

COMPARATIVE STUDY OF GEOSYNTHETICS USED AND UNUSED ROAD PAVEMENT AND CASE STUDY

¹Kitture S.P., ²Omkar D Belhekar, ³Saurabh S Jadhav, ⁴Gaurav R Jagtap, ⁵Nikhil P Meher

¹Assistant Professor, ^{2,3,4,5}Student,
¹Department of Civil Engineering,
¹Sinhgad Academy of Engineering, Pune.

Abstract : A Geo-synthetic material consists of synthetic fibres and are composed of yarns. These yarns are made up of polypropylene or polyester resins. They are well known for their unique properties like non-biodegradable and long life span. These polypropylene synthetic fibres are given shape according to the need of work and categorized by different names such as Geotextiles, Geogrids, Geo composites, Geo-membranes etc. In road pavement, there are different layers and these geo-synthetic materials can be used to make them more durable and sustainable. In country like India they can be proved to be more efficient and useful in construction practices.

IndexTerms - Geo-synthetic, Geotextile, Geo-grid, Separation, Drainage, Reinforcement.

I. INTRODUCTION

In the areas having soft strata, or low strength of subgrade and also in rainy season, numerous incidents like road sinking, flowing of the road pavement, potholes occur every year. These scenarios happen because of the less or no drainage provided, no reinforcement to the subgrade and lack of clear separation between various layers of road pavement. Due to all these adversities the road condition deteriorates.

To overcome these situations, we must provide a proper drainage mechanism, reinforcement and the separation to the road pavement. Using Geo-synthetic materials we can overcome these scenarios in a very cost effective and sustainable manner. In the conditions mentioned earlier, geosynthetic materials have proved to be an effective solution to be implemented.

1.1 OBJECTIVES

1. To do a brief comparison and cost estimation of Geo-synthetics used road pavement and a normal road pavement.
2. To provide economy and sustainability to the road pavement.
3. To do a case study of the affected road and provide a solution to it.

1.2 NEED

1. To prevent the underlying strata from flowing with rainwater.
2. To prevent the road from deformation.
3. To prevent mixing of various layers of the road.
4. To achieve economy in the construction.
5. To ensure sustainability of the road.

1.3 METHODOLOGY

1. Firstly, we'll study the concept 'Geo-synthetics.'
2. Then we'll identify effective methods for design of geo-synthetics road.
3. Then we'll do a brief comparison of Geo-synthetics used road pavement and a normal road pavement.
4. We'll Estimate the cost of both the road pavements
5. Then finally we'll do a case study of Punyadham Ashram road, kondhwa, Pune.

2. GEOSYNTHETICS MATERIAL

Geo-synthetics are generally used for stabilizing the terrain. They are made up of polymeric materials. Due to polymeric in nature, they are used in the road pavements for durability and sustainability. Use of geo-synthetic materials can significantly increase the safety factor, improve stability of the road pavement and also reduces the cost of construction compared to other conventional construction practices in use. It is generally used where is a loose soil strata. It strengthens the sub strata and provide strength to the embankment to withstand the forces exerted upon it.

3. TYPES OF GEO-SYNTHETICS

They can be categorized as Geogrid, Geotextiles, Geo-membranes, Geo-nets, Geo-composites. In this particular context we are going to give emphasis on Geo-grid and Geo-textiles.

3.1 Geo-grid



Fig -1: Geo-grids

They are made up of polymer materials. Their hard strands are arranged in longitudinal and transverse direction to form a uniformly distributed grid like apertures in the resulting sheet. There are many application areas to it but exclusively they are used for reinforcement purpose in a estimated work.

It can classified into two type

1. Woven
2. Non-woven

Functions of Geo-grid

There are many as such functions but mainly used for reinforcement purpose in the pavement construction.

3.2 Geo-textiles



Fig -2: Geo-textiles

It is a class of industrial grade textiles and are generally made up of polypropylene/polyester resins. These resins contain yarns. These yarns are knitted or woven into such shape to form flat, composite sheets. They are made up of synthetic fibres hence biodegradation and short life span are not the problems. They are porous and allow liquid to pass through them.

It can classified into three type

- 1.Woven
- 2.Non-woven
- 3.Knitted

Functions of Geo-teaxtile

1. Separation`
2. Drainage
3. Filtration

The materials which we are going to use in our project are geogrid- For reinforcement purpose and geotextiles for separation and drainage purpose. Let's move to our first objective i.e. comparative study of geo-synthetic used and unused road pavement.

4. COMPARISON IN TERMS OF FUNCTIONS

4.1 Separation

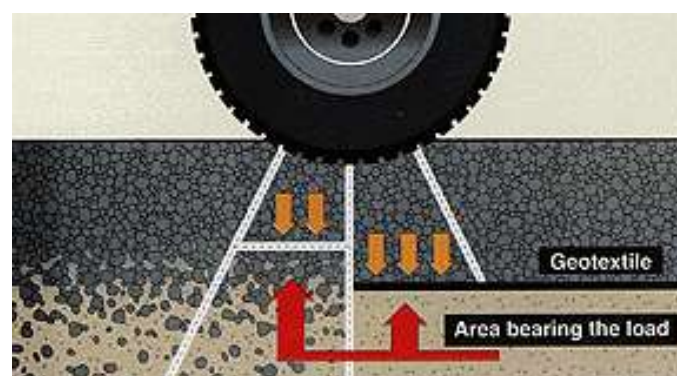


Fig -3: Separation Of Road

As we can see from above figure, that there is no separation provided to the layers of pavement hence due to lack of separation when load is exerted upon them, the particles of the sub strata get displaced and mix with the below layers. But when we place geotextiles in the pavement, various layers of the pavement get properly separated from each other thus we get clear separation between the two layers and hence it prevents the displacement of particles under applying load.

4.2 Drainage

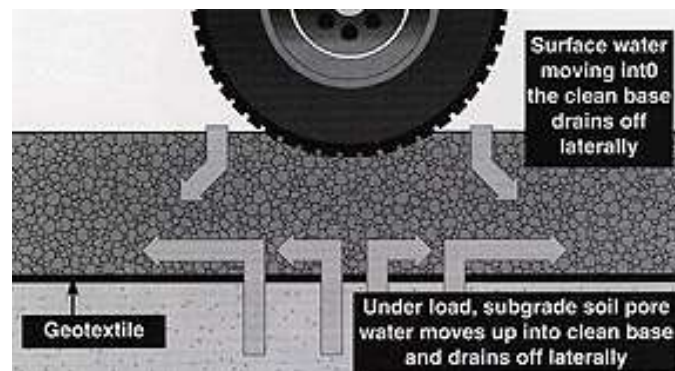


Fig -4: Drainage of Road

In water logging areas if there's no proper drainage provided to the pavement, the water gets accumulated on the pavement and erodes the surface layers of the pavement and eventually results into potholes, road sinking like adversities. But if we provide a proper drainage mechanism along with the geotextile, Geotextiles being permeable membrane, helps to drain out the excess water from the pavement by allowing to percolate it and prevents the adversities mentioned above.

4.3 Reinforcement

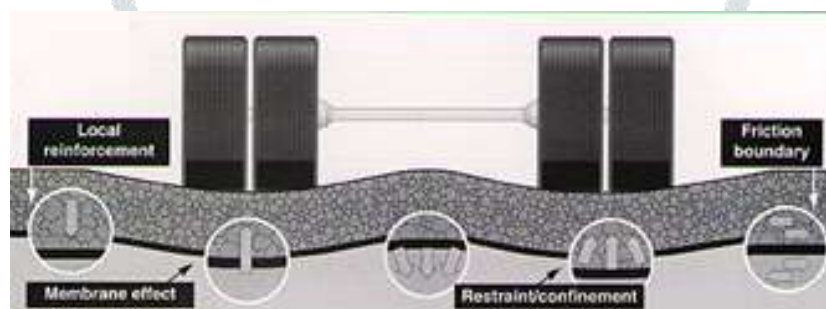


Fig -5: Reinforcement of Road

In case of soft soils like clay, black cotton soil etc, the subgrade constructed upon it is not stable and susceptible to deformation when applied load. Thus when these pavements experience loading, gets deformed and give rise to many road adversities.

This situation can be overcome by using geogrids to reinforce the sub strata. Geogrid holds the particles of subgrade firmly and do not let them to escape under loading conditions subsequently preventing the problem of deformation, and flowing of the road pavement.

5. COST ESTIMATION

Table -1: Cost comparison between normal road pavement and Geo-synthetic used road pavement

| SR. NO. | TYPES OF WORK | QUANTITY | RATE | AMOUNT (Normal Pavement) | AMOUNT (Geo-synthetic pavement) |
|---------|---|--------------|------|--------------------------|---------------------------------|
| 1 | Excavation for side drainage. | 540 Cum | 72 | 38880 | 38880 |
| 2 | Providing earthwork in embankment. | 2000 Cum | 151 | 302000 | 302000 |
| 3 | Providing laying spreading and compacting stone aggregates. | 700 Cum | 1846 | 1292200 | 1292200 |
| 4 | Transportation and spreading of hard murum. | 120 Cum | 557 | 66840 | 66840 |
| 5 | Compacting hard murum on both side. | 800 Sqm | 16 | 12800 | 12800 |
| 6 | Providing and constructing 75mm thick MPM | 4000 Sqm | 213 | 852000 | 852000 |
| 7 | Premix surfacing 20mm thickness | 4000 Sqm | 152 | 608000 | 608000 |
| 8 | Geo-textile | 4000 Sqm | 14 | - | 56000 |
| 9 | Geo-grid | 4000 Sqm | 40 | - | 160000 |
| | | TOTAL | | 3172720 | 3388720 |

Here we can see the price difference is around 2 lakhs. But if we think in the context of maintenance and other costs, its noting in compare to them. To elaborate it more we will have to see case study

6. CASE STUDY

Address-

Punyadham Ashram Road,
Survey Number 38/39 ,
Pisoli Road ,Off Somji Chowk , Kondhwa Khurd,
Pune-411028.

1. The road has been built 3 times since 2017.
2. In every monsoon it gets deteriorated and PMC reconstructs it every summer.
3. So, instead of reconstructing and thereby spending wholesome amount of money, we can surely afford the method of laying geo-synthetics. Articles published in the Times of India regarding deterioration of the road.



Fig -6: Article 1

There is a heavy water logged on road due to which transportation is highly impossible. Need to look into it seriously since it happens in every rain season.



Fig -7: Article 2 and 3

A few months back it was constructed but after rains, became pathetic. Residents request for immediate repair as it is very difficult to communicate on this road on daily basis. Complaint is registered with govt; but it has been closed with the reason 'Lack of funds.

6.1 PROBLEM AND SOLUTION

Problem 1: Mixing of various layers of strata

Solⁿ: Can be eliminated by using geotextiles for separation of different layers.

Problem 2: Water logging

Solⁿ : Can be eliminated by providing proper drainage mechanism using geotextiles.

Problem 3: Potholes and road sinking

Solⁿ : Can be eliminated by using geo-grid to reinforce the subgrade.

Also, Ministry of Road transport and Highways has circulated a GR F. N. RW/NH-33044/64/2018-S&R(P&B) dated July 16, 2018 instructing concerned officials to promote the use of Geo-synthetics in road construction.

In this GR, Indian Road Congress has issued some guidelines regarding the use of geo-synthetics. The solutions provided by us to this affected road completely go hand-in-hand with those guidelines.

7. CONCLUSION

1. Geosynthetic materials are proved to be an effective solution to the problems of road sinking, pothole occurrence etc.
2. It's also a cost effective solution and helps to achieve economy in the construction.
3. The solutions provided to the affected road can be applied effectively to rejuvenate its condition.

8. REFERENCES

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