Vibration-Based Damage Detection Of An Actual Steel Plate Girder Bridge Under Local Damage And Varying Temperature

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This study aims to investigate how the local damage and varying temperature affect changes in modal frequencies of a steel plate girder bridge. Vibration monitoring and a damage experiment was conducted on a real steel plate girder bridge. Identified frequencies of the bridge showed that, once artificial damage introduced, the 1st bending frequency increased while though frequencies of the 2nd and 3rd bending modes decreased. As an alternative method for the modal parameter-based damage detection, a method using system matrix as damage sensitive feature and Bayesian hypothesis test was proposed. FE analysis (FEA) is also carried out to clarify possible reasons for the different changing trends of frequencies focusing on both damage and temperature changes. In the FEA, the cantilever steel pivot bearing at support was modeled as longitudinal spring since displacement measurement at supports showed different longitudinal displacement under different level of damage. It is noted that the temperature difference was up to 15 degrees Celsius through the damage experiment which also causes longitudinal movement of the bearing. Bayesian hypothesis-based damage detection method successfully detect anomalies due to the damage. The FEA demonstrated that the frequency for the 1st bending mode was more sensitive to changes in the boundary condition than changes in stiffness of girder. In addition, sensitivity analysis showed the effect of local damage and temperature changes on the dynamic and static response of the bridge.