

Structural Health Assessment of a Masonry Bridge Using Wireless

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Abstract : Masonry bridges are the iconic heritage transportation infrastructure throughout the world. Continuous increase in traffic loads and speed have kept engineers in dilemma about their structural performance and capacity. Henceforth, research community has an urgent need to propose an effective methodology and validate on real-time bridges. The presented research aims to assess the structural health of an Eighty-year-old masonry railway bridge in India using wireless accelerometer sensors. The bridge consists of 44 spans with length of 24.2 m each and individual pier is 13 m tall laid on well foundation. To calculate the dynamic characteristic properties of the bridge, ambient vibrations were recorded from the moving traffic at various speeds and the same are compared with the developed three-dimensional numerical model using finite element-based software. The conclusions about the weaker or deteriorated piers are drawn from the comparison of frequencies obtained from the experimental tests conducted on alternative spans. Masonry is a heterogeneous anisotropic material made up of incoherent materials (such as bricks, stones, and blocks). It is most likely the earliest largely used construction material. Masonry bridges, which were typically constructed of brick and stone, are still a key feature of the world's highway and railway networks. There are 1,47,523 railway bridges across India and about 15% of these bridges are built by masonry, which are around 80 to 100 year old. The cultural significance of masonry bridges cannot be overstated. These bridges are considered to be complicated due to the presence of arches, spandrel walls, piers, foundations, and soils. Due to traffic loads and vibrations, wind, rain, frost attack, high/low temperature cycles, moisture, earthquakes, river overflows, floods, scour, and soil under their foundations may cause material deterioration, opening of joints and ring separation in arch barrels, cracks in piers, loss of brick-stones and mortar joints, distortion of the arch profile. Few NDT tests like Flat jack Tests are being employed to access the homogeneity, durability of masonry structure, however there are many drawbacks because of the test. A modern approach of structural health assessment of masonry structures by vibration analysis, frequencies and stiffness properties is being explored in this paper.

Keywords : masonry bridges, condition assessment, wireless sensors, numerical analysis modal frequencies

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