Geophysical Research Abstracts
Vol. 19, EGU2017-2364, 2017
EGU General Assembly 2017

Flood Early Warning in Bridge Management System: from idea to implementation

Igor Kerin (1), Damir Bekić (2), Panagiotis Michalis (3), Hrvoje Šolman (4), Paul Cahill (5), Gordon Gilja (6), Vikram Pakrashi (7), John Lapthorne (8), and Eamon McKeogh (9)

(1) MaREI Centre, Environmental Research Institute, University College Cork, Cork, Ireland (igor.kerin@ucc.ie), (2) University of Zagreb, Faculty of Civil Engineering, Water Research Department, Zagreb, Croatia (damir.bekic@grad.hr), (3) University of Zagreb, Faculty of Civil Engineering, Water Research Department, Zagreb, Croatia (pmichalis@grad.hr), (4) Arctis d.o.o., Zagreb, Croatia (hrvoje.solman@arctis.hr), (5) MaREI Centre, Environmental Research Institute, University College Cork, Cork, Ireland (paul.cahill@ucc.ie), (6) University of Zagreb, Faculty of Civil Engineering, Water Research Department, Zagreb, Croatia (ggilja@grad.hr), (7) Dynamical Systems & Risk Laboratory, School of Mechanical and Materials Engineering, University College Dublin, Dublin, Ireland (vikram.pakrashi@ucd.ie), (8) Roads Design Office, Cork County Council, Cork, Ireland (John.Lapthorne@CorkCoCo.ie), (9) University College Cork, School of Engineering, Cork, Ireland (e.mckeogh@ucc.ie)

Recent advances in computational speed, cloud systems and GPRS data are some of the factors that have resulted in an increased number of operational and fully automatized Flood Early Warning Systems (FEWS). Flood forecasting is becoming a well-recognised solution for flood management as an indirect measure for minimising the risk should preventive or defence measures prove ineffective or are not feasible for implementation. Public acceptance of FEWS as a standalone solution is still considered to be at low level. Further public engagement regarding engineering risks and providing timely notifications and warnings can, however, establish the true value of such a system to the society in general. Flood risks can be direct, resulting in damage to buildings, infrastructure and natural resources, or indirect, which can be related to disaster losses leading to declines in commercial output or revenue and impact on wellbeing of people, typically from disruptions to the flow of goods and services. Flood risk and structural risks are closely related, thereby impacting the maintenance and management of bridges assets over watercourses.
Many studies indicate that most bridge collapses are related to hydraulic effects and consequently scour issues (i.e. the removal of riverbed around bridge foundations due to flowing water). Consequently, hydraulic, hydrologic and geotechnical expertise and knowledge can lead to introducing FEWS as a key tool for Bridge Scour Management System (BSMS), forming a part of a BMS. The implementation of this concept was initiated with the EU/FP7 funded project BRIDGE SMS. The project introduces BSMS into the overall BMS to develop a reliable decision support tool which would efficiently manage bridge failure risks in a cost-effective way. This is accomplished through the development of FEWS, alongside monitoring systems that can provide important information about environmental and structural conditions at the catchment area and bridge site respectively. The recorded rainfall from instrumentation deployed over a catchment is used as input data for hydrological modelling and now-casting, which results in flow hydrographs at the bridge containing flow rates and water level information. Soil moisture data is also used to determine the appropriate hydrological model set-up, such as dry, medium or saturated catchment conditions. The output from the hydrological model is a now-cast flow hydrograph, with a lag time of up to 24 hours. Discharge hydrograph is correlated to water levels using an existing rating curve and to the flow velocity using discharge-flow velocity curve. Water levels and flow rates are correlated to the flow velocity which provide the basis for the prediction of scour depth. FEWS in BMS introduces readiness for extreme flood events, pointing out key indicators prior to an event. Also, by considering climate change effects which is resulting in more extreme weather phenomena's, FEWS provides important information about bridge safety and assists to coordinate resources in an efficient and cost-effective way.

Acknowledgement
The authors wish to acknowledge the financial support of the European Commission, through the Marie-Curie Industry-Academia Partnership and Pathways Network BRIDGE SMS (Intelligent Bridge Assessment Maintenance and Management System) - FP7-People-2013-IAPP- 612517.