Geocomp

Technologies to manage risk for infrastructure

Project Brief

The Oosterschelde Project

Client:

State Department for Public Works

Location:

Holland

Services Provided:

- Provided analytical studies of stability and deformation
- Developed analytical models predicting displacement

Value Provided:

- Design evaluation and recommendations for stability of flood barrier helped predict permanent displacement

Background & Project Challenges

The Oosterschelde Project is a key part of Holland's defense network against flooding from the North Sea. Without it, more than half of Holland would be underwater after a major North Sea storm.

The original design was for a permanent dam to close off the 7-km-wide Oosterschelde Bay which would turn it into a fresh water lake. Environmental studies indicated that this would have a severe impact on the breeding grounds for fish in the North Sea. The dam concept evolved into a system of gates that could be raised in normal seas and lowered during storms. The gates would be supported by massive caissons buried in the seabed.

Serious concerns for stability of the loose sands and silts in the soil foundations under static and cyclic loading as well as piping from the head differential led the Owner to form an outside consulting board for the geotechnical aspects of the project.

Geocomp Role & Accomplishments

Geocomp served as a member of the Consulting Board providing consultation, analytical studies of stability and deformations, selection of soil properties, and evaluation of design. This was one of the first projects in which finite element method (FEM) was used to determine permanent displacements resulting from cyclic loads.

In addition to analyses, Geocomp led a research team to examine the behavior of the loose sands and silts under cyclic loading. Using cyclic triaxial testing, Geocomp demonstrated that for the anisotropic stress conditions that exist beneath a structure, the driving concern for design is permanent displacement, not liquefaction. This finding caused the geotechnical work to change focus from liquefaction to cyclic displacement. The research team used this information to develop analytical models to predict permanent displacement of the dam structures from cyclic loading by storm tides and waves.

This was considered one of the largest civil works projects and one of the most technically-demanding projects requiring innovative solutions to deal with serious concerns about liquefaction and piping of the foundation materials. The project was one of the first major civil projects to employ extensive amounts of geosynthetic materials to protect the foundation bed from piping and scour.