Future proofing our built environment and infrastructure

HR Wallingford

Timely detection of the onset of potential flooding in urban environments has been the objective of the UrbanFlood Project. It uses interactive sensor networks to warn of changes in the condition of flood defences and the development of increased flood risk.

More than two-thirds of European cities have to deal with flood risk management issues on a regular basis. These issues will worsen if the predicted effects of climate change result in more extreme conditions. Early Warning Systems (EWS) can play a crucial role in mitigating flood risk by detecting adverse conditions and predicting the onset of a significant event, even a catastrophe. They can provide real-time information during an event, and can fulfil multiple roles as general information systems, decision support systems and alarm systems. Their benefits are applicable to a range of stakeholders, including the Government, industry and the general public.

HR Wallingford is the UK partner of the EC-funded FP7 UrbanFlood project that is creating an EWS framework – linking sensors to predictive models and emergency warning systems via the internet. The new system interprets data from sensors to:

- assess flood defence condition;
- update likelihood of failure; and
- predict the failure mode and potential consequential inundation.

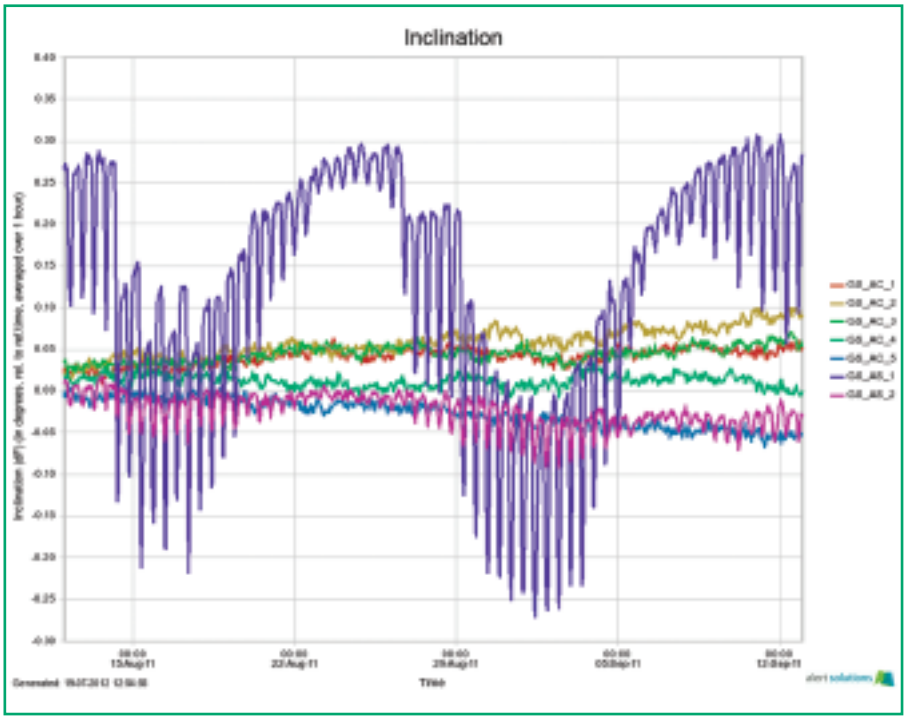
UrbanFlood has three pilot sites at which the technology it is developing is being applied and validated. The sites are Amsterdam, Boston and Rees (Germany). Boston is a town on the east coast of England with a high risk of flooding; and was selected because the "Haven" section of its River Witham is subject to tidal forcing of up to 6 metres, and has a history of embankment slope instability. Sensors installed in the river banks detect changes below ground such as temperature, moisture and movement. The data is sent to a control room via the internet, so that the status of the flood defences can be continuously monitored. The sensors installed at the three sites include:

- micro-opto-electro-mechanical systems (MEMS) able to detect local tilt, pore pressure and seepage; and
- sensor-enabled geotextile strips to detect soil strain along the embankments.

The data from the sensors is further used with different models for dike stability evaluation. The AI (Artificial Intelligence) component is used for online signal processing and detection of anomalies in dike behaviour. Any detected anomalies trigger a re-assessment of the likelihood of levee breach, and of any consequential flood propagation and impacts on the defended urban area, such as the need for community evacuation.

Visualisation of the on-line sensor data, and any resulting potential embankment breaching with consequential flooding and people movements, is achieved via a multi-touch screen interface. Early trials suggest that this approach will be appropriate for use by flood and emergency managers.

For further information, please contact Alex Topple, Senior Engineer, Floods, HR Wallingford (01491 822381; E-mail: a.topple@hrwallingford.co.uk).



(Top) *Multi-touch screen interface in action.*
(Above) *Sensor inclination responding to tidal forcing at Boston.*