

Evaluation Of The Dynamic Characteristics Of A Single-Span Prestressed Concrete T-Girder Bridge Before And After External Prestressing

Sania GOHAR, Tran Tien DAT, Yasunao MATSUMOTO

For widespread problem of aging of bridges in Japan and other countries, practical application of structural monitoring technique has been attracting significant attention for efficiency, sophistication, and labor-saving in bridge maintenance. Expected role of monitoring technique includes the detection of damages and deteriorations and the confirmation of repair and reinforcement effects. In the present study, the dynamic characteristics of an existing prestressed concrete, PC, bridge were evaluated before and after reinforcement to provide a practical example to show the applicability of vibration-based bridge monitoring to confirm the effect of reinforcement. A single-span post-tensioned PC T-girder bridge suffered bending and diagonal cracks in two outer girders and some amounts of decreases in prestress were estimated in a detail survey. For the improvement of the stress condition in the girders, it was decided to apply external prestressing. Vibration measurements were conducted in the bridge before and after external prestressing in its operational conditions. Eight piezoelectric accelerometers were attached to the bottom side of the main girders to measure vibration response of the bridge. To identify the modal properties of the bridge, operational modal analysis using Eigensystem Realization Algorithm was applied to vibrations after vehicles passed over the bridge, which can be regarded as free vibration responses. It was found that the natural frequency of the first bending mode of the bridge after external prestressing was higher than that before external prestressing by 3.2%, while the natural frequencies of some higher order vibration modes that were able to be identified from operational modal analysis did not show significant change. Considering the corresponding mode shapes for the vibration modes that did not show differences in natural frequency before and after external prestressing, minor bending deformation in the mode shapes occurred in the middle of span where the bending and diagonal cracks were observed. In the mode shape of the first bending mode, signs of change in mode shape appeared, which could be attributed to partial decrease in stiffness.