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Damage assessment of bridge infrastructure subjected to flood-related hazards

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Transportation assets represent a critical component of society's infrastructure systems. Flood-related hazards are considered one of the main climate change impacts on highway and railway infrastructure, threatening the security and functionality of transportation systems. Of such hazards, flood-induced scour is a primarily cause of bridge collapses worldwide and one of the most complex and challenging water flow and erosion phenomena, leading to structural instability and ultimately catastrophic failures. Evaluation of scour risk under severe flood events is a particularly challenging issue considering that depth of foundations is very difficult to evaluate in water environment.

The continual inspection, assessment and maintenance of bridges and other hydraulic structures under extreme flood events requires a multidisciplinary approach, including knowledge and expertise of hydraulics, hydrology, structural engineering, geotechnics and infrastructure management. The large number of bridges under a single management unit also highlights the need for efficient management, information sharing and self-informing systems to provide reliable, cost-effective flood and scour risk management.

The "Intelligent Bridge Assessment Maintenance and Management System" (BRIDGE SMS) is an EU/FP7 funded project which aims to couple state-of-the art scientific expertise in multidisciplinary engineering sectors with industrial knowledge in infrastructure management. This involves the application of integrated low-cost structural health monitoring systems to provide real-time information towards the development of an intelligent decision support tool and a web-based platform to assess and efficiently manage bridge assets.

This study documents the technological experience and presents results obtained from the application of sensing systems focusing on the damage assessment of water-hazards at bridges over watercourses in Ireland. The applied instrumentation is interfaced with an open-source platform that can offer a more economical remote monitoring solution. The results presented in this investigation provide an important guide for a multidisciplinary approach to bridge monitoring and can be used as a benchmark for the field application of cost-effective and robust sensing methods. This will deliver key information regarding the impact of water-related hazards at bridge structures through an integrated structural health monitoring and management system.

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