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ROAD IMPROVEMENT THROUGH GEOTEXTILES FOR FUTURE DEVELOPMENT

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Abstract
Road improvement is a very necessary aspect as we aim to create better roads which are faster, safer and has a longer life. Soils are a natural substance and thus their properties vary greatly from place to place. Some soils are particularly weak like sand and some have other properties like swelling in presence of moisture. For any struture to provide adequate service througout its life the quality of soil plays a major role. Roads are a vital infrastructural resource which play a major role in the quality of life of people. Roads over weak soils get damaged quickly, for example roads in the himalayan region often get washed out due to combinaton of weather and poor lateritic soils. Road improvement and soil stabalization becoomes a vital tool to maintain roads in such a area to reduce any disruption caused by poor quality of roads. Road improvement is done by many methods which are discussed and focus is kept on geosynthetics as they are the likeliest candidate to have a solution for all types road improvement issues. Like, stabalisation of soil, providing seperation among layers, drainage, reinforcement etc. Installation of geosynthetics for seperation, stabilisation, and base reinforcement is done as part of the project to test the efficacy and versitility of the geosynhtetics.

Key Words: Road improvement, Soil Stabalization, Geosynthetics.

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1. INTRODUCTION

1.1 INTRODUCTION

As utilized as a part of this segment, street change implies the repair or potentially overhaul of existing streets. Street change is recognized from street upkeep by the nature and degree of the work. Street change incorporates changes to street arrangement, subgrade extending, huge repair/redesign of street surfacing, repair/substitution of stream intersections, repair/substitution of waste structures, and repair/expulsion of insecure material. Street support incorporates routine forming of the street surface, cleaning and upkeep of waste structures, spot treatment/repair of street surfaces, and vegetation control nearby streets.

Conditions commonly leading to a road improvement project:

- Road subgrades, alignments and/or surfacing need to be upgraded to meet current or future transportation needs.
- Fill slopes with old sidecast material are at risk of failure.
- Cut slopes show signs of failure
- Road fills are showing signs of failure
- Drainage structures are in need of repair, upgrading, or replacing.
- Stream crossings are in need of repair, upgrading, or replacing.
- Unsafe conditions in the transportation system must be repaired.
- Other unsatisfactory conditions are in need of repair.

Road improvement provides an opportunity to upgrade, improve, or repair a road that is substandard in one or more of its design elements. Improvements may include, but not be limited to, the following:

- Re-aligning the horizontal and/or vertical alignment of the road.
- Upgrading the size and/or number of culverts to current standards.

- Upgrading stream crossings to current fish passage standards.
- Installing additional cross drainage structures.
- Reshaping the roadbed and/or ditchline for improved surface drainage.
- Upgrading the road surface by adding new rock.
- Removing and/or stabilizing fill slopes that exhibit instability.
- Relocating sections of roads away from sensitive areas such as streams.
- Repair of washouts, fill or cut slope failures, and severe damage to road surfacing.

In general, stream crossings and unstable fill and cut slopes present the greatest challenge

to road improvement, and the greatest opportunities for future erosion prevention and rehabilitation.

2 METHEDOLOGY

Road improvement provides an opportunity to upgrade, improve, or repair a road that is substandard in one or more of its design elements. Road improvement strategies are the specific actions and standards that will lead to achieving the goals and objectives of this section of the manual. All of the strategies listed in the sections on Transportation Planning, Road Design and Road Construction apply to Road Improvement as well. To avoid redundancy those strategies will not be listed in this section. However, there are some additional strategies that apply to Road Improvement, which will be listed in this section.

2.1 Planning Road Improvement

Road change arranging will utilize the greater part of the methodologies recorded in the area on Transportation Planning. A key procedure from that segment is the inventory of the present state of the road framework. The inventory will incorporate data on: road surface seepage; road surfacing condition; stream crossing structures; avalanche dangers; and zones of the road framework that need moving up to meet present and future needs. The Forest

Road Hazard Inventory Protocol created as a major aspect of the Oregon Coastal Salmon Recovery Initiative gives a framework to social event quite a bit of this data. As said in the segment on Transportation Planning, a more complete road inventory framework will be created later on. Until the new inventory framework is set up, areas should accumulate supplemental data to proficiently and successfully get ready for road change venturesInformation from the road inventory can be used to help identify priorities for road improvement projects. Conditions identified in the inventory that will be considered a priority for repair include.

i. Stream Crossings/Fish Passage
ii. Sidecast Failures/ Slope Stability
iii. Water Quality/Sediment Delivery
iv. Current/Planned Uses of the Road
v. Design Road Improvement
vi. Road/Stream Crossing Restoration Guide.
vii. Construction Of Road Improvement Projects

2.2 Ground improvement techniques for road improvement

Transportation is one of the fields which play an important role in the development of a country. There are many means of transportation such as road, railway, airways etc... But the main mode of transportation is always road or highways.In the process of road development, the alignment of road may have to be fixed through the soils which may not bear the traffic loads .There are various techniques of ground improvement.

2.2.1 Methods for ground improvement

1. Soil stabilization
2. Vertical drains
3. Stabilization trenches
4. Capillary cut-off

5. Soil nailing
6. Vibro compaction
7. Dynamic compaction

2.3 Special idea for road improvement road improvement by Geotextile

Soil alone is strong enough in compression but comparatively weak in tension. Reinforcing soil is the technique where tensile elements are placed in the soil to improve stability and control deformation. The gotextiles are used as reinforcement, their prime role is to provide tensile strength to soil at strain level which is compatible with the performance of the soil structure. Textiles are used as reinforcement in the form of fibres, fabric form like woven, knitted, non wovens. Geosynthetics are used as reinforcement in paved roads, in railway tracks, embankment of shallow weak soils, earth retaining walls, mining subsidence protection etc.

2.3.1 History of Geotextile Applications

Materials were first connected to roadways in the times of the Pharaohs. Indeed, even they battled with precarious soils which rutted or washed away. They found that common strands, textures or vegetation enhanced road quality when blended with soils, especially flimsy soils. Just as of late, in any case, have materials been utilized and assessed for current road development. This reality sheet illuminates the perplexity over terms and meanings of geotextiles, and examines their basic roadway and disintegration control applications.

Fig 2.1 Geotextile-related materials.

2.3.2 Important Characteristics Of Geotextiles

The characteristics of geotextiles are broadly classified as:

i. Physical properties

ii. Mechanical properties

iii. Hydraulic properties

iv. Degradation properties

v. Endurance properties

2.3.3 Selection Of Fibre For Geotextiles

Different fibres from both natural as well as synthetic category can be used as geotextiles for various applications.

Natural fibres: Natural fibers in the form of paper strips, jute nets, wood shavings or wool mulch are being used as geotextiles. In certain soil reinforcement applications, geotextiles have to serve for more than 100 years. But bio-degradable natural geotextiles are deliberately manufactured to have relatively short period of life. They are generally used for prevention of soil erosion until vegetation can become properly established on the ground surface.

Synthetic Fibres: The four main synthetic polymers mostwidely used as the raw material for geotextiles are –polyester, polyamide, polyethylene and polypropylene.The oldest of these is polyethylene which was discoveredin 1931 by ICI. Another group of polymers with a longproduction history is the polyamide family, the first of which was discovered in 1935. The next oldest of the four main polymer families relevant to geotextile manufacture is polyester, which was announced in 1941. The most recent polymer family relevant to geotextiles to be developed was polypropylene, which was discovered in 1954.

2.3.4 Geotextiles and Their Application

Geotextiles made of materials are most ordinarily utilized. The cosmetics of these textures decides their best application, so it is critical to comprehend their qualities. Geotextiles can be created as a non-woven, a sewed, or a woven texture. We will concentrate on the non-woven and woven textures since weaved texture is infrequently utilized. Regardless of whether the texture is woven or non-woven is an imperative trademark in picking a geotextile for a specific utilize. The non-woven texture, which resembles a felt texture, is a course of action of filaments either arranged or arbitrarily designed in a sheet. Materials usually made of non-woven texture incorporate upholstered furniture covers and fabric insides of vehicles. These textures can be fabricated in an assortment of ways, holding filaments together utilizing substance, warm or mechanical procedures.

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Fig 2.2 Non-woven geotextile fabrics

Fig 2.3 Woven Textiles fabric

The mode of operation of a geotextile in any application is defined by six discrete functions: separation, filtration, drainage, reinforcement, sealing and protection. Depending on the application the geotextile performs one or more of these functions simultaneously.

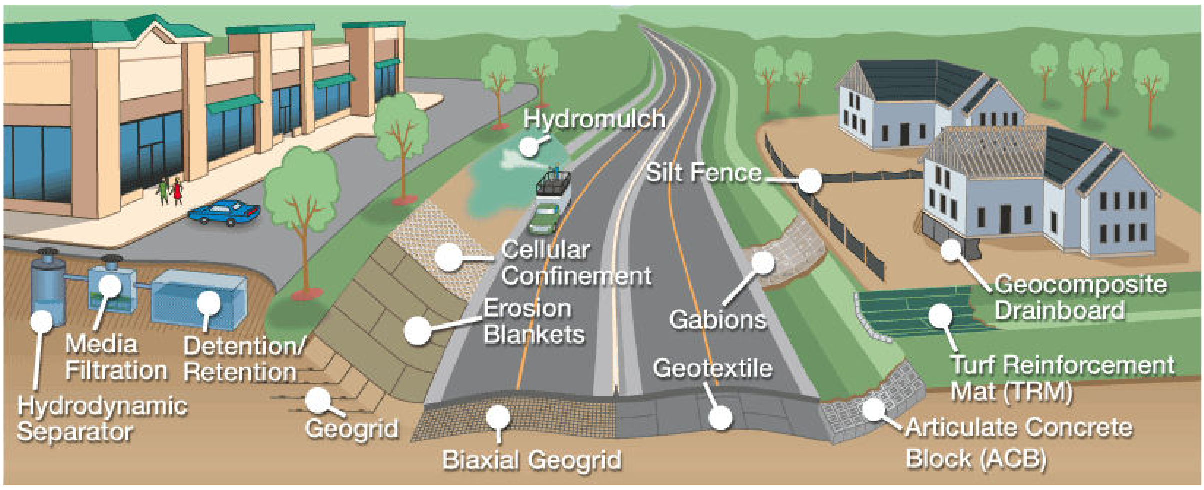

Fig 2.4 Application areas of Geotextiles

2.3.5 Geotextiles for Erosion Control

Geotextiles can be used many ways for erosion control. One of these is with riprap along stream banks, lake shores, and other bodies of water to keep finer soils beneath the riprap from eroding.(Figure 8). Geotextiles recommended for erosion control should have permeability, resistance to abrasion, and high resistance to ultraviolet rays as primary considerations.

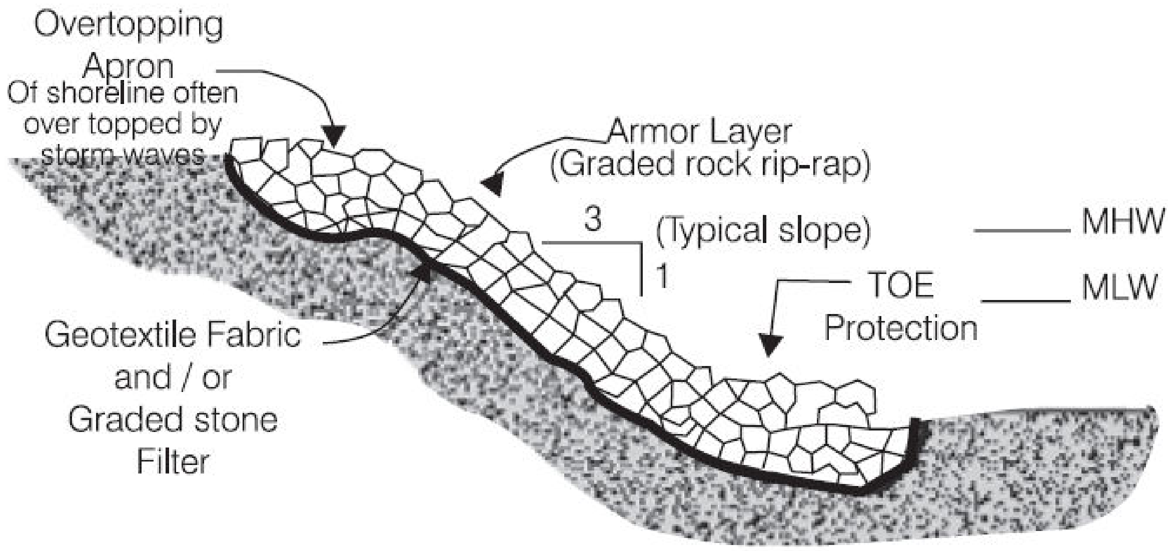

Fig 2.5 Typical erosion control system for lake shore, stream bank, culvert outfall or ditch protection

2.3.6 Use of Jute Geotextiles in Road Construction

The performance of pavements constructed on soft soils can be improved using jute geotextiles. Jute fabric when used as separator prevents the penetration of subgrade material into voids of granular base course. On the basis of settlement calculations, it was estimated that as much as 30 per cent of the fill sinks into the soft subsoil during construction itself, necessitating large quantities of costly fill material,thereby, pushing up the cost of construction. The problem was solved through the use of jute geotextiles. Monitoring of completed embankment i.e. both treated and control stretch showed better performance of road embankment constructed using jute geotextile. Vegetative turfing represents one of the most important corrective measures. In the case of freshly exposed cutting made for road construction, vegetative turfing is important, even as a preventive measure. In the case of

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deep-seated slides, however, vegetative turfing is only one of the techniques among available corrective measures and as such it can prove to be effective only when conjointly implemented with other corrective measures. Based on several field trials carried out by the Institute, the use of jute geogrid technique has been developed for treatment of erodible slopes as a part of landslide correction works.

Fig 2.6 Laying of Jute Geotextiles for ground improvement

Fig 2.7 Growth of vegetation on slopes covered with jute geotextiles

Fig 2.8 Laying of Jute geotxtileas Trench Drain

Fig 2.9 Condition of road stretch after Monsoon Rains

2.4 Installation of Geosynthetics for separation, stabilization and base reinforcement

2.4.1 Site Preparation

Clear and grade the installation area. Remove all sharp objects and large stones. Cut trees and shrubs flush with the subgrade. Removal of topsoil and vegetation mat is not necessary, but is recommended where practical.

2.4.2 Deployment of the Geosynthetic

Unroll the geosynthetic on the prepared subgrade in the direction of construction traffic. Hold the geosynthetic in place with pins, staples, fill material or rocks. Adjacent rolls should overlap in the direction of the construction. Depending on the strength of the subgrade, the overlaps may have to be sewn.

2.4.3 Placement Of The Aggregate

Place the aggregate over firm subgrades by back dumping aggregate onto the geosynthetic and then spreading it with a motor grader. For weaker subgrades, dump onto previously placed aggregate and then spread the aggregate onto the geosynthetic with a bulldozer. On weaker subgrades, a sufficient layer of aggregate must be maintained beneath all equipment while dumping and spreading to minimize the potential of localized subgrade failure.

2.5 Geosynthetics in roads and pavements

Subgrade Separation and Stabilization, Base Reinforcement, Overlay Stress Absorption and Reinforcement

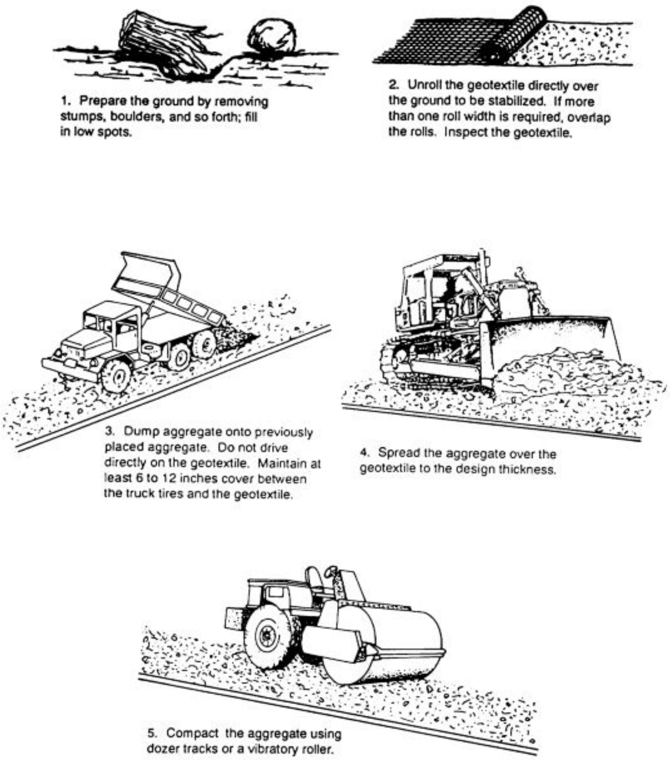

Fig 2.10 Geosynthetics in road development

Repair damaged geosynthetics immediately. Clear the damaged area and an additional three feet around it of all fill material. Cover the cleared area with a piece of the geosynthetic. The

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patch should extend at least three feet beyond the perimeter of damage. Replace the aggregate and compact to the specified density.

When constructing over weak subgrades, back-dumping of the aggregate is required Normal construction activities, including aggregate spreading and compaction are used. Caution should be used when selecting compaction equipment. When thin lifts are used, vibratory compaction is not recommended until a minimum 12-in (30 cm) compacted thickness is achieved. Use of such equipment may result in damage to the geosynthetic.

A surface treatment such as an asphalt layer or a double or triple-treatment can be placed once the base course is complete and structurally sound.

2.6 Geosynthetic testing and specifying

Most specifiers and users of geosynthetics establish required physical property values for the geosynthetics to be utilized in their project based on standard tests. This practice is common for most engineering materials and is certainly recommended for geosynthetics. National standards bodies, such as the AMERICASociety for Testing and Materials (ASTM) have established standard tests for geosynthetics. These standard tests can be used to compare specific properties of different geosynthetics.

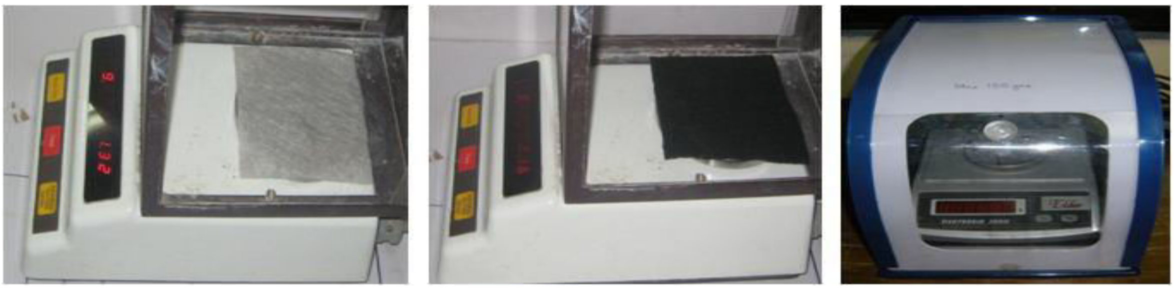

Figure 2.11 Unit mass measurement apparatus

Thickness (ASTM D5199)

- Geotextiles exhibit different thickness according to different pressures.
- The thickness is measured to an accuracy of 0.02 mm under a specified pressure of 2.0 kPa.
- Sample size is 200 mm □ 200 mm. The thickness is generally in the range of 0.25 to 8.5 mm.

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- The thickness of geogrids and geomembranes are measured under a normal stress of 20 kPa.

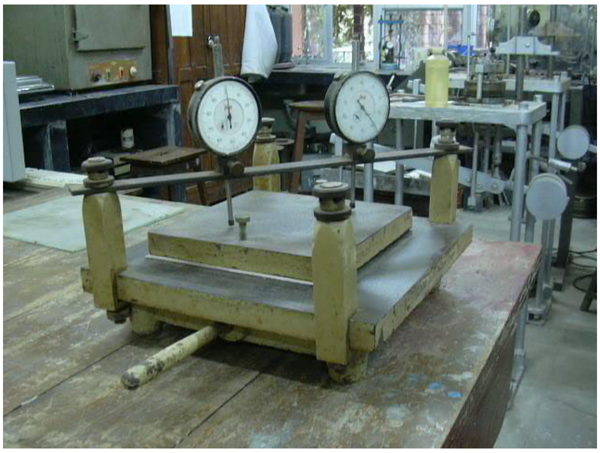

Fig 2.12 Thickness measurement apparatus

3. CONCLUSION

Soil stabilization is a very necessary process to build safer and durable structures. The above project has clearly shown the many ways the soil can be reinforced. Soil reinforcement is very vital in disaster management as we do not want lines of communication to be destroyed. Geo textiles are much easier, faster and safer than other methods of soil reinforcement and stabilization. Textiles are not only clothing the human body but also our mother land in order to protect her. The structural stability of the soil is greatly improved by the tensile strength of the geosynthetic material. Geotextiles like geonets, geogrids, geocomposites are functioning as separator, filter, drainage material, reinforcement, sealing & protection. The reinforcement acts to prevent lateral movement because of the lateral shear stress developed. Reinforcement provided by the geotextiles and geogrids allow embankment & roads to be built over very weak soils & allows for steeper embankments to be built. Therefore, the geotextiles are applied in paved roads, rail road embankment stabilization, erosion control, sport field construction.

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