INSTRUMENTING THE PERFORMANCE OF LEVEES AS PART OF REAL-TIME FLOOD MANAGEMENT: AN APPLICATION OF THE EU URBANFLOOD PROJECT AT BOSTON UK

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The UrbanFlood project will create an Early Warning System framework that can be used to link sensors via the Internet to predictive models and emergency warning systems. The data collected from the sensors will be interpreted to assess the condition and likelihood of failure; different models will be used to predict the failure mode and subsequent potential inundation in near real time. Through the Internet, additional computer resources required by the framework are made available on demand. The project includes three pilot sites to apply and validate at full scale the technology being developed in the project: Amsterdam (Netherlands), Boston (UK) and St Petersburg (Russia). Other papers will discuss the information and communication technology aspects of this project; this paper focuses on a description of the selection, design and installation of the instrumentation and the early dissemination and analysis of the results at one of the pilot sites, Boston.

Boston (UK) is a small historic town on the east coast of England located near the Wash with a population of about 60,000. More than 50% of homes (i.e. more than 15,000 homes) are at significant risk of flooding from a combination of high tide and storm surge in the North Sea. The main area of the town is a little inland from the coast but is affected by tidal rivers in which the spring tide range is about 6m. Levees have been constructed on superficial alluvial deposits of sand and clay beneath over glacial boulder clay. A mixture of different levees exist, but for this project a simple embankment was selected at a location with a history of instability on the riverward face.

The instrumentation was selected on the basis of previous experimentation and comparison of instruments installed in full scale dike failure tests in the Netherlands (IjkDijk). Installed in CPT holes were

- Dutch developed MEMS modules (GeoBeads) able to detect local tilt, pore pressure and temperature, the latter as a proxy method for detecting water flow
- Two types of US developed Shape Acceleration Arrays able to detect global tilt and one type also able to detect pore pressure

In addition, fibre optic cables, able to detect surface strain by Bragg diffraction, were installed along the entire 300m in the crest and front slope of the embankment.

The gathered data is being used to detect anomalies, supported by an Artificial Intelligence system. If an anomaly is detected, this then triggers assessment of the likelihood of levee breach. If breach is likely, the consequences in terms of flood propagation and damage in the defended urban area are assessed via high speed computer modelling.

Results are being displayed on the project website. There are also plans to set up a visitor centre in the town where this information is made available and is linked to future plans for improvement of the levees in Boston.