



Assessment and Remediation of Infrastructure Scour: A Case Study for M9 Forth Bridge

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This study discusses how adhering to the processes outlined within BD 97/12 “The Assessment of Scour and Other Hydraulic Actions at Highway Structures” of the Design Manual for Roads and Bridges (DMRB) has highlighted a multi span structure carrying the M9 motorway over the River Forth as being particularly at risk of scour. A risk rating of 2 was assigned to the structure.

Through this process, it was identified that the combined effect of natural (bend) scour, constriction scour and local scour has led to substantial erosion of the revetment protecting the south abutment and carrying a public footpath. Although to a lesser extent, scour has also taken place at the north bank, around one of the partially submerged intermediate supports, close to the north abutment.

M9 Forth Bridge is a twin decked structure having a longitudinal joint in-between decks which has failed principally above the south abutment revetment. Water leaking through this failed section of joint is creating a further deteriorative effect within this already substantially eroded revetment.

The deterioration noted at the south abutment is of particular concern, not only due to piers and abutments not being founded on solid rock and therefore being susceptible to failure from scour effects, but also due to the presence of multiple utilities buried transversely within the eroding embanked revetment and some of them being exposed. Furthermore, the public footpath has been deteriorated.

Pre-commencement surveys and investigations have identified further complications in the area, with the presence of highly concentrated populations of protected species in the river, as well as the overall bridge headroom to river level limiting extensive engineering works from being undertaken. Site surveys have also established evidence of historic rock armour scour protection measures which had been put in place along the south riverbank but have been washed away. These protection measures have failed either due to ineffective design or possibly due to the effects of climate change leading to the exacerbation of flooding effects and increasingly destructive extreme hydrologic events. The failure and displacement of the rock armour has exposed the south abutment revetment to full effects of the combination of scour types taking place at this location.

Following the identification of the presence of multiple scour types taking place, a sustainable Geoweb protection system has been designed to rebuild the revetment and provide protection against scour, safeguarding the utilities contained within the revetment and the travelling public. Furthermore, a drainage system included within the Geoweb system is designed to accommodate for water leaking from the structure, hence preventing it from causing further deterioration.

Studies have demonstrated the Geoweb as being capable of providing resistance to further scour and erosion over extended periods. Following implementation of the Geoweb, the effects will be closely monitored during the two yearly General Inspections and 6 yearly Principal Inspections required as outlined in BD 63/17 “Inspection of Highway Structures” of the DMRB.