

464-

SUMMARY OF COMPLETED PROJECT

Project No. DST sponsored DST/TSG/NTS 2009/ 32 TO CSIR-CSIO and CSIR-CRRI

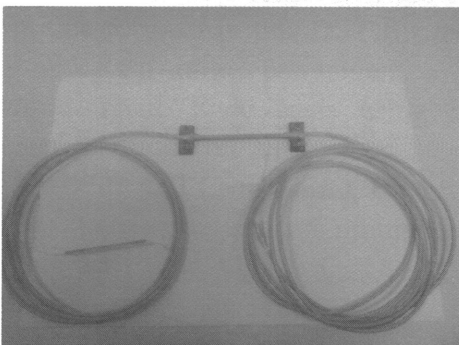
Project Title: Development of FBG Based Distributed Strain Sensor System for Concrete Bridges

Summary:

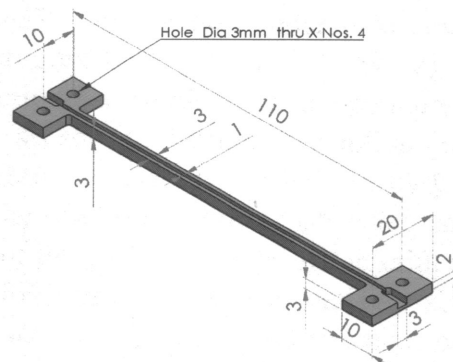
Civil Structures such as buildings, bridges, dams, tunnels, ports etc are expensive assets of the modern society that need to be functional for a long time under complex conditions, thus their constant monitoring is pivotal to prevent catastrophe and ensure safety. Bridges are lifelines of a Nation's infrastructure and massive investments are being made in the Highway Sector year after year. Health monitoring of bridges used to involve strict periodic maintenance procedures, regular visual inspections and use of conventional sensors i.e. electric strain gages (ESGs).

Development of fiber optics has led to a significant growth in the field of sensors as they offer several advantages. The Fiber optic sensors (FOSs) have certain advantages such as their small size, light weight, immunity to Electromagnetic fields (EMI), ability to work in harsh environment, suitability for embedding, multiplexing and remote sensing, which make them perfect alternative to ESGs. Fiber Brag Grating based fiber optic sensors (FBGs) are intrinsic fiber elements inscribed in photosensitive fibers where index of refraction in the fiber core is periodically modulated by illuminating with UV light. If light from a broadband source is transmitted through such a fiber, one particular wavelength is scattered by this periodic refractive index variation and will be missing from the transmission spectrum and after due calibration can sense strain in the system.

Single and multiple FBGs on acrylate coated photosensitive silica optical fibers were designed, fabricated, recoated, characterized and used as strain sensors. These were embedded in reinforced concrete beams and tested in the laboratory. Packaged FBG sensors have been designed and developed for surface strain mapping. Strain-temperature discrimination technique based on dual FBG sensors has been developed. Besides measurement of strain in structure, wavelength calibration and temperature characteristics of the FBG sensors were also studied.



(A) The Packaged Sensor



(B) Packaging for FBG Sensor