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ROAD CONSTRUCTION WITH GEOGRID

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ABSTRACT

The use of geosynthetic reinforcing components to reinforce the ground to operate on very soft and weak ground in the building of asphalted or unpaved vehicle roads and rail systems is known as road and railway stabilisation. In applications such as geogrids, roads, trains, airports, and other earthworks with weak ground strength, geosynthetics improve the performance and design life of highway and railway construction structures. Traditional road building products have a significantly lower value, and geosynthetics have a much faster, easier installation technique, which speeds up the construction process. Before the geosynthetic granular substrate is laid down on roadways, geosynthetics are laid down on the weak base floor. The slab's structural integrity is protected by geosynthetics, which prevent the granular sub-base material from sinking into the weak substrate.The use of geosynthetics extends the flooring's care requirements when it's installed on a shaky foundation.

Keywords: Geogrid, Geosynthetics, Geotextiles, Lightweight, Economical.

I. INTRODUCTION

Synthetic goods used to stabilise terrain are known as geosynthetics. They are polymeric goods that are utilised to tackle civil engineering issues. Geotextiles, geogrids, geonets, geomembranes, geosynthetic clay liners, geofoam, geocells, and geocomposites are among the eight primary product categories. The goods' polymeric nature makes them suited for usage on the ground where long-term durability is required. They can also be employed in open environments. Geosynthetics come in a wide variety of shapes and materials. Roads, airfields, railroads, embankments, retaining structures, reservoirs, canals, dams, erosion control, sediment control, landfill liners, landfill covers, mining, aquaculture, and agriculture are just a few of the civil, geotechnical, transportation, geoenvironmental, hydraulic, and private development applications where these products are currently used.

Research Objectives :

The goal of this study is to examine the many types of geosynthetics that are accessible, as well as the effectiveness of geogrid in road building and maintenance. The following goals have been identified to help attain this goal:

(1) To classify the geosynthetics that are now available in the country.

(2) To identify the basic material used to make the geotextile, a type of geosynthetic material.

(3)To test the performance of the geotextile after it has been incorporated into some collected soil components.

(4) Analyze the findings and give recommendations for best practises.

II. LITERARUEREVIW

1.	Giroud and Noirway	(1982) produced a design chart for unpaved pavement employing geosynthetic at the interface of the base layer and subgrade soil after conducting considerable research. Ramaswamy and Aziz (1989) investigated the behaviour of jute reinforced subgrade soil under dynamic load in an experimental study.
2.	Mehndiratta et al	According to Patel, 1990 and 1993, a typical mould with a diameter equivalent to three times the plunger diameter is insufficient for

		determining CBR value because the small size mould will provide more confinement to the geotextile. As a result, the mold's diameter is expanded to 5 times that of the plunger. In addition, the mould-plunger diameter ratio (D/d) is adjusted from 2 to 5 to investigate the influence of lateral confinement on CBR value of reinforced soil, while the vertical pressure (surcharge), specimen thickness, and compaction method are kept the same as in the standard test.
3.	Mehndiratta et al	On unreinforced and geotextile reinforced subgrades, (2005) conducted CBR and plate load tests. When coir is substituted with synthetic geosynthetic geotextiles, the elastic modulus of the coir reinforced layer only increases by 5%. They also looked into coir's durability by speeding up its decomposition. Coir that has been treated with phenol has been found to have a longer life. Rao (2007) compiled his geosynthetics and state-of-the-art advances work into a book.
4.	Babu et al,	On the basis of laboratory experiment data and mathematical formulations, a design approach employing IRC principles for the design of coir geotextiles reinforced roads was created in 2008.
5.		The application of geosynthetics in civil engineering construction has increased dramatically over the last three decades. This is the product of ongoing research in laboratories and on the ground around the world.

III. TYPES OF GEOGRID

1) Plastic Geogrid: During manufacturing, the square or rectangular polymer mesh can be stretched uniaxially or biaxially according to the varied stretching directions. It punches holes in extruded polymer sheets (mainly polypropylene or high-density polyethylene) and then stretches them in a directed manner under heating conditions. The uniaxially stretched grid is created by extending the sheet in a direction perpendicular to its length; the biaxially stretched grid is created by stretching the uniaxially stretched grid in a direction perpendicular to its length.

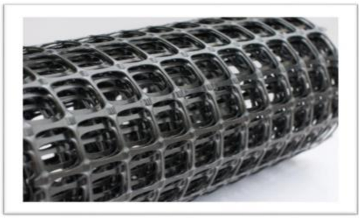

Fig 1: Two-waPlasticic Geogrid

2) Mine Geogrid: A type of plastic mesh used in underground coal mines is known as mining geogrid. The primary basic material is polypropylene. It is a "double-resistance" plastic mesh with an overall structure generated by biaxial stretching that has been coated with flame retardant and antistatic technology. The item is simple to assemble, inexpensive, safe, and attractive. Artificial roof meshes in coal mines are also known as mine geogrids, which are two-way stretch plastic mesh false roofs. The mining geogrid was created specifically for supporting the fake roof and roadway of the coal mine's underground mining face. It's made up of a variety of high-molecular-weight polymers and various additives.

Fig 2: Mine Geogrid

3) Steel Plastic Geogrid: A high-strength reinforced geotextile belt composed of specially treated high-strength steel wire (or other fibres), polyethylene (PE), and other additives are added to produce a composite high-strength tensile strip through extrusion, and the surface has a rough pressure pattern. The single belt is then weaved or sandwiched vertically and horizontally at a specific distance, and its junction is made by welding its junction with a special strengthening bonding fusion welding technology, which is a reinforced geogrid.

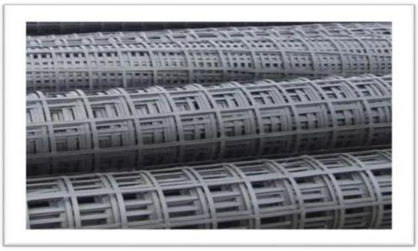

Fig 3: Steel plastic Geogrid

4) Fiberglass Geogrid: Fiberglass geogrid is made up of glass fibres and a mesh structure material that is woven together. It is a geocomposite material developed by a specific coating technique to protect the glass fibre and increase overall performance. Glass fibre is mostly made up of silicon oxide, an inorganic substance. It possesses exceptionally stable physical and chemical qualities, as well as high strength, high modulus, good wear resistance, and great cold resistance, with no long-term creep. Good performance; the mesh structure causes the aggregate to interlock and limit; the asphalt mixture's load-bearing ability is improved. The geogrid's wear resistance and shear capacity are substantially improved because the surface is coated with special modified asphalt, which has dual composite qualities.

Fig 4: Fiberglass geogrid

5) Polyester Fiber Warp Knitted Geogrid: The basic material for polyester fibre warp knitted geogrid is high-strength polyester fibre. The warp knitting directional structure is used, and the fabric's warp and weft threads are not twisted together. To make a solid connection, the intersections are linked and joined with high-strength fibre filaments, giving full play to the mechanical capabilities. Geogrid made of high-strength polyester fibre warp-knitted The grid has a high tensile strength, a small elongation force, a big tear resistance strength, a tiny vertical and horizontal strength difference, UV ageing resistance, wear resistance, corrosion resistance, and is lightweight and robust.It has an interlocking force with soil or gravel and can be used to reinforce soil. Shear resistance and reinforcement play an important part in improving the soil's integrity and load capacity.

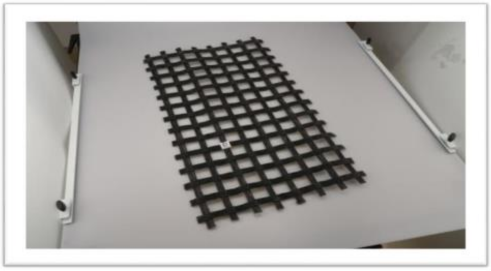

Fig 5: Polyester Fiber Warp Knitted Geogrid

6) Bi-axially Stretched Plastic Geogrid: It can be used for a variety of applications including dam and roadbed reinforcement, slope protection, cave wall reinforcement, and foundation reinforcement for permanent loads such as big airports, parking lots, docks, and freight yards.

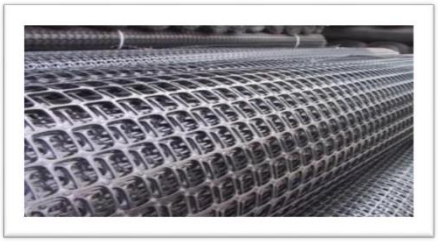

Fig 6: Biaxially Stretched Plastic Geogrid

7) Uni-axially Stretched Geogrid: Uni-axially stretched geogrid is a type of high molecular polymer with anti-ultraviolet and anti-aging additives as the major raw material. The previously distributed chain molecules are reoriented and organised in a linear condition after uniaxial stretching. Extruded and pressed into a thin plate, punched into a regular mesh, and then stretched longitudinally, it is a high-strength geotechnical material. The macromolecules are brought into a directional linear condition in this process, resulting in the formation of an oblong network-like integral structure with uniform distribution and high node strength.

Fig 7: Uniaxially Stretched Geogrid

IV. METHODOLOGY

1). Method A—Testing a Single Geogrid Rib in Tension (N or lbf). –

Using a constant rate of extension testing machine, a single representative rib specimen of a geogrid is clamped and subjected to a tensile force. The specimen's tensile force required to fail (rupture) is recorded. The average of six single rib tensile tests is then used to calculate the ultimate single rib tensile strength (N or lbf). When determining the tensile strength of a geogrid, the common practise is to pull a single rib in tension until it fails and then observe its behaviour. A secondary method of determining the strength of an inisolation junction is to pull a longitudinal rib away from its transverse rib junction.Because there is no normal stress on the geogrid structure, the junction strength test must be performed with the complete geogrid structure contained within soil embedment. This is a considerably more difficult test that will be described in the section on anchorage strength from soil withdrawal. A single rib tension strength test simply involves pulling a single rib to failure using a constant rate of extension testing machine. This is most likely a longitudinal rib in unidirectional geogrids. Both longitudinal and transverse ribs must be evaluated in bi-directional geogrids. Equivalent wide-width strength can be determined using the ribs' repeat pattern.Alternatively, a large number of ribs can be evaluated at the same time to provide a more statistically correct wide-width strength result. A junction or node strength test can also be done in isolation. The test method employs a clamping fixture that grabs the geogrid's transverse ribs adjacent to and on each side of the longitudinal ribs. A conventional clamp grips the lower portion of the longitudinal rib, and both clamps are put in a tensile testing machine, where the test specimen is torn apart. The strength of the connection is measured in force units. A full roll width swatch from each roll in the lot sample takes long enough in the machine direction for the laboratory sample.The sample may be taken from the end portion of a roll provided there is no evidence it is distorted or different from other portions of the roll. The specimens shall consist of three (3) junctions or 300 mm in length (12 in.), in order to establish a minimum specimen length in the direction of the test (either the machine or cross-machine direction). All specimens should be free of surface defects, etc., not typical of the laboratory sample. Take no specimens nearer the selvage edge along the geogrid than 1/10 the width of the sample. Prepare each finished specimen, as shown in Fig.4.1, to contain one rib in the cross-test wide by at least three junctions (two apertures) long in the direction of the testing.

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Method B—Testing Multiple Geogrid Ribs in Tension (kN/m or lbf/ft.) :

A rather wide specimen is grasped over its whole width in the clamps of a constant rate of extension type tensile testing equipment, which applies a uniaxial load to the specimen until it ruptures at a set rate of extension. Machine scales, dials, recording charts, or an interfaced computer can be used to calculate the test specimen's tensile strength (kN/m or lbf/ft), elongation, and secant modulus.

Method C—Testing Multiple Layers of Multiple Geogrid Ribs in Tension (kN/m or lbf/ft.) :

A reasonably wide, multiple-layered specimen is grasped over its whole width in the clamps of a constant rate of extension type tensile testing equipment, which applies a uniaxial load to the specimen until it ruptures at a set rate of extension. Machine scales, dials recording charts, or an interfaced computer can be used to calculate the test specimen's tensile strength (kN/m or lbf/ft), elongation, and secant modulus.

V. INSTALLATION PROCEDURE

We should make sure that the subgrade is fit for geogrids installation and make detailed plans for the installation steps.

↓

Clear the construction site; eliminate the un-useful materials. Some sharp objects may cause damage to the geogrids. So the clean work is a necessity

↓

Smooth the ground, flat the soil. The flat ground can make the geo-grid bear balanced forces.

↓

Place geogrids rolls in position and unroll the geogrids smoothly. Correct installation method can greatly improves the bearing capacity of geogrids.

↓

Add the fill materials. Use the excavator to push the fill materials forward evenly on the geogrids. Minimize the wrinkles on the geogrids. flat and check the pavement

VI. APPLICATIONS AND ADVANTAGES OF GEOGRID

ADVANTAGES OF GEOGRID:

1. strength, modest creep, adaptability to various types of soil, fully fulfil the high-grade highway in the usage of a big retaining wall

2. When compared to the previous plastic geogrid, it not only has a high bearing capacity, corrosion resistance, and anti-aging properties, but it also has a high strength geomembrane friction coefficient, perforation uniformity, construction ease, and a long service life, among other benefits.

3. may effectively control lateral land displacement, considerably improve the foundation's bearing capacity, biting effect, effectively improve the load bearing surface of the embedded lock, and improve the foundation's stability and firmness.

4. Efficiently avoid damage from mechanical compaction and construction damage.

5. compared with the traditional grille, more suitable for embankment reinforcement, deep-sea operations, so as to solve other materials due to seawater erosion Cao Zheng corrosion resistance, low strength and short service life shortcomings

6. The use of geogrids results in a more economical construction.

7. It is environmental friendly.

8. Imparting geogrids makes the members more durable since it resists environmental attacks.

9. It prevents the soil from erosion.

GEOGRID APPLICATIONS:

It can be used for roadbed reinforcement and pavement reinforcement on a variety of roadways, trains, and airports. It can be used to support the foundations of permanent loads such as big parking lots and dockyards. It can be used to protect railway and highway slopes. Culvert reinforcement that can be used. It is appropriate for secondary reinforcement of a soil slope reinforced by a one-way tensile geogrid in order to strengthen the slope and prevent soil erosion. Tunnel reinforcement, mine.

VII. CONCLUSION

According to our findings, the reduction in base course thickness caused by geogrid reinforcement for a subgrade soil tends to decrease as traffic volume increases. The benefits of using geogrids to reduce base course may be felt most in lesser volume roads, particularly in areas where water may flow into the bottom layers of pavements, as with untreated shoulders and poor surface maintenance where the road base may be pervious, or in high rainfall areas.

VIII. LIMITATIONS

- Possible Damage To Geogrid
- Irregular Geometry
- Incomplete Codes And Standardisation

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