Contribution ID: **74** Type: **Oral Presentation**

Fibre Bragg grating sensor to measure shrinkage in a concrete overlay.

Tuesday, 30 June 2015 14:00 (20 minutes)

Abstract content
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Concrete shrinkage of large flat surfaces, such as concrete overlays in parking lots or warehouse flooring, leads to costly rework, repairs and safety hazards. Shrinkage affects the structural performance, causing cracking and curling, which is not only aesthetically undesirable but also provides ingress points for water and other chemicals that can deteriorate the overlay. It is necessary to quantify the shrinkage so that preventive and corrective measures can be taken to ensure quality overlays.

Concrete shrinkage is conventionally measured using electrical resistance strain gauges and mechanical strain gauges. In this study, embedded Fibre Bragg Gratings (FBG's) used as optical sensors, were investigated as an alternative to conventional measuring methods.

FBG's used as strain and temperature sensors were embedded into a square concrete overlay. The strain FBG sensors were pre-stressed to accommodate for shrinkage of the concrete. Steps were taken to compensate for the effects of temperature on the FBGs.

Three specimens were produced to record data over a 10 day period and the results were compared with a conventional strain gauge (CSG). It was found that the FBG's were more sensitive than the CSG over the first 6 days but converged to the same total shrinkage at the end of the measuring period, thus demonstrating the feasibility of using FBGs to measure shrinkage in concrete overlays.

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Session Classification: Photonics

Track Classification: Track C - Photonics