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IMPROVEMENT IN STRENGTH OF ROAD SURFACE BY SOIL STABILIZATION

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Abstract: *Soil stabilization a general term for any physical, chemical, biological, or combined method of changing a natural soil to meet an engineering purpose. Improvements include increasing the weight bearing capabilities and performance of in-situ subsoils, sands, and other waste materials in order to strengthen road surfaces.*

Keywords: *AggreBind, Soil Stabilization, Rammed Earth, SCB, CKD*

[1] INTRODUCTION

Stabilization in a broad sense incorporates the various methods employed for modifying the properties of a soil to improve its engineering performance. Stabilization is being used for a variety of engineering works, the most common application being in the construction of road and airfield pavements, where the main objective is to increase the strength or stability of soil and to reduce the construction cost by making best use of locally available materials.

Principles of Soil Stabilization:

Natural soil is both a complex and variable material. Yet because of its universal availability and its low cost winning it offers great opportunities for skilful use as an engineering material.

Not uncommonly, however the soil at any particular locality is unsuited, wholly or partially, to the requirements of the construction engineer. A basic decision must therefore be made whether to:

• Accept the site material as it is and design to standards sufficient to meet the restrictions imposed by its existing quality.

• Remove the site material and replace with a superior material.

• Alter the properties of existing soil so as to create a new site material capable of better meeting the requirements of the task in hand.

[2] EVOLUTION

Soil Stabilization or Rammed Earth has been used for thousands of years as a basic building material. Soil stabilization from the Ancient Pyramids to the Great Wall of China, soil has provided structural solutions that were principally based on the binding properties of clay soils. Throughout Latin America soil stabilization of sorts was achieved with clay-based soil blocks (rammed earth blocks or earthen blocks) were known as the Adobe Block. In our rapidly changing and developing world we have needed to find alternatives to dependency clay-based soils for soil stabilizing and soil stabilization.

Unlike portland cement, soil cement with low tensile strength, asphalt, tree resin, ionic stabilizers and others,

- AggreBind's unique characteristics offer soil stabilization solutions that are readily available from most on-site materials.

- AggreBind offers environmentally friendly solutions.
- AggreBind was developed to meet today's environmental concerns and today's specific engineering challenges.
- AggreBind is a cross-linked styrene acrylic polymer that makes it the perfect soil stabilizing product.
- Soil Stabilization with AggreBind does **not** need clay.
- AggreBind can effectively stabilize a wide range of on-site materials including sub-soils, sands, and waste construction/mine materials. Sieve analysis is highly recommended.
- AggreBind works with stabilizing soil contaminated mining materials and non-organic waste materials.
- Recycled AggreBind roads and blocks are ideal for soil mixing and aerating of fields.

[3] APPLICATIONS

AggreBind is ideal for Specialty Applications and can replace traditional house construction methods and road construction soil stabilization methods such as:

- Soil-cement base (SCB)
- Soil nailing
- Jet grouting and Grout of the soil
- Erosion Blanket and Erosion control for dust control
- Sediment Control and management of mine dumping waste

Soil stabilization products are varied on the market and often mislead the user because they refer to their product as a soil stabilizer. This is a very misused term and unfortunately it misleads the users. In many parts of the world, Indonesia and Malaysia, India, in various countries of Latin America and Africa, there have been stabilized soil projects that failed or did not perform as promised and represented.

- Some of these products simply neutralize the interaction between clay particles to allow the platelets to be compacted with no true binding or soil stabilization action.
- Some soil-binders do not work with non-cohesive materials such as sand.

- Some soil stabilizers improve the CBR by only 2-3 times. (Any conventional soap product can do this.)
- Some products require medium to high clay content for stabilizing, essentially lubricating the clay to bind when compacted. (Sometimes they call this increasing plasticity and to do so they say add clay. In fact, they are actually clay-based soil stabilizers.)
- Some soil stabilizer products are based on tree resins, presenting themselves as "ionic stabilizers" and a "green" alternative to bitumen, etc. This class of resin-based soil stabilizers generally needs a minimum of 15% clay content and an annual maintenance program or topping-up of the surface. (There claim is to be bio-degradable. A bio-degradable road is guaranteed to breakdown rapidly.)

These various alternatives cause confusion and doubt in the marketplace. These assumptions, based on poor experiences with so called soil stabilizers, create misconceptions about AggreBind.

[4] OBJECTIVES

The prime objective of soil stabilization is to improve the California Bearing Ratio of in-situ soils by 4 to 6 times. The other prime objective of soil stabilization is to improve on-site materials to create a solid and strong sub-base and base courses. In certain regions of the world, typically developing countries and now more frequently in developed countries, soil stabilization is being used to construct the entire road.

In the past, soil stabilization was done by utilizing the binding properties of clay soils, cement-based products such as soil cement, and/or utilizing the "rammed earth" technique (compaction) and lime.

Some of the 'green technologies' are: enzymes, surfactants, biopolymers, synthetic polymers, co-polymer based products, cross-linking styrene acrylic polymers, tree resins, ionic stabilizers, fiber reinforcement, calcium chloride, calcite, sodium chloride, magnesium chloride and more. Some of these new stabilizing techniques create hydrophobic surfaces and mass that prevent prevents road failure from water penetration or heavy frosts by inhibiting the ingress of water into the treated layer.

However, recent technology has increased the number of traditional additives used for soil stabilization purposes. Such non-traditional stabilizers include: Polymer based products (e.g. cross-linking water-based styrene acrylic polymers that significantly improves the load-bearing capacity and tensile strength of treated soils), Copolymer Based Products, fiber reinforcement, calcium chloride, and Sodium Chloride.

Traditionally and widely accepted types of soil stabilization techniques use products such as bitumen emulsions which can be used as a binding agents for producing a road base. However, bitumen is not environmentally friendly and becomes brittle when it dries out. Portland cement has been used as an alternative to soil stabilization. However, this can often be expensive and is not a very good "green" alternative. Cement fly ash, lime fly ash (separately, or with cement or lime), bitumen, tar, cement kiln dust (CKD), tree resin and ionic stabilizers are all commonly used stabilizing agents.

[5] ADVANTAGES

Treatment of soils offers technical, economic, ecological and environmental advantages.

Technical advantage

Treatment with lime and/or cement or cementitious road binders allows production and use of homogeneous, long-lasting and stable materials with mechanical characteristics comparable to those of graded aggregate with cementitious binders. In addition, these materials are characterised by great stiffness and excellent fatigue strength. They show good performance in hot weather, with no deformation or rutting, and good performance on exposure to freeze-thaw cycles due to the stiffness of the material and the slab-side effect.

Economic advantage

Field recycling is a significant savings factor as this reduces to a minimum stripping cuts, landfill, provision of aggregates and thus the cost of their transport. The absence of transport of aggregates and of cuts to the landfill contributes to preserving the road network in the vicinity of the building site. Also, these are very economical techniques, especially on account of the shorter duration of the works: compared to a conventional solution, the savings are of the order of 30%.

Ecological and environmental advantage

Cold treatment reduces pollution and discharge of fumes into the atmosphere. Moreover this technique allows significant global energy savings by reducing the transport of materials, the quantity of materials for landfill (thus limiting indirect effects - nuisance to users and residents) and fatigue of the road network adjacent to the site.

Field recycling minimises exploitation of aggregates deposits (quarries and gravel pits), non-renewable natural resources. This contributes to preserving the environment.

[6] SCOPE OF RESEARCH

Soil treatment is used to make embankments, capping layers, base courses of transportation infrastructures such as roads, TGV foundations, industrial and airport foundations.

Treatment for soil improvement, which aims to modify the characteristics of materials, generally the moisture content, to facilitate their use.This type of treatment is appropriate for a short-term objective.

Treatment for soil stabilisation**,** which aims to increase performance in resisting, in particular, mechanical and climatic stresses and increase the service life of the structure. This type of treatment is appropriate for a long-term objective.

REFERENCES:

1. Al-Amoudi, O.S.B., K. Khan and N.S. Al-Kahtani, 2010. Stabilization of a Saudi calcareous marl soil. Constr. Build. Mater., 24(10): 1848-1854.
2. Alawaji, H.A., 2001. Settlement and bearing capacity of geogrid-reinforced sand over collapsible soil. Geotext. Geomembranes, 19(2): 75-88.
3. Alhassan, M., 2008. Permeability of lateritic soil treated with lime and rice husk ash. Assumption Univ., J. Thailand, 12(2): 115-120.
4. Al-Tabbaa, A., 2012. General report session 3-soil mixing 1- soil stabilisation: Surface mixing and laboratory mixtures. Cambridge University, United Kingdom.
5. Arman, A. and G.A. Munfakh, 1970. Stabilization of Organic Soils with Lime. Engerning Research Bulletin No. 103, Louisiana State University, Baton Rouge, LA.
6. Attoh-Okine, N.O., 1995. Lime treatment of laterite soils and gravels-revisited. Constr. Build. Mater., 9(5): 283-287.
7. Azadegan, O., S.H. Jafari and J. Li, 2012. Compaction characteristics and mechanical properties of lime/cement treated granular soils. Electron. J. Geotech. Eng., 17: 2275-2284.
8. Improvement in Lowland and other Environments. ASCE Press, New York.
9. Beubauer Jr., C.H. and M.R. Thompson, 1972. Stability properties of uncured lime-treated fine-grained soils. HRB, Highway Research Record 381, pp: 20-26.
10. Birchal, V.S.S., S.D.F. Rocha and V.S.T. Ciminelli, 2000. The effect of magnesite calcination conditions on magnesia hydration. Miner. Eng., 13(14-15): 1629-1633.
11. Bonomaluwa, B.B. and T.A. Palutnicowa, 1987. The formation of soil and humus. Agricultural Publishing House, Beijing, pp: 140-141.
12. Braga Reis, M.O., 1981. Formation of expansive calcium sulphoaluminate by the action of the sulphate ion on weathered granites in a calcium hydroxide-saturated medium. Cement Concrete Res., 11(4): 541-547.
13. Brandl, H., 1981. Alteration of soil parameters by stabilization with lime. Proceeding of the 10th International Conference on Soil Mechanics and Foundation Engineering. Stockholm., 3: 587-594.
14. Broms, B. and P. Boman, 1977. Stabilization of Soil with Lime-soil

Columns. Design Handbook, 2nd Edn., Royal Institute of Technology, Stockholm, Sweden.

15. Buensuceso, B.R., 1990. Engineering behavior of lime treated soft bangkok clay. Ph.D. Thesis, Asian Institute of Technology, Bangkok.