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A STUDY ON IMPROVING THE LATERAL RESISTANCE OF A RACE TRACK USING VARIED INCLINATION OF GEO-GRID PATTERNS

RUBESH M[1], SHAKESPEARE S[2], SOLOMON R[3], SASIREKHA T[4], VAITHIYANATHAN G[5]

[1,2,3,4] *Students, Department of Civil Engineering, SRM Valliammai Engineering College, Chengalpattu, Tamilnadu*
[5]*Assistant Professor, Department of Civil Engineering, SRM Valliammai Engineering College, Chengalpattu, Tamilnadu*

Abstract - *A racetrack is a facility built for racing of vehicles, unlike other roads these tracks should be laid with extra care and safety, because it involves vehicles operating at its full power, on the tracks. Hence the construction of a race track by conventional method is not so economical thereby introducing geo-grids can increase the strength, especially the lateral resistance and thereby reduce the cost of construction. The lateral resistance of the pavement should be high at the horizontal curves, hence introducing an inclined geo-grids at the curves might improve the life of pavement, Our project statement is that the placement of geogrid in the roads in a designed manner (inclined patterns), might improve the lateral stability of the roads, and it's done by resisting the actual direction of vehicle load, thereby laterally restraining the displacement of the pavement further achieving the stability in required manner.*

Key Words: *Race track, Geogrid, designed manner, lateral restraining, Stability.*

1.INTRODUCTION

A pavement is a structure consisting of superimposed layers of processed materials above the natural soil sub-grade, whose primary function is to distribute the applied vehicle loads to the sub-grade. The pavement structure should be able to provide a surface of acceptable riding quality, adequate skid resistance, favourable light reflecting characteristics, and low noise pollution. The ultimate aim is to ensure that the transmitted stresses due to wheel load are sufficiently reduced, so that they will not exceed bearing capacity of the sub-grade. Two types of pavements are generally recognized as serving this purpose, namely flexible pavements and rigid pavements.

Philosophy of Pavements

- Pavements are alive structures
- They are subjected to moving traffic loads that are repetitive in nature
- Each traffic load repetition causes a certain amount of damage to the pavement structure that gradually accumulates over time and eventually leads to the pavement failure. Thus, pavements are designed to perform for a certain life span before reaching an unacceptable degree of deterioration. In other words, pavements are designed to fail. Hence, they have a certain design life.

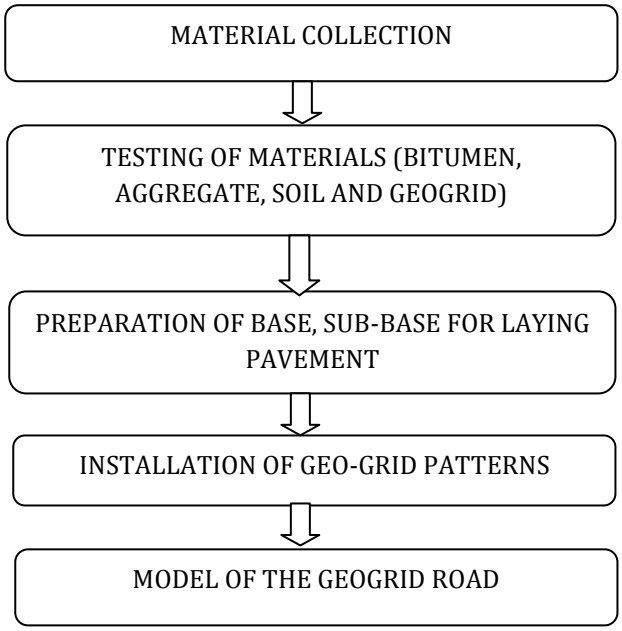
2. NEED FOR STUDY

To Reduction in pavement repair works in racetracks and also, to examine Improved lateral resistance property improves the power of the vehicle and thereby Reduce the thickness of pavement, reduce the cost of road construction.

3. OBJECTIVE OF THE STUDY

- To study the performance of suitable Geo-grids for enhancement of lateral resistance.
- To develop a strategy in placing the geo-grid in an inclined manner.
- Increase the service life of road.

4. METHODLOGY



5. GEOGRID

A geogrid is geosynthetic material used to reinforce soils and similar materials. Geogrids are commonly used to reinforce retaining walls, as well as subbases or subsoils below roads or structures. Soils pull apart under tension. Compared to soil, geogrids are strong in tension. The high demand and application of Geogrids in construction are due

to the fact that it is good in tension and has a higher ability to distribute load across a large area. The geosynthetic material, geogrids, are polymeric products which are formed by means of intersecting grids. The polymeric materials like polyester, high-density polyethylene and polypropylene are the main composition of geogrids. These grids are formed by material ribs that are intersected by their manufacture in two directions: one in the machine direction (md), which is conducted in the direction of the manufacturing process. The other direction will be perpendicular to the machine direction ribs, which are called as the cross-machine direction (CMD).

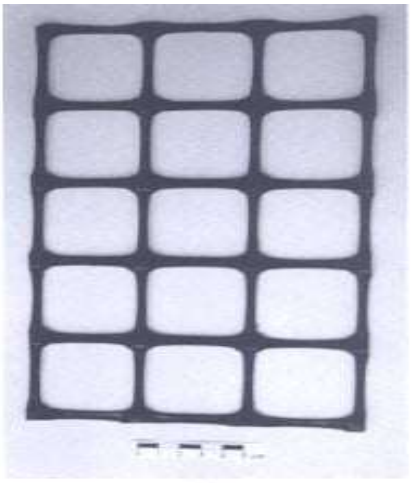


Fig 5.1- Biaxial geogrid

6. PRELIMINARY TEST ON MATERIALS

In this chapter the required preliminary test was conducted on the following materials and the results are discussed.

- Bitumen
- Aggregates
- Soil

6.1 Test on bitumen

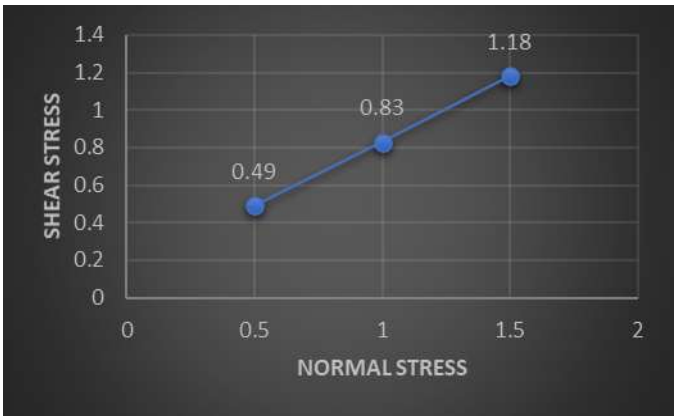
S.no	Test Name	Test Value
1	Penetration Test	58 mm
2	Ductility Test	73 cm
3	Softening point test	65°C
4	Specific gravity test	0.99

6.2 Test on aggregate

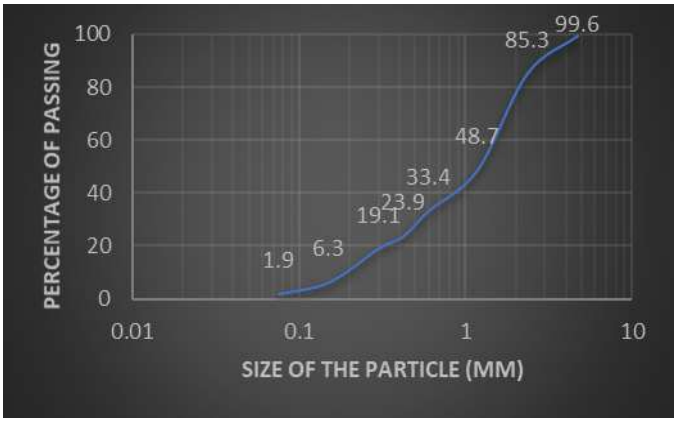
S.no	Test Name	Test Value
1	Impact Test	24.35%.
2	Crushing Strength test	8.3%
3	Abrasion Test	11.4%
4	Specific gravity test	2.57
5	Shape test (Elongation index)	39.13%

6.3 Soil test

S.no	Test Name	Test Value
1	Direct shear Test	From graph
2	Particle size distribution	From graph
3	Specific gravity test	2.512
4	Permeability test	0.0165 cm/sec



Graph 6.1 Direct shear test curve



Graph 6.2 Particle size distribution curve

7. PROCEDURE FOR ROAD CONSTRUCTION

A general overview of the equipment and procedures involved in the construction flexible pavements. The equipment includes hot-mix operations, placement equipment, and compaction equipment. Construction procedures is discussed below.

7.1 EXCAVATION OF SOIL

The land is excavated for laying of road, excavation is done manually no machineries were use in excavation, the excavated ground is the levelled by carrying out of cutting and filling operations, sub base layer is hard soil stratum which is actually available at the site , and hence therefore the existing soil stratum is watered and voids are removed and then compacted using hand compaction equipment , intensity of blow and number of blows are varied to ensure the better compaction of the soil stratum.

Fig 7.1 Excavation of soil

7.2 SUB-BASE COURSE (GRANNULAR SUB BASE):

- Aggregates of 40mm is adopted for a firm base of road.
- As per norms, the base extends to a thickness of 100mm from the well compacted strong sub base layer
- The layer is placed for 100mm, and compacted completely.
- A boundary is provided with bricks to act as a shoulder for the road construction, and also to facilitate compaction.

Fig 6.2 GSB layer

7.3 BASE COURSE (WET MIX MACADDAM):

- Aggregates of size 25 mm to 40 mm is adopted as a wet mix macadam.
- As per norms, the (WMM) extends to a thickness of 100mm from the well compacted strong Base layer,
- The layer is placed for 50mm, and compacted completely., in order to remove the voids available, the layer is watered and then compacted similar to the sub base and base layer, the procedure is not mandatory but done to enable better compaction achievement,
- After proper compaction a layer of geo grid is placed above the (wmm), then strings of geo fabrics are tied to it manually with equidistant spacing.
- The geo grid is to be placed in a designed manner, (i.e.) A layer of bi axial geo grid is placed in the mid depth of the WMM and another one is laid above dense bitumen concrete (DBC).
- Geo grid is placed and both the geo grids are tied to one another by using of same geo grid strings so as to hold the pavement particles in a position as well as to facilitate the lateral resistance improvement.
- After placing of geo grid a 50 mm, layer of (wmm) is placed and compacted completely. In order to remove the voids available, the layer is watered and then compacted similar to the sub base and base layer.

Fig 7.3 WMM layer

Fig 7.4 Geogrid laid in WMM layer

7.4 MIX DETAILS:

- The bituminous mix is done in the following procedure

- The grade of bitumen chosen is VG 30
- The bitumen is heated to 150˚c and maintained at that temperature ± 5˚c and then the heated aggregates are also added to the bitumen and then mixed for a period of time, later then transported to the laying location,
- In our case the mix was done near the site of placing and hence the transport is done manually with safety precautions.
- The mix is done in a ratio, that the weight of bitumen added is 5.5% of the weight of aggregate. (As per IRC minimum bitumen content is 4.5%)
- When the temperature is at 135 ˚c to 250 ˚c the compaction is most efficient at this temperature.

7.5 BINDER COURSE (DENSE BITUMENOUS MACADAM):

- A layer of dense bitumen concrete is to be laid for 50 mm.
- In here, the dense bitumen suggests usage of 12 mm aggregate, along with the bitumen for making bitumen mix.
- The mix is done as per norms and placed in the site with utmost care and compacted with hand compactor with the placed mix at a temperature of 150˚c.
- The pavement is allowed to dry for 48 hours with gradual loads and no impact loads are allowed over the pavement.
- After drying, geo grid is placed and the strings are tied to it manually.

Fig 7.8 Before laying the geogrid

Fig 7.9 Laid geogrid in DBC layer

7.6 SURFACE COURSE (BITUMINOUS CONCRETE):

- The next layer is a layer of bituminous concrete, consisting of 6mm aggregates.
- The similar mix procedure is adopted and the mix is done.
- The placed bituminous layer is then to be compacted and is done as per IRC considerations unlike the dense bitumen concrete this doesn't allow enough voids between the particles
- The mix proportions were done in the same manner that, the weight of bitumen added is 5.5% the weight of aggregate.
- Bitumen (VG 30 Grade) is melted and poured at the BC layer.
- Quarry dust laid on the top of the pavement.

Fig 7.10 BC layer

Fig 7.11 Seat Coat

Fig 7.12 Final model of the geogrid road

3. CONCLUSIONS

Thus our model is made to resist the lateral loads transferred to the moving vehicles along the tracks, the load resisting action is achieved by the geo grid strings that are tied between the layers of road, In case of any lateral load, the cumulative action of the strings resists the force and overcomes the actual force since the cumulative strength of the geo grids is far better in resisting the actual loads. The properties of geogrid are determined in accordance with ISO 2602:1980, (BS 2846: Part 2:1981). Tensar SS40 geogrids are inert to all chemicals naturally found in soils and have no solvents at ambient temperature. They are not susceptible to hydrolysis and are resistant to aqueous solutions of salts, acids and alkalis and are non-biodegradable.

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