"APPLICATION OF POLYMERIC MATERIALS FOR MAINTAINING RURAL PAVEMENT PERFORMANCE"

Dr. S.S. Goliya

Associate Professor, S.A.T.I. (Engg. College), Vidisha (M.P.) India,

Abstract - ***India is a developing country, where country's economy is based on agriculture. Due to this agriculture based, transportation plays vital role in India. Transportation in India is on the rapid stage as the country is on its developing feature and globalization. Highways play an important role in transportations. Consequently highways should be designed in proper way and should be economical. Existing highways are properly designed and well oriented but rural roads should be well designed, constructed and maintained so as to serve the villagers.***

This study "APPLICATION OF POLYMERIC MATERIALS FOR MAINTAINING RURAL PAVEMENT PERFORMANCE" gives us a view in order to use the polymeric materials such as geosynthetics in the up gradation and maintaining the rural pavement performance. Geosynthetics are the polymeric materials which are used to stabilize the surface the polymeric nature of the material makes the suitable at the place where high durability is required

A case study of nearby village of Vidisha district has been taken and the pavement is reinforced and maintained with the various geosynthetics. Consequences showed that this material increase the pavement performance and also serve as a better economical solutions as compared to other recommendations.

Keywords— Maintenance priority, Sustainable management, Maintenance Management, Pavement performance, Resources.

I . INTRODUCTION

The use of polymeric materials i.e. geosynthetics in construction projects has attained a wonderful recognition over the past 30 years. Ranging from the reinforcement and severance functions in roadway construction, to the filtration functions in earthen dams, geosynthetic applications are as diverse as the types of geosynthetics are sick bright on today's market. Of exceptional interest to civil engineers is the use of geosynthetics to reinforce roadways. Sometimes it is essential to construct a road on very poor quality soil, and the planned use of the road does not advantage the expenditure of constructing a elevated quality road. Examples of such roads are service or right to use logging roads, and low volume rural roads. The use of geosynthetics in large-scale civil construction projects has not only saved both time and money, but also made the consequential structures safer.

Rural Road connectivity is an important constituent of rural expansion by promoting access to economic and social services and thus generating amplified undeveloped incomes and productive employment opportunities. It is also a key component in ensuring poverty decrease. It was touching this surroundings of deprived connectivity that the Prime Minister declared in 2000 a massive rural roads Programm. The Prime Minister's Rural Road Programme (Pradhan Mantri Gram Sadak Yojana, PMGSY) set a target of: Achieving all-weather road access to every village/habitation with a population greater than 1000 by 2003.provided that all-weather road access to all villages/habitations of population greater than 500 people.

A great variety of harmful factors concern the service life of roads including ecological factors, subgrade circumstances, traffic loading, utility cuts, road widening, and aging. These factors supply to an uniformly wide range of pavement circumstances and troubles which must be taken in the maintenance of the pavements.

II. SCHEMATIC PORTRAYAL OF RURAL ROADS

2.1 Planning of Road

Linking rural habitations all the way through good quality all weather roads, which provide way in to services and also opportunities for the rural population to mushroom their income is an significant part of the socio-economic development procedure. For sustainable development through rural roads, it is necessary that a proper Master Plan is prepared in order that all behavior connecting to rural roads such as structure, Up-gradation and protection can be taken up methodically within the casing work of this Master Plan.

2.1.1 District Rural Roads Plan (DRRP)

The District Planning Committee is the Constitutional Body created in the District for ensuring proper preparation of Plans for the development of the District. The District Rural Roads Plan is one which would have a tremendous bearing on the all round socio-economic development of the District. Therefore, it would be appropriate if all the Block Rural Roads Plans are scrutinised by the District Planning Committee.

2.1.2 Programme Implementation Unit (PIU)

As per PMGSY Guidelines and as detailed, every State is to identify and Executing Agency for the execution of the Programme. The Executing Agency is expected to set up the Programme Implementation Unit (PIU) in each District. In most States, the Public Works Department (PWD)/ Rural Engineering Service (RES) has been identified as the Executing Agency by the State Government. The PIU at the District Level is usually headed by a Superintending Engineer/ Executive Engineer of the Division of the PWD/ RES. The Preparation of the Master Plan for each Block is the responsibility of the PIU, who must ensure that it has the approval of the Panchayati Raj Institution. Care must also be taken to see that the proposals of the MPs and MLAs, who have an intimate knowledge of their areas, are fully taken into consideration while preparing/ finalizing the Plans.

2.1.3 The Steps wise in Preparation of DRRP

The Ten Major Steps in the preparation and finalization of the District Rural Roads Plans are as under:

I. Preparation of Data base.
II. Map preparation.
III. Preparation of a list of Unconnected Habitations and the selection of the optimal road links.

IV. Consideration and approval by the Intermediate Level Panchayat.
V. Submission of the Block Level Rural Roads Plan to the District Planning Committee.
VI. Scrutiny by the District Planning Committee
VII. Consideration and approval by the District Panchayat.
VIII. Forwarding of the District Rural Roads Plan to the State Level Standing Committee.
IX. Vetting of the District Rural Roads Plan by the State Level Standing Committee.

III. DESIGN OF ROAD

3.1 Route Selection and Alignment

The District Rural Roads Plan gives guidance on the general topology of the network of rural roads required to connect all eligible rural habitations. This will have to be translated on to the ground in the form of properly aligned road links.

The IRC: SP 20:2002, Rural Roads Manual gives detailed guidance on selection of the alignment. The following supplementary points need to be kept in mind at the time of alignment definition:

In order to minimize/ avoid land acquisition, the alignment should follow existing cart tracks and footpaths to the maximum extent possible, subject to considerations of geometrics and hydrology.

It is always useful to consider 2 or 3 possible route alignments and evaluate each alternative for the construction costs to be incurred and related benefits accrued, before finalizing an alignment. By adopting such an approach, many unfavorable features can be avoided like long length covered by problematic soils (e.g., Black Cotton soils), too many cross-drainage works, high cost bridges, landslide susceptible slopes on hill roads etc. Similarly, the ease with which the desired geometric design standards can be attained may vary from one alternative to another alternative.

3.2 Geometric Design Standards

The IRC Rural Roads Manual gives the geometric design standards to be followed. Particular attention is required in adopting the Carriageway Width (CW) based on traffic volume considerations. Once the CW is fixed, compatible Roadway (RW) and Road Land Width (RLW) will have to be provided. Where traffic is likely to be very low as in short roads terminating in dead ends, and is not likely to increase substantially in future, a carriage way of 3.0 m may be designed instead of the normal 3.75 m.

3.3 Topographical and Related Ground Surveys

The recommended ground survey technique comprises of three sequential stages vise

1 Reconnaissance.
2 Preliminary Survey and
3 Final Location Surveys.

3.3.1 Reconnaissance

Reconnaissance starts with a field inspection by walking, riding on ponies (in hills) or driving in jeeps. All information of value, either in design, construction, maintenance or operation of the facility should be collected, which may include, inter alia, the following:

- Details of route vis-à-vis topography of the area – plain, rolling or hilly.
- Requirements of cross-drainage works – type, number and length.
- Gradients that are feasible, specifying the extent of deviations needed.
- Curves and hair-pin bends etc.
- Existing means of communication – mule tracks, jeep tracks cart tracks etc.
- Constraints on account of built-up areas, monuments and other structures.
- Road length passing through different terrains, areas subjected to inundation and flooding, areas of poor drainage conditions, unstable slopes etc.
- Climatic conditions – temperature, rainfall, water table and its fluctuations etc.
- Facilities/ Resources available e.g., availability of local labour, contractors etc.
- Access points indicating possibility of induction of equipment.
- Period required for construction.
- Villages, hamlets and market centers connected.
- Economic factors – population served agricultural and economic potential of the area.
- Crossing with railway lines and other existing roads.
- Position of ancient monuments, burial grounds, cremation grounds, religious structures, hospitals and schools etc.

Only simple instruments like Compass, Abney level, Altimeter, Clinometer, Ghat tracer etc. are required in the Reconnaissance survey.

3.3.2 Preliminary survey

It is a relatively large-scale investigation of the alternative(s) thrown up as a result of the Reconnaissance survey. The survey consists in establishing a base-line traverse. For hill roads, it may be necessary to cut a trace of 1.0-1.2m wide to enable the traverse survey to be carried out. A theodolite or compass is used for traversing and levels are taken along the traverse and across it. The distances are measured continuously along the traverse line with a metallic tape. Bench marks should be established at intervals of 250 m to 500 m and the level should be connected to the GTS datum. Physical features such as buildings, trees, burial grounds, monuments, railway lines, canals, drainage channels etc should be located by means of offsets. The width to be covered for such detailing should be about the land width proposed to be acquired. Information on highest flood level, rainfall intensity, catchment areas of streams etc should be collected. The survey enables the preparation of a map including the plan and longitudinal section. The scales generally recommended are:

Built-up areas and hilly terrain	: 1:1000 for horizontal scale 1:100 for vertical scale

Plain and rolling terrain : 1:2500 for horizontal scale
1:250 for vertical scale

3.3.3 Final Location Survey

After the preliminary survey and Transect Walk, the final alignment is to be determined. The purpose of the final location survey is to fix the centreline of the selected alignment in the field and to collect additional data for the preparation of the drawings. The centre line is translated on the ground by continuous transverse survey and pegging the same. The points of transit (POT) should be clearly marked on the ground by a nail in the existing pavement or a hub in concrete on a new alignment. Suitable references (at least two) should be marked permanently on the ground. The horizontal intersection points (HIP) should be similarly marked on the ground and referenced. All curve points viz beginning of transition (BS), beginning of circular curve (BC), end of circular curve (EC) and end of transition (ES) should be marked and referenced. The centreline should be staked at 50 m intervals in plain terrain and 20m intervals in hilly terrain. Bench marks should be left permanently at 250 m intervals. The cross-sections taken during the preliminary survey should be supplemented by additional cross-sections at the curve points. Generally, cross-sections should be available at intervals of 50-100m in plain terrain, 50-75m in rolling and 20 m in hilly terrain. Survey can be accomplished these days by a Total Station, with assistance from GPS (Geographic Positioning System) which determines the location of survey points by satellite. But in the absence of these instruments, an ordinary theodolite, leveling instrument and compass would be acceptable.

3.3.4 Some Concepts of Geometric Design of Rural Roads

3.3.4.1 **Geometric Design-**

It has been indicated that the geometric standards for Rural Roads are to be as given in IRC SP 20:2002. However, practical difficulties sometimes normally arise in providing the recommended geometrics due to no availability of land, with no scope even for acquisition. In such cases, efforts must be made to provide the geometrics within the land available by shifting the centre line to the extent possible. If even after this, Standard Geometrics like Radius of Curvature, gradient etc. cannot be provided for the normal design speed, the geometrics are to be designed as per the ground conditions and the corresponding safe speed determined. Appropriate signboards must be erected on either side indicating the safe speed at which the vehicles can travel in such stretches. In addition at accident prone locations, speed reducing devices such as rumble strip should be provided.

3.3.4.2 **Pavement Design**

The estimation of design parameters is the most important issue in the design of pavement. It has been noticed quite often that there is a tendency to estimate the design CBR on the conservative side and also to inflate the amount of traffic expected. The combined effect of this is over design of the pavement, which in turn is reflected in higher costs of construction. This engineering skill of the PIU lies in ensuring quality with economy. Not only must CBR be estimated properly, the conditions in which it is to be estimated also need to be consciously determined. It is always not necessary to adopt 4 day soaked CBR for design, since this represents the worst condition of design. Depending upon the pattern of conditions prevailing at the site, the CBR may be determined at the equilibrium moisture content in cases where the sub grade is not likely to come in contact with water either due to capillarity or through percolation from the top. Similarly, the estimation of base year traffic should be done judiciously taking guidance from the recently constructed roads in similar conditions. The traffic must have some correlation with the agricultural surplus of the area and its expected growth rate.

When marginal aggregates and locally available material are used, special care should be taken in material characterization. While adopting a particular method of stabilization, the efficacy of use of the most suitable stabilizing agent is to be established and accordingly used in the design. Detailed specifications are available for various methods of stabilization in the publication 'Specification for Rural Roads' published by the IRC. In the conditions where the lead distance for bringing the aggregates is high, alternative methods of aggregate free construction or limited use of aggregates shall be explored.

3.3.4.3 **Design of CD Structures-**

The proper location of the CD works and their design with proper estimation of expected discharge from the catchments is extremely important. The type of CD Structure is to be decided based on the site conditions. Type designs sometimes may lead to problems at a later stage. Therefore, care must be taken in the location of CD Works, estimation of discharge and designing appropriate CD Structure.

The possibilities of adopting causeways need to be fully explored where minor /major bridges are proposed, for cost effectiveness.

IV. QUALITY MANAGEMENT

In order to achieve the aim of building safe and durable roads economically, the road structure should meet certain requirements. The characteristics that such a structure should posses should be specified through codes of practices and enforced through contract documents. Laying down not only the technical specifications but the workmanship and the testing and acceptance criteria, Quality Control comprises the operational techniques of controlling quality. A Quality Assurance Standard is set when the Quality Control system is operationalized using human resources, trained to a particular standard. Quality Management includes quality planning to maintain a Quality Assurance Standard, as well as Quality Control. Quality Management which includes an external mechanism providing Quality Assurance and an internal mechanism to constantly improve the quality system is termed Total Quality Management (TQM) and PMGSY Quality Management is intended to evolve in that direction.

PMGSY aims at Quality Assurance through procedures prescribed in the PMGSY Quality Control Handbook and enforced through the contracts framed under the Standard Bidding Document process. Quality Control operational procedures described below need to be supported by the requisite training and HRD measures in the SRRDAs, PIUs and contracting personnel to generate the requisite Quality Assurance.

V. TECHNICAL ASPECTS OF GEOSYNTHETIC TECHNOLOGY

5.1 General

Geosynthetics consists a variety of synthetic polymer materials that are particularly made-up to be used in geotechnical, geo-environmental, hydraulic and transportation engineering applications. It is an appropriate to distinguish the main function of a geosynthetics as being one of division, filtration, drainage, intensification, fluid/gas containment, or erosion control. In some cases they may serve double functions.

Geosynthetics are artificial materials used to recover soil situation. The appearance is derivative from: Geo = earth or soil + Synthetics = man-made Geo- synthetics are prepared from petrochemical-based polymers that are physically motionless and will not crumble from bacterial or fungal action. though the majority are basically element inert some may be spoiled by petrochemicals and most have some degree of vulnerability to sunlight.

"Geo-synthetics are synthetic products, where at least one of the components is made from a synthetic or natural polymer, in the form of a sheet, a strip or a three dimensional structure, non-woven, knitted, or woven which is used in contact with soil/rock and/or other materials in geotechnical and civil engineering applications".

5.2 Types of Geo Synthetics

5.2.1 Geotextiles

Geo textiles form one of the two largest groups of geosynthetics. Their rise in growth during the past 35 years has been nothing short of extraordinary. They are indeed textiles in the traditional sense, but they consist of synthetic fibers rather than natural ones such as cotton, wool, or silk. Thus bio degradation and subsequent short lifetime is not a problem. These synthetic fibers are made into flexible, porous fabrics by standard weaving machinery or are matted together in a random non woven manner. Some are also knitted. The major point is that geotextiles are porous to liquid flow across their manufactured plane and also within their thickness, but to a widely varying degree. There are at least 100 specific application areas for geotextiles that have been developed; however, the fabric always performs at least one of four discrete functions: separation, reinforcement, filtration, and/or drainage.

Photograph: - Geotextiles

5.2.2 Geogrids

Geogrids represent a rapidly growing segment within geosynthetics. Rather than being a woven, nonwoven or knitted textile fabric, geogrids are polymers formed into a very open, grid like configuration, i.e., they have large apertures between individual ribs in the transverse and longitudinal directions. Geogrids are

(a) either stretched in one or two directions for improved physical properties,

(b) made on weaving or knitting machinery by standard textile.

Photograph. Geogrids

Manufacturing methods, or (c) by bonding rods or straps together. There are many specific application areas; however, they function almost exclusively as reinforcement materials.

The latest development in stiff polymer geogrid manufacture is based on an isosceles triangular aperture, produced by a new manufacturing technique from a punched then stretched polymer sheet. Whereas uniaxial and biaxial geogrids offered maximum in-plane stiffness in one and two axis, respectively, the triangular aperture results is a near isotropic in-plane stiffness. Whilst being isotropic the stiffness of the triangular style geogrid still remains less than traditional square style geogrids when the square geogrids are measured in multi axial directions.

5.2.3 Geonets

Geonets, called geospacers by some, constitute another specialized segment within the geosynthetics area. They are formed by a continuous extrusion of parallel sets of polymer ric ribs at acute angles to one another.

Photograph. Geonets

When the ribs are opened, relatively large apertures are formed into a netlike configuration. Two types are most common, either biplanar or triplanar. Their design function is completely within the drainage area where they are used to convey liquids of all types.

5.2.4 Geomembranes

Geomembranes represent the other largest group of geosynthetics, and in dollar volume their sales are greater than that of geotextiles. Their growth in the United States and Germany was stimulated by governmental regulations originally enacted in the early 1980s for the lining of solid-waste landfills. The materials themselves are relatively thin, impervious sheets of polymeric material used primarily for linings and covers of liquids- or solid-storage facilities. This includes all types of landfills, reservoirs, canals, and other containment facilities. Thus the primary function is always containment as a liquid or vapor barrier or both. The range of applications, however, is great, and in addition to the environmental area, applications are rapidly growing in geotechnical, transportation, hydraulic, and private development engineering

5.2.5 Geosynthetics clay liners:

Geosynthetics clay liners, or GCLs, are an interesting juxtaposition of polymeric materials and natural soils. They are rolls of factory fabricated thin layers of betonies clay sandwiched between two geotextiles or bonded to a geomembrane. Structural integrity of the subsequent composite is obtained by needle-punching, stitching or physical bonding. GCLs are used as a composite component beneath a geomembrane or by themselves in geoenvironmental and containment applications as well as in transportation, geotechnical, hydraulic, and many private development applications.

5.2.6 Geofoam:

Geofoam is a product created by a polymeric expansion process resulting in a “foam” consisting of many closed, but gas-filled, cells. The skeletal nature of the cell walls is the unexpanded polymeric material. The resulting product is generally in the form of large, but extremely light, blocks which are stacked side- by-side providing lightweight fill in numerous applications. The primary function is dictated by the application; however separation is always a consideration and geofoam is included in this category rather than creating a separate one for each specific material.

5.2.7 Geocells

Geocells (Cellular Confinement Systems) are three- dimensional honeycombed cellular structures that form a confinement system when infilled with compacted soil. Extruded from polymeric materials into strips welded together ultrasonically in series, the strips are expanded to form the stiff (and typically textured and perforated) walls of a flexible 3D cellular mattress.

VI CONSTRUCTION OF ROAD BY USING GEOSYNTHETICS

6.1 Overview

We have taken a case study of Vidisha district nearby village pavement in which rural pavement is constructed maintained by using a fibre i.e. geosynthetic .A huge diversity of harmful factors influence the overhaul life of roads and pavements counting environmental factors, subgrade circumstances, traffic loading, utility cuts, road widening, and aging. These factors supply to an evenly wide diversity of pavement situation and harms which must be addressed in the upholding of the pavements if not dealt with during initial construction.

Pavement upholding treatments are often unsuccessful and short lived due to their incapability to both pleasure the reason of the troubles and renovate the existing pavement condition. The main cause of distress in pavements is that they are quite porous with 30 to 50% of rainfall surface water infiltrating throughout the pavement, softening and deteriorating the pavement subgrade and base, accelerating pavement deprivation. Obtainable pavement distress such as surface cracks, rocking joints, and subgrade failures cause the swift mirror image of furious up through the preservation behavior.

Therefore, the preferred strategy for long-term road and pavement performance is to build in safeguards during initial construction. These performance safeguards include stabilizing the subgrade against moisture intrusion and associated weakening; strengthening road base aggregate without preventing efficient drainage of infiltrated water and as a last resort, enhancing the stress absorption and moisture proofing capabilities of selected maintenance treatments. Geosynthetics are the most cost-effective tools for safeguarding roads and pavements in these ways.

6.2 Subgrade Separation and Stabilization

6.2.1 The Problem

Temporary roads used for hauling and access roads that are subject to low volumes of traffic are often constructed without asphalt or cement concrete surfacing. In these cases, a layer of aggregate is placed on the prepared subgrade of these roads to improve their load carrying capacity. Problems are usually encountered when the subgrade consists of soft clays, silts and organic soils. This type of subgrade is often unable to adequately support traffic loads and must be improved.

6.2.2 **The Geosynthetic Solution**

Geosynthetics are proving to be a cost effective alternative to traditional road construction methods. As a result, the application of geosynthetics to the construction of unpaved roads over soft subsoils has become quite popular. Design has focused on the stabilization of the subgrade and the reinforcement of the aggregate, leading to the identification of two important functions: membrane action and lateral restraint. Membrane action is the ability of a geosynthetic material to reduce and spread stress arising from the weak subgrade. Lateral restraint, sometimes called confinement, is the lateral interaction between the aggregate and the subgrade with the geosynthetic. The presence of the geosynthetic restrains lateral movement of both the aggregate and the subgrade, improving the strength and stiffness of the road structure.

6.2.3 **Separation**

At small rut depth, the strain in the geosynthetic is also small. In this case, the geosynthetic acts primarily as a separator between the soft subgrade and the aggregate. Any geosynthetic that survives construction will work as a separator.

6.2.4 **Stabilization**

For larger rut depths, more strain is induced in the geosynthetics. Thus the stiffness properties of the geosynthetic are essential. A considerable reduction in aggregate thickness is possible by the use of a geosynthetic having a high modulus in the direction perpendicular to the road centerline; however, the benefits of the geosynthetic are not wholly dependent on the membrane action achieved with a stiff geosynthetic. Lateral restraint produced by the interaction between the geosynthetic and the aggregate is equally important. The following general conclusions can be drawn relating to a typical road base.

6.3 Design for Stabilization

The design of geosynthetic-reinforced unpaved roadways has been simplified into design charts that relate aggregate thickness requirements to a range of subgrade strengths, based on standard highway design loading and various allowable rut depths.

6.4 Installation of Geosynthetics for Separation, Stabilization, and Base Reinforcement

6.4.1 Site Preparation

Clear and grade the installation area. Remove all sharp objects and large stones. Cut trees and shrubs flush with the subgrade. Removal of topsoil and vegetation mat is not necessary, but is recommended where practical.Excessively soft spots or voids may be unsuitable for geosynthetic installation. Fill these areas with select material and compact prior to geosynthetic installation. The problem area may be enhanced by using a geosynthetic at the bottom of the excavation prior to backfilling.

6.4.2 Deployment of the Geosynthetic

Unroll the geosynthetic on the prepared subgrade in the direction of construction traffic. Hold the geosynthetic in place with pins, staples, fill material or rocks. Adjacent rolls should overlap in the direction of the construction. Depending on the strength of the subgrade, the overlaps may have to be sewed.

Table: Overlap Specifications

Soil Strength (CBR)	Overlap Unsewn in (cm)	Overlap Sewn in (cm)
Less than 1	-	9 (23)
1 – 2	38 (97)	8 (20)
2 – 3	30 (76)	3 (8)
3 & Above	24 (60)	-

6.4.3 Placement of the Aggregate

Place the aggregate over firm subgrades by back dumping aggregate onto the geosynthetic and then spreading it with a motor grader. For weaker subgrades, dump onto previously placed aggregate and then spread the aggregate onto the geosynthetic with a bulldozer. On weaker subgrades, a sufficient layer of aggregate must be maintained beneath all equipment while dumping and spreading to minimize the potential of localized subgrade failure.

Avoid traffic directly on the geosynthetic. When using construction equip equipment on the aggregate, try to avoid any sudden stops, starts or sharp turns. Maintain a minimum lift thickness of 6-inches (15 cm) except in cases of low volume roads. Compact the aggregate to the specified density using a drum roller. Fill any ruts with additional aggregate and compact as specified.

Photograph. - Fabric Unrolled and Overlapped (or seamed)

6.4.4 Geosynthetic Benefits in Road Construction

➢ Stress Relief - Nonwoven geotextiles, a.k.a. paving fabrics, have high elongation and low tensile strength and are used for stress relief. When saturated with asphalt, the flexible interlayer allows considerable movement around a crack but nullifies or at least lessens the effect the movements have on the overlay.

➢ Waterproofing - When saturated with an asphalt cement tack coat, the fabric interlayer becomes a moisture barrier within the pavement, preventing infiltration. Lower moisture content in the roadbase and in the soil subgrade increases the strength of these materials.

➢ Reinforcement- A reinforcing interlayer resists horizontal movement of cracks in the old pavement and/or, when used over a leveling course or a paving fabric, holds the overlay together while allowing the cracked pavement underneath to move independently. Both approaches reduce reflective cracking in the overlay.

6.5 Maintenance of Road by using Geosynthetics

6.5.1 Problem

Road surfaces must be maintained regularly. Commonly, a paved road becomes a candidate for maintenance when its surface shows significant cracks and potholes. The rehabilitation of cracked roads by simple overlaying is rarely a durable solution. The crack sunder the over lay rapidly propagate through to the new surface. This phenomenon is called reflective cracking.Cracks in the pavement surface cause numerous problems, including:

- Riding discomfort for the users.
- Reduction of safety.

The Problem is site conditions are very poor like, Black cotton soil, CBR less than 2, High water table, Traffic medium, Commercial vehicles mainly carrying sand and Sugarcane and other crops on this route.

Usually the road constructed in this section would not last for more than 6 months, developing severe rut depths and pot holes and would become almost unmemorable

6.5.2 Installation of Geotextile

Before the Installation of Geotextile for the soil stabilization some important options are follows,

- **Surface preparation** - Surface preparation like well compacted by roller, layout of road with center line and width of road marking etc.

Photograp : Surface compaction

- **Lying of Geotextile -** Lying of Geotextile after the completion of surface preparation we are unrolled the Geotextile on the road surface by manually with very carefully.

CONCLUSIONS AND RECOMMENDATIONS

The use of geogrids in road foundations clearly benefits pavement performance, potentially leading to longer service lives for roads and reduced maintenance costs.

To increase performance, roads are sometimes reinforced with geosynthetic polymer arterials, including geogrids and geotextiles. Geogrids consist of polymers formed into relatively rigid, gridlike configurations. They are commonly placed between the sub-grade and base or base and sub-base layers of roads to add strength and stiffness and to slow deterioration. Geotextiles are polymer fabrics that may also provide some reinforcement, but are used primarily to:

- The deflection response of roadway is governed by the Young's modulus of the geosynthetic used. Since the loading considered for this study was light, the roadway remained elastic under application of the load. Therefore, the response of the reinforced system depended on the stiffness of the geosynthetic used. For this study, the stiffest geosynthetic produced a 0% to 15% reduction in normalized deflection relative to the unreinforced roadway depending on the cross section considered.
- The addition of geosynthetic reinforcement affects the horizontal stress distribution when loaded. The horizontal stress distributions were calculated at three sections within the loaded soil. The stress distributions showed that the geosynthetics were in a state of tension upon application of the load. This indicates that the tensioned membrane effect was providing additional support to the wheel load. The magnitude of tension in the geosynthetic depended on the stiffness of the geosynthetic, with the stiffest geosynthetics yielding the largest tension values. Additionally, the stiffness of the subgrade affected the geosynthetic tension, with the softer subgrade producing a larger tension. No significant deviations in horizontal stress were seen in the base material or the subgrade.
- Facilitate filtration and water drainage through road foundation soils without the loss of soil particles.
- Provide separation between dissimilar base materials, improving their integrity and functioning.
- Provide a stable construction platform over soft or wet soils, facilitating the movement of equipment and the process of soil compaction. Of several kinds of geotextiles, Type V is the most commonly used in Minnesota, primarily as a separator. Despite the relatively widespread use of geosynthetics in reconstructing paved county roads and state trunk highways as well as in constructing new roads, their performance has not been well documented in Minnesota. Research was needed to obtain field data that would indicate whether geosynthetics extend the service lives of roads and reduce the need for maintenance.

The service life of a roadway may also be increased with the addition of geosynthetic reinforcement.

Based on the work described in previous chapters, the following recommendations are made.

- In deflection-related design conditions, the use of geosynthetic reinforcement to significantly reduce deflections may be relied upon only when the subgrade material is of very poor quality.
- Other beneficial effects of geosynthetic reinforcement should be considered when separation and bearing capacity during construction are of concern. However, these effects were not investigated in this project.
- Further study should be conducted regarding the benefit/cost issues regarding the geosynthetic reinforcement of low volume roads.

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