

In-Service Structural Condition Assessment of Cable-Stayed Bridges Using Strain Monitoring Data under Environmental Effects

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Abstract

Long-span cable-stayed bridges have complex and vulnerable systems, and the structural performances of in-service cables-stayed bridges are affected by many environmental factors including thermal (temperature, humidity, solar radiation), wind, rain, etc. Therefore, efficient inspection and maintenance strategies are needed to ensure their serviceability and integrity. Structural health monitoring approaches are utilized to secure the structural and operational safety of them recording different response measurements. Strain measurements offer information about stresses experienced by the bridge during its operation and are better suited to characterize the local deficiency and damage of an element than global responses. The present paper investigates the measured field strain responses of the deck, pylon, and cables of long-span cable-stayed bridges under environmental effects. The new Kömürhan long-span cable-stayed bridge with a single invert Y pylon constructed in Turkey, which was opened to the traffic in January 2021, is selected as an application. Firstly, in-service structural condition assessment of the bridge is detailly evaluated using the strain responses recorded along the deck, pylon, and cables during two periods with relatively high and low temperature. Then, the relationships between the measured strain response and environmental effects such as temperature, humidity, solar radiation, wind, and rain are determined for the cable-stayed bridge. The results provide valuable strain response knowledge about the operational conditions of long-span cable-stayed bridges in terms of serviceability, strength, reliability, and maintenance.