



## INNOVATION EDGE™: FIBRE OPTIC MONITORING TECHNOLOGY

**Main Image:** Fibre Optic Monitoring Technology installed in concrete segments on Crossrail Thames Tunnel C310

The Hochtief Murphy Joint Venture, in conjunction with the University of Cambridge, developed the Fibre Optic Monitoring Technology to receive live information of the Crossrail Thames Tunnel C310 performance.

### Description

The Fibre Optic Monitoring Technology was developed by Hochtief Murphy Joint Venture (HMJV) in conjunction with the University of Cambridge. Prior to casting, the fibre optic cables are installed in the reinforcement cage of tunnel segments. The cast-in cables in adjacent segments are then connected around the ring to achieve an overall monitoring matrix. As each ring is built, the fibre optic connections inside the segments are clipped manually via a junction box. Once the full tunnel ring has been constructed, the completed fibre optic circuit is then connected to an analyser.

With the complete circuit in place, the Fibre Optic Monitoring Technology makes it possible to obtain real time information about how the built ring is performing under the dynamic forces of the ground and passing trains. This helps in designing future tunnels and provides analysis of the condition of the tunnel over its lifespan.

## The Benefits

- Provides live information about the condition of a tunnel throughout its whole life cycle allowing proactive remedial measures, if necessary, before damage has occurred.
- Provides a benchmark for future real-time lifecycle data collection.
- Gives access to valuable information on ground movement and integrity of the structure for infrastructure owners.
- Provides information which may assist in improving the construction processes in terms of finding ways of building faster, more efficiently, and with more confidence.
- Durability, stability and resistance of the fibre optic sensor to external influences are beneficial to the long-term health evaluation of civil and geo-engineering structures.

## Application

The Fibre Optic Monitoring Technology was applied on the Crossrail Thames Tunnel C310 project carried out by Hochtief Murphy Joint Venture (HMJV). The £260m project comprised twin-bored tunnels that were 3km long and 6.2m internal diameter, as well as, 1km of associated approach structures.

The cost for the fully installed technology was approximately £90,000 (£58,000 for material and £32,000 for installation).

At the time of writing, the specific project benefits are still being assessed. It is envisaged that the ultimate benefit will be additional knowledge on its real-time structural condition. The information gathering will inform and assist with leaner tunnel design and construction.

## End User Feedback

The implementation of the Fibre Optic Monitoring Technology for tunnel segments at C310 is a good example of the benefits of close collaboration between the construction industry and academic bodies.

“The project is a clear demonstration of academia and industry working together to deliver technological innovation.” – **Professor Robert Mair, University of Cambridge**

“The fibre optic strain gauges are installed at predetermined points within the tunnels and will record data over time. This data will provide information on tunnel loading over its lifecycle. HMJV wish to capitalise on construction phase measurements which could have significant benefit to segmental lining designs” – **Neil Hodgetts, HMJV Quality Manager**



The Fibre Optic Monitoring Technology

## Market Potential

The Fibre Optic Monitoring Technology can be used to monitor bridges, tunnels, piles, anchored walls, dams, historical monuments or nuclear power plants and gas pipelines.

Many different parameters can be determined by means of utilising the technology, including temperature, quantity of loads, deformations, strains and tensile modulus displacements.

## Learn More

For more information, please contact Murphy Marketing & Communications Department at [communications@murphygroup.co.uk](mailto:communications@murphygroup.co.uk)

This is a brief description of the solution as we have applied it and should not be taken as exact. Its application must take into account the local environment and specific project requirements.



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