US Army Corps of Engineers
Engineer Research and Development Center

Internal Erosion R&D

Need

Backward erosion piping (BEP) is a type of internal erosion that gradually erodes soil from the foundation of dams and levees. If erosion is allowed to progress completely through the foundation, the embankment is likely to collapse and fail. Reliable methods for predicting BEP progression are needed to assess and manage BEP risks. USACE motivation for BEP Research and Development stems from the following:

Eroded foundation sand is deposited on the ground surface in a sand boil, indicating BEP has initiated.

- USACE risk assessments indicate that BEP accounts for 1/3 of portfolio risks associated with dams and 1/3 of risks associated with levees (prior to overtopping);
- Over 1,000 sand boils occurred along the Mississippi River levees in 2011 alone indicating the prevalence of BEP on USACE levees;
- Limited resources make it impossible to remediate BEP everywhere it is observed. Reliable BEP predictions are critical for focused application of these limited resources.

Large uncertainty associated with existing methods for predicting BEP progression makes it difficult to distinguish high risk locations from lower risk areas. R&D is being conducted to develop a new, more reliable framework for predicting the progression of BEP.

Approach

FRM R&D is developing a new framework for BEP prediction by attempting to simulate erosion progression using local hydraulic gradients measured directly in the laboratory as an erosion criteria in numerical models.

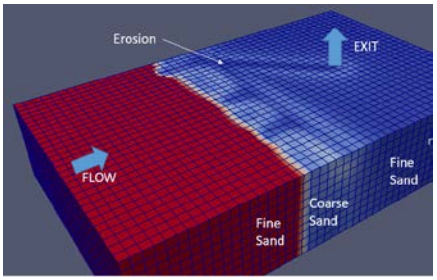
Outcomes

The results of this research will be a laboratory test for measuring soil susceptibility to BEP and numerical models for simulating BEP progression.

New research needs are continually submitted by USACE FRM Communities of Practice to focus future research investigations and products. Statements of Need can be submitted by USACE on the R&D Gateway (https://gateway.erdc.dren.mil/son/index.cfm?Cop=Flood&Option=Start).

Laboratory experiment for measuring hydraulic conditions at initiation of BEP on slopes.

Laboratory experiment for measuring hydraulic criteria for BEP pipe progression.



Numerical model of third party experiment using measured BEP progression criteria.

More Information

For more information on this project, please visit the project wiki page (available here) or contact Bryant Robbins at bryant.a.robbins@usace.army.mil.

For more information on FRM R&D, see the ERDC FRM wiki:
https://wiki.erdc.dren.mil/Flood_and_Coastal_Storm_Damage_Reduction_Research_Program