CHARACTERISING THE DYNAMIC RESPONSE OF A DEFORMED MASONRY ARCH RAIL BRIDGE USING MONITORING AND REMOTE SENSING

Sinan Acikgoz*, Hesham Aldaikh, Matthew DeJong, Cedric Kechavarzi, Kenichi Soga

University of Cambridge
Department of Engineering
Trumpington Street, Cambridge CB2 1PZ
{msa44, hsha2, mjd97, ck209, ks207}@cam.ac.uk

ABSTRACT

Numerous masonry arch bridges in the UK have significant deformations and are carrying traffic and rail loads. Often the structural assessment of these bridges is carried out by evaluating their ultimate limit state with little consideration for deformed geometry and continued degradation under service loads. This paper summarises recent work to assess a Victorian masonry arch rail bridge using novel sensing technologies. The objectives were to quantify the current damage state, understand the three-dimensional dynamic response under service loads, and observe continued crack propagation. Initially, to determine the current geometry, a laser scanning survey was carried out. A comparison between ideal geometric shapes and the deformed geometry quantifies the differential settlement experienced by the bridge piers. With accompanying structural analyses, these settlements are utilized to evaluate the current damage state of the bridge. Then, a deployment of quasi-distributed Fibre Bragg Grating (FBG) sensors and distributed fibre optic sensors is described. FBG sensors are utilized to explore the dynamic response under service loading, while only the distributed strain sensors are utilized to evaluate the long term crack propagation. Preliminary monitoring demonstrates how the dynamic response mechanism engages with the existing cracks and quantifies the diurnal and seasonal changes in crack opening.