CONDITION ASSESSMENT OF A WROUGHT-IRON RAILWAY BRIDGE

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Introduction

In this paper, experimental and analytical procedures for the design checking and remaining life estimation of a truss type wrought iron railway bridge are presented. The bridge, having a single span of 32.5 m (Figure 1), has been in operation since 1880, initially with trains having steam engines. Presently it carries a single railway line with trains having diesel engines of axle loads up to 16.5 tons. It is anticipated that in order to meet the future demands the engine axle loads will be increased to 20.0 tons. The main objective of this study is to check the bridge under working conditions and determine its remaining life, under increased axle loads.

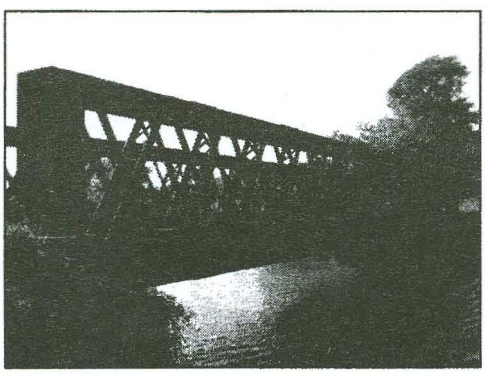

Figure 1. Railway bridge

Methodology and Results

To achieve the above mentioned objectives the overall testing and analysis procedures were divided into several stages. Firstly a condition survey of the bridge was carried out and bridge material was tested in the laboratory to determine its mechanical properties. This revealed that the bridge is in good condition except for some corrosion in a few members, and that bridge material has a density of 7600 kg/m^3, a Young's modulus of 195 GPa, an ultimate strength of 360 MPa, and a fatigue limit, at one million cycles, of 165 MPa.

Next a three dimensional finite element model (Figure 2) for the bridge was prepared using the general purpose finite element package SAP2000 (Computers and Structures Inc, 2008). Even though the bridge has riveted connections it was modelled as a rigidly jointed frame, as there is much rigidity at the joints (Spyrakos, 2004). A preliminary static analysis of the model was done with an M8 engine load to determine stresses and displacements in the bridge and identify its critical members. A modal analysis gave a fundamental frequency of 2.85 Hz in a sway mode.