



## Inspection and Risks of Hidden Defects

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### Summary

Inspection of structures is usually a straight forward and routine activity mainly concerned with serviceability issues but on occasions it can present problems. These problems arise when critical defects are hidden from view and if left to develop can lead to collapse of the structure without warning. In practice there have been a number of occasions when bridges have collapsed soon after an inspection which had shown that there were apparently no serious defects.

Three very different examples having hidden defects are described and discussed. These involve a cast iron beam, a post-tensioned concrete deck and holding down bolts on a steel viaduct.

**Keywords:** Collapses, hidden defects, inspection, cast iron, steel, post-tensioned concrete.

### 1. Introduction

The efficient and economic management of existing bridges has become recognized as being a key task for the bridge engineer and has attracted considerable attention and much research. Bridge management systems (BMSs) have been developed with the objective of providing supportive data to aid decision making on how best to direct resources within ageing and varied bridgestocks.

In a survey of bridge managers in the UK, Flaig and Lark [1] set out to identify the priorities of maintenance, repair and rehabilitation. What was seen as being a surprising result was that all correspondents purported to consider safety of the structure as being a most important issue whereas the BMSs they use tend to be dominated by serviceability issues. The response is not really surprising as safety is universally regarded as paramount and in any case no bridge manager could be seen to respond otherwise in the current environment.

Collapses can and do occur for a variety of reasons, as summarised by Smith [2] when he analysed 143 failures, including 86 between 1961 and 1976. At that time inspections had a relatively low profile and Smith was more interested in factors such as age of the bridge at collapse and the cause of collapse. In the time since Smiths' review there have continued to be collapses despite the introduction of successively improved regimes of inspection and bridge management.

This paper addresses collapses of bridges having critical defects that were difficult to inspect without dismantling components or carrying out intrusive investigations. The following examples are of events ranging from historic to recent times.