M.Sc. Thesis

ASSESSING SCOUR HOLE DEVELOPMENT AT STRUCTURES' FOUNDATION

Context. When designing hydraulic structures, foundations (or parts of) are located in open channels (like bridge piers) or in the sea (like offshore wind foundations). The structures influence the motion of the water around them, and in combination with erodible beds, the resulting sediment transport gradients could lead to local erosion (scour) around the base of the foundation. Scour can lead to structural failure and needs to be managed. Knowing the depth, extent and time development of scour holes at the base of foundations is crucial for the design of the foundation: the information can be used to determine if extending the foundation depth is a viable option, or if designing a scour protection is a more cost-efficient option. Assessing scour hole development is, in general, not a trivial task. Especially for milder conditions, where the external forcing does not often exceed the threshold of motion, we often see a huge bandwidth of possible scour depths with current approaches, likely related to uncertainty in the threshold of motion of sand, in combination with the threshold of scour development around a structure. Uncertainty related to natural variation of the alluvial bed, fluctuation in conditions and simply uncertainty in scour assessment methods further adds up to the great variation in assessing scour depths.

Objective. This project proposes to study the implementation of the various sources of uncertainty in scour assessment, and to associate a risk profile to scour assessment. Project outcomes will allow to have a better understanding of the consequences of scour assessment on the design of hydraulic structures.

Methodology. The ratio between the maximum scour depth (that potentially could occur under certain hydraulic conditions) and the installed depth of the foundation is the major parameter affecting the safety of a foundation. Various methods exist to determine the maximum scour depth, like Sheppard et al. (2006), Breusers (1977) or Raaijmakers & Rudolph (2008). A sensitivity analysis will be run to understand the relative importance of the various parameters, and then explore related uncertainty. A risk profile will be developed and linked to issues of foundation design and/or retrofitting (e.g. scour protection) for selected case studies, e.g. offshore wind farms in the North Sea and the Baltic Sea, characterized by significantly different dynamics.

THIS M.Sc. RESEARCH TOPIC IS IN COLLABORATION WITH Deltares

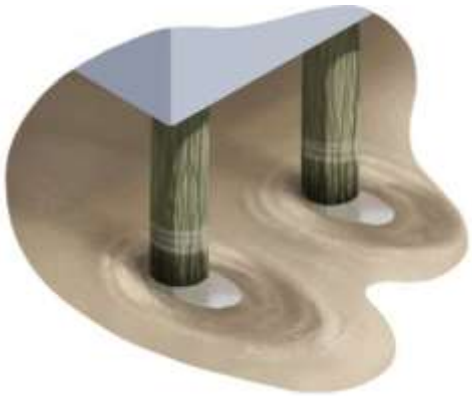

Figure 1. *Scour describes the particular type of localized soil erosion that happens around elements of a foundation (e.g. bridge, offshore wind, building foundation).*

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