# Fatigue Behaviour of a riveted beam-to-column connection

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## Abstract

Fatigue failures are of concern for steel bridges due to the likelihood of the steel to deteriorate under variable stresses, being recognised as the major cause of failure in metallic bridges. Residual life calculations of existing bridges in operation should take into account fatigue as a progressive damaging mechanism. The S-N approach is widely used to assess the fatigue damage of riveted connections, which is included in design codes of practice (ex: EC3-1-9, AASHTO). Alternatively, fracture mechanics has been applied to assess the residual fatigue life of damaged riveted connections. This approach requires the knowledge of the initial defect, which may be assessed by inspection. In order of obtaining a global fatigue approach is used the fracture mechanics complemented by another approach to assess the crack initiation. Local approaches to fatigue, based on local or notch stresses or strains, are normally used to assess the fatigue crack initiation. This global fatigue approach is more versatile design alternative than the S–N approach. This paper presents an experimental program of fatigue tests performed with down-scale riveted connection. The down-scale geometry is a beam-to-column connection that was motivated by a potential critical detail of the Trezói Railway Bridge. Experimental S-N data from the fatigue tests of riveted joint are compared with the EC3-1-9 class 71 S-N curve.

**Keywords:** Fatigue; Riveted Connections; S-N Curves; Ancient Bridges.

## 1 Introduction

Bridges are very complex structures that are built to support dynamic loads resulting from traffic actions (e.g. cars, trucks, trains, etc). The action of the dynamic loads over these structures is responsible for their progressive damaging due to fatigue. This is a major concern of designers and owners of the structures since they need to guarantee significant operational safety levels in order to avoid catastrophic collapses with strong social and economic impact.

The awareness of fatigue behaviour of bridges did not appear with the construction of the first metallic riveted bridges at the end of XIX century. Only some decades ago, the fatigue design became a concern of engineers. This happened with the development of the first design rules that included a fatigue design section. Nowadays there is a full awareness for the need of a fatigue design



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