A

Seminar report

On

Soil Cement

Submitted in partial fulfillment of the requirement for the award of degree of Civil

SUBMITTED TO:

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SUBMITTED BY:

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Acknowledgement

I would like to thank respected Mr…….. and Mr. ……..for giving me such a wonderful opportunity to expand my knowledge for my own branch and giving me guidelines to present a seminar report. It helped me a lot to realize of what we study for.

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Preface

I have made this report file on the topic **Soil Cement**; I have tried my best to elucidate all the relevant detail to the topic to be included in the report. While in the beginning I have tried to give a general view about this topic.

My efforts and wholehearted co-corporation of each and everyone has ended on a successful note. I express my sincere gratitude to …………..who assisting me throughout the preparation of this topic. I thank him for providing me the reinforcement, confidence and most importantly the track for the topic whenever I needed it.

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Content

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Introduction

Soil cement is frequently used as a construction material for pipe bedding, slope protection, and road construction as a sub base layer reinforcing and protecting the sub grade. It has good compressive and shear strength, but is brittle and has low tensile strength, so it is prone to forming cracks.

Soil cement mixtures differ from Portland cement concrete in the amount of paste (cement-water mixture). While in Portland cement concretes the paste coats all aggregate particles and binds them together, in soil cements the amount of cement is lower and therefore there are voids left and the result is a cement matrix with nodules of uncemented material.

What is Soil Cement?

Soil cement is a construction material, a mix of pulverized natural **soil** with small amount of portland **cement** and water, usually processed in a tumble, compacted to high density. Hard, semi-rigid durable material is formed by hydration of the **cement** particles.

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Why Use Soil-Cement?

Failing granular-base pavements, with or without their old bituminous mats, can be salvaged, strengthened, and reclaimed as soil-cement pavements. This is an efficient, economical way of rebuilding pavements. Since approximately 90 percent percent of the material used is already in place, handling and hauling costs are cut to a minimum. Many granular and waste materials from quarries and gravel pits can also be used to make soil-cement; thus high-grade materials are conserved for other purposes.

Highway and city engineers praise soil-cement's performance, its low first cost, long life, and high strength. Soil-cement is constructed quickly and easily – a fact appreciated by owners and users alike.

How is Soil-Cement Built?

Before construction begins, simple laboratory tests establish the cement content, compaction, and water requirements of the soil material to be used. During construction, tests are made to see that the requirements are being met. Testing ensures that the mixture will have strength and long-term durability. No guesswork is involved.

Soil-cement can be mixed in place or in a central mixing plant. Central mixing plants can be used where borrow material is involved. Friable granular materials are selected for their low cement requirements and ease of handling and mixing. Normally pugmill-type mixers are used. The mixed soil-cement is then hauled to the jobsite and spread on the prepared subgrade.

Compaction and curing procedures are the same for central-plant and mixed-in-place procedures.

There are four steps in mixed-in-place soil-cement construction; spreading cement, mixing, compaction, and curing. The proper quantity of cement is spread on the in-place soil material. Then the cement, the soil material, and the necessary amount of water are mixed thoroughly by any of several types of mixing machines. Next, the mixture is tightly compacted to obtain maximum benefit form the cement. No special compaction equipment is needed; rollers of various kinds, depending on soil type, can be used. The mixture is cemented permanently at a high density and the hardened soil-cement will not deform or consolidate further under traffic.

Curing, the final step, prevents evaporation of water to ensure maximum strength development through cement hydration. A light coat of bituminous material is commonly used to prevent moisture loss; it also forms part of the bituminous surface. A common type of wearing surface for light traffic is a surface treatment of bituminous material and chips .5- to .75-inch thick. For heavy-duty use and in severe climates a 1.5-inch asphalt mat is used.

Contractors bidding on soil-cement jobs know that construction will be relatively easy and problem-free; weather delays rare; and reworking of completed sections unnecessary.

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Objective of the Work

- To study about soil cement roads.
- To study about construction methods.
- Discuss about various properties of soil cement roads.
- Discuss about advantages and disadvantages of soil cement roads.

Soil Cement Road

Soil-cement is a highly compacted mixture of soil/aggregate, Portland cement, and water. Soil-cement differs from Portland cement concrete pavements in several respects. One significant difference is the manner in which the aggregates or soil particles are held together. A Portland cement concrete pavements mix contains sufficient paste (cement and water mixture) to coat the surface area of all aggregates and fill the void between aggregates. In soilcement mixtures, the paste is insufficient to fill the aggregate voids and coat all particles, resulting in a cement matrix that binds nodules of uncemented material. It is widely used as a low-cost pavement base for roads, residential streets, parking areas, airports, shoulders, and materials-handling and storage areas. Its advantages of great strength and durability combine with low first cost to make it the outstanding value in its field.

A thin bituminous surface is usually placed on the soil-cement to complete the pavement. material used for soil cement are soil cement and water. The use of soil-cement can be of great benefit to both owners and users of commercial facilities. Its cost compares favorably with that of granular-base pavement. When built for equal load carrying capacity, soil-cement is almost always less expensive than other low-cost site treatment or pavement methods. The use or reuse of in-place or nearby borrow materials eliminates the need for hauling of expensive, granular-base materials; thus both energy and materials are conserved.

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Performance of Soil Cement

Soil-cement thicknesses are less than those required for granular bases carrying the same traffic over the same subgrade. This is because soil-cement is a cemented, rigid material that distributes loads over broad areas. Its slab-like characteristics and beam strength are unmatched by granular bases. Hard, rigid soil-cement resists cyclic cold, rain, and spring-thaw damage. Cement stabilizes soil in two ways. First, it reduces soil plasticity, especially for the soil in which there is high amount of clay particles.

The second is cementation which is very important because clay is not its main composition. In fine grained silty and clayey soils, the hydration of cement develops strong linkages between the soil aggregates to form a matrix that effectively encases the soil aggregates. Old soil-cement pavements in all parts of the continent are still giving good service at low maintenance costs. Soil-cement has been used in every state in the United States and in all Canadian provinces.

Specimens taken from roads show that the strength of soil-cement actually increases with age; some specimens were four times as strong as test specimens made when the roads were first opened to traffic. This reserve strength accounts in part for soil-cement's good long-term performance.

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Types of soil cement

Cement-modified soils (CMS)

A cement-modified soil contains relatively small proportion of Portland cement. The result is caked or slightly hardened material, similar to a soil, but with improved mechanical properties - lower plasticity, increased bearing ratio and shearing strength, and decreased volume change.

Soil-cement base (SCB)

A soil-cement base contains higher proportion of cement than cement-modified soil. It is commonly used as a cheap pavement base for roads, streets, parking lots, airports, and material handling areas. Specialized equipment, such as a soil stabilizer and a mechanical cement spreader is usually required. A seal coat is required in order to keep moisture out. For uses as a road construction material, a suitable surface coating, usually a thin layer of asphalt concrete, is needed to reduce wear.

In comparison with granular bases, soil cement bases can be thinner for the same road load, owing to their slab-like behavior that distributes load over broader areas. In-place or nearby located materials can be used for construction - locally found soil, stone, or reclaimed granular base from a road being reconstructed. This conserves both material and energy.

The strength of soil-cement bases actually increases with age, providing good long-term performance.

Cement-treated base (CTB)

A cement-treated base is a mix of granular soil aggregates or aggregate material with Portland cement and water. It is similar in use and performance to soil-cement base.

Acrylic copolymer (Rhino Snot)

Developed for the U.S. Military in desert conditions and commercially trademarked, "Rhino Snot" is a water soluble acrylic copolymer applied to soil or sand which penetrates and coats the surface. When dry, it forms a waterproof, UV-resistant, solid bond which binds the soil together reducing dust. In higher concentration it creates a durable surface that can withstand heavy traffic allowing existing soil to be used for roads, parking lots, trails and other heavy traffic areas.

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Advantages

Economic and Environmental Benefits

1. Low First Cost
Soil-cement is often more economical to construct than bases through the use of soil material on or near the commercial paving site.any in-place non-organic,low plasticity soils can be used.Also,nearby borrow soil can provide an excellent material source,requiring lower cement contents than clay and silt soils.Borrow soils do not have to be expensive base-course material;almost any granular material is suitable.

2. Fast Construction
Modern methods and equipment make soil-cement processing simple and efficient.In-place soils are processed at the paving site.When borrow soil is used,itn is usually mixed in a central plant the borrow source,the hauled to the paving site to be compacted. Finished to grade,and cured.There is no mellowing period or other delays in the construction process.In addition,soil-cement is stable immediately after construction and gains strength rapidly.

3. Recycling of Existing Materials.
Making good soil-cement out of old flexible pavement is nothing new;it has been done for years.Failed flexible pavements contain materials that can be salvaged economically by recycling-breaking them up,pulverizing them,and stabilizing them a minimum quantity of Portland cement to make a new soil-cement base.There is no disposal problem as is commomly found when old pavements are dug out.Since approximately90% of the material used is already in place,handling and hauling costs are cut to a minimum.Many granular and waste materials from quarries and gravel pits can also be used to make soil-cement,thus conserving high-grade materials for other purposes.

Engineering Benefits

1.Stiffness
Soil-cement is a low-cost pavement base offering the feature most essential for long-lasting parking and storage areas-stiffness. Large paved areas must maintain their original grade and must not develop depressions or potholes if they are to drain freely during rains, thereby preventing puddles and damage from water that seeps through and weakens the underlying soil.The stiffness of a cement-stabilized base acts to distribute loads over a wider area,reducing subgrade stresses and allowing the maintain its original grade for many years without costly resurfacing or repairs.

Stabilized Base vs. Unstabilized Base

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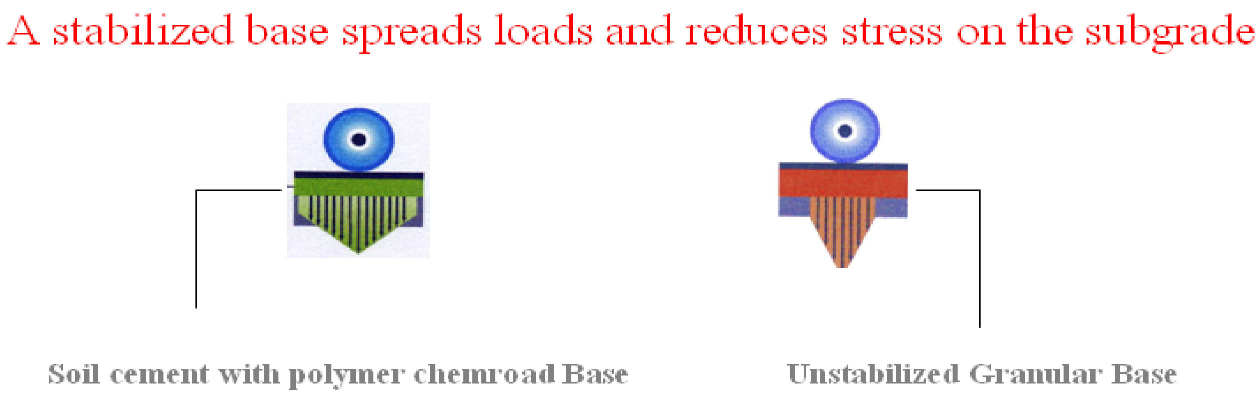

Soil-cement does not rut or consolidate.As a cemented material,it does not soften when exposed to water.When rutting occurs in an unstabilized base material or the underlying subgrade soil,a simple overlay of the pavement surface is insufficient to correct the cause of the rutting.With a stabilized base,rutting is confined to the asphalt surface layer and is relatively simple and less expensive to correct.

2. Great Strength

Cores taken from soil-cement pavements furnish proof of its strength. Samples taken after 15 to 20 years show considerably greater strength than sample taken when the pavement was initially built. Because the cement in soil-cement continues to hydrate for many years, soil-cement has “reserve” strength and actually grows strength and actually grows stronger.

Soil-cement thickness requirements are less than those for granular bases carrying the same traffic over the same subgrade. This is because soil-cement distributes loads over broad areas. Its

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slab-like characteristics and beam strength are unmatched by granular bases. Strong, stiff soil-cement resists cyclic cold, rain and spring-thaw damage.

3. Superior Performance

More than 70 years of collective experience have demonstrated that different kinds of soil-cement mixtures can be tailored to specific pavement applications,all achieving superior performance as a result of soil-cement's strength.Thousands of miles of soil-cement pavement in every state in the United States and in all the Cannadian provinces are still providing good service at low maintenance costs.

Cement-treated bases are designed to be virtually impermeable,so that even under frost conditions no ice lenses can form in the base layer.With a granular,unbound material,if poor drainage exists or groundwater rises,the base can easily become saturated,causing significant strength losses.The cement-stabilized layer,on the other hand,will maintain significant strength even in the unlikely event it becomes saturated.

The higher stiffness of cement-treated bases leads to lower pavement deflections and lower asphalt strains,resulting in longer fatigue life for the asphalt surface.The use of soil-cement actually reduces the occurrence of fatigue cracking,a common pavement failure.

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Disadvantages

1. Need to follow the standard strictly. if not, the result May not work properly.

2. Water still be able to penetrate if Capillary void too big.

3. If the percentage of Cement too high, it'll create crack. Due to less flexibility (too brittle) Normally the optium percentage of cement shall be lesser than 7% by weight of dry soil.

4. It's not suitable for some type of soils.

5. The homogeneously mix is strictly concened,then this process need experienced supevisor or quality equipment to process.

6. Can not operate if moisture of soil above 10%.

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