



# Structural Health Monitoring of a masonry viaduct with Fibre Bragg Grating sensors

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## Abstract

The Marsh Lane viaduct is a masonry railway bridge constructed during the 19th century nearby Leeds Central Railway Station. The bridge appears significantly damaged due to the increase of the operational train loads over the last decades and due to environmental effects. Due to this degradation, extensive repair was conducted in 2015. After this repair work, an extensive fibre optic sensor network was installed below three spans of the bridge to monitor surface strains at 68 locations on the underside of the arch spans. The paper compares data collected from two monitoring periods, 16 months apart. Combining statistical analysis and signal processing techniques, the results show that local damage, as well as change in the global dynamic behaviour of the structure over time, can be effectively detected with the use of Fibre Bragg Grating sensors.

**Keywords:** ageing infrastructure, remote monitoring, fibre optics, signal processing, damage detection, masonry deterioration

## 1. Introduction

As the population grows, an increasing number of people rely on established transport and utilities networks. In particular, ageing masonry bridges comprise 50-60% of the European rail stock [1, 2].

The majority of these structures were built more than a century ago, before the enforcement of building codes, and their condition deteriorates with time due to the combined action of increased train loads, support movements, and environmental effects. Today, engineers are facing