

Waves effect on erosion and efficiency of soft shore protection technique in lakes

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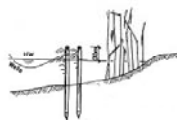
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Preamble

Shores erosion in lakes and well-adapted shore protection techniques are topics where further systematic research remains a need. The general approach used in seas and oceans in this domain is not always the same one applicable in shallow lakes, where soft protection measures, inspired from biotechnical engineering, are the most adapted. Unfortunately, the scientific basis for the design of such measures are almost inexistent. Thus, the actual practice in shore protection, for a security reason, overestimate the design of the structures which could be unfavourable for the maintain of the coastal natural aspect. To go against that, at the Lake Bienne in Switzerland, pioneer soft designs are being set up (cf. Fig. 1).



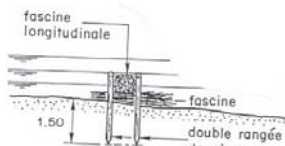
Gravel Embankment



Palissade



Breakwaters



Brushwood



Groins made with tree trunks

Figure 1: Typical shore protection measures used in the Lake Bienne

Scientific Goals

Figure 2 shows the need of further systematic research to investigate the interaction between the shore protection measures the hydrodynamic of a site and the sediment transport or erosion.

The numerical modeling will be based on physical tests carried out in a wave tank of the laboratory. These later will be used as a tool to calibrate the basic model of the designed software.

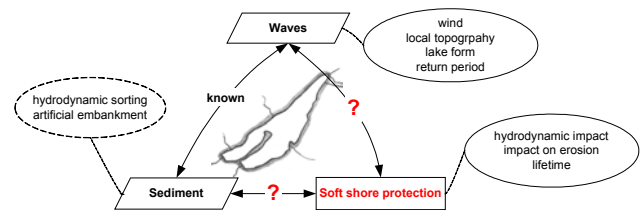


Figure 2: Further researches are needed to understand the interaction of the soft shore protection techniques with waves and sediment transport

Furthermore, the goal of the research is the numerical modeling on the physical phenomenon focused on the two following points:

- The wave refraction and interaction with the bathymetry and the sediment on the bottom on the lake,
- The influence on the geometry and type of the shore protection measures on bottom sediment transport, the energy dissipation of the incident and reflected waves and the shoreline development.

Technical Goals

The main goal of the research project is the fight against shore erosion using well-adapted measures for shallow lake conditions. Their functionality will be evaluated on short, middle and long-term conditions. Concretely, the research will provide the necessary tools to construction engineers, which will allow an optimal design of the soft shore protection measures shown in Figure 1. The design recommendations will take into consideration the environmental impact on the landscape and the shore, the criterion that influence their lifetime and any eventual maintenance. Finally the conditions for using these measures in some other shallow lake in Switzerland will be analysed.

Methodology

The methodology of the research project is subdivided onto three phases as shown in Figure 3.

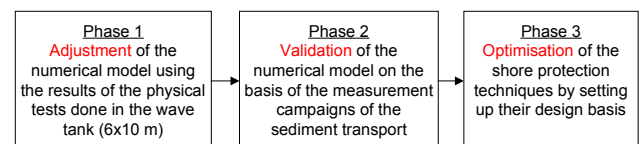


Figure 3: Simplified diagram indicating the adopted methodology for the research program

The phase 1 concerns the adjustment of the numerical model built with the software MIKE 21 using the tests results of the physical model. The phase 2 will provide the bases for the validation of the model adjustment done in phase 1, being based on the measurement campaigns of the bottom sediment transport in the lake and the wave generated wind. The phase 3 will give the scientific basis and criterion for the design of the shore protections measures in order to have an optimal effect against bank erosion. Furthermore, it will provide technical recommendation for their construction, done till now without any theoretical back up.