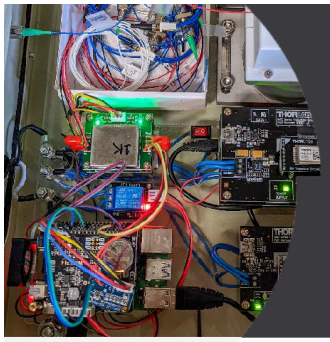
8.4 Fact Sheet



SmartCrete CRC Project 21.FT.0010-P

FTP1 – Innovative and economical photonic sensor interrogation

Australian utilities spend upwards of $100m every year in the management and repair of concrete gravity sewers. A SmartCrete CRC Project developed a cost effective field deployable photonic sensor system to help target appropriate rehabilitation expenditure and improve predictive strategies.

Background

Deterioration of concrete wastewater pipelines due to corrosion is a global problem that custodians of this vital infrastructure face daily. Premature pipe failure brings high financial, public health and environmental costs. Asset managers are currently unable to monitor real-time corrosion in live sewers and its contributing factors over long periods using conventional sensing methodologies.

Sydney Water, Melbourne Water, and Macquarie University recently showed that optical fibre-based sensing platforms sustain performance in harsh sewer environments over long periods. Photonic sensing, therefore, promises to improve sewer pipe management by providing in-situ monitoring capabilities that will reduce the need to enter sewer pipes and provide superior predictive corrosion strategies. Such systems though relied on expensive commercial interrogators, limiting their use for scalable deployment.

This SmartCrete CRC Project took a bold, innovative approach to provide global wastewater utilities with cost-effective information about their concrete infrastructure. An affordable optical fibre sensor system was developed that industry can adopt to cultivate strategic plans for concrete corrosion mitigation in sewers. The new sensor product will serve as an alternative solution to the current expensive systems on the market for future industry applications.

Objectives & Approach

- Develop an economical optoelectronic sensor platform to replace the expensive interrogators (upwards of AUD 40k) that were used in past installations.
- Use off-the-shelf commercially available telecommunications components in the system design to drive down the cost.
- Develop optimised optical processing methods to convert proven field-tested fibre sensor data into relevant measurands.

Sensor Interrogation

A novel deploy box to interrogate sensors in the field was developed in this Project. The design of the optoelectronic interrogator system swept a narrow laser line across a known reference response and the target sensors simultaneously. The system's accuracy was comparable with a leading commercial device. For portable field use, the hardware had low energy needs, being compatible with battery/solar powered operation, and offered remote real-time monitoring capabilities through the use of emerging cloud-based Internet of Things (IoT).

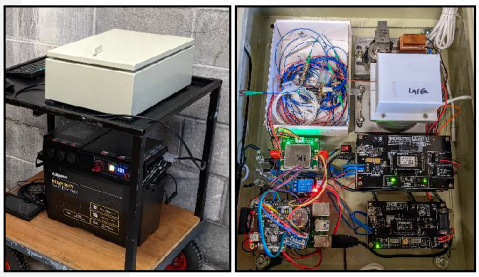
Cost Effective Fibre Sensors

Macquarie University fabricated optical fibre sensors (based on Bragg gratings) using stable laser inscription techniques in commercially available telecommunications fibre.

SmartCrete CRC · MACQUARIE University · Sydney WATER · Melbourne Water

Validation via Field Trial

The battery operated sensor system was deployed at a University site with exposure to outdoor environmental conditions. Real-time sensor data was collected remotely. The sensor system maintained accurate monitoring with a commercial device over the 2 months of field-testing.



This work was performed in-part at the OptoFab node of the Australian National Fabrication Facility, utilising NCRIS and NSW state government funding.

Outcomes & Benefits

- An affordable (less than AUD 5k), energy efficient, field deployable optical fibre sensing system was developed.
- The optical sensing system will not only reduce monitoring costs, but also facilitate improved management of concrete pipe deterioration.
- A reduction of human traffic in live sewers due to in-situ optical fibre monitoring will reap occupational health and safety benefits.

Timing

The 12-month project finished in October 2022.

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