Elements of Pavement Design by using Geo-Textile

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Abstract— In the recent emphasis on the development of road infrastructure in India basically cement concrete pavement are being constructed on several state of national highways. In this case pavement thickness are very high of life of road is not more, I have using geo pavement to reduce the total thickness of the pavement system. In this study a comprehensive life-cycle cost analysis of geo-textiles stabilized pavement including initial construction future maintenance rehabilitation & user costs is considered. The findings in this study are limited to the design feature unit costs performance models assumed in this analysis.

Key words: Geo-Textiles, Granular Materials, Groundwater Inflow, Failure Criteria, Edge Drain

I. INTRODUCTION

Geo-textiles are synthetic fabrics made out of nylon, polyester polypropylene or polyethylene which aid to drainage problem in highway. Geotextiles serve as a substitute to fine aggregate filter. They can also be effectively used for promoting vegetative turning. Geo-textiles in bringing about separation between the soil sub grade the granular layer & thereby preventing intrusion of the soil into the stone matrix is becoming popular. Geo-grids which are available in a range of thicknesses of the mesh & opening sizes, achieve the reinforcing action more effectively. The Geo-textile brings about rapid drainage of water within the pavement thus preventing any flooding of the pavement.

II. METHODOLOGY

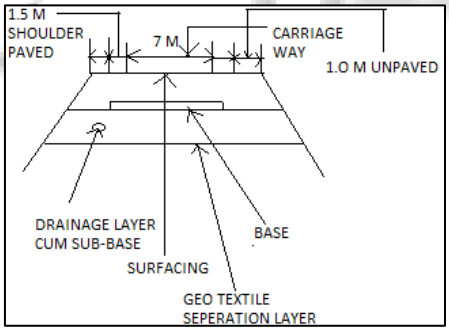

Fig. 1: Methodology

A. Function of Geo-textile

Geo-textiles perform one or more basic function filtration, drainage separation erosion control, sediment control, and reinforcement & moisture barrier.

B. Filtration

A filtration medium, the fabric of a proper aperture size can prevent the loss of particles of size layer than the aperture. For this purpose, the equivalent opening size of the fabric should be less than D_{85} of the soil. ($D_{85}$is the 85percent size 85 percent being less than this size.)

C. Drainage

The geo-textile brings about rapid drainage of water within the pavement thus preventing any flooding of the pavement. The need for draining the water that enters the pavement layers away from the sub-grade is now recognized as a standard practice of pavement design. A sketch showing a drainage layer is given in fig (1) the drainage layer extends over the full width of the embankment. The drainage layer must permit the drainage of the water & hence it must be sufficiently open graded.

D. Separation

Separation is prevent their mixing under the influence of water into two parts (a) filtering (b) reinforcement.

1) Filtering

For example if a base course of stone aggregate is laid on a sub-grade layer of expansive soil the latter can work up into the interstices of the former thus impairing its strength. If a geo-textile layer is interposed in bet^n physical separation is ensured.

2) Reinforcement

The reinforcing layer the fabric increases the tensile strength of the soil fabric system. This permit greater load on weak soil thus resulting in economy in pavement construction.

E. Erosion Control

In erosion control the geo-textile protects soil surfaces from the tractive forces of moving water or wind & rainfall erosion. The geo-textile is placed in the ditch & is secured in place by stakes or is covered with rock or gravel to secure the geo-textile shield it from ultraviolet light & dissipate the energy of the flowing water. The geo-textile is anchored to the slope holding the soil & seed in place until the seeds germinate & vegetative cover is established.

F. Sediment Control

After some period of time particles accumulate against the geo-textiles reducing the flow of fluid & increasing the presser against the geo-textile. The sediment control function is actually a filtration function.

G. Moisture Barrier

Both woven & nonwoven geo-textile can serve as moisture barriers. This prevents the tensile strength must be developed at sufficient & retaining structure a woven geo-textile is recommend because it can provide high strength at small strains. Small strain to prevent excessive movement of the reinforce structure. Small strain to prevent excessive movement of the reinforced structure. This function plays an important role in the use of geo-textile .in paving over lay system. In an AC pavement system the geo-textile provides a stress relieving inter layer between the exiting pavement structure it acts as a filter to allow water but not find material to pass through it.

H. Laboratory Evaluation

- Weight: Ten samples each 250mmx250mm are taken from the fabric and then mean and standard deviation calculated.
- Thickness: The instrument must be capable 10mm to an accuracy of at least 0.002mm

- Tensile strength: The wide width symbol strips of 50mm and 200mm were evaluated for their strength characteristics on CRE tester.
- Tear strength testing: This test method determines the tear propagation characteristics of the fabric and strength required. This test method covers the measurement of the tearing strength of textile fabrics by the tongue (single rip) procedure using a CRE-type tensile testing machine. This test measures peak force, tearing force, and tearing strength.

1) How This Test Works

Rectangular specimens are place into the CRE tester. One side of the cut end is clamped into the upper jaw and the other is clamped into the lower jaw. The jaws move apart at a constant rate until the fabric begins to tear. Depending on the nature of the specimen, the tearing force will be shown as a peak or a series of peaks. The highest peaks appear to reflect the strength of the yarns, fiber bonds, or fiber interlocks (individually or in combination) needed to continue a tear.

I. Drainage Application

1) Water Control

Control of water is critical to the performance of building, pavement, embankment, retaining walls & other structures. Geo-textile have been used to toe drains of embankments where they are easily accessible if maintains is required & where function can be detected.

2) Granular Drain Performance

Proper performance in granular drains the designer requires drain materials to meet grain size requirement based on grain size of the surrounding soil. The two principal granular filter criteria piping & permeability have been developed empirically through project experience & laboratory testing.

Retention or pumping resistance criteria:-

1) For fine grained soils with more than 50% passing through a no 200 sieve.

Woven AOS≤/D_{85}

AOS-apparent opening size

NONWOVEN AOS≤/85 D_{85}

AOS≥ NO 50 sieve or opening smaller than 0.297mm

2) For granular materials with 50% or less passing through a no 200 sieve AOS≤BxD_{85}

In which B=1 When cu≤2 or ≥8, b=0.5 cu

When 2 ≤cu ≤4 B=8/cu

When 4 < cu <8 & cu is the co-efficient of uniformity= D_{60}/D_{10}

3) When the protected soil contain particles from in (25.4mm) to those passing through a no 200 sieve only the portion passing through a no. A sieve should be used to determine the grain size.

J. Permeability Criteria

The results give the permittivity of the fabric, which must be multiplied by the thickness of the fabric to obtain its permeability. To reduce hydraulic head loss in the filter $ increase drainage efficiency the fabric must be more permeable than the adjacent soil.

- K (fabric ≥k (Soil)
- Clogging criteria
- Woven percent open area ≥ 4%
- Nonwoven porosity ≥ 30%

K. Application of Geo Textile

Geo textiles for subsurface drainage may be used as an envelope of trench drains a wrapping of pipe drain or a filter of drainage layers. Fig shows the various uses of geo textiles for pavement sub-drainage.

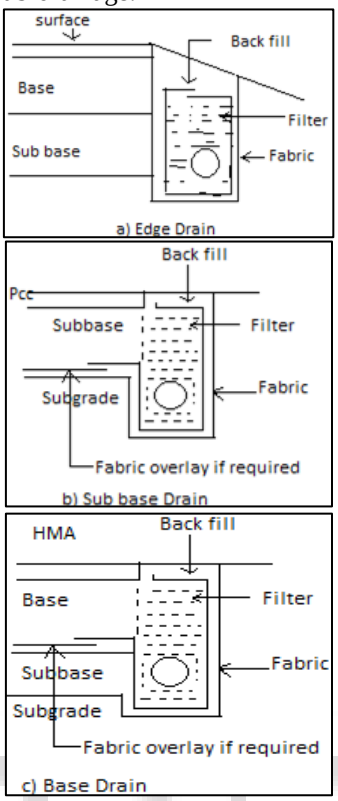

Fig. 2: Application of Geo Textile

III. Discussion

In many cases, while state highway Engineers conduct a LCCA the user cost components are usually excluded from LCCA. This exclusion has resulted in total cost underestimation. In this study, three work zone induce user cost components are considered, delay, fuel consumption & accident cost in terms of the work zone induced user costs, user delay costs usually occupy the highest proportion among the three user cost components. User delay costs are mainly affected by the amount of traffic on the roadway. As a result roadways with higher traffic volumes will have higher user delay costs.

IV. Conclusion

Drainage is one of the most important factors in pavement design. Although highway engineers have long paid much attention to surface & ground water drainage very little has been done to provide drainage for surface infiltrations through joints & cracks & porosity for the melt water from ice lenses. Geo-textiles have been used in pavement to either extend the service life of the pavement or to reduce the total thickness of the pavement system. However the economic benefits of using this material are still not clear. In general, most of the geo-textile related life cycle cost analysis of geo-textile stabilized pavement, including initial construction, future maintenance, and rehabilitation & user costs is considered.

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Even a burning desire can't be sustained in the absence of a proper infrastructure. One has to have a direction to proceed in a correct path to follow. I attempt to thank all those people who have helped me in this small endeavor.

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