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RESEARCH HIGHLIGHTS

STRUCTURAL HEALTH MONITORING OF BRIDGE STRUCTURES USING VIBRATION APPROACH

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The demand for better condition monitoring of structures and infrastructure is increasing worldwide due to the fact that many existing civil assets are at risk of aging, which leads to serious structural deterioration. It is necessary to assess their structural health conditions to mitigate risks, prevent disasters, and plan for rehabilitation to extend their service life for a sustainable environment.

Structural health monitoring (SHM) is a method of observing and assessing a process that involves regularly sampling response measurements to track changes in the material and geometric properties of structures. The characteristic of ultra-high-performance concrete (UHPC) bridge structures, which are smaller and slenderer, makes them more susceptible to external dynamic excitations like vehicle-induced vibrations. Therefore, this project was conducted to obtain vibration information.

The project combined an ambient vibration-based approach, a finite element model, and model updating to evaluate the structural effectiveness of the ultra-high-performance concrete road bridge.

The updated dynamic parameter of the first dominant natural frequency, which falls within the acceptable natural frequency range according to EN1991-2:2003, was indicated to be in agreement with the structural serviceability. This monitoring technique is extremely advantageous since it causes no damage to existing bridge structures and does not disrupt traffic operations.

The team has successfully conducted monitoring of both the UHPC road bridge and the steel train bridge. We offer a better solution through the establishment of a reliable monitoring technique for vibration serviceability assessment on existing civil engineering assets. This technique benefits by ensuring structural safety and providing information for immediate maintenance actions, thus reducing structural maintenance costs.

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