

Static and Fatigue Behaviour of FRP-Reinforced Concrete Beams and an SHM System with Fiber Optic Sensors under Different Weathering Conditions

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Structural health monitoring (SHM) techniques are often used for detecting damage and diagnosing the structural conditions. There are many issues related to installation and constructability of SHM systems and in-situ installation of fibre optic sensors (FOS) on rebars in reinforced concrete (RC) elements. Here, a solution is provided for installation of a FOS strain sensor by mounting it on a supplementary bar a priori and then attaching it to the main reinforcing bar of interest at the construction site prior to concrete pouring. Such innovative deployment system for FOS is particularly advantageous for developing a practical SHM system for infrastructure. However, the performance of such systems under various loading and climatic conditions is not very well known. The objective of this research is to assess the performance of the said system used in concrete beams reinforced with FRP (fibre-reinforced polymer) bars, under normal and adverse environmental conditions such as, immersion, fatigue and cyclic immersion in alkaline solution. The results show that the proposed FOS system is efficient and useful in capturing the real strain in control and the wet and dry condition. Electric strain gauges were found to perform poorly in adverse conditions.

Record of the entire response of the structure to external loads of a structure makes it possible to identify and analyze periodic events. It helps a better evaluation of the acquired data. By the time the collected data will be more valuable and increases the knowledge of the users for forecasting of future structural behaviour and more reliable risk estimates. The results validates application for normal status with low alkalinity environment.