PAMS (Performance-based Asset Management System) - Phase 2

Project Summary SC040018/S1

A new report by the Environment Agency explores the best way to assess the condition of and manage flood defence systems.

Managing flood defence assets to ensure their acceptable performance over time is a considerable challenge. Thus, the Environment Agency set up a project to develop methods and tools to improve the way we manage our flood and coastal defence assets. The aim of the so-called Performance-based Asset Management System (PAMS) is provide evidence to support asset managers, particularly in planning when and how to make interventions in defence systems.

The main issues facing asset managers which the PAMS project was required to address were:

- difficulties in properly assessing the condition of flood defences (including deterioration of their parts) through monitoring or inspection;
- the complexity of each flood defence system with a number of different parts, all of which contribute to its state and the way it performs in a flood;
- the relationship between the condition of the overall system or its parts and its performance in response to floods of different severity;
- difficulties in establishing how a flood defence's performance will improve following interventions ranging from routine maintenance (such as clearance of plants) to major refurbishment (such as heightening of a waterfront wall).

This report covers Phase 2 of the PAMS project, which was carried out by a team of experts led by HR Wallingford Ltd and working with Environment Agency and Local Authority staff. The project team developed a series of principles to guide the work:

- adopting a tiered approach to risk assessment, with actions and level of detail proportionate to the estimated risks;
- understanding the potential failure modes of assets to focus inspection, risk assessment and management where it is most needed;
- understanding the performance of an asset across a range of potential flood loadings including its resilience to loadings beyond the design standard;
- adopting a systems approach to focus attention (inspection, investigation, intervention) on weak points in the overall system;
- being able to attribute flood risk to specific defences and channel lengths;
- making decisions about assets based on an appreciation of whole-life costs.

Three pilot projects were carried out to explore practical issues faced by asset managers. The chosen pilot sites were: (1) the Thames estuary representing an estuarine defence system; (2) the Great Eau river (Lincolnshire) representing a channel-dominated fluvial system; and (3) West Bay (Dorset) representing a coastal defence system. A fourth pilot was independently commissioned by the Humber strategy team to examine Sunk Island on the North shore of the outer Humber estuary. The pilot project covered:

- an assessment of management issues and available data;
- setting up a geographical information system to reflect local conditions in sufficient detail to evaluate flood risk in the system and its parts;
- carrying out any necessary site investigations;
- adjusting computer models to assess system or asset performance and to attribute flood risk;
- providing decision support information for planning or interventions.

Visually inspecting the condition of flood defences – as is currently practiced - is prone to subjectivity. An evidence-based and less subjective approach was developed in this report, building on the potential failure modes of each asset type. This approach is now embedded in the updated Condition Assessment Manual (CAM2) used by managers.

A series of flow charts to assess performance features was also developed for embankments, vertical sheet piled and gravity walls, covering the majority of Environment Agency asset types.

Testing of the flow charts on 139 assets around the country led to a proposed method for calculating overall condition grade scores which is compatible with scores obtained by the traditional visual approach.

The report recommends developing the flow charts and method further, along with carrying out more research to confirm the link between the visual condition of a flood defence system and its performance.

Time curves for assets to deteriorate and maintenance costs are also outlined in this report, to assess the timing of the need for interventions and to help calculate whole-life costs. These are being further developed in a separate project on deterioration and whole-life costs.

The report evaluates a range of approaches to describing asset response (resilience) to various flood loadings, including traditional deterministic methods (single value of loading), fragility curves (which indicate the asset's response over a range of loading conditions) and a reliability tool.

The report recommends that a tiered approach is developed with guidance on a range of methods from simple qualitative screening to structure-specific probabilistic assessments. Probabilistic methods can be used to describe asset response, particularly in the management of complex, high risk or costly defence systems and where the decision is finely balanced or critical.

The project has produced guidance on how to prepare asset-specific fragility curves. This approach was trialled successfully on the West Bay and Thames pilot sites. However, it should be supported by visual and expert inspections where necessary, particularly for localised weak spots.

As rivers and watercourses are frequently flood defence assets, this project established condition grading methods for channels. The report also outlines procedures for the newly available Conveyance Estimation System (CES) to help plan the maintenance of a water channel whose performance is limited by channel roughness or blockage. The report used this approach to evaluate different channel maintenance strategies on the Great Eau; the pilot showed the effects of maintenance on water level regime, along with ways to optimise flood risk reduction within a budget.

The project developed a way to analyse the performance of flood risk management systems, and attribute flood risk to individual parts of a (or lengths of linear defence) system. A simplified approach to assessing asset criticality was developed alongside this, called the RAFT tool. The report recommends that more research is carried out to produce software and a guide on how to attribute risk and use this in planning asset management interventions.

This summary relates to information from project SC040018, reported in detail in the following output(s):

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