Erosion Detection with a Fiber Optic Sensor-Enabled Geotextile

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The fiber optic sensor-enabled geotextile

Principle

It combines:
1. the geotextile mechanical properties (protection, soil friction, reinforcement) and hydraulic properties (filtration, drainage)
2. with the fiber optic sensing technology.
The fiber optic sensor enabled geotextile:

- **Performance**

Combined measurement of:
- **Temperature** (0.1°C) good indicator of leakage (< 1 l/m/min.)

![Diagram showing optical fibre and leakage measurement](image)
The fiber optic sensor enabled geotextile:

- **Performance**

Combined measurement of:

- **Temperature**  (0.1°C)
  good indicator of leakage (< 1 l/m/min.)
- **Strain**  (0.01%)
  good indicator of movement
Examples

1. Experimental dike : Ijkdijk piping (NL)

2. Canal dike (Marne to Rhine) (F)
IjkDijk project – Piping experiment (2009)

Sensor geotextile

Fibre optics

Downstream and upstream the experimental dike

Phase 2 (bassin A)

Clay

Sand

0 0.6 1.6 4.3 8.0 10.7 10.8

x (m)

Fond étanche

ITA_0 ITA_1 ITA_2 ITA_3 ITA_4 ITA_5

1:1 1:2 1:2

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IjkDijk project – Piping experiment

Visible piping channels

15 m

1/3
IjkDijk project - Piping experiment

Collapse:
05/12/09 – 12:00
12
30/11/09 – 12:30

Temperature

Strain

waterflow

top view

Upstream

Downstream
Temperature

Strain

01/12/09 – 12:00

Upstream

Downstream
Temperature

Strain

waterflow

Upstream

Downstream

02/12/09 – 12:00

top view
Temperature and Strain analysis

Upstream and Downstream

Waterflow and Strain analysis

Collapse – 18 h
05/12/09 – 12:00

04/12/09 – 18:00

Temperature and Rain analysis

Collapse – 18 h
05/12/09 – 12:00
Temperature

Strain

Upstream

Downstream

Collapse – 6 h
05/12/09 – 12:00

05/12/09 – 06:00

Waterflow
Temperature

Upstream

Downstream

Strain

Collapse

05/12/09 – 12:00

waterflow
Examples

1. Experimental dike: Ijkdijk piping (NL)

2. Canal dike (Marne to Rhine) (F)
Marne to Rhine canal dike (F)
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Raw temperature data

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Marne to Rhine canal dike (F)

Processed temperature data on 25.04.2009 – eDF models
Marne to Rhine canal dike (F)

Raw strain data

27.06.2009

Top

Middle

Bottom

45 m (0.03%)

10 m
Conclusions

• The fiber optic sensor technology is accurate, reliable, durable and fit the need to monitor long distance hydraulic works.

• The fiber optic sensor-enabled geotextile combines strain/movement and temperature/leakage monitoring, helpful for scour erosion detection.
Thank you for your attention