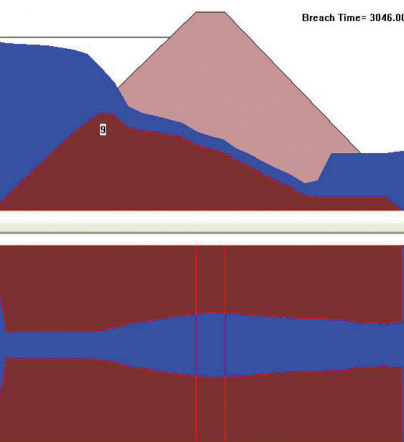


Breach modelling



HR Wallingford combines expert staff with many years of experience of undertaking embankment and dam breach studies, with continuous software development of specialist breach models, to offer unrivalled assurance that your particular breach situation will be modelled correctly.

HR Wallingford uses the process-based embankment breach models AREBA and HR BREACH and EMBREA to predict breach outflow hydrographs and breach dimensions for embankment failures due to overflow, or piping. In the case of failure due to overflow, the models account for differences in the erosion behaviour between embankments constructed of cohesive material, and embankments constructed of non-cohesive material.

All three models are applicable to trapezoidal shaped embankments, and account for:

- > the effects of different reservoir shapes, or river hydrographs,
- > drowning of the breach flow,
- > differences in properties of the embankment construction materials,

The models all produce a breach hydrograph, and give the growth in breach dimensions with time. Despite these similarities, there are clear differences in how they work, and their applicability.

HR BREACH (within InfoWorks – RS)

HR BREACH encapsulates a one-dimensional flow model which accounts for a constant degree of flow contraction, and a simple geotechnical failure model to simulate breach in the case of homogeneous embankments, with or without a homogeneous core of a different material. Since floods can result in large number of fatalities and/or substantial economic losses, accurate flood spreading predictions are necessary to design appropriate action plans and to reduce and manage flood risk. For this reason HR BREACH has been integrated into the well proven InfoWorks-RS model which has one-dimensional and two-dimensional flood modelling capabilities. The features of the HR BREACH model include:

- > modelling breach flow using a mesh based modelling approach;
- > modelling the geotechnical behaviour rather than pre-defining breach shape;
- > accounting for the presence of both rip-rap and grass surface protection;
- > modelling homogeneous embankments with a simple core as well as fully homogeneous embankments;
- > operating with a flexible user interface in an MS Windows environment, allowing easy input, manipulation, and visualization of data;
- > showing screen graphics of the breach growth as the model runs;
- > accepting any head-time or flow time description as an upstream boundary condition;
- > seamless incorporation within InfoWorks-RS flood modelling software;
- > also available as a standalone product on a consultancy basis only.

AREBA

The AREBA model was designed for use within system risk models and uses analytical expressions for the erosion rate, in combination with a pre-defined breach shape to predict breach hydrographs and changes in breach dimensions. AREBA has a run time of less than one second and is therefore ideal for use in scoping studies, or probabilistic studies where numerous model runs are required. AREBA has the following features:

- > breach formation is modelled in case of homogeneous embankments;
- > differences in the degree of flow contraction between the different stages of the breach are accounted for;
- > the presence of a grass surface protection can be accounted for;
- > Upstream boundary conditions are given by a box shaped, pyramid shaped, or prism shaped reservoir with a constant inflow, and /or outflow, for a specified duration of time;
- > drowning of the breach flow is accounted for.

EMBREA

EMBREA is a stand-alone model which has been developed by HR Wallingford to model the breaching process in embankments constructed with zones of different materials.

Whilst most flood embankments tend to be of homogeneous construction, properly designed and engineered embankment dams are often constructed with different 'zones' or layers of material. Layers of different materials can also be found in (originally) homogeneous embankments or dams that have been raised at some point in their life

With EMBREA, HR Wallingford has a breach model which is able to simulate the failure of zoned embankments. EMBREA's unique features include:

- > accounting for temporal changes in the magnitude of vertical and horizontal flow contraction through the breach;
- > containing a geotechnical failure model that accounts for the zoned structure of the embankments when determining the geotechnical stability of the embankment;
- > simulating breach formation of embankment with zones of different erodibility in the case of failure by piping or surface erosion.