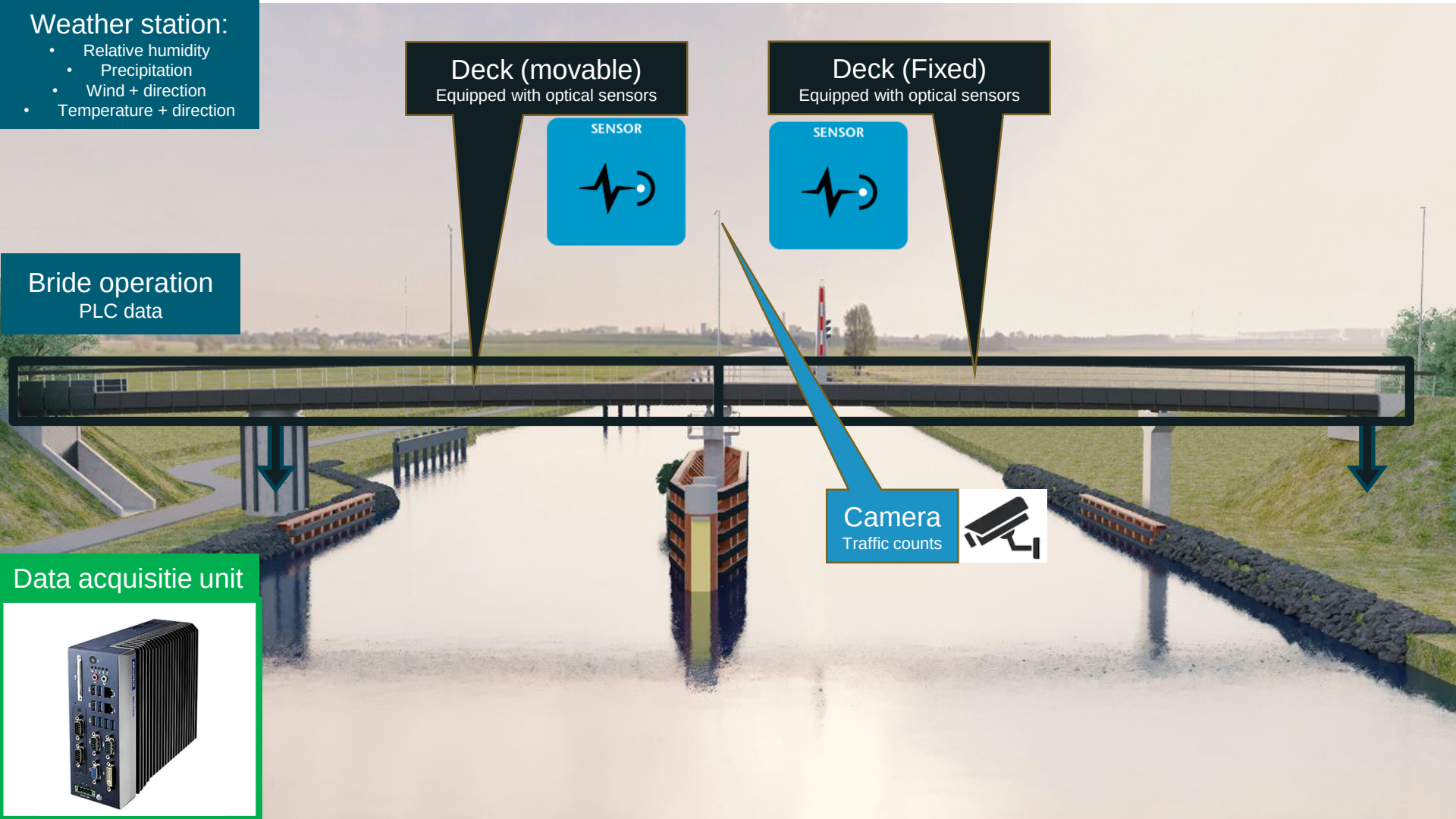
Insights, understanding, experience material, artifical intelligence & machine learning

DATABASES

Data met predefined correlations

ANALYSING EN PREDICTING CONDITIONS

I.e. strucutural health monitoring, recgonizing issues and planninng maintenance

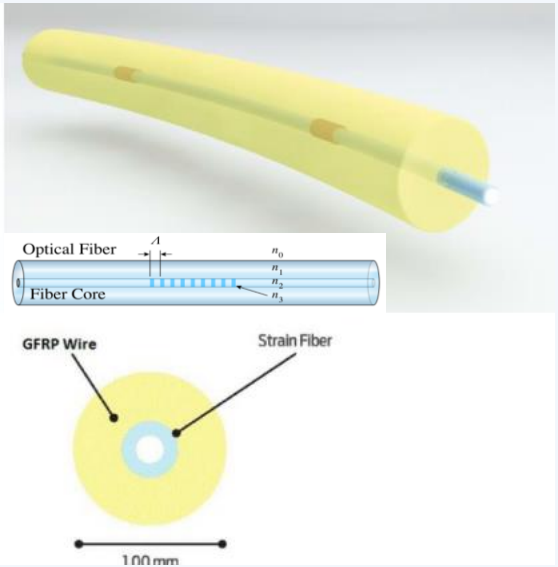

Weather station:
• Relative humidity
• Precipitation
• Wind + direction
• Temperature + direction
Deck (movable)
Equipped with optical sensors
SENSOR
Deck (Fixed)
Equipped with optical sensors
SENSOR
Bride operation
PLC data
Camera
Traffic counts
Data acquisitie unit

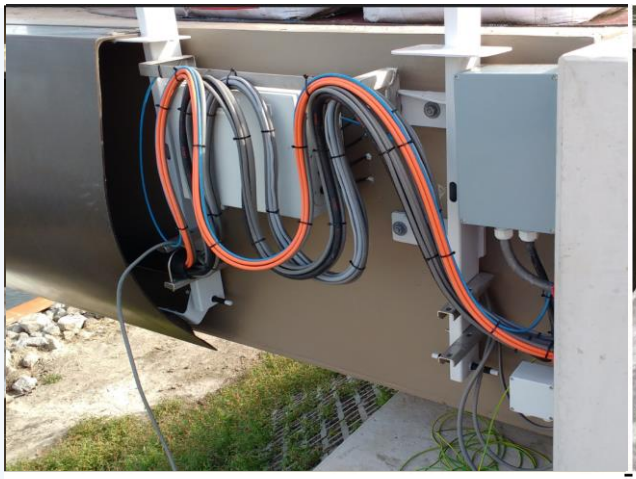
Sensors

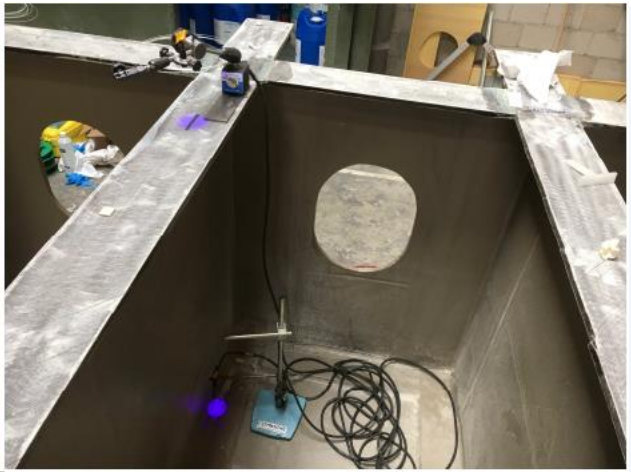
- FBG = Fibre Bragg grating sensors
- Ws = Wind speed (m/s)
- Wr = Wind direction (rad clockwise 0=north)
- T = Temperature (graden Celsius)
- Lv = Humidity (%)
- Ld = airpressure (mBar)
- Rm = Rainfall (mm/24hour)
- Uvm = uv (W/m2)
- AO = bridge opening (cumulative count)

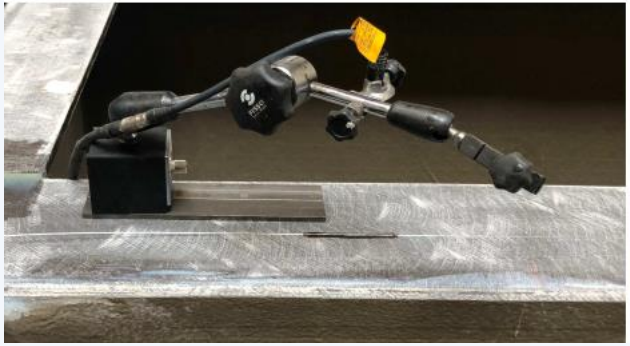
- DUm = Operative hours motor (cumulative count hours)
- Dufo = Operative hours frequency (cumulative count hours)
- TLO = Duration opening/closure(UTC time)
- POn = Position opzetwerk noord (angle RAD, 0-90 DEG)
- KOn = force opzetwerk noord (0-43800 N/m)
- POz = Positie opzetwerk zuid (angle RAD, 0-90 DEG)
- KOz = force opzetwerk zuid (0-43800 N/m)

> 200 sensors places in and between the decks


Optical Fiber
Fiber Core
GFRP Wire
Strain Fiber
100 mm

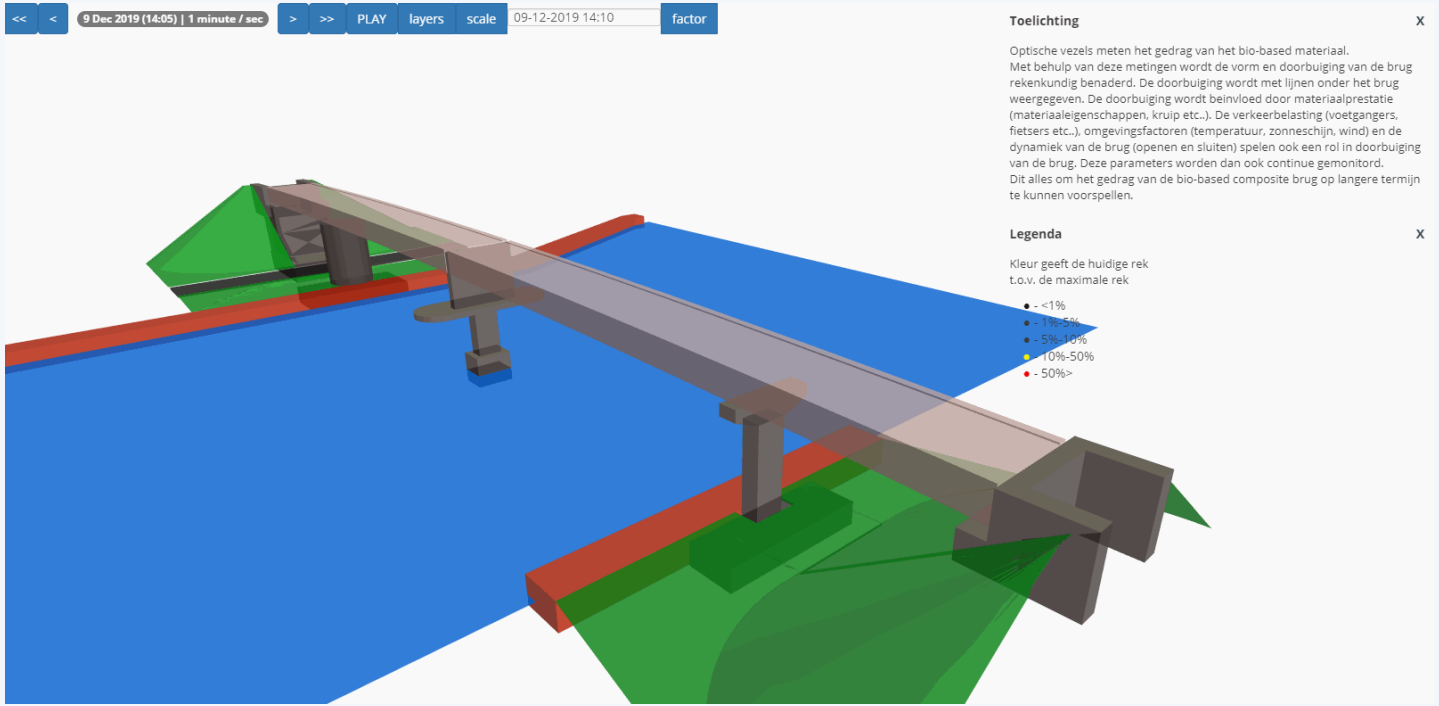







C3_3


FBGS
FBG-scan 808D



https://www.biobasedbrug-ritsumasyl.nl/

We were “launching customer”.

Who will be next client?


www.drive.frl