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Vibration-based monitoring in concrete bridges

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Describing performance through SHM

【Background】

Present methods to measure the structural performance of concrete bridges are time exhausting and highly expensive. Using structural health monitoring techniques (SHM), such as vibration-based monitoring, will optimize time and resources when dealing with bridge inspections. This SHM techniques have been used efficiently in damage detection, but using this data to describe the current structural performance is a new challenge.

【Objective】

The development of efficient tools to judge the condition and deterioration rate in concrete bridges is highly needed. Finding the link between structural health monitoring and structural reliability will benefit maintenance management. Correlations between parameters used in different fields is the first step to obtain performance through SHM.

【Approach】

Experimental tests are carried out in different type of concrete specimens, typical post-tensioned concrete (PC) beams and also concrete box girders. The tests consist in several static loadings and vibration response tests along the whole process. The static test aim is to change the intrinsic parameters of the specimens and produce some damage as well as change in the performance. While the vibration response tests will allow to monitor the change in modal parameters due to the effect of the static tests. Frequency response functions are easily calculated since an impact hammer is used when collecting the vibration response.

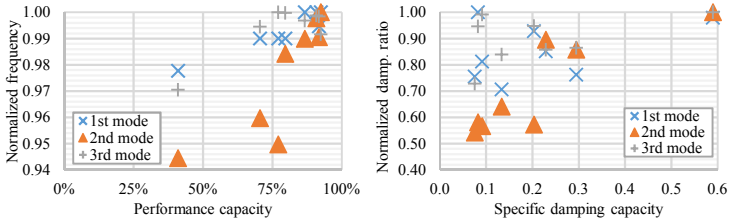
【Publication】

Energy dissipation and absorption capacity on experimental modal parameters of a PC girder, International Conference DAMAS, July 2017, Kitakyushu, Japan.

Energy capacity influence on modal parameters of prestressed concrete box girders, 8th Thematic Conference on Smart Structures and Materials VIII ECCOMAS, June 2017, Madrid, Spain.

【Results】

Test outcomes in PC beams show that values from the second natural mode of the element (frequency and damping ratio) have a better fit than other modes and that is more reliable to changes in its health condition.



Results from the concrete box girders indicate that unsymmetrical damage affects the monitored parameters (G1:non-symmetric damage–G2:symmetric).