



## Evaluation regarding Fatigue for Various Types of Hangers used for Tied Arch Bridges

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### Abstract

The roads represent an important heritage. Even more than corrosion, the fatigue is the principal aging process that affects the durability of steel bridges. Several examples illustrate in the article the importance of affecting a right consideration to the fatigue design of bridges.

Details that may appear as accessory to most of the usual bridge designers may be in fact of a crucial importance. It is in particular the case of the welded joints. The fillet joints are much more sensible to the fatigue stresses and should be avoided when there is a doubt, because their evaluation is very complicated. If the designer of a bridge uses such attachment in the project for tender, he has to verify the relevance regarding fatigue because the time for such studies is generally not available during the execution studies.

Calculation FEM techniques are used to evaluate the stress modified by the concentration factor that has to be taken into account for the fatigue design. For bridges, many fatigue details are classified in the Eurocode 3 ( part 9 ) from tests. But some details that cannot be found in the Eurocode, and must however be studied and evaluated by computation. The article presents an example where the fatigue class of the detail regarding longitudinal stresses is evaluated thanks to a FE-modelization according to the 2008 IIW Fatigue Recommendations at the location of the attachment of different types of hangers.

**Keywords:** Steel tied arch bridges; hangers; fatigue; features; welded attachments; Fatigue stress modified by a stress concentration factor

### 1 Experience for tied arch bridges design

The author has a long experience in the design of tied arch bridges. At S etra he designed the Saint-Gilles Bridge over River Rhone [1] with cable-stays for a span of 120m (Figure 1) and the much smaller Roboul bridge of Figure 2 for the East-

Pyrenean local Authority in France [2]. He was then involved with the Roboul bridge in the conception of a pilot-project for a Mediterranean bridge allowing to cross a river in one span without intermediate piers to reduce the hydraulic impact, the risk of the soil to be washed away near the intermediate pier, and to preserve upstream area from catastrophic flooding [3]. For