

ON THE SUSTAINABLE RESTORATION DESIGN OF A HISTORICAL STEEL RAILWAY BRIDGE

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ABSTRACT

This paper presents a methodology applied for the restoration design of the old steel truss Echedoros River Railway Bridge. Such an intervention can be characterized as sustainable if the design considerations include the assessment of the remaining fatigue life, the estimation of the future traffic demands and the evaluation of the total cost of the project. The certification of the design criteria used in the present study, i.e. loads and resistance assessments is mainly based on the Guidelines entitled ‘Sustainable Bridges’, which have been recently produced by the European Commission. The Echedoros River Railway Bridge due to its position used for decades to be one of the most important structures of the railway network in the northern part of Greece. The bridge been classified as a historic structure, was completely reconstructed in 1946 after the 2nd World War in its present form that consists of two spans with one concrete support in the middle of the river and two main truss girders with riveted connections for each opening. In the present work a finite element analysis model of the whole bridge and several partial finite element analysis models of critical details have been studied using ANSYS software including solutions for critical traffic, earthquake and fatigue loading combinations. With this framework the field conditions of the most representative details have been simulated taking into consideration different local deficiencies and possible failures. As result an evaluation of extreme stress areas on gusset plates and a more representative stress distribution among the connecting rivets has been obtained. The restoration of the old steel-truss railway bridge with riveted connections is mainly limited by its strength against fatigue and influenced by the ultimate strength of its structural members. So, the proposed methodology leads to a more accurate and robust restoration design.

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