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Assessment of Subgrade Strength Parameters in The Design of Durable Rigid Pavements

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***Abstract*—The durability and performance of rigid pavements largely depend on the engineering properties of subgrade soils. This research evaluates the strength characteristics of clayey silt and moorum soils through laboratory investigations such as Atterberg Limits, Modified Proctor Compaction Test, and California Bearing Ratio (CBR) test. The obtained results were utilized in pavement thickness design based on IRC recommendations. The experimental analysis indicated that moorum soil possesses superior engineering properties with higher dry density and CBR values compared to clayey silt soil. The study highlights the importance of proper subgrade evaluation for the construction of durable rigid pavements.**

***Index Terms*—Rigid Pavement, Subgrade Soil, CBR Test, Pavement Design, Soil Stabilization, Compaction.**

I. INTRODUCTION

Pavement design is an important aspect in highway engineering because the life and performance of pavements mainly depend on the quality and strength of subgrade soil. The subgrade acts as the foundation for pavement layers and supports traffic loads transferred through the pavement system. Weak subgrade conditions can result in excessive deformation, cracking, rutting, and reduction in pavement service life.

Rigid pavements are generally constructed using cement concrete slabs and require adequate subgrade support to resist wheel loads effectively. Therefore, evaluation of soil strength parameters is necessary before the design and construction of pavements. Laboratory testing methods such as Atterberg limits, Proctor compaction test, and CBR test are commonly used to determine the engineering properties of soils. The present study focuses on the evaluation of clayey silt and moorum soils for rigid pavement applications. The obtained results help in understanding the suitability of locally available soils for pavement construction.

II. EXPERIMENTAL METHODOLOGY

Soil samples were collected from selected locations and tested in the laboratory according to IS 2720 standards. The tests conducted in this study include Grain Size Analysis, Liquid Limit Test, Plastic Limit Test, Modified Proctor Compaction Test, and California Bearing Ratio (CBR) Test.

The Grain Size Analysis was conducted to determine the distribution of particle sizes. Atterberg limits were used to evaluate the consistency and plasticity characteristics of the soil. Modified Proctor Compaction Test was performed to determine optimum moisture content and maximum dry density. The CBR test was conducted to evaluate the load-bearing capacity of the subgrade soils.

Table I: Summary Of Engineering Properties

Property	Clayey Silt	Moorum	Remarks
Liquid Limit (%)	45.60	40.50	Moderate Plasticity
Plastic Limit (%)	25.35	22.27	Stable
MDD (g/cc)	1.83	2.02	Higher for Moorum
OMC (%)	12	10.60	Optimum Value
CBR (%)	5.04	10.09	Better Strength

III. RESULTS AND DISCUSSION

The test results indicated considerable variation in the engineering behavior of the tested soils. The clayey silt soil exhibited higher plasticity compared to moorum soil. Higher plasticity generally results in poor load-bearing capacity and higher deformation under traffic loads.

The Modified Proctor Compaction Test results showed that moorum soil achieved a maximum dry density of 2.02 g/cc at an optimum moisture content of 10.60%, whereas clayey silt soil achieved 1.83 g/cc. Higher dry density values indicate better compaction characteristics and greater resistance to deformation.

CBR values obtained from laboratory testing clearly indicated that moorum soil possesses higher load-bearing capacity compared to clayey silt soil. Hence, moorum soil can be considered more suitable for pavement subgrade applications.

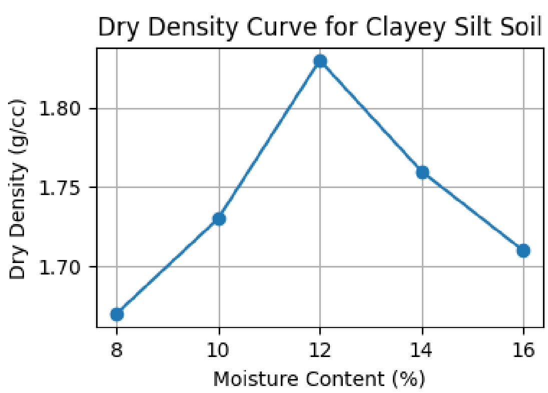

Fig.1 Dry Density Curve for Clayey Silt Soil

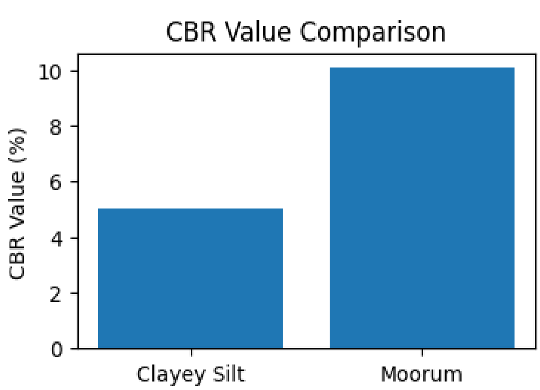

Fig.2 Comparison of CBR Values

IV. PAVEMENT DESIGN CONSIDERATIONS

Pavement thickness design was carried out using IRC recommendations considering traffic volume, subgrade strength, and climatic conditions. Proper drainage systems and stabilized sub-base layers are essential to improve pavement durability and reduce maintenance costs.

The study also emphasizes that the use of stronger subgrade materials reduces pavement thickness requirements and enhances the long-term performance of rigid pavements.

V. CONCLUSION

The study concludes that subgrade strength parameters significantly influence the design and durability of rigid pavements. Among the tested soils, moorum soil exhibited superior engineering properties due to higher dry density and CBR values. Proper evaluation and stabilization of weak soils can improve pavement performance and reduce maintenance costs.

The results obtained from this research are useful for highway engineers, researchers, and pavement designers in selecting suitable subgrade materials for durable pavement construction.

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