Case Study Beneficial Use of Sediments

Project	*Gothenburg Port Field Trial*
Classification	*R3B_2018_SE*
Major Function	*Reclamation*
Other Functions	*Raw material, Remediation*
Location	*Arendal, Gothenburg Port, Sweden*
Volume	*Volume reused (15,000 m³)*
Technique	*Process stabilisation of contaminated sediments with hydraulic binders*
Contaminants	*Tri-butyl tin*
Granulometry	*Silty clay*
Scale	*Pilot scale*
Client	*Gothenburg Port*
Executor	*Consultant: COWI, Gothenburg, Contractor: PEAB Grundlaggning, Research Institute: Swedish Geotechnical Institute (SGI)*
Research program	*N/A*
Contact	*Contractor: PEAB Grundlaggning, Helsingborg, Sweden* *Consultant: COWI, Gothenburg*
Year start – end	*2018 – 2022*

Description of the project

Planned expansion in Gothenburg Port will stabilise up to 1,000,000 m^3 of contaminated dredged sediments in two phases from 2018 to 2022. The sediment is contaminated with TBT, mean level in the order of 250 µg/kg dry solids. The dredged sediments will be mixed with hydraulic binders to provide structural strength and minimize leaching of TBT, for re-use as fill to expand the surface area of the port by 200,000m^2.

A preliminary laboratory evaluation[1] of candidate hydraulic binders: ordinary Portland cement, ground granulated blast furnace slag (GGBS) and coal tar ash, was carried out to determine the most suitable binder combination for the full-scale project. The laboratory testing concluded that the GGBS binder contributed most to reduction of leaching of TBT and reduction of pH. Two candidate binder recipes were then selected for full-scale evaluation in a field trial[2,3], which commenced in April 2017. These were a GGBS:cement mix (50:50), and a GGBS:cement:ash mix (25:50:25).

Process stabilization was used where the sediment was pre-mixed with the stabilizing binders before placement in the field. Mixing was carried out in a specialist mixer[4] that mixes the wet sediment with the binder pastes, where mixes are pumped in to a cylindrical drum under high pressure. The energy of the pumping is sufficient to generate a homogenous mix of the sediment and the binders. The sediment/binder mix was pumped from the mixing plant to the placement lagoons 600 m distant (bounded by sheet pile walls). The mix was placed under water. Placing temperature was 5 ^{O}C, and after activation and hydration of the binder, the internal temperature of the system rose to 14^{O} C, and thereafter remained at 14^{O} C.

Seismic p-wave measurements of in-situ strength at 28 days give the 50:50 GGBS:cement strength of 300 kPa, whilst the GGBS:cement:ash mix is in the order of 60 kPa. The design strength of the stabilised sediment is 70 kPa.

Graphical information

Figure 1. Sediment stabilised with GGBS:cement binder in Gothenburg Port Arendal Field Trial

Figure 2. Binder/sediment mixing plant provided by PEAB

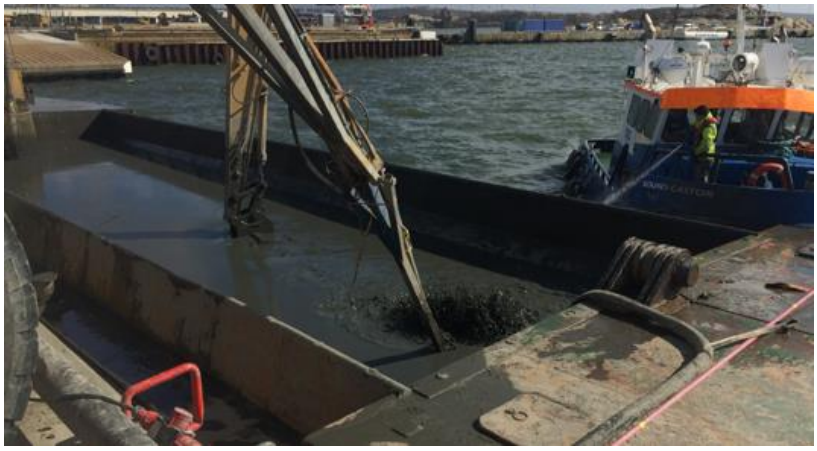

Figure 3. Sediment being homogenised in barge prior to mixing with binder

References/web links

1. *Laboratory study: "GÖTEBORGS HAMN AB, ARENDAL 2 FÄLTFÖRSÖK– SLUTRAPPORT LABORATORIEFÖRSÖK: BINDEMEDELSRECEPT FÖR STABILISERING OCH SOLIDIFIERING AV MUDDERMASSOR, COWI Gothenburg, Kristina Bernstén, Anna Wilhelmsson, February 2016*
2. *Field Trial Project: https://www.portofgothenburg.com/news-room/news/dredging-spoils-used-to-build-new-freight-terminal-at-the-port-of-gothenburg/*
3. *Video of field trial: https://vimeo.com/216844512 (password: kunder22)*
4. *Mixing technology: http://www.peabgrundlaggning.se/sv/Produkter--Tjanster/Solidifiering/*