



Condition Evaluation of Riveted Steel Bridges by Minimal Invasive Methods

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Summary

When searching for effective methods of investigating and rating existing bridges, the different characteristics of bridges recommend a limitation of the subject: Concrete bridges show other problems than steel or stone bridges.

For a specific large group of bridges, riveted steel bridges, figure 1, which were built during the period of time from 1850 to 1950, a set of new methods has been developed and approved which promise to improve considerably the diagnosis, rating and restoration of old steel bridges.

Adapting the often used terminology of medicine, the term **minimal invasive methods** has been introduced comprising all the relevant methods and techniques. Up to now, the different methods have been part of adjacent fields like non-destructive testing or material testing or experimental structural analysis as well as fracture mechanics as a theoretical tool. However, only all of them, in a concerted action, lead to a new quality of investigation and rating.

The different methods and their concerted application are presented and some examples of successful application are given.

Keywords: Existing steel bridges, minimal invasive methods, non-destructive testing, material identification, structural identification, remaining fatigue life, fracture mechanics

1. Introduction

Experts generally agree about the fact, that all the methods of designing a structure are not adequate when investigating and rating an old structure. Of course, these methods are also necessary, however, much more is needed for a sound rating of an existing bridge [1]. Existing bridges may have damages after many decades of heavy loading and deterioration. And it is necessary to identify the damage, to detect cracks or loose rivets or deformed members or areas of heavy corrosion. Even the material differs from today one.

Contrary to the design procedure, the bridge exists and all the methods well known from other fields of technology can be applied: Non-destructive testing, measurement of straining during test loading and traffic, material testing (if necessary), application of fracture mechanics to fatigue straining and crack growth.

Not only one or two of the methods are the crucial tool, but the set of all methods brought together. This is the same approach as used in medicine, when applying ultrasound and radiographic investigation and mammography and endoscopy of knee-joint (arthroscopy) or stomach (gastro-camera). Following the terms of medicine, the term "**minimal invasive methods**" has been introduced.

The range of available methods will be presented and their application and approval will be exemplified.