

(the coal quay area in Svea); an Arctic coastal structure exposed to loads from waves and sea ice, with challenging sedimentation systems and unstable permafrost.

Three additional studies of coastal protection structures were started in 2013, where experience from site investigations, modelling and laboratory studies will be verified through large-scale field studies in 2014. The projects aims at studying different techniques for Arctic coastal erosion protection, with use of local soils that are adapted to local conditions:

- Thermal protection
- Stabilized soils
- Geosynthetics containers filled with fines

Construction materials

A challenge when building in the Arctic is the lack of high quality construction materials. The studies here involve using locally available soils in building coastal protection structures in combination with geosynthetics. A traditional type of construction would include importing crushed bedrock and aggregates for concrete. Part of the study is to reduce transportation for these types of constructions, seeing it from environmental

and financial perspectives. The geosynthetics used in future systems will be designed for Arctic conditions. The geosynthetic fabrics will have the properties and ability to withstand the forces from waves and ice impact and abrasion from ice and sea bed sediments. Other required properties are connected to hydraulic processes in around the bags, where loss of soils through the geosynthetic fabric can be a challenge. In 2013 Gunther Kassner in and around University of Applied Sciences, Munster, did his master's thesis on concrete produced with aggregates from Arctic soils, as filling material in geosynthetic containers. The project was done in cooperation with SINTEF and was based on mixing and testing concrete with aggregates for the Longyearbyen area. It also studied the properties of the concrete under Arctic conditions. The tests were carried out in the laboratory. Results from the study showed poor resistance against freeze/thaw cycles as shown in Figure 17 (Borås test). Soils in Svalbard are mostly from sedimentary rocks where the characteristics are low density and open structure. Most of the Svalbard soil particles have a tendency to absorb water in the open structure, when water is available, and crack when temperatures are below zero.



Erosion protection in Kapp Amsterdam, Svea.