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VIBRATION-BASED DAMAGE DETECTION AND PERFORMANCE ASSESSMENT FOR PC GIRDERS

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【Background】

Concrete is widely used in developing countries as a prime material in bridge structures, although, their current performance is an uncertainty because of poor maintenance. Inspections in concrete structures are mainly qualitative, meaning that the engineer performs an evaluation based on his own experience and judgment only. Therefore, how to detect damage or even the current condition of a concrete bridge is one of the challenges for vibration-based SHM.

【Objective】

This research aims to identify a variable that can be used as damage indicator or that links the performance of the structure. This study also aims to clarify if the remaining deformation is correlated to the deviations in mode frequencies and damping ratio. The final goal is to confirm if vibration-based monitoring can be implemented as a real world application when inspecting concrete bridges.

【Approach】

Changes in the fundamental modal parameters, such as mode frequency and damping ratio, are studied before and after different levels of static loads. Impact hammer and shaker are used to identify these features along with servo-accelerometers. After reaching a specific loading-unloading stage, a tendon of the girder is cut at one end while the dynamic response of the structure is recorded simultaneously. A probabilistic description of the modal parameters is carried out in order to establish the degree of variation in the vibration response and observe the correlation with the structural performance.

【Publication Plan】

Performance assessment of a PC girder by means of monitoring vibrations, 11th German-Japanese Bridge Symposium, August 2016, OIT, Osaka, Japan

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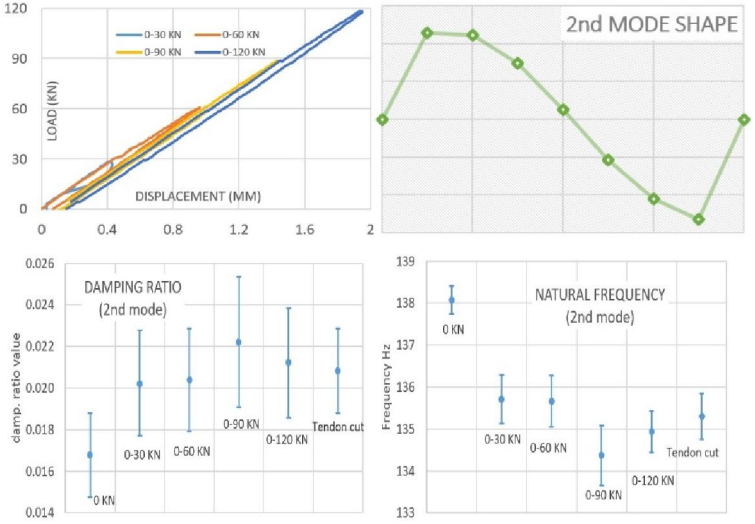
Attempting to publish in the International Conference on Structural Dynamics, EURODYN2017

【Results】

The experiment showed that the change in natural frequency deviations and damping ratios are minor after each loading stage and also after the tendon cut.



The vibration response is highly sensitive to the tendon cut and it can be used for damage detection.