

R&D Interim Guidance notes (GN1&2)

Coastal Flooding Hazard by Wave Overtopping SHADOW Phase 1

GN1- Use of numerical models of Wave overtopping: a summary of current understanding

GN2- Wave overtopping of simple embankments: improved methods (empirical model guidance)

Background to R&D project

In the UK, the primary concern in designing seawalls and related sea defence structures is identifying the overtopping performance, and then relating this with confidence to the intended structure geometry. Empirical methods (formulae or simple computer software) are available to assist this design process, but are limited to simple generic structure shapes, and restricted ranges of geometry. Methods to predict overtopping of shallow sloping seawalls or composite sections show wide margins of uncertainty, and the different models show relatively poor agreement. There is increasingly a need for more general methods that may be applied across the range of typical coastal structures that are to be found around the UK. This is especially important with regard to the expected sea level rise of at least 300mm over the next 50 years, and the increased confidence levels that are required on the overtopping performance of new and refurbished structures where public safety is concerned.

Results of R&D project

This research has in part focussed on obtaining new data sets for test structures that have not been tested previously, and on reproducing comparative data sets for existing empirical methods. These data have been collected for 2 and 3-dimensional structure configurations, for 2-dimensional partially armoured and rock mound structures, and will be used for a variety of analytical purposes. Originally conceived to extend the range of predictive tools and provide good quality data to use for calibrating and validating numerical models of wave overtopping, the research has developed beyond the original scientific objectives. Since this project was commissioned, a number of additional research projects have begun (see final paragraph of summary), and this has allowed the research team to significantly extend the scope of the original proposal. The series of 3-dimensional tests were extended to investigate a vertical wall with a shallow sloping approach where impulsive breaking can occur, and on a slope of 1:2. The combined efforts of the two research projects have allowed a substantially wider range of seawall and test conditions to be examined.

The research has provided new data which will enable existing design methods to be improved and updated. These data will improve significantly the accuracy of existing prediction methods. Calibration of the wave conditions and the development of the test programme have provided data for use in validating and calibrating the numerical model ANEMONE OTT 1d.

Additional studies under FD2410 and the project extension FD2412 have been enhanced by support from the EU research project CLASH (“Crest level assessment of coastal structures by full scale monitoring, neural network prediction and hazard analysis on permissible wave overtopping”), and through collaborations with the German Coastal Research Station, Nordene; Liverpool University; and Universities of Edinburgh & Sheffield (VOWS project). Elements of testing and analysis started under FD2410 have been extended and will now be reported under FD2412. Measurements of overtopping under 3-dimensional conditions (SHADOW 3-D) have been extended by collaboration with the VOWS research project supported at Edinburgh & Sheffield by EPSRC which has used shared facilities and measurement methods. The main test results from SHADOW 3-D will be reported during FD2412, with further analysis being reported by University of Liverpool and under the CLASH combined database project (CLASH work package 2).

R&D Outputs and their Use

The notes (intended for publication using electronic media) summarise interim guidance that was developed in project FD2410 and has been revised as part of project FD2412. More complete guidance is being developed as part of FD2412 and final results are due for delivery in 2004/2005.

The guidance notes update the technical guidance on the use of empirical overtopping predictions and the use of numerical models contained within the Environment Agency Overtopping Manual. Any user of this manual should take the appropriate action to refresh their knowledge of these subject areas.

These R&D Interim Guidance notes relate to R&D Project FD2410/12 and the following R&D outputs:

- **R&D Interim Guidance notes FD2410/GN1 - *Use of numerical models of wave overtopping: A summary of current understanding.*** December 2003
- **R&D Interim Guidance notes FD2410/GN2 - *Wave Overtopping of simple embankments: Improved methods.*** December 2003

Internal Status: Released internally External Status: Released to public domain

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The above outputs are available under the Engineering Theme on the Environment Agency website www.environment-agency.gov.uk/floodresearch or Defra http://www2.defra.gov.uk/research/Project_Data. Copies are held by all EA Regional Information Centres.