CASE STUDY

Roadway Monitoring

ABOUT WILTON ROAD

Industry: Civil
Location: Appin, Australia

Wilton Road is a two-lane road with a portion of its 23-mile span located near a mining site operated by Southern Coalfield of New South Wales (NSW). The road is particularly prone to structural distress due to mine subsidence movements and mining-induced ground strains. Much of the ground strain is transferred to the pavement through ground movement and interface friction between structural layers.

The Challenge

The local authorities needed a way to measure Wilton Road for stresses and movement in the pavement in order to avoid a collapse or other catastrophic incident.

The Solution

In a first of its kind installation, Luna Innovations worked alongside the Roads and Traffic Authority of NSW and BHP Billiton Illawarra Coal to successfully implement the use of optical fibers embedded in the roadway to monitor for mining-induced strains in a road pavement.

Luna developed a method of embeding one or more optical fiber(s) into a glass fiber reinforced composit (GFRC) cable, in order to protect the fiber from breakage. These cables can be up to kilometers in length, are readily deployed in the field, and provide a very high level of protection to the fiber, all while maintaining its sensitivity to changes in temperature and strain.

During installation, the optical fiber sensors encased in GFRC were placed in the asphalt layer approximately 5 cm below the surface down a 90-meter-long section of pavement on Wilton Road. Temperatures are also measured at strain sensing locations for determining thermally induced strains.

The Results

The optical sensing monitoring conducted at Wilton Road successfully demonstrated that distributed Fiber Bragg Grating (FBG) sensors can reliably be used to measure mining-induced strains in road pavement since the sensors and monitoring system remained stable throughout the monitoring period. Sensing networks can inforporate tens, hundreds, or even thousands of FBG sensors distributed over large distance.

A Luna sm125 was used in the field for its proven reliability and accuracy

INSTRUMENTS USED

(1) Luna sm125 Optical Sensing Interrogator was used in conjunction with (5) FBG Distributed Temperature Sensor Cables and (10) FBG Distributed Strain Sensing Cables

Epoxy resin poured around the 1 mm diameter cables in one application

Sensors embedded into wet pavement and manually placed into groove via spool reels

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