QUANTIFYING THE BENEFITS FOR USING GEOSYNTHETICS IN UNBOUND BASE COURSE OF PAVEMENTS IN HIGH PI CLAYS

By: Ranjiv Gupta[1] and J. G. Zornberg, Advisor[2]

ABSTRACT

Flexible pavements over high plasticity index (PI) clays (soils which expand and shrink due to moisture change) in Texas has shown excessive and premature cracking even under low traffic loads. The methods used to stabilize the subgrade over such sensitive soils have been lime stabilization and geogrids. But there is an absence of accepted design methodology to do the same. The present study aims at constructing field test sections on actual pavements with and without geogrids having lime stabilization. This would help to collect quantitative performance data on the lime stabilized and geogrid reinforced pavement sections. Further, a series of geosynthetic products from various geosynthetic manufacturers will be used. This would help to compare performance of various products and evaluate the geogrid material properties leading to a suitable design methodology.

INTRODUCTION

The volumetric changes occurring in high PI clays have caused early cracking of flexible pavements in Texas. Previous studies have recommended use of lime stabilization and geosynthetics to stabilize the subgrade layer of such pavements. Lime stabilization reduces the swell potential of soil thereby preventing pavement failure. On the other hand, geosynthetics (geogrids) have been used in such pavements as the base aggregate reinforcement materials. They increase the structural or load-carrying capacity of a pavement system by providing lateral confinement to the subgrade. This improved pavement performance by the use of geosynthetics is well recognized but the parameters that contribute to such improvement are still unclear. The present work aims at determining the properties of geogrids used in unbound bases of pavements and developing material specifications for their use by practicing engineers. For this various field test sections on actual pavements with and without geogrid would be constructed. This will lead to quantification of the benefits obtained by using geogrids, and comparing the cost and performance with conventional technique of lime stabilization.

MOTIVATION

The overall goal of the proposed research includes:

- Identification of suitable technique to prevent cracking in pavements
- Evaluating parameters contributing to improvement in pavement performance in terms of
  - geogrid material properties
  - pavement characteristics
- Establishing the appropriate material specifications and methodology for design of pavement sections using geogrids

[1] PhD Student, Civil Eng. Dept., University of Texas at Austin, ranjiv@mail.utexas.edu
[2] Professor, Civil Eng. Dept., University of Texas at Austin, zornberg@mail.utexas.edu

MATERIALS

"Geosynthetics are defined as the planar products manufactured from polymeric material, which are used with soil, rock or other geotechnical engineering related material as an integral part of a man-made project structure or system" (ASTM, 1995). Geogrids constitute a category of geosynthetics designed preliminary to fulfill a reinforcement function. They have a uniformly distributed array of apertures between their longitudinal and transverse elements. The apertures allow direct contact between the geogrid and the backfill soil, thereby providing lateral restraint or confinement to the subgrade. Figure 1 shows a typical geogrid section.

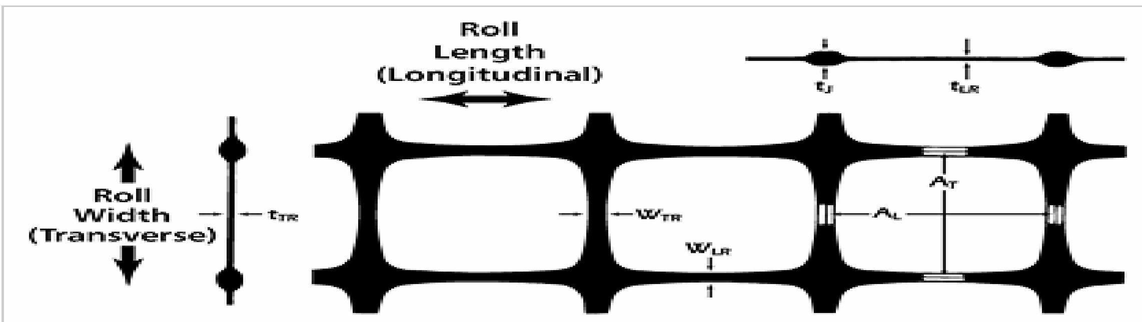

Fig. 1 Typical geogrid section (TENSAR manufactured geogrid)

FIELD TEST SECTIONS

The test sections would be constructed on actual pavement consisting of layers of geosynthetic reinforcement. Further a control section having no reinforcement would also be constructed. This would lead to identification of sections with and without geosynthetics that have shown poor and good performance with repeated traffic loading over a given time period. Fig.2 shows a typical field sections consisting a geogrid and no geogrid reinforced pavement.

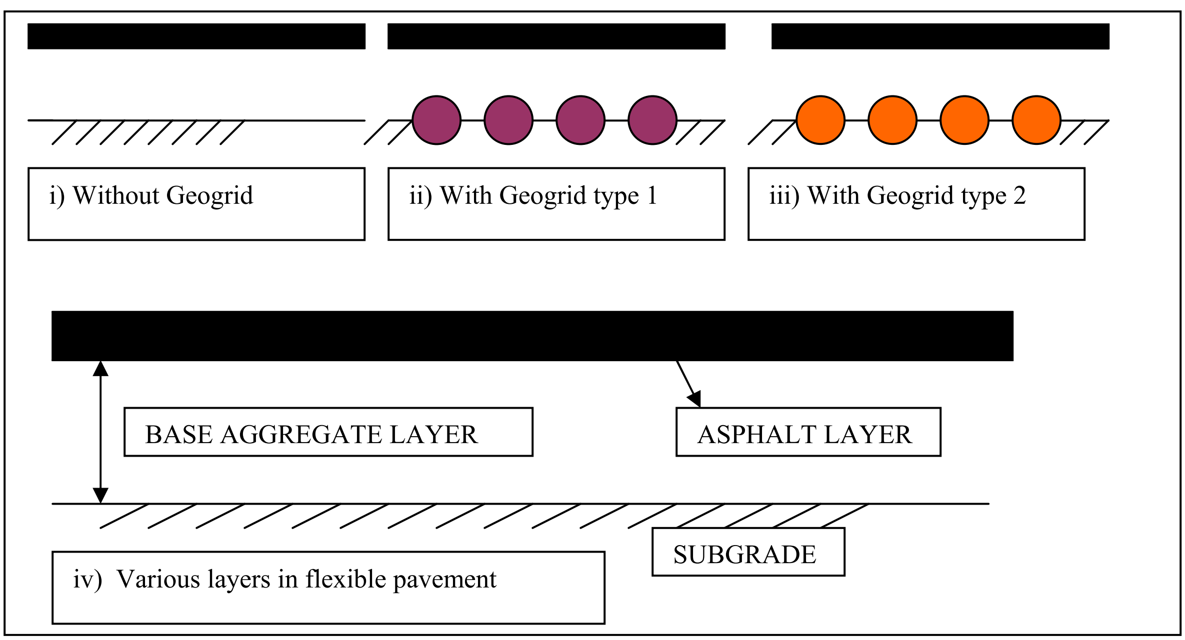

Fig.2. Typical Geogrid reinforced pavement test section

CURRENT WORK

As part of the preliminary investigation, first series of test were conducted on a farm to market road. Non destructive testing techniques i.e., Rolling Dynamic Deflectometer (RDD) and Falling Weight Deflectometer (FWD) for pavement testing were adopted. The objective of the field testing was to asses the condition of pavement before constructing the test sections. Fig. 3 shows RDD and FWD machines in operation during pavement testing.

Fig 3: RDD and FWD testing done at pavement on a Farm to Market Road

RESULTS AND ANALYSIS

FWD testing helped in calculating the subgrade modulus of the pavement whereas RDD testing gave a continuous deflection profile of the pavement to be compared with the later test sections. Fig. 4 shows a typical deflection profile given by RDD and subgrade modulus evaluated by FWD using EVERCALC program.

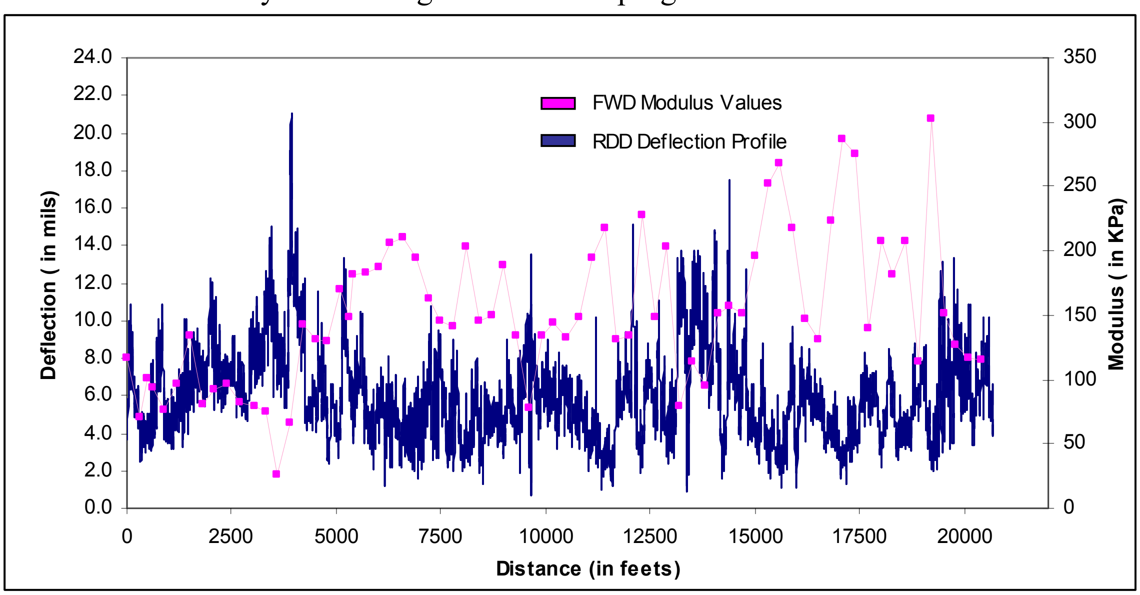

Fig.4 RDD deflection profile and subgrade modulus values by FWD for given pavement section before construction of test sections

The results have shown presence of varying subgrade modulus throughout the pavement cross section. The values of high deflection given by RDD were in close agreement with lower subgrade modulus values by FWD (the weak subgrade would show higher deflection and lower modulus value). Based on the above investigation the test section would be constructed such that each material lies in a similar deflection profile region. This would help in better evaluation of the various materials and quantify the degree of improvement over relatively weak and strong subgrade. Further test would be conducted immediately after the construction of the test section and at regular time intervals to monitor the behavior of pavement under traffic conditions and seasonal variation.

CONCLUSION

The varying deflection profile given by RDD has helped to distinguish the weak and strong subgrade. These details could not be captured by regular discrete point testing method like FWD as they assume uniform subgrade properties between two testing points. Further the effect of geogrids can now be better evaluated as it can be compared on the basis of relative improvement over weak and strong subgrade.

REFERENCE

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