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# A Stabilization of Subgrade Using Geo-synthetic Material

[1]Navjot Singh Rajput, [2]Er.Brahamjeet Singh, [3]Dr.Sandeep Singla

*[1]M.Tech. Scholar, Civil Engg. Deptt. RIMT University Punjab*
*[2,3] Professor, Civil Engg. Deptt. RIMT University Punjab*

***ABSTRACT:***
***Soil stabilization is a process of treating soil to maintain or improve the performance of the soil as a construction material and most importantly to minimize the cost of earthworks. Numerous methods are available in literature for soil stabilization. Geo-synthetics are preferred in the pavement foundation layers just for the separation, lateral drainage, filtration and other purposes. The processes by which the geo-synthetics provide reinforcement when placed at the sub-base and sub-grade interface include the lateral confinement of sub-base material and there is an increase in the bearing capacity. The increase in the bearing capacity, permeability is very useful in reducing the settlement of the soil at the site. The increase in the urbanization has led to the scarcity of lands as a result roads and buildings are constructed over soils with low bearing capacity. The good flow of road depends on the property of subgrade. This paper thus focuses on the effect of stabilizing locally available soil with various types of geo-synthetics. This paper explores to investigate about the stabilization of the subgrade by using the geo-synthetics like geo-textiles, geo-grids etc to evaluate the strength of the poor soil by conducting standard proctor compaction tests, OMC tests and CBR tests***

***KEY WORDS: Stabilization, CBR Test, OMC, Geo-grid, Geo-synthetic***

## INTRODUCTION:

Roads are an integral lifelines of the economy making possible trade and commerce. Roads are the most preferred modes of transportation among all. The performance of the pavement depends on the quality of the material used in the road construction. Subgrade is the in-situ material upon which the pavement structure is placed and developed. When the soil on the project site cannot support the masses, ground improvement techniques are implied to increase the strength and enhance the performance of the underneath applied loadings in order to get stability. Engineers are trying their best to develop and maintain the pavement infrastructure by increasing the bearing capacity of the soil and by proper designing the subgrade. The different practices includes the various types of geo-textiles, geo-nets, geo-grids, geo-composite ete. Geo-synthesis have proven to be the most versatile and cost effective ground modification material. The use of the Geo-synthesis expanded rapidly in the civil engineering area, geo-technical, environmental, coastal and hydraulic areas.
A geo-grid refers to the geo-synthetics material consisting of connected parallel sets of tensile ribs with sufficient size to allow strike through surrounding soil, stone or other geotechnical material. The high tensile strength and stiffness of geo-grids make them effective.

## 1. GEO-SYNTHIC:

Geo-synthetics are used in the pavement foundation layeres for separation, filtration, lateral drainage and reinforcement perposes (Berg et al. 2000). The processes by which geosynthetics provide reinforcement, when placed at the sub-base and sub-grade interface at the site work, which finally results in the increase in bearing capacity effectively.

### Types:

The various types of geo-synthetics are given as under:
1. Geotextiles (GT)
2. Geo-grids (GT)
3. Geo-nets (GN)
4. Geo-pipe (GP)
5. Geo-composite (GC)

### Various applicatios of the geo-synthetics are:

The main applications are given as under:

**In first application**: In this application, the construction of unpaved road over soft subsoil has been popular and at the small rut depth the strain in geo-synthetics is also small and geo-synthetic acts primarily as a separator between the soft subgrade and aggregates.

**In second application**: In this application, an addition of appropriate geo-synthetics, the soil geo-synthetic aggregate system gains stiffness. The SGA system is able to provide the following structural benefits:

1. It improves vertical stress distribution on the subgrade and prevents the lateral spreading of the base.
2. It also reduces the shear stress in the subgrade and takes care of it.

The increase in confinement and thus, the stiffness of base in the rest applications of geo-synthetics also improves.

## LITERATURE REVIEW:

**1. Chaudhary et al. (2012):** To find out the insertion of a single layer of reinforcement within the expensive soil, subgrade controls the swelling significantly. The CBR values of soil increases when a single layer of reinforcement is placed horizontally within the soil.
The CBR value of the soil increases when a single layer of reinforcement is placed horizontally and It is also known that the geo-textile offers better reinforcing efficiency as compared to the geo-grid and can be used for low cost road projects in rural areas.

**2. Stalin et al.(2010)** find out, reinforced benefits of geo-grid at different depth from the top of specimen i.e, CBR values for soaked and un- soaked CBR and the important findings of this research are summarized as :
The CBR of a soil increases when it is reinforced with a single layer of geo-grid. In case of un-soaked, CBR value is increased from 6.5% for virgin soil to 15.05% when geo-grid is is placed at 0.2H and in case of soaked, CBR values increases from 2.9% to 9.4% for geo-grid position at 0.2%.

**3. Shanker et al. (2004)** have reported a similar study on coir fiber stabilized lateritic soil and it was observed that in the lateritic soils, CBR value increases up to 10% by volume of coir fibers added. The maximum value of the CBR is attained at the specific fibers content corresponding to the specific optimum moisture content attained by the soil-coir matrix.

**4. Kumar et al,** find out that the CBR of a soil increases up to nearly three times (CBR value 8.8%) whe it is reinforced with a single layer of geo-grid.
Kumar et al, find out that the CBR of a soil increases up to nearly three times (CBR value 8.8%), when it is reinforced with a single layer of geo-grid. The amount of the improvements depends upon the soil and position of geo-grids. CBR value of the soil increases with the increase in the number of reinforcing layers. The value of CBR can also increase by providing two or more geo grids**.**

**Experimental Study:**

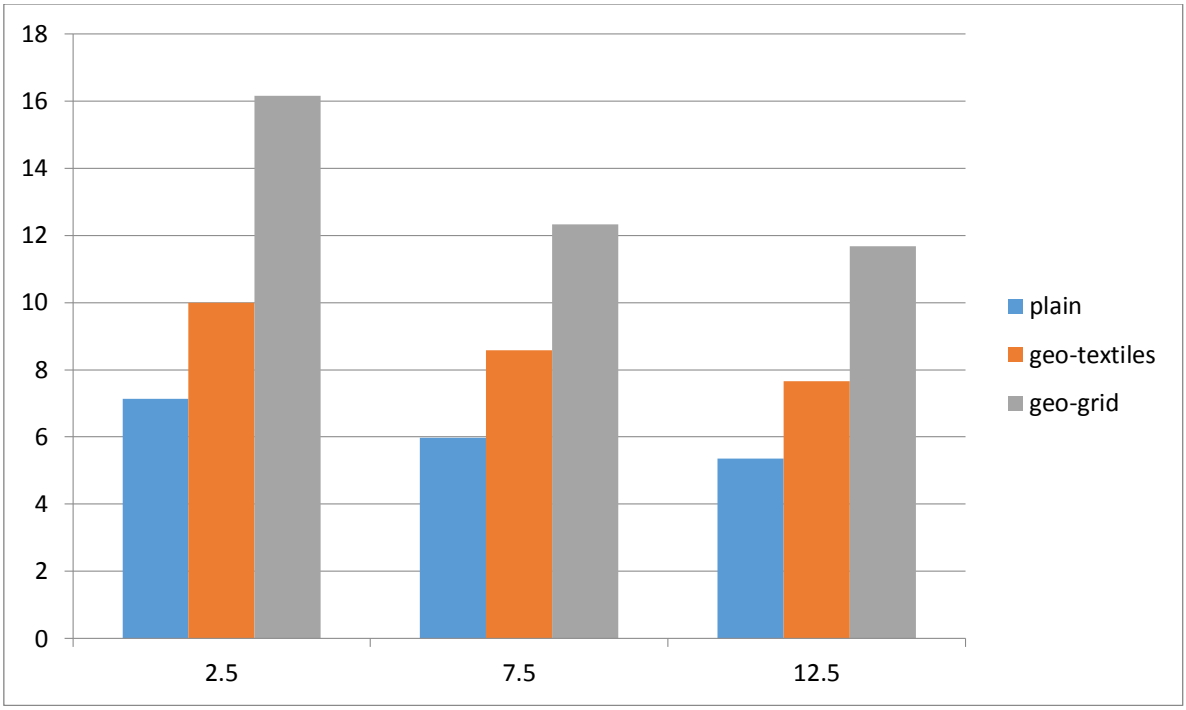
**Soils used in the project:**
Some major kinds of soil are given as under:
1. Black cotton soil- marshy regions, dried up to river or lake beds etc.
2. Marine clay- river delta, high rainfall zone, d/s of erosion prone areas.
3. Red laterite soil- plateaus, boulder regions.
4. Granular soil –desert regions, coastal areas etc.

**Collection and storing of samples:**
1. Black cotton soil is collected from Narsapur Medak.
2. Marine clay is collected from Maisammaguda.
3. Red laterite soil is collected from laboratory premises where a work for gardening is under-going. This soil is broken down to make it free from lumps and all the non-required waste was carefully picked out and cleaned.
4. Granular soil was collected from Bahadhurpally.

**1. Black cotton soil (CBR test) OMC-25% MAX. dry density :1.56x103 kg/m3**

**Table 1 CBR Test for (BCS)**

| PENETRATION MM | CBR (Plain soil) | CBR (Geo-textiles) | CBR (Geo-grids) |
|---|---|---|---|
| 2.5 | 7.136 | 9.996 | 16.153 |
| 7.5 | 5.983 | 8.574 | 12.329 |
| 12.5 | 5.361 | 7.662 | 11.674 |

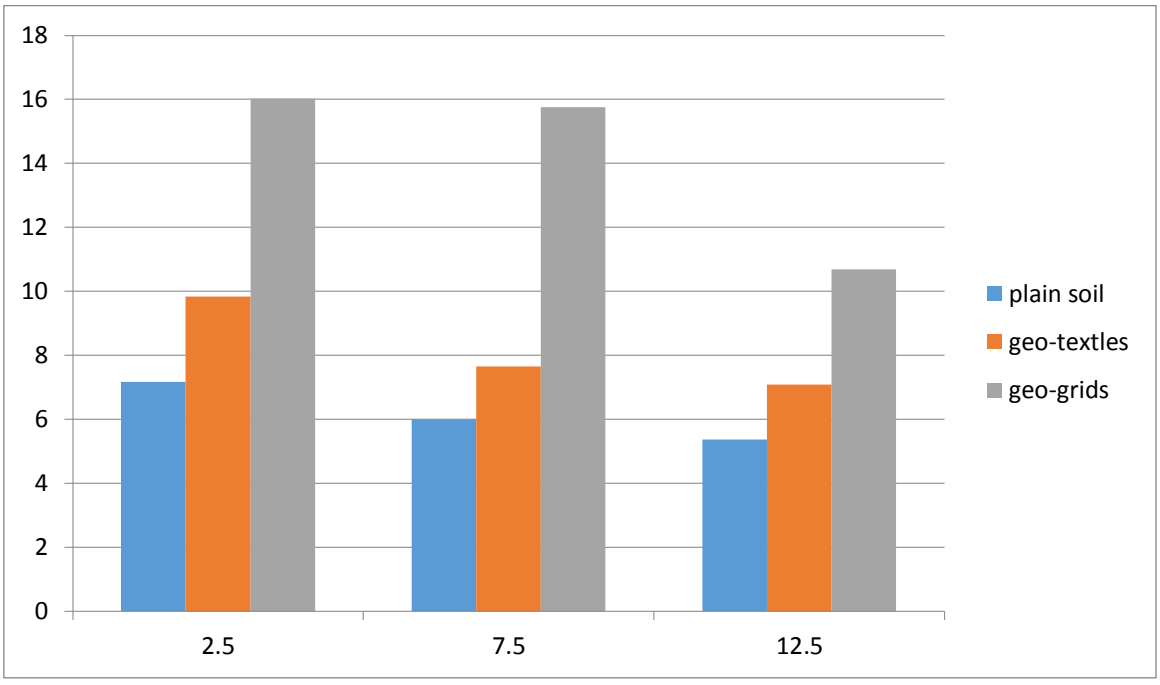



**GRAPH 1 (CBR for BCS)**

**2. Marine clay: OMC-25%**

**Table 2 (CBR Test for MC)**

| PENETRATION MM | CBR (Plain soil) | CBR (Geo-textiles) | CBR (Geo-grids) |
|---|---|---|---|
| 2.5 | 7.172 | 9.835 | 16.026 |
| 7..5 | 5.996 | 7.645 | 15.764 |
| 12.5 | 5.368 | 7.085 | 10.683 |

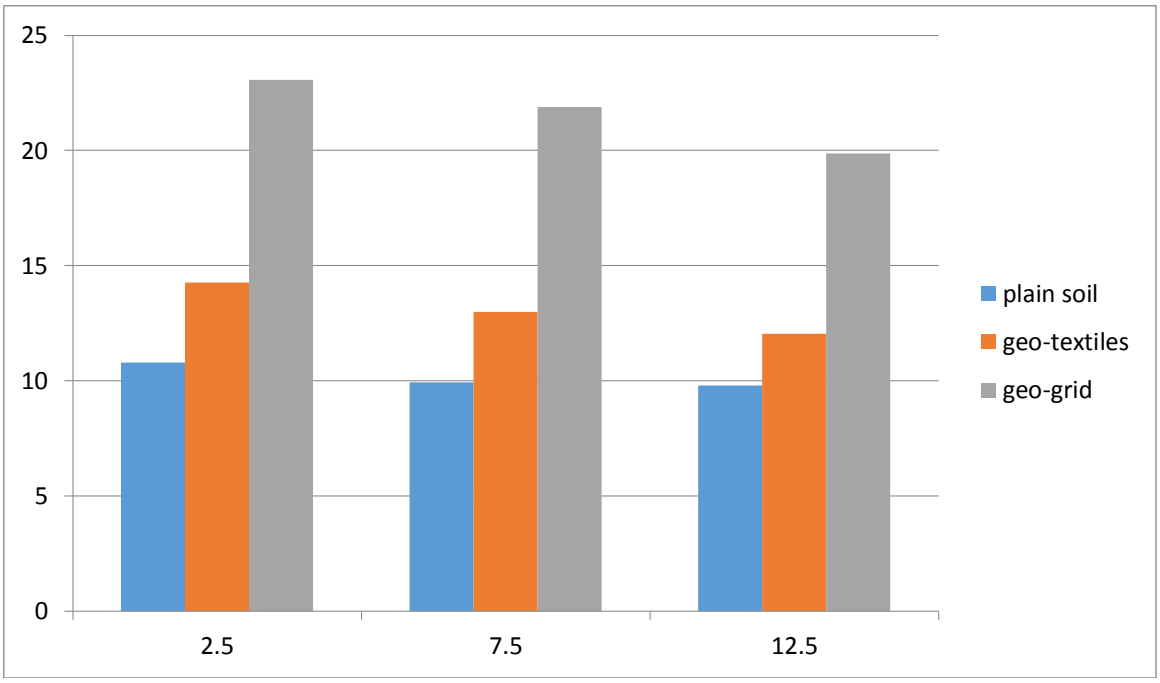



**GRAPH 2 ( CBR FOR MC)**

**3. Red laterite soil. OMC-25%**

**Table 3 (CBR Test for RLS)**

| PENETRATION MM | CBR (Plain soil) | CBR Geo-textiles | CBR Geo-grids |
|---|---|---|---|
| 2.5 | 10.796 | 14.254 | 23.064 |
| 7.5 | 9.932 | 12.999 | 21.881 |
| 12.5 | 9.783 | 12.038 | 19.869 |

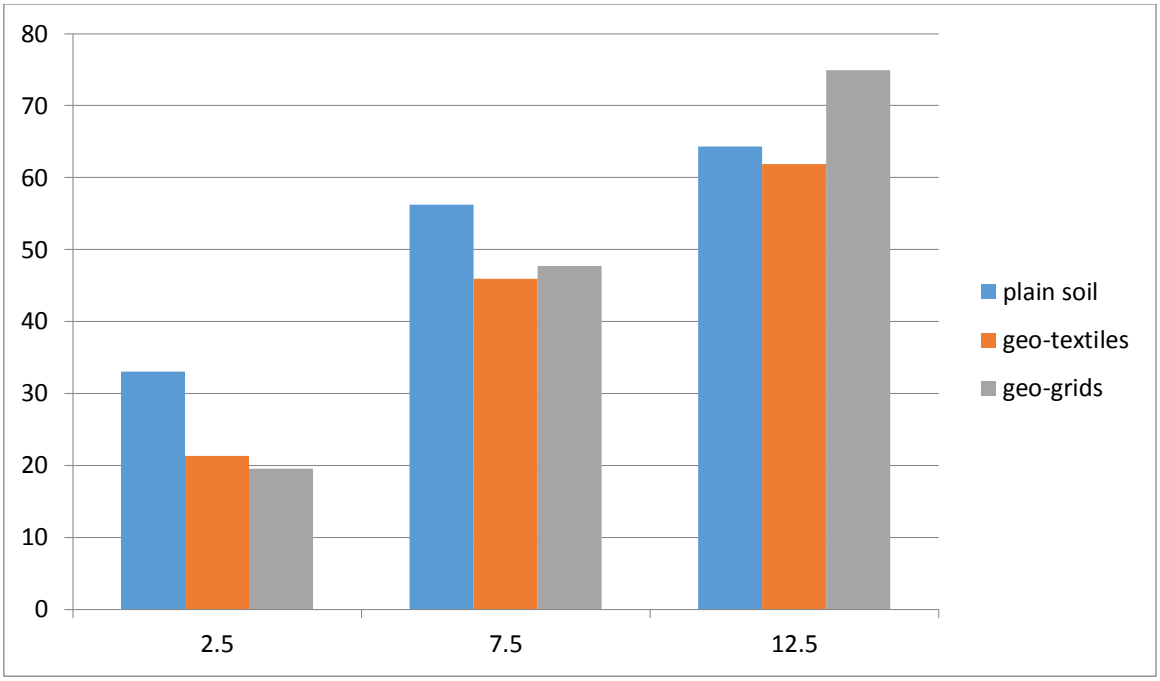



**GRAPH 3 (CBR FOR RLS)**

**4. Granular soil: OMC-25%**

**Table 4 (CBR FOR GS)**

| PENETRATION MM | CBR (Plain soil) | CBR (Geo-textiles) | CBR (Geo-grids) |
|---|---|---|---|
| 2.5 | 33.056 | 21.352 | 19.520 |
| 7.5 | 56.238 | 45.969 | 47.689 |
| 12.5 | 64.354 | 61.876 | 74.936 |




**GRAPH 4 (CBR FOR GS)**

## CONCLUSION:

Granular soil has shown improvement in the CBR values for geo-grids and has nearly doubled for the penetrations of 2.5 mm and 7.5mm for geo-grids, this implies that the application of geo-grids for the pavement in case of granular soil can reduce the thickness of the layer by almost half of the original depth as the granular soil have shown higher values of CBR. Black cotton soil had tripled its strength when the geo-grids 40x40 were used for the reinforcement of soil. All the three clayey soils i.e. red laterite, marine and black cotton soil have positively responded to the geo-textile in the contradiction with the sandy soils.

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