The Mass Stabilisation Process

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Development
Mass-stabilisation was developed in Finland in the early 90’s. The method is used in Scandinavia to stabilise organic soils like peat, gyttja and mud. Previously the only solutions for these type of soils were to excavate or depress rock into the soil.

Position in the market
The method is used to stabilise road and railroad embankments, reclamation of land in harbour areas and to bind polluted soils.
The Mass Stabilisation Process

The total soil volume is stabilised in order to create a block that can carry the load of the embankment. The binder generally consists of cement, quick lime, slag or a mixture of the above. After mass stabilisation the stabilised block is much stiffer than the original soil, which will reduce the settlements and improve stability. Mass-stabilisation (MS) is usually used in combination with lime/cement (LC) columns where the top very soft (primary organic) soils are mass-stabilised and the underlying soft clay is stabilised with lime/cement columns.

The mass-stabilisation production rate is highly dependent on the type of project and the amount of binder. Generally the production rate varies between 300-500 m$^3$/16 hrs shift.

The mixing tool has a diameter of 1.0m. The tool is specially developed to cut and tear the peat structure. The binder is blown out into the soil both during the insertion and exertion.

The MS mixing tool can be designed to suit special soil conditions and stabilisation purposes.
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Installation

The mass-stabilisation unit contains one machine with a separate shuttle. The machine has a track pressure of 34 kPa and the shuttle has a track pressure of 53 kPa (fully loaded with binder). The drilling auger can reach 3.5 m, measured from the tracks, and the stabilising depth is 5 m.

**Installation**

1. **Installation of lime-cement columns**
   Lime-cement columns are installed in the underlying clay.

2. **Mass Stabilisation**
   The MS-work is carried out in small cells of 3 times 4.5 m where each cell has a specific ID-number. The total amount of binder is registered in the machine computer and printed out for each cell.

3. **Installation of geo-textile and fill**
   A pre-loading bed is created directly after mixing. The bed is build of a geo-textile to separate the mixed soil from the fill (cross-material) followed by 0.3-0.5 m of fill, a geo-grid and 0.3-0.5 m of fill.
Site Investigation and Laboratory Testing

Mass-stabilisation is an alternative solution for very soft soils like organic soils, mud and peat. To determine whether or not the method is appropriate for a project, requires site investigations showing the depth of the soil layers, the water content, density, classification of the peat structure/classification of the soil (if not peat) and the pH-value.

Laboratory testing is vital when determine if the MS method is suitable for the project. The mixing of soil and binder in laboratory indicates the required mixing energy and the type of binder that would be suitable for the soil.

Before a project starts, field test in at least one test area is performed. The mixing process and the binder reaction in the soil can vary from the binder reaction in laboratory. The shear strength and compression module in the soil can also vary from the laboratory results. The final design is determined after evaluation of the field test.

Unconfined compression tests are carried out on the mixed samples. The result from the compression test shows the ultimate bearing capacity. The undrained shear strength and compression module (Young’s module) can then be evaluated.
**Production Control**

The inspection and quality control of mass-stabilisation is similar to the control of lime/cement columns.

The production tests are carried out by SCPT (Standard Column Penetration Test) and by measuring the settlements. Test pits can be an appropriate method to investigate the homogeneity of the mixed soil. CPT (Cone Penetration Test) and load tests can be used as complementary tests.

It can generally be said that the MS-process has a quick settlement development, with half of the total settlements being developed within 1 month. The initial settlement varies between 5-20cm.