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HAMMERSMITH BRIDGE – INTEGRATION OF SITE TESTING AND NUMERICAL ANALYSIS

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SUMMARY

Hammersmith bridge is a chain suspension bridge crossing the River Thames between Hammersmith and Barnes in West London. The bridge was built in the late 1880's and is a listed heritage structure that still forms part of the London transport network. The age and type of the bridge, together with the number of historic interventions and partial refurbishments, makes it challenging to perform an analysis that is representative of the current state. The analytical work was informed by a detailed 3D laser scan under road closure, controlled instrumented load tests, vibration tests for the hangers and incremental centre hole drilling (ICHD) for the chains. The material properties of various elements were confirmed by positive material identification (PMI) and in-situ hardness testing whilst non-destructive testing techniques such as alternating current field measurement (ACFM) were employed to test for fatigue damage. This paper summarises the methodology adopted to correlate field data with structural analysis so that the assessment is representative of the real bridge.

Keywords: *Chain Suspension Bridge, Testing, Analysis.*

1. INTRODUCTION

Located in West London, Hammersmith Bridge carries the A306 Hammersmith Bridge Road 225m across the River Thames. The 1880s suspension chain bridge (128m main span) is a grade II* listed structure, which in the UK means that it is particularly important and of more than special interest. Due to structural concerns the bridge was recently closed for vehicular traffic. Prior to closure it was restricted to vehicles with a maximum GVW of 7.5T except for emergency vehicles and one 12T GVW public bus in each direction at any one time.

The bridge deck comprises timber or metal panels that are supported by longitudinal timber baulks spanning between transverse wrought iron girders. The carriageway and footpaths are separated by steel longitudinal stiffening girder trusses which are connected to the transverse girders and are supported on bearings at the piers and abutments. The deck is suspended from wrought iron or steel hangers. Each plane of hangers is connected to the upper and lower suspension chains in an alternating pattern. The chains comprise series of "eye-bar" links arranged in alternating sets of eight or nine. The tower saddles are supported on laminated neoprene bearings which are mounted on top of wrought iron truss towers. Each pair of towers is braced over the carriageway by means of a deep box girder. The towers are founded on concrete piers clad in masonry and are housed inside a free-standing ornate cast iron cladding. At the abutments, the chains are deviated through splay saddles mounted on cast iron pedestals. The deviated chains are anchored to mass concrete gravity blocks via cast iron anchor plates. A view of the bridge is presented in Fig. 1.

The bridge has undergone a number of repairs and modifications during its service life. The more important of these include replacement of the original lattice deck girders with fabricated steel trusses, introduction of mechanical bearings at the ends of the trusses, replacement and re-stressing of hangers and replacement of the original rollers at the tower saddles with laminated neoprene bearings. It is worth noting that not all of the interventions were implemented simultaneously and their effects were introduced on a structure with different characteristics. Although records of these works were kept, they generally concentrate on the particular task and did not capture the overall state of the structure at the time of the works.

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