Development of Mass Stabilisation Technique for Contaminated Sediments

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The principle of the mass stabilisation technique is to mechanically mix the soft soil materials, like dredged sediment with the stabilising agent (binder). The progress of the technique for mass stabilisation of soft soil materials has been important in Finland since the beginning of 1990's. The first test stabilisation was made with peat at Veittostensuo in 1993. Since then the technique has spread very quickly especially in the Nordic countries.

The first time to apply the mass stabilisation technique to the dredged sediments was in the Hamina harbour in 1996 in Finland. After this the technique has become very popular. Especially the possibility to use contaminated and soft dredged sediments in the construction of harbours has met significant interest of the harbour authorities and other stakeholders. The mass stabilisation of contaminated sediments has three specific objectives: first to turn dredged contaminated sediments into less harmful materials, second to turn the soft sediment materials into stable and solid materials so that they can be used for construction purposes (e.g. as base for the container storage areas), and third to make a sustainable harbour infrastructure development possible (for example by compensating the use of natural aggregates with stabilised sediment materials).

The need for an effective technique to treat contaminated sediment for beneficial purposes is evident. The dredging of the waterways of the seaside harbours is a continuous and necessary process and the amount of contaminated sediment materials is known to be very high.. For example organic tin compounds like TBT can be found in the sediments of each seaside harbour.

The mass stabilisation technology for contaminated sediments has been developed in several practical cases. Vuosaari harbour, Helsinki Finland (2005-2006), has been a typical case where the geotechnical characteristics of sediment vary significantly between the different dredging points. This makes it challenging to develop an adequately effective binder admixture for the stabilisation. During the development of the binder recipe also the effect of the binder to the leaching of TBT was tested. The results indicate that a binder admixture containing coal fly ash and cement is more effective to stabilise TBT-contaminated sediments than cement alone. In Trondheim, Norway (2002-2003), it was possible to show that the use of appropriate industrial by-products in the binder admixture can have a significant effect on the strength development of the stabilised sediments and, consequently, on the economy of the mass stabilisation technique. In the on-going case of Turku harbour, in Finland, the demonstration project concentrates on the testing of an environmentally friendly dredging method and a new economically and technically effective process stabilisation system. Also a versatile set of different binder admixtures will be tested for the stabilisation.

The development of the binder recipes has been important for each of the cases. It has been shown that the chosen binder can affect the technical characteristics (the strength development) and the environmental behaviour (leaching of contaminants) of the stabilised material. The choice of the binder will also affect the stabilisation costs: the calculations have shown that the choice of binder can save even 70 per cent of the total binder material costs. This has a significant meaning as the binder costs stand for from 50 to 70 per cent of the total mass stabilisation costs.