DESIGN OF FLEXIBLE PAVEMENT USING GEO TEXTILE AND GEO GRID

Malik Aneeq Manzoor[1*] and Waseem Akram[2]

Abstract

According to estimations, India's total road length as of March 31, 2018, was 6,603,293 km (4,103,096 mi), making the country's road system the second largest in the world behind the United States. Nevertheless, due to problems like the development of potholes, localized depressions, and settlement cracks and ruts, particularly during the wet season, the roads are not producing the anticipated results. Several forms of study have been conducted to address these problems, but few or no significant findings have been made. The literature study in this research offers suggestions for ways to reinforce the road pavement in snowy areas while considering cost-and raw-material-effectiveness. (Goud et al., 2022a) Also, the issue of frequent freezing and thawing brought on by unstable temperatures and an abundance of snowfall causes various kinds of damage to the pavement's structural element sand renders the road portion impassable. By using geotextile sand geo grids properly, this issue may be solved.

Keywords: localized depressions, settlement cracks, raw-material-effectiveness, geotextiles, geogrids.

[1*]Research Scholar, Department of Transportation Engineering, School of Civil Engineering, Lovely, Professional University, GT Road Phagwara,144411, E-Mail: waseem.19417@lpu.co.in
[2]Assistant, Professor Department of Civil Engineering, Lovely Professional University, GT Road Phagwara, 144411⁾ Email: malikaneeq19@gmail.com@gmail.com

***Corresponding Author: Waseem Akram**
*****Research Scholar, Department of Transportation Engineering, School of Civil Engineering, Lovely, Professional University, GT Road Phagwara,144411, E-Mail: waseem.19417@lpu.co.in

DOI: - 10.48047/ecb/2023.12.si5a.0412

1. Introduction

1.1Introduction

Beyond only facilitating speedy and enjoyable transportation, the Indian Road network has numerous more uses. Regional or inter state transportation activities. (Mittaletal.,2020) It serves many purposes than just facilitating the swift and comfortable circulation of interstate or regional traffic. The presence of soft/loose soil at ground level is the engineers' major issue while developing roadways in India's plains and coastal regions. It costs more money to build highways over this loose soil since bigger granular materials are needed. Alternatively, attempting to lessen the pavement layer's thickness in order to build a building that is more cost-effective would lead to early pavement degradation and render the road inaccessible shortly after construction. This issue might get considerably worse if there is little or no drainage. Certain states in India that are situated in high-rain fall regions have weak subgrade condition sand in adequate drainage.

One of the primary causes of the awful condition of the roads in those states is this (Xu, n.d.). (Ibrahim et al., 2017) The country's transportation network is an essential part of its infrastructure and is essential to its sustained economic growth. After the United States, India has the second-largest road network in the world. Better pavement is required for commercial vehicles to efficiently navigate through traffic as freight traffic increases. In addition, most commercial vehicles transport loads that are greater than what is allowed, further harming pavements. (Ketemaet al.,2016)

The longevity of the pavement is also influenced by the subgrade soil's resilience. One of the main problems that highway engineers must solve is the subgrade's unstable nature. Pavements may break partially or entirely when roads are running on a problematic subgrade, such as expanding soil or soft and collapsible subgrades, and frequent failures require a lot of care.(Baadiga et al., 2021a) Economical flexible pavement structures, therefore, require sub grade with good engineering properties in order to maximize the service life of a roadway section and minimize the thickness of flexible pavement structures while taking strength, drainage, ease of compaction, and permanency of compaction into consideration.

This can be accomplished by adding strong soil where weak soil had existed, or by applying any other suitable approach for ground rehabilitation. Geogrids perform separation and reinforcement, two of the primary functions of geosynthetics, when they are used in a pavement system. (Goud et al., 2020a) Due to the wide aperture diameters of most commercial geo grid products, geogrids are frequently not used to segregate materials with various characteristics. The ability of a geogrid to divide the two materials depends on their gradations, which is frequently outside the range of typical paving materials. Even with their drawbacks, geogrids might be able to provide some level of isolation. Due of this, separation is not the main goal of geogrids used in pavements.

Geogrids' primary function nis to mechanically improve the technical properties of the pavement system in order to reinforce the pavements. the rein forcing strategies connected to geogrids. (Narendra Goud & Uma shankar, 2022; Zehawi etal.,2022)

To create a flat permeable sheet, a geotextile, a form of industrial textile, is constructed from polypropylene or polyester resin and threads that have been needle punched, woven, knitted, thermally or chemically bonded, or the rm ally or chemically bonded. Pool liners, trampolines, carpet backing, and car trunk liners are further uses for industrial textiles.(de Souza Bueno & Gabriel Zornberg, n.d.) These specific geosynthetic materials have gain ed prominence during the past fifteen years.

It has more than 80 applications, mostly because of how resistant it is to biodegradation. Geotextiles are fabrics, while not being in the traditional meaning of the word. (Baadiga et al., 2021b; Goudetal., 2022b) These are not natural fabrics like cotton, silk, or wool. Geotextiles, which are synthetic fibres, can be used to make a flexible, porous, nonwoven needle-felt fabric.

1.2 Aims and Objectives

- To make a strong durable road pavement
- To increase the load-bearing capacity in snow-bound regions
- To determine the optimum quantity of geo-grids per km of length
- To determine the strength of such roads to ensure it with stands heavy loads.

1.3 Rationale for doing this research

The paper rationalizes the need for research on the use of geotextiles and geogrids in reinforcing road pavement in snowy areas. The paper suggests that the use of geotextiles and geogrids can be an effective way to improve the strength, stability, and durability of road pavement in snowy areas. However, the paper also highlights the need for further research to validate the findings of the literature study and address some of the limitations and challenges in the use of geotextiles and geogrids in road pavement reinforcement. The paper suggests several future works that can help to further improve the use of geotextiles and geogrids in road pavement rein for cement and make it more effective and sustainable.

These future works include conducting field tests, investigating long-term durability, studying the effect of different types of geotextile sand geogrids, developing guidelines for design and construction, and studying the effect on the environment t and sustainability. In summary, the paper rationalizes the need for research on the use of geotextiles and geogrids in reinforcing road pavement in snowy areas to improve the effectiveness and sustainability of road pavement rein for cement.

2.1 Literature Review

2.2 Empirical Study

The purpose of the literature review that was carried out for this research paper was to examine all the previous research that has been under taken on the use of geotextile sand geogrid sin the construction of flexible pavement. This review was conducted with the intention of gathering pertinent information and data in order to support the aims of the research study. The literature review is a vital phase in any research project since it helps to discover gaps in current knowledge and offers a basis for subsequent research. This step should be completed as early in the research process as possible

2.3 Research Gap

From the research study carried out, it can be said that further work is to be carried out regarding formation of potholes, localized depression, and settlement cracks. This is very less successful outcomes or desirable results have been identified thus far. More emphasis is to be laid on the usage of geotextile sand geogrid sin regions with variable temperatures.

Also, more research is to be carried out regarding how to reduce the thickness of roads with geogrids/ geotextiles installed. There is still a need for study on the long-term performance of these materials, despite the fact that there have been many studies on the usage of geotextiles and geogrids in flexible pavement design. In particular, there is a dearth of thorough studies that assess the efficiency of geotextile sand geogrid sin reducing pavement distress and enhancing pavement performance over long durations, such as 10 years or more. Moreover, research is required to evaluate the performance of various geotextile and geogrid type sin flexible pavement design as well

As to look into how various design elements, including sub grade feature sand traffic loads, affect the performance of these material sin these applications.

3.1 Research Methodology

3.2 Research approach and design

3.10 Material Characterization: Describe the geotextile sand geogrids that will be utilized in the research. To do this, laboratory tests must be performed to as certain the materials' mechanical and physical characteristics, such as tensile strength, elastic modulus, and creep behaviour.

3.11 Pavement Design: Construct a flexible pavement with geotextiles and geogrids. To do this, it will be necessary to calculate the ideal number of geo-grids per km of length as well as the necessary pavement layer thickness. The design should also take the local climate and traffic load in to account.

3.12 Field Installation: Put the pavement in the field where it was supposed to go. The subgrade will need to be ready the geotextile sand geogrids will need to be setup, and the layer soft he pavement will need to be built.

3.13 Load Testing: Test the built-up pavement's strength and capacity to with stand loads by per forming load tests. The pavement will need to be subjected to large loads, and the resulting deformation and stress will be measured.

3.14 Performance Evaluation: Assess the created pavement's performance over time. Its performance under traffic loads and environmental circumstances will be monitored, and its deformation, cracking, and other signs of distress will be measured.

3.15 Data Analysis: Use the proper statistical techniques to the data collection analysis. The performance of the pavement with and without geotextiles and geogrids will be compared, and the materials' efficiency in boosting the pavement's strength and load-bearing capacity will be assessed.

3.2 Materials and Testing

The different types of materials that we are going to use in this research are mentioned below: Geotextiles Geogrids

3.21 Geotextiles:

Geotextiles are polymer fabrics that are utilised in the building of breakwaters, harbour works, highways, drainage, and other civil engineering structures (Joshi & Arora, 2015). Geotextiles are fabrics used in geotechnical applications, such as embankments for roads and railroads, earth dikes, and structures for coastal protection, and are created to carry out one or more fundamental tasks, such as filtration, drainage, separating soil layers, reinforcement, or stabilisation. Because of this, practically all geotextile applications are multifunctional.

3.22 Geogrids:

A geogrid is a geosynthetic material that is used to strengthen soil and other materials. Under strain, soils split apart. Geogrids have more tension than dirt does.

Unlike in the absence of this characteristic, they are able to distribute pressures across a broader region of soil. (Shu Ing, n.d.) Polyester, polyvinyl alcohol, polyethylene, and polypropylene are just a few examples of the polymer materials that are frequently used to create geogrids. They can be created by weaving or knitting yarns, heat-welding material strips, or punching a grid of holes in sheet so f material and stretching them out in to a fabric.

4.0 Results and Findings

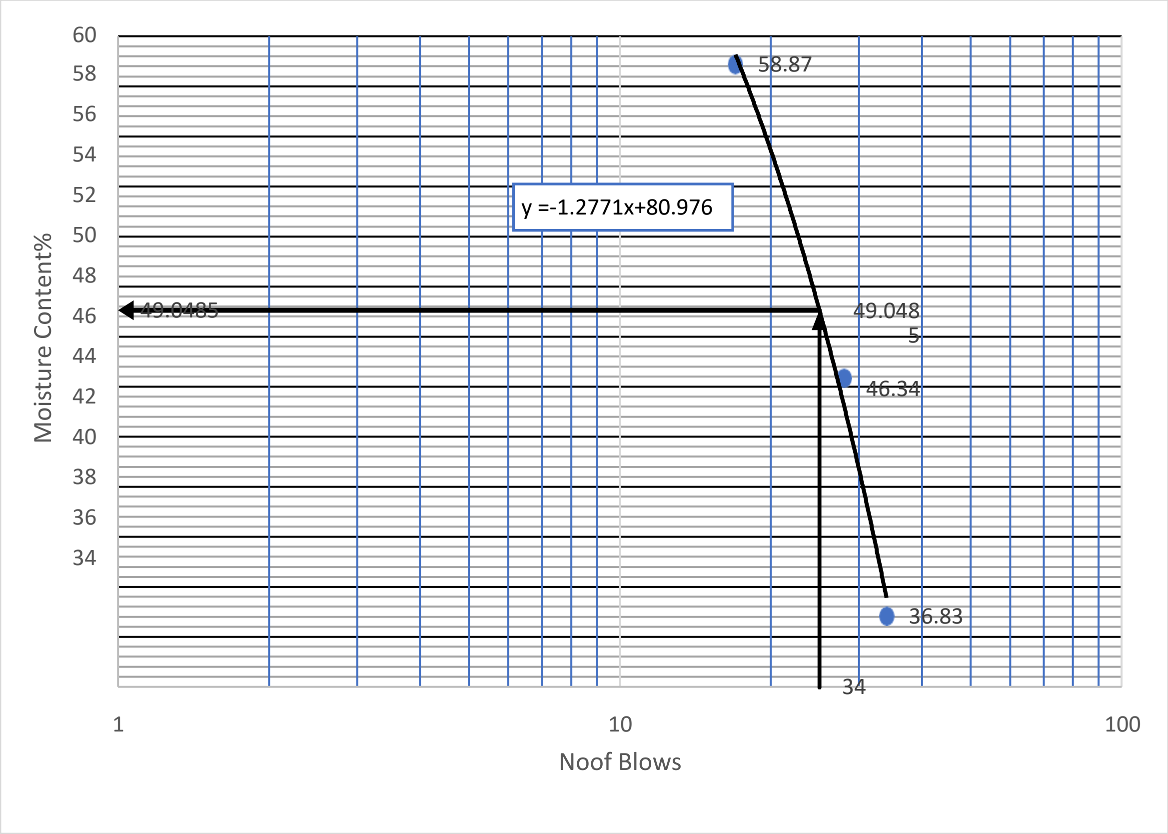

Figure1: Liquid Limit Graph

From the given data points, we can observe that as the number of blows decreases, the moisture content tends to decrease as well. This implies an inverse relationship between the number of blows and the moisture content.

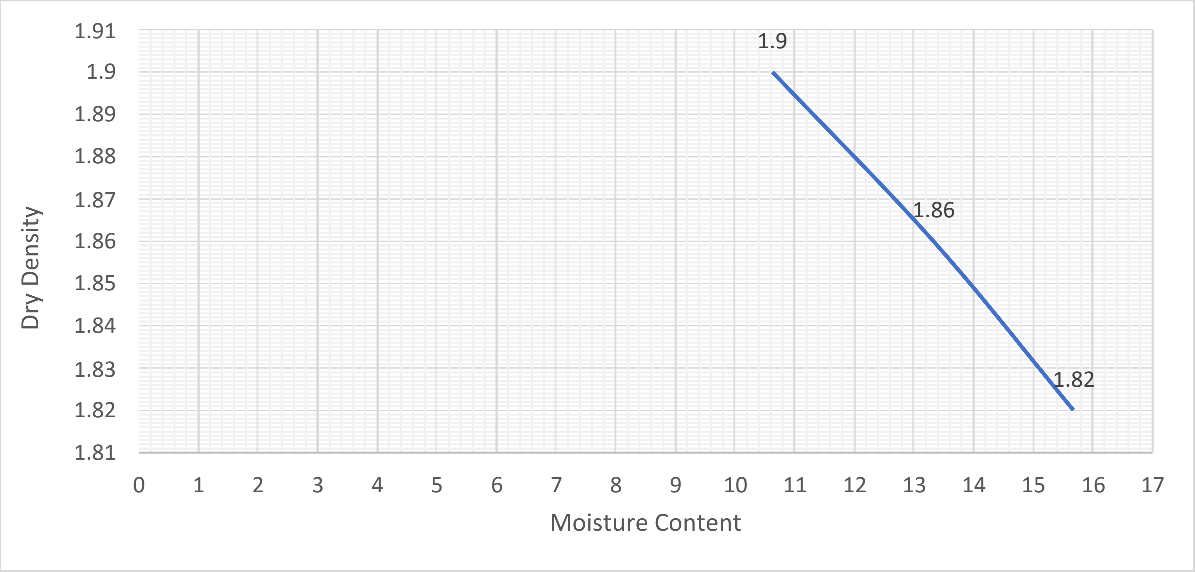

Figure2: Standard Proctor Test with out using geotextile-12%watercontent.

From the data points, we can observe the following trends:

As the moisture content increases from 10.63% to 15.68%, the dry density decreases from 1.90 to 1.82. This suggests that the soil sample is becoming less compacted as the moisture content increases. The data point at13.33% moisture content and a dry density of 1.86 falls between the other two data points. This indicates an intermediate level of compaction compared to the other two moisture contents. Based on the set rends, it is possible to infer that the moisture content significantly affects the compaction characteristics of the soil. As the moisture content increases beyond the optimum moisture content, the soil becomes more saturated, resulting in a decrease in dry density. To determine the optimum moisture content, which represents the moisture content that results in the highest dry density, it is necessary to plot all the data points on a graph and identify the moisture content that corresponds to the maximum dry density. Overall, this analysis suggests that for the given soil sample, compaction is more effective at lower moisture contents(closerto10.63%),and as the moisture content increases beyond the optimum, the compaction efficiency decreases, resulting in lower dry densities.

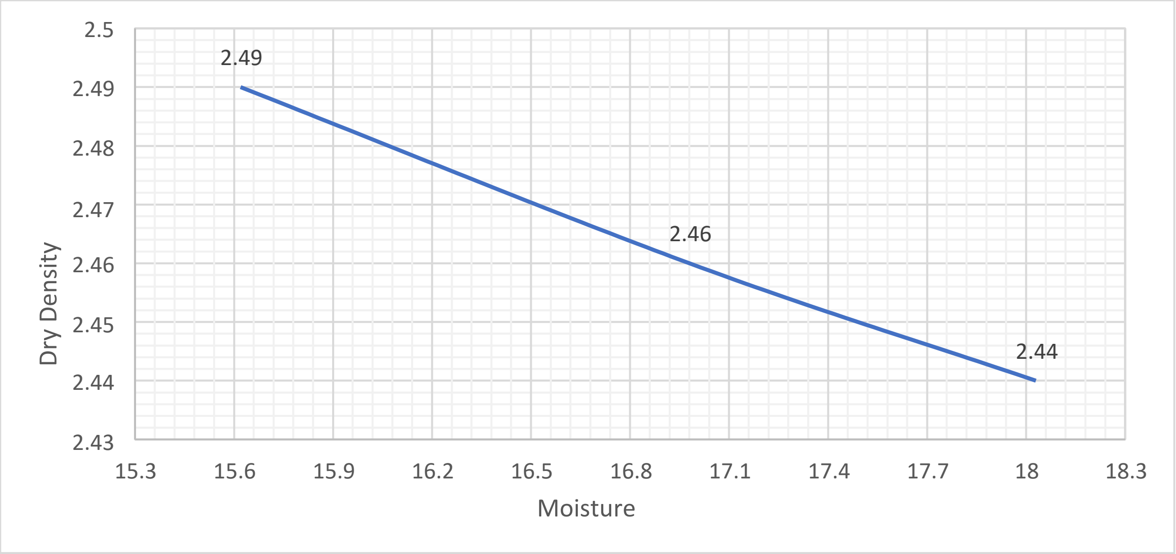

Figure3: Standard Proctor Test without using geotextile-16% water content.

From the given data points, we can observe the following trends:

As the moisture content increases from15.62% to 16.98%to18.03%, the dry density decreases from 2.49 to 2.46 to 2.44, respectively. This indicates that as the moisture content increases, the compaction efficiency decreases, resulting in lower dry densities. Based on these trends, we can infer that the soil sample is becoming less compacted as the moisture content increases. This suggests that the given soil sample has exceeded the optimum moisture content for compaction, and further increases in moisture content lead to reduced dry densities. To determine the optimum moisture content accurately, it is essential to plot all the data point sonagraph and identify the moisture content at which the dry density reaches its maximum value. In summary, the analysis indicates that the compaction efficiency decreases as the moisture content increases beyond the optimum level. It emphasizes the importance of achieving and maintaining the optimum moisture content during compaction to ensure the highest possible dry density and desired engineering properties for the soil.

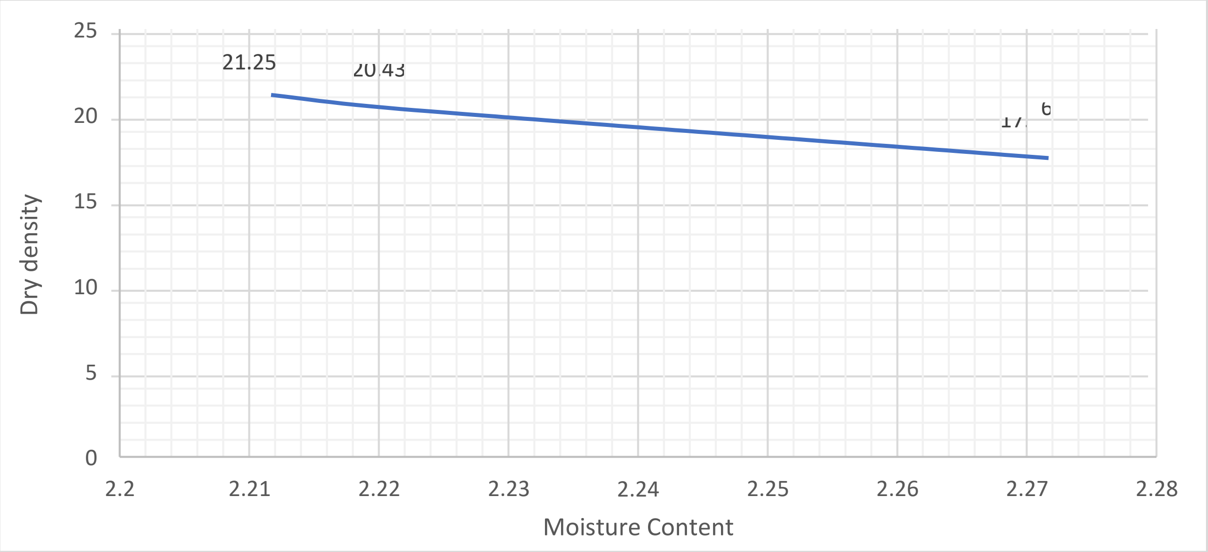

Figure4: Standard Proctor Test without using geotextile-20%watercontent.

From the given data points, we can observe the following trends:

As the moisture content increases from 17.56% to 20.43 % to 21.25%, the dry density decreases from 2.27 to 2.22 to 2.21, respectively. This indicates that as the moisture content increases, the compaction efficiency decreases, resulting in lower dry densities. Based on the set rends, it is evident that the soil sample is becoming less compacted as the moisture content increases. The decreasing dry density suggests that the soil has surpassed the optimum moisture content for compaction. Further increases in moisture content result in reduced compaction and lower dry densities. To accurately determine the optimum moisture content, it is crucial to plot all the data points on a graph and identify the moisture content at which the dry density reaches its maximum value. In summary, the analysis indicates that exceeding the optimum moisture content leads to a decrease in compaction efficiency and lower dry densities. It emphasizes the importance of careful moisture control during compaction to achieve the desired engineering properties and maximize the dry density of the soil.

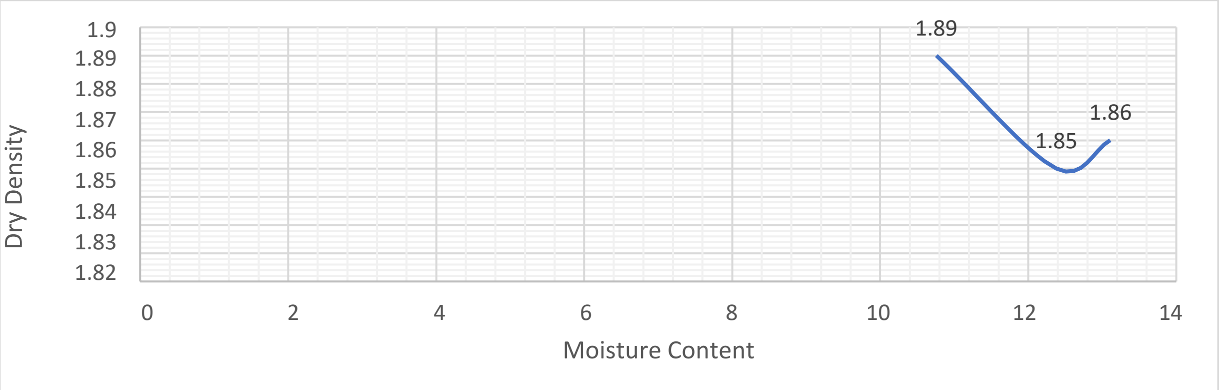

Figure5: Standard Proctor Test using geotextile-10%water content from 3cmtop.

Based on these data points, we can observe the following trends:

As the moisture content increases from 10.76 % to 12.38 % to 13.11 %, the dry density decreases from 1.89 to 1.85 to 1.86, respectively.

This indicates that as the moisture content increases, the compaction efficiency decreases, resulting in lower dry densities. The difference in dry density between the data points is relatively small, suggesting a relatively stable compaction behavior within the specified range of moisture content. Based on these trends, we can conclude that the soil is relatively responsive to compaction, as the change in dry density is relatively small with changes in moisture content. This suggests that the soil may have a relatively low plasticity and is likely to achieve reasonably high compaction at lower moisture contents.

It is important to note that these conclusions are based on the limited data points provided. To gain a more comprehensive understanding of the compaction behavior, it is recommended to collect additional data points across a wider range of moisture contents. Overall, the analysis indicates that compaction efficiency decreases as the moisture content increases with in the given range, leading to lower dry densities.

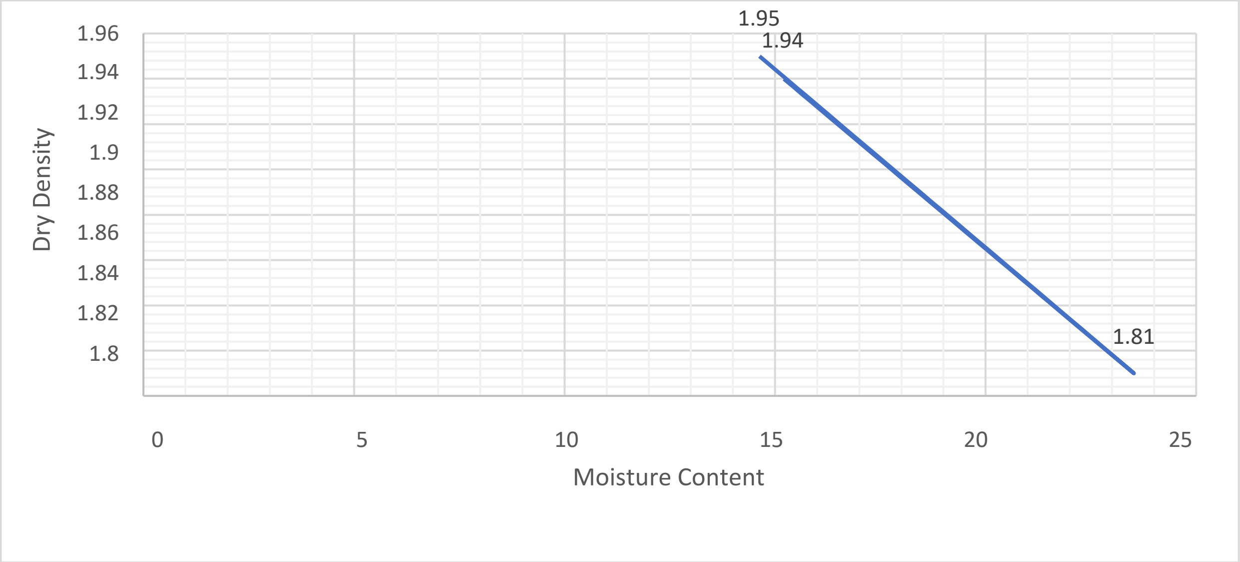

Figure6: Standard Proctor Test using geotextile-14%watercontentfrom 3cm top.

Based on these data points, we can observe the following trends:
As the moisture content increases from 15.21% to 23.52% and then decreases to 14.63%, the dry density fluctuates. This indicates that the moisture content has a significant impact on the compaction and resulting dry density.

The dry density is highest at a moisture content of 1.95, decreases at 23.52%, and then increases again at14.63%. This suggests that the optimum moisture content lies somewhere between the given data points. Based on these trends, it appears that the soil is relatively sensitive to changes in moisture content. The fluctuating dry densities indicate that the soil's compaction behavior varies with different moisture contents. To determine the optimum moisture content more precisely, it would be helpful to collect additional data points covering a wider range of moisture contents and plot them on a graph.

This will allow for a more accurate identification of the moisture content that yields the maximum dry density. In summary, the analysis suggests that the soil's compaction efficiency is affected by changes in moisture content. To achieve the desired dry density, it is crucial to find the optimum moisture content through further testing and data collection.

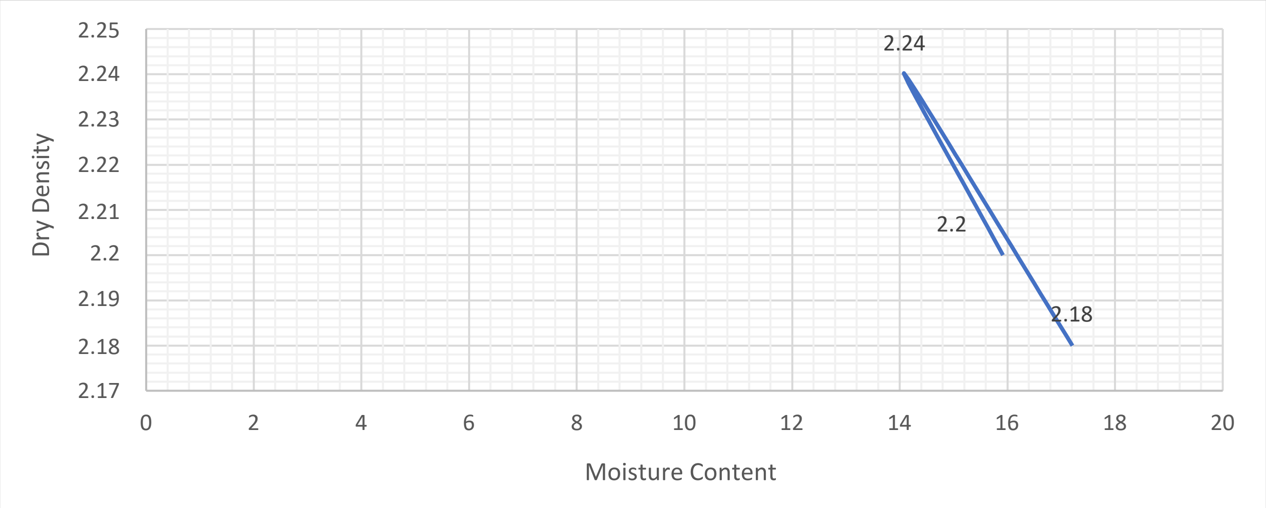

Figure7: Standard Proctor Test using geotextile-18%watercontentfrom 3cm top.

Based on these data points, we can observe the following trends:

As the moisture content decreases from 17.21% to 14.10% and then increases to 15.92%, the dry density also fluctuates. This indicates that the moisture content has a significant influence on the compaction and resulting dry density. The dry density is highest a ta moisture content of 14.10 %, decreases at 17.21 %, and then increases against 15.92 %. This suggests that the moisture content at 14.10% might be closer to the optimum moisture content for achieving the highest dry density. Based on these trends, it appears that the soil's compaction behavior is sensitive to changes in moisture content within the given range. The fluctuations in dry density indicate variations in compaction efficiency at different moisture contents. To determine the optimum moisture content more precisely, it would be beneficial to gather additional data points across a wider range of moisture contents and plot the monagraph. This will facilitate the identification of the moisture content that yields the maximum dry density. In summary, the analysis suggests that the soil's compaction efficiency is affected by changes in moisture content. Further testing and data collection are recommended to determine the optimum moisture content accurately for achieving the desired dry density inthetop3cmof the soil.

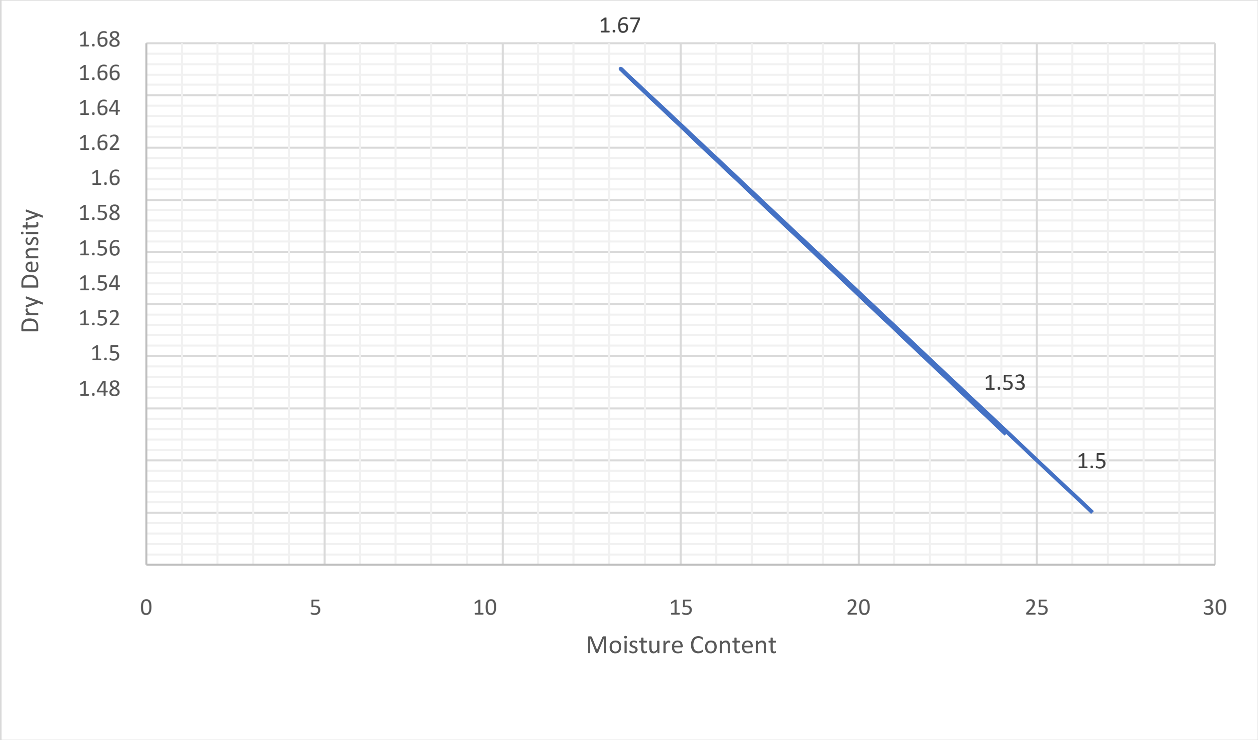

Figure8: Standard Proctor Test using geotextile-10%watercontentfrom 6cm top.

Based on these data points, we can observe the following trends:

As the moisture content varies from 24.13% to 13.33% and then increases to 26.56%, the dry density also fluctuates. This indicates that the moisture content has a significant impact on the compaction and resulting dry density. The dry density is highest at a moisture content of 1.67, decreases at 24.13%, and then further decreases at 26.56 %. This suggests that the moisture content at 13.33% might be closer to the optimum moisture content for achieving the highest dry density. Based on these trends, it appears that the soil's compaction behavior is highly sensitive to changes in moisture content with in the given range. The fluctuations in dry density indicate variations in compaction efficiency at different moisture contents. To accurately determine the optimum moisture content, it is recommended to collect additional data points across a wider range of moisture contents and plot them on a graph. This will provide a clearer understanding of the relationship between moisture content and dry density, enabling the identification of the moisture content that yields the maximum dry density. In summary, the analysis suggests that the soil's compaction efficiency is significantly influenced by changes in moisture content. Further testing and data collection are needed to determine the optimum moisture content for achieving the desired dry density in the top 6 cm of the soil.

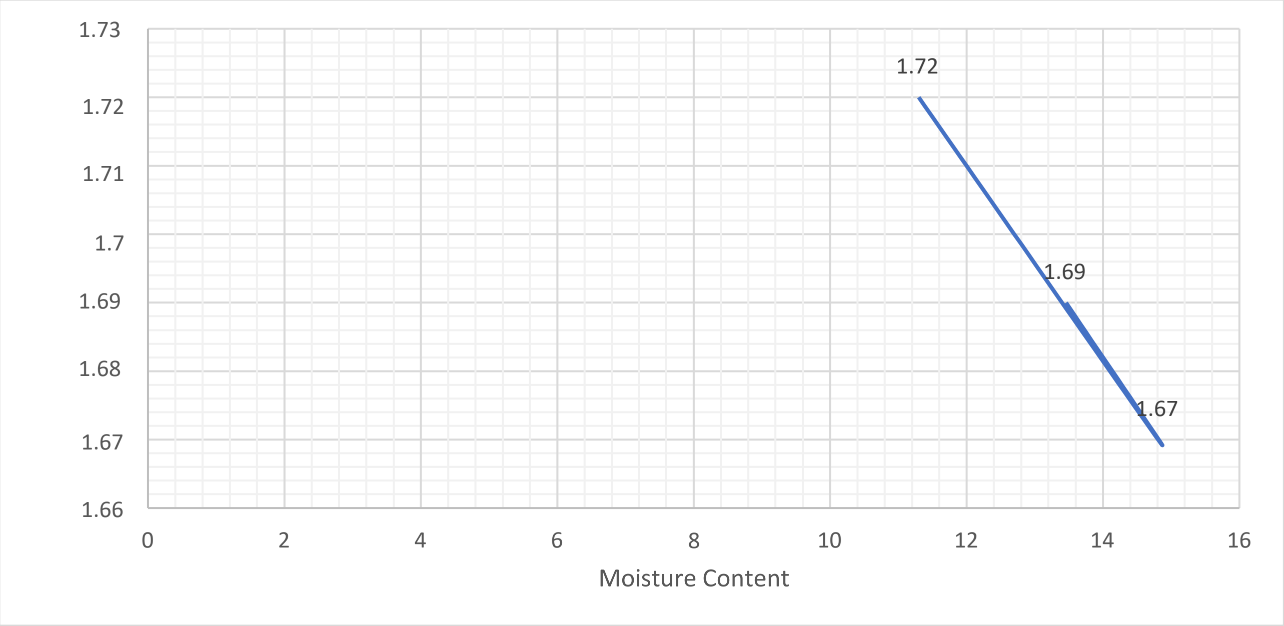

Figure9: Standard Proctor Test using geotextile-14%water content from 6cm top.

Based on these data points, we can observe the following trends:

As the moisture content varies from 13.46% to 14.81% and then decreases to 11.30%, the dry density also fluctuates. This indicates that the moisture content has a significant impact on the compaction and resulting dry density. The dry density is highest at a moisture content of 1.72, slightly lower at 1.67, and then further decreases at 1.69. This suggests that the moisture content at 11.30% might be closer to the optimum moisture content for achieving the highest dry density. Based on the set rends, it appears that the soil's compaction behavior is sensitive to changes in moisture content within the given range. The fluctuations in dry density indicate variations in compaction efficiency at different moisture contents. To accurately determine the optimum moisture content, it is recommended to collect additional data points across a wider range of moisture contents and plot the monagraph. This will provide a clearer understanding of the relationship between moisture content and dry density, enabling the identification of the moisture content that yields the maximum dry density. In summary, the analysis suggests that the soil's compaction efficiency is influenced by changes in moisture content. Further testing and data collection are needed to determine the optimum moisture content for achieving the desired dry density in the top 6 cm of the soil.

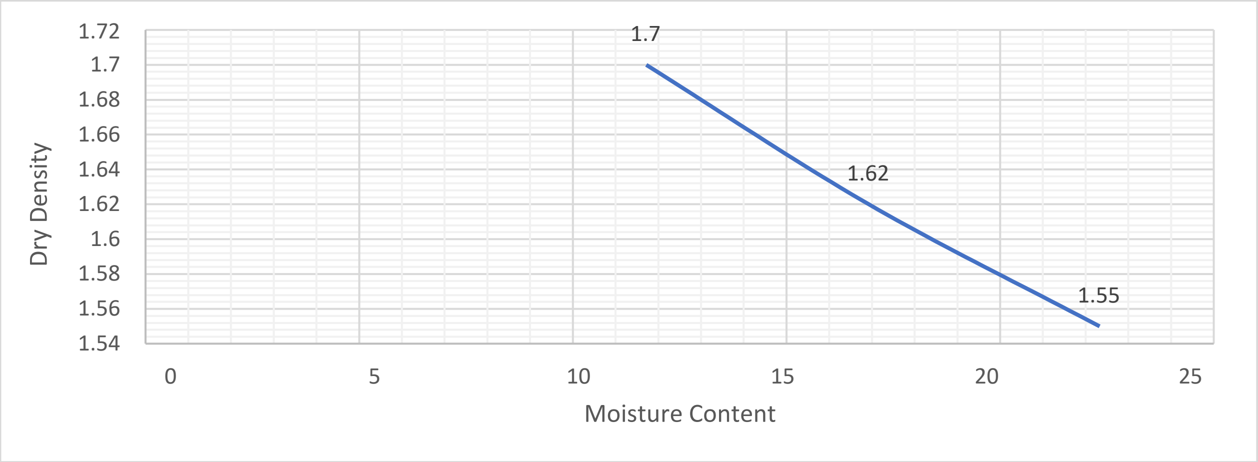

Figure9: Standard Proctor Test using geotextile-18%watercontentfrom 6cm top.

Based on these data points, we can observe the following trends:

As the moisture content varies from 22.33% to 16.93% and then increases to 18.72%, the dry density also fluctuates. This indicates that the moisture content has a significant impact on the compaction and resulting dry density. The dry density is lowest at a moisture content of 1.55, increases slightly at 1.62, and then further increases at 1.70. This suggests that the moisture content at 18.72% might be closer to the optimum moisture content for achieving the highest dry density. Based on the set rends, it appears that the soil's compaction behavior is sensitive to changes in moisture content within the given range. The fluctuations in dry density indicate variation sin compaction efficiency at different moisture contents. To accurately determine the optimum moisture content, it is recommended to collect additional data points across a wider range of moisture contents and plot them on a graph. This will provide a clearer understanding of the relationship between moisture content and dry density, enabling the identification of the moisture content that yields the maximum dry density. In summary, the analysis suggests that the soil's compaction efficiency is influenced by changes in moisture content. Further testing and data collection are needed to determine the optimum moisture content for achieving the desired dry density in the top 6cm of the soil.

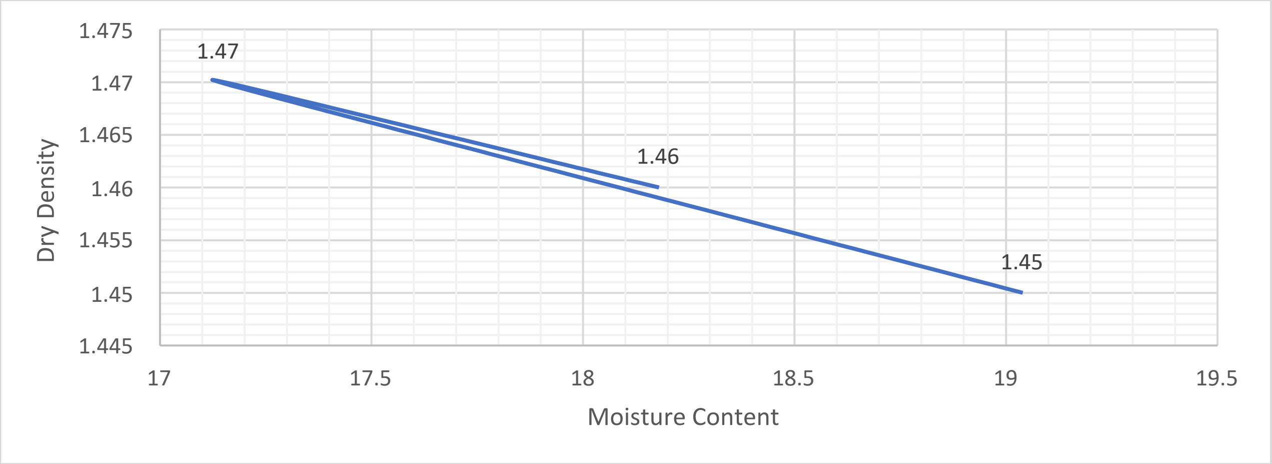

Figure9: Standard Proctor Test using geotextile-10%watercontentfrom 9cm top.

Based on these data points, we can observe the following trends:

As the moisture content varies from 18.18% to 17.14% and then increases to 19.04%, the dry density fluctuates. This indicates that the moisture content has an influence on the compaction and resulting dry density. The dry density values are relatively close to each other, with only slight variations. This suggests that the soil's compaction behavior remains relatively stable within the given moisture content range. Based on these trends, itappearsthatthesoil'scompactionbehaviorislesssensitivetochangesinmoisturecontentwithinthegivenra ngeof data points. The relatively small fluctuations in dry density indicate consistent compaction efficiency. To determine the optimum moisture content more precisely, it is recommended to collect additional data points across a wider range of moisture contents and plot them on a graph. This will provide a clearer understanding of the relationship between moisture content and dry density, enabling the identification of the moisture content that yields the maximum dry density. In summary, the analysis suggests that the soil's compaction behavior remains relatively stable with in the given range of moisture content in the top 9 cm. Further testing and data collection are needed to determine the optimum moisture content for achieving the desired dry density in this specific depth range without using a geotextile.

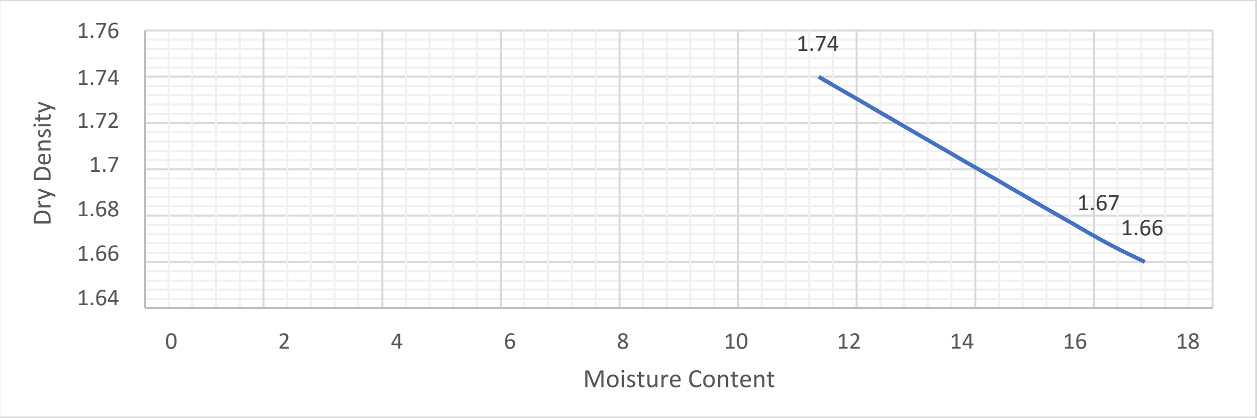

Figure10: Standard Proctor Test using geotextile-14%watercontentfrom9cm top.

Based on these data points, we can observe the following trends:

As the moisture content varies from 16.88% to 16.09% and then decreases to 11.36%, the dry density slightly fluctuates. This indicates that the moisture content has a minor influence on the compaction and resulting dry density. The dry density values are relatively close to each other, with only slight variations. This suggests that the soil's compaction behavior remains relatively stable within the given moisture content range. Based on the set rends, it appears that the soil's compaction behavior is not significantly sensitive to changes in moisture content within the given range. The small fluctuations in dry density indicate consistent compaction efficiency. To determine the optimum moisture content more precisely, it is recommended to collect additional data points across a wider range of moisture contents and plot them on a graph. This will provide a clearer understanding of the relationship between moisture content and dry density, enabling the identification of the moisture content that yields the maximum dry density. In summary, the analysis suggests that the soil's compaction behavior remains relatively stable with in the given range of moisture content in the top 9 cm. Further testing and data collection are needed to determine the optimum moisture content for achieving the desired dry density in this specific depth range without using a geotextile.

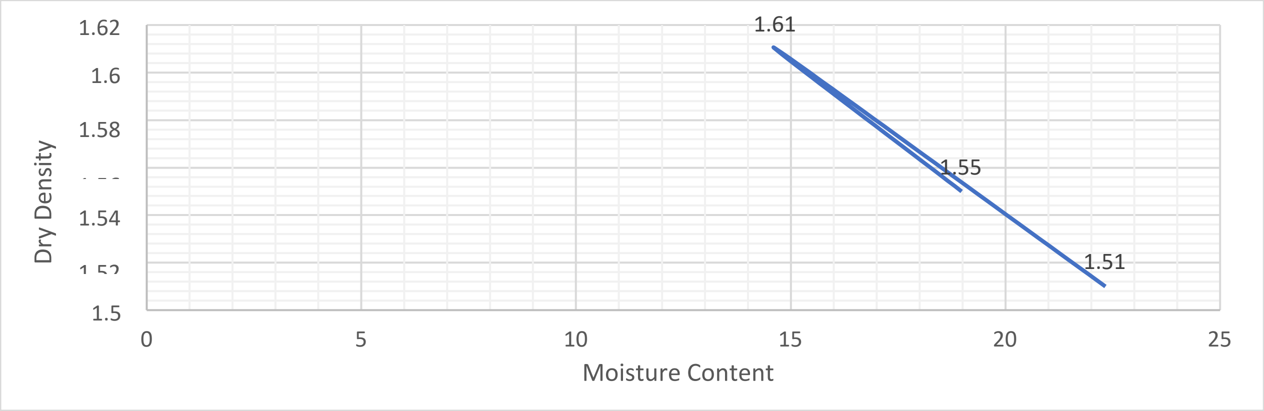

Figure10: Standard Proctor Test using geotextile-14%water content from 9 cm top.

Based on the provided data points, we can analyze the Standard Proctor Test without using geotextile graph from top 9 cm as follows:

Moisture content: The moisture content ranges from 14.66% to 22.23%. The highest moisture content is 22.23% and the lowest is 14.66%. It can be observed that as the moisture content increases, the dry density decreases. Dry density: The dry density ranges from 1.51 g/cm3 to 1.61 g/cm3. The highest dry density is 1.61 g/cm3 and the lowest is 1.51 g/cm3. It can be observed that as the moisture content increases, the dry density decreases. Overall, the trend in this graph is similar to the other Standard Proctor Test graphs without using geotextile.

As the moisture content increases, the dry density decreases. It is important to note that the maximum dry density is not achieve din this test, indicating that the soil may not be compacted to its full potential.

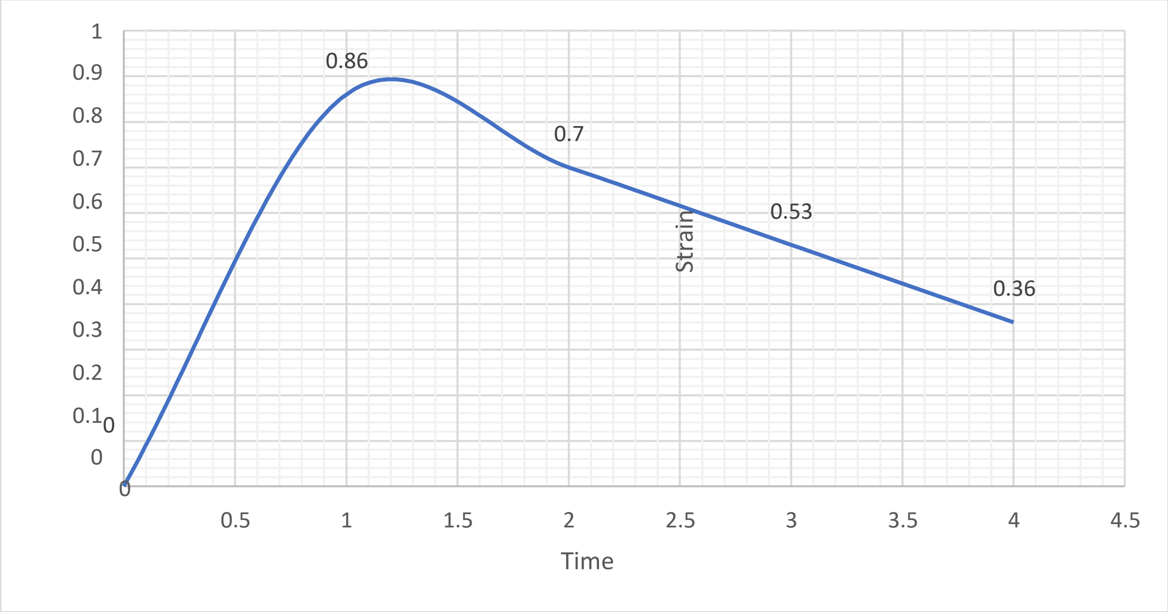

Figure10: Creep Testing

Based on these data points, we can observe the following trends:

Strain:
The strain values increase as the time progresses. Initially, the strain is zero at the start of the test. However, as time passes, the strain values increase gradually.

Time Period: The time also increases progressively from 0 to 4. Each sub sequent data point represents an increase in the time elapsed during the creep test.

Based on these trends, it can be inferred that the material under test exhibits creep behavior. Creep refers to the time-dependent deformation or strain that occurs under a constant load or stress. In this case, as the time period increases, the strain of the material also increases, indicating its tendency to deform over time under the applied load. To further analyze the behavior, additional data points and a longer time period would be beneficial.

This would provide a more comprehensive understanding of the creep characteristics of the material. In summary, based on the provided data points, the analysis suggests that the material under test exhibits creep behavior, with the strain increasing gradually as the time progresses. Further testing and data collection are recommended to fully characterize the creep properties of the material.

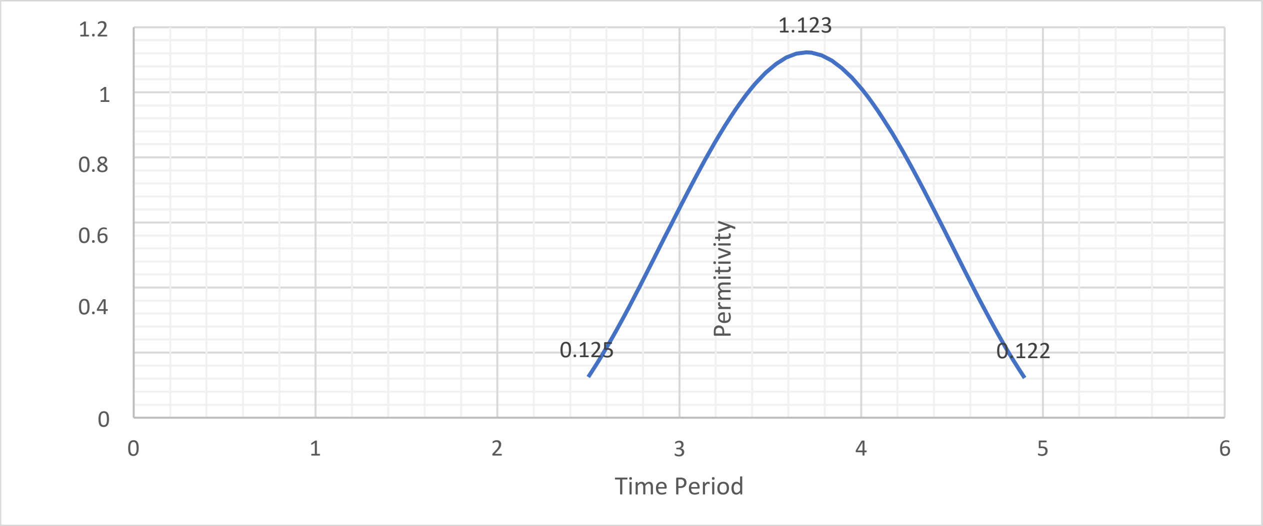

Figure 10: Permittivity Testing Based on these data points, we can observe the following trends:

Permittivity:
The permittivity values show as light decrease as the time period increases. Initially, the permittivity is 0.125 at a time of 2.5. However, as the time increases to 3.7 and 4.9, the permittivity values decrease slightly to 0.123and 0.122, respectively.

Time Period:
The time values increase progressively from 2.5 to 4.9. Each subsequent data point represents an increase in the time elapsed during the permittivity testing.

Based on these trends, it can be inferred that the material under test exhibits as light decrease in permittivity overtime. Permittivity is a measure of a material's ability to store electrical energy in an electric field. The decrease in permittivity values may indicate a change in the electrical properties of the material as the time increases.

To further analyze the behavior and draw more conclusive in sights, it would be helpful to have additional data points and a broader range of time periods. This would provide a more comprehensive understanding of the permittivity characteristics of the material under varying conditions. In summary, based on the provided data points, the analysis suggests that the permittivity of the material shows as light decrease as the time period increases. Further testing and data collection with more data points and a wider range of time periods would be beneficial to fully characterize the permittivity behavior of the material.

5.1 Conclusion and recommendations

5.2 Linking with objective

The objective of the research paper is to investigate the impact of geotextiles on the performance of flexible pavement. The study aims to design and construct a flexible pavement with geotextile sand geo grids, and evaluate its performance over time. (Goud et al., 2020b) The literature review conducted in the paper is linked with the objective as it provides insights into the best practices for using geotextiles and geogrids in flexible pavement design. The material characterization, pavement design, field installation, load testing, and performance evaluation are all steps taken to achieve the objective of there search paper.

5.3 Recommendation

Based on the finding soft his research paper, it is recommended that geotextile sand geogrids be used in the design and construction of flexible pavements in snowy areas. The use of these materials can improve the pavement's strength and load-bearing capacity, reduce shrinkage impact, and enhance drainage and subgrade stability at a reasonable cost. (Wagdevi, n.d.) The study also highlights the importance of proper material characterization, pavement design, field installation, load testing, and performance evaluation in achieving optimal results. Overall, the paper provides valuable insights into the application of geotextiles and geogrids in flexible pavement design and can be useful for engineers and researchers working in this field.

Conclusion

The paper concludes that the use of geotextiles and geogrids can be an effective way to reinforce road pavement in snowy areas. The literature study conducted in the paper provides evidence of the effectiveness of geotextiles and geogrids in improving the strength, stability, and durability of road pavement. The paper suggests that the use of geotextiles and geogrids can be cost-effective and environmentally friendly compared to traditional methods of road pavement reinforcement. The paper also highlights the importance of considering factors such as local climate, traffic load, and soil properties when designing and constructing road pavement with geotextiles and geogrids. The paper suggests that the design and construction of road pavement with geotextiles and geogrids should take into account the specific needs and conditions of each project to ensure that the road pavement is constructed properly and meets there quired standards. However, the paper also high lights some of the limitations and challenges in the use of geotextiles and geogrids in road pavement reinforcement. For example, the paper suggests that the effectiveness of geotextiles and geogrids can be affected by factors such as UV radiation, temperature, and moisture. Therefore, it is important to investigate the long-term durability of geotextiles and geogrids in road pavement reinforcement to ensure that they can withstand harsh weather conditions and remain effective overtime. (Park & Chang, 2015) The paper suggests several future works that can help to further improve the use of geotextiles and geogrids in road pavement rein for cement. These include conducting field tests to study their effectiveness, investigating their long-term durability, studying the effect of different types of geotextiles and geogrids, developing guide lines for their design and construction, and studying heir effect on the environment and sustainability. In conclusion, the paper provides valuable insights into the use of geotextiles and geogrids in road pavement rein for cement and suggests several future works that can help to further improve their effectiveness and sustainability. The paper highlights the importance of considering factors such as local climate, traffic load, and soil properties when designing and constructing road pavement with geotextiles and geogrids, and suggests that the use of geotextiles and geogrids can be a cost-effective and environmentally friendly alternative to traditional methods of road pavement rein for cement.

References

1. https://morth.nic.in/sites/default/files/BRS_Final.pdf
2. Park, K.C. and Chang, Y.C., 2015. An Analytical Study of Flexible Pavement Design Using Resilient Modulus Model of Expanded Polystyrene (EPS). Journal of the Korean Geosynthetics Society, 14(2),pp.35-44.
3. Ketema, Y., Quezon, E.T. and Kebede, G., 2016. Cost and benefit analysis of rigid and flexible pavement: a case study at Chancho–Derba-Becho road project. International Journal of Scientific &Engineering Research, 7(10),pp.181-188.
4. Tasnim, S., Shaikh, F.U.A., Sarker, P., Doh, S.I. and Albtoosh, J.F.A.A., 2021. A Comprehensive Review of Flexible Pavement Failures, Improvement Methods and its Disadvantages. Key Engineering Materials, 879, pp.136-148.
5. Joshi, B. and Arora, D.R., 2015. Pavement Design by Using Geotextile. International Journal of Civil Engineering and Technology, 6(11).
6. Mittal, D., Meena, S., Phagna, D., Kumar, R. and Sachdeva, S.N., ECONOMY OF DESIGN OFFLEXIBLEAND RIGID PAVEMENTS.
7. Xu, Q., 2017. A potential l new structural design for flexible pavement
8. WAGDEVI, K. and KIRAN, G.U., GEOTEXTILE USING IN ROAD PAVEMENT DESIGNS AND CONSTRUCTION.
9. Correia, N.D.S., 2014. Performance of flexible pavements enhanced using geogrid-rein forced as phalt overlays. PhD Tesis), São Carlos School of Engineering, São Paulo, Brazil.
10. de Souza Correia, N., 2014. Performance of flexible pavements enhanced using geogrid-rein forced as phaltoverlays.
11. Goud, G.N., Mouli, S.S., Umashankar, B., Sireesh, S. and Madhira, R.M., 2020. Design and sustainability aspects of geogrid-reinforced flexible pavements—An Indian perspective. Frontier sin Built Environment, 6,p.71.
12. Narendra Goud, G. and Umashankar, B., 2022. Assessment of embodied carbon for geogrid-rein forced flexible pavements. Transportation Infrastructure Geotechnology ,9(2),pp.206-219.

13. Goud, G.N., Ramu, B., Umashankar, B., Sireesh, S. and Madhav, M.R., 2022. Evaluation of layer coefficient ratios for geogrid-reinforced bases of flexible pavements. Road Materials and Pavement Design,23(1),pp.199-210.
14. Baadiga, R., Balunaini, U., Saride, S. and Madhav, M.R., 2021. Effect of geogrid type and subgrade strength on the traffic benefit ratio of flexible pavements. Transportation Infrastructure Geo technology, pp.1-31.
15. Baadiga,R., Balunaini,U., Saride, S. and Madhav, M.R.,2021. Influence of geogrid properties on rutting and stress distribution in rein forced flexible pavements under repetitive wheel loading. Journal of Materials in Civil Engineering, 33(12),p.04021338.
16. Goud, G.N., Mouli,S.S., Umashankar, B.,Sireesh, S. and Madhira, R.M.,2020. Design and sustainability aspects of geogrid-reinforced flexible pavements—An Indian perspective. Frontiers in Built Environment, 6,p.71.
17. Narendra Goud, G. and Umashankar, B., 2022. Assessment of embodied carbon for geogrid-reinforced flexible pavements. Transportation Infrastructure Geotechnology, 9(2), pp.206-219.
18. Goud, G.N., Ramu, B., Umashankar, B., Sireesh, S. and Madhav, M.R., 2022. Evaluation of layer coefficient ratios for geogrid-reinforced bases of flexible pavements. Road Materials and Pavement Design, 23(1), pp.199-210.
19. Baadiga, R., Balunaini, U., Saride, S. and Madhav, M.R., 2021. Effect of geogrid type and sub grade strength on the traffic benefit ratio of flexible pavements. Transportation Infrastructure Geo technology, pp.1-31.
20. Baadiga, R., Balunaini, U., Saride, S. and Madhav, M.R., 2021. Influence of geogrid properties on rutting and stress distribution in reinforced flexible pavements under repetitive wheel loading. Journal of Materials in Civil Engineering, 33(12), p.04021338.