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# Assessment of bridge abutment scour and sediment transport under various flow conditions

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Safety of bridges over watercourses can be compromised by flow characteristics and bridge hydraulics. Scour process around bridge foundations can develop rapidly during low-recurrence interval floods when structural elements are exposed to increased flows. Variations in riverbed geometry, as a result of sediment removal and deposition processes, can increase flood-induced hazard at bridge sites with catastrophic failures and destructive consequences for civil infrastructure.

The quantification of flood induced hazard on bridge safety generally involves coupled hydrodynamic and sediment transport models (i.e. 2D numerical or physical models) for a range of hydrological events covering both high and low flows. Modelled boundary conditions are usually estimated for their probability of occurrence using frequency analysis of long-term recordings at gauging stations. At smaller rivers gauging station records are scarce, especially in upper courses of rivers where weirs, drops and rapids are common elements of river bathymetry. As a result, boundary conditions that accurately represent flow patterns on modelled river reach cannot be often reliably acquired. Sediment transport process is also more complicated to describe due to its complexity and dependence to local flow field making scour hazard assessment a particularly challenging issue.

This study investigates the influence of flow characteristics to the development of scour and sedimentation processes around bridge abutments of a single span masonry arch bridge in south Ireland. The impact of downstream weirs on bridge hydraulics through variation of downstream model domain type is also considered in this study. The numerical model is established based on detailed bathymetry data surveyed along a rectangular grid of 50cm spacing. Acquired data also consist of riverbed morphology and water level variations which are monitored continuously on bridge site. The obtained data are then used to compare and calibrate numerical models for several flood scenarios.

The determination of the boundary conditions is followed by physical modelling to investigate the development of scour around bridge elements. The comparison of surveyed data with the obtained numerical and physical modelling results provide an insight of various flow patterns and their influence on riverbed morphology. This can deliver important information needed for assessment of structural risk associated with flood events.

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