

SOIL STABILISATION

Stabilisation of Sulfate Bearing Soils

Stabilisation with lime, cement or other binders is a well-established, cost-effective method of converting weak soil into a useable and environmentally sound construction material, which can be used as a foundation for roads, pavements, embankments, reinforced earth structures, railways, housing and industrial units.

Very occasionally, the presence of sulfate in the original soil has caused swell and heave of the stabilised layer. Updated guidelines from the Soil Stabilisation Group explain the mechanisms responsible for sulfate heave and how to avoid it.

It has been well-known for over fifty years, that soils containing sulfates can cause expansion problems when stabilised with lime or Portland cement. In the presence of water, the reaction of calcium (from lime or cement), alumina (a primary constituent of clay) and sulfate produces calcium-aluminate-sulfate-hydrate minerals, which can produce high swell pressures and disruptive increases in volume, sufficient to cause disruption of overlying layers.

As well as sulfates, sulfides can also be a risk factor for soil stabilisation because disturbance of a soil can induce sulfides to oxidise and increase the sulfate level. This oxidation is accelerated during soil stabilisation operations by both the pulverisation process and by the use of lime and/or cement, which increases the pH level and thereby decreases the chemical stability of the sulfides.

The updated guidelines highlight the need for a thorough assessment of the site, including comprehensive sampling and testing for sulfates and sulfides. They describe the test methods, explain the significance of what they measure and advise on how to evaluate the potential of the soil for expansion. The guidance goes on to explain how alternative binders such as ground granulated blastfurnace slag (GGBS) should be considered when there are high levels of sulfate or sulfide in the soil and concludes with sections on laboratory tests for potential swelling and good construction practice for the stabilisation of clays.

■ Guidelines for Stabilisation of Sulfate-Bearing Soils may be downloaded from: www.britpave.org.uk/SoilStabProcessPublications.ink



The A6 north of Bedford was built on a capping layer, consisting of stabilised clay. The clay soil contained high concentrations of sulfur and sulfates and comprehensive laboratory testing was carried out before deciding to carry out the stabilisation with a combination of 2% lime and 2% GGBS, to avoid expansion due to sulfates.



Hump in experimental road, caused by expansion of underlying stabilised soil