

Risk, Performance and Uncertainty in Flood and Coastal Defence – A Review

Technical Summary: FD2302

Joint Defra / EA Flood and Coastal Erosion Risk Management R&D programme

Background to R&D project

Defra, the Environment Agency and other operating authorities manage flood and erosion risks through a range of policy and planning systems and operational activities. Various measures such as building, maintaining and operating defences, regulating and controlling development, and flood forecasting and warning contribute to the aim of risk reduction.

Development of risk-based approaches to decision-making requires an appropriate understanding of the underpinning concepts, tools and techniques. In particular it is important that those carrying out R & D and developing guidance have a common framework for risk-based decision-making. This is also a prerequisite for effective and efficient management of risk.

This project has reviewed:

- Issues surrounding flood and erosion management from a risk and performance perspective.
- The principles of risk, performance and uncertainty and the related definitions.
- The application of these principles in decision-making practice.
- The need to move towards a more integrated risk-based decision-making framework.
- Supporting tools and techniques.

Results of R&D project

Risk - principles and issues

The report (FD2302/TR1) recommends that risk is used to mean a combination of the *probability* of an event occurring and the impact or *consequence* associated with that event. It recommends the use of the 'Source-Pathway-Receptor' model to understand the linkage between the hazard and consequences. The report also discusses the language of risk such as return period, frequency and probability. An important conclusion is that risk assessment and management places the emphasis on the harm to 'receptors' (e.g. people, property or the environment). The *significance* of risk can be related both to individuals, and to groups of individuals or property. A well designed risk system will adopt a structured approach including hazard identification, establishing the nature and magnitude of consequences, characterising and quantifying the risk. This process can be used to support decision-making between options, and as the basis for evaluating the performance of risk management activities.



Performance - key principles and issues

This part of the R & D project has established the basis for performance review and performance management, and will be used to support the approach to performance evaluation set out in Defra's Project Appraisal Guidance. In common with the risk-based approach, performance-based engineering focuses on outcomes as a result of the range of possible demands that may be placed on the system. This can be contrasted with a standards-based approach centred on the severity of a load that a defence is expected to withstand. Preliminary performance measures and indicators are proposed for the main flood and coastal risk management activities. Ongoing monitoring related is an essential part of assessing performance and risk.

Risk tools and techniques

There is a wide range of tools and techniques to support risk and performance. The project has collected examples of many of these. They are divided into three categories from 'high level' methods which are generally qualitative and rely heavily on judgement, to the most detailed methods which are quantitative and may require a lot of data and specialist analysis. Uses of the different methods are illustrated with examples.

Uncertainty - types and sources

Uncertainty refers to a lack of sureness, arising from both natural variability and randomness, or lack of knowledge. Consideration of uncertainty provides the decision-maker with additional information on which to base a decision, and helps to target attention on areas in need of further investigation. The study proposes a classification of uncertainty, and recommends that results from modelling and data collection should include information on uncertainties. Uncertainty handling should be an integral part of the decision-making processes.

R&D Outputs and their Use

R & D Report FD2302/TR1 is a full report of the Risk, Performance and Uncertainty Review. Relevant recommendations are being implemented through a range of R & D projects. In future this Review should be used to inform a wide range of policy and process developments in Defra, the Agency and other operating authorities. The Review will form the basis for training and dissemination events due to be held in 2003. It will also help to build understanding of risk, performance and uncertainty in the Agency and other operating authorities.

This R&D Technical Summary relates to R&D Project FD2302 and the following R&D output:
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The above outputs may be downloaded from the Defra/EA Joint R&D FCERM Programme website (www.defra.gov.uk/environ/fcd/research). Copies are also available via the Environment Agency's science publications catalogue (<http://publications.environment-agency.gov.uk/epages/eapublications.storefront>) on a print-on-demand basis.

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