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Stabilization of the Gravels Material for Road Sub-Base: Flexible Pavement

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Abstract: ***In many parts of India, high-quality aggregates that match the standards are becoming increasingly scarce and expensive. High-quality aggregates are required in both the base and sub-base course according to traditional flexible pavement requirements. In many circumstances, locally available aggregates do not fit the standards, and the aggregates that do must be transported over vast distances. This act greatly raises the cost of their construction, as well as their ongoing maintenance and restoration. Thus, in a big country like India, using locally available marginal materials in flexible pavement building is one of the viable solutions to high pavement construction costs and a lack of quality aggregates sources.***
A broad definition of a marginal aggregate is "any aggregate that does not fully conform to the specifications used in a country for normal road aggregates but can be successfully used in special conditions, made possible by climatic characteristics or recent advances in road techniques, or after being subjected to special treatment." So, if the usage of local resources can be permitted through appropriate material or structural design modifications, construction can be hastened and significant monetary savings can be realised. The study's major goal is to add cement and bitumen emulsion to locally accessible gravel soil/marginal aggregate (Moorum) to improve its qualities. An attempt has been made to use cement for increasing the strength of the gravel and emulsion for increasing the water resisting capacity. The whole work involves increasing strength of gravel soil (Moorum) and expressed in terms of CBR and UCS value.

I. INTRODUCTION

In many areas, high-quality aggregates are becoming increasingly rare and expensive. Flexible pavement base course materials and asphalt concrete mixtures must meet traditional flexible pavement criteria, which call for high-quality aggregates. Locally accessible aggregates are increasingly failing to fulfil necessary criteria, and aggregates that do meet the specifications must be imported to the site at great price. One of the best solutions to high pavement construction prices and a lack of quality aggregate sources is to use marginal aggregates in flexible pavement construction. "Any aggregate that is not typically usable because it lacks the properties specified by the specification, but could be successfully employed by changing regular pavement design and construction," according to a broad definition of a marginal aggregate. Although it is tempting to use locally accessible marginal materials, the decision to accept or reject these resources should be made only after a thorough review. The decision should be based on an assessment of the material qualities and how they will effect the pavement's design, performance, and construction. Any anticipated cost savings will be lost if potential problem areas are not recognised. (Source: Marginal aggreagges in flexible pavement: Background survey and experimental plan, U.S. Department of Transportation Federal Aviation Administration, Final report, 1994)
This study will seek to describe the impact of employing marginal aggregates in flexible pavements in engineering terms. The effectiveness of strategies for raising marginal aggregate performance to that of standard aggregates will be assessed. The main focus is will be on marginal aggregates for flexible pavements.

A. Need for Present research

Both advantages and disadvantages should be considered while deciding whether or not to employ marginal materials. Because some parts of the situation cannot be measured in monetary terms, this is not an easy decision to make. The technical examination of marginal materials for usage should be used. Economic and environmental factors should both be taken into consideration. (Source: Manuel C.M. Nunes, University of Nottingham, 1994, Enabling use of marginal aggregates in road construction.)

1) Availability and cost-effectiveness: - To justify the development, marginal materials must be available in sufficient numbers and at suitable locations (or be inexpensively transported to the sites).
2) Adequacy in terms of technology: - To maintain an appropriate standard of quality and performance, suitable physical, mechanical, and chemical qualities are necessary.
3) Environmental acceptability: During construction and for the life of the pavement, all materials utilised must not be potentially hazardous to the environment.

(Source: Manuel C.M. Nunes, University of Nottingham, 1994, Enabling use of marginal aggregates in road construction.)
When compared to their frequent waste character, the use of marginal materials at subbase and road base level represents a value added application that might help make these aggregates more competitive against conventional materials and lessen the importance of hauling costs over long distances. Some stabilisation may be required for this aim in order to increase their performance. (Source: Manuel C.M. Nunes, University of Nottingham, Enabling use of marginal aggregates in road construction, 1994.)

B. Objective and Scope of Work

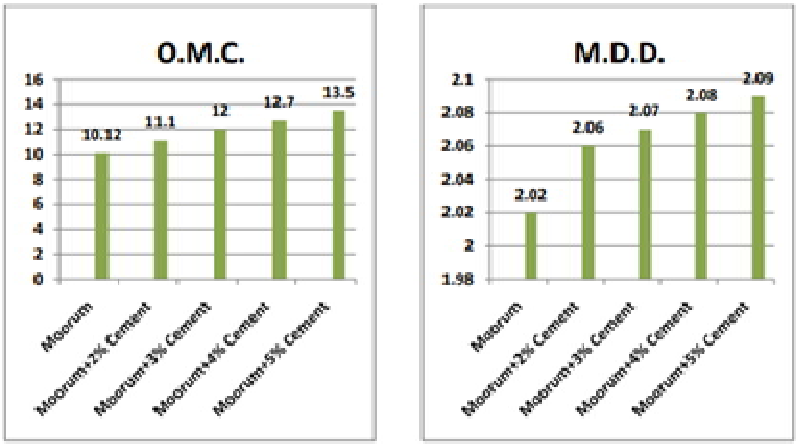
The marginal aggregates employed in this study are Moorum, which is a fragmented weathered rock with varied quantities of silt and clay that occurs naturally in India. For the construction of Road 5, it is regarded as a low-grade marginal material. It is widely available throughout the United States, with significant differences in quality from one region to the next in terms of crushing and impact value, grain size, clay, and deleterious content. In comparison to ordinary aggregates, it has a poor bearing capacity and a high water absorption value. It is used in the construction of foundation/sub base courses in India's rural roadways, along with appropriate stabilising procedures. Moorum is a locally accessible marginal aggregate found throughout the world in different parts of our country. It has less productive use as compared to other marginal aggregates.

1) To allow for the most appropriate use of moorum in pavement construction (in the base/sub base course) by assuring adequate strength and shear value results.
2) To investigate the characteristics of moorum with the addition of cement and bitumen emulsion.

II. RESULT DISCUSSION

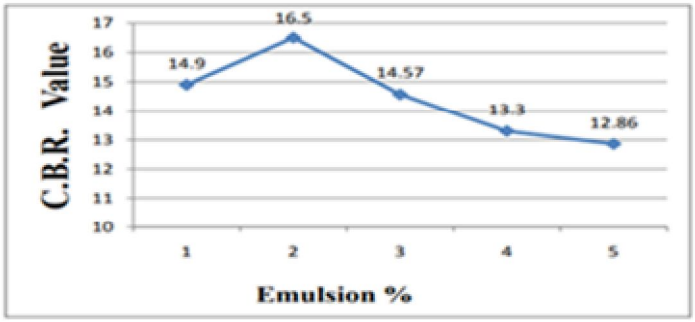
The experimental test was conducted on moorum with adding two additives OPC 43 grade cement and bitumen emulsion. SS-2 emulsion is used in this to study to observe the changing properties of moorum after adding the additives.

1) Changes in different Properties of Moorum after Addition of Cement
2) Change in O.M.C and M.D.D.



Changes in Different Properties of Moorum after Addition of Emulsion (SS-2)

A. Change in C.B.R. values with varying % of emulsion



III. CONCLUSIONS

According to the results of the investigation, the value of soaked C.B.R. and U.C.S. of Moorum increases significantly with the addition of both cement and SS-2 emulsion as stabilisers. So, bearing in mind the criteria for gravel to use in the sub-base course of rural roads, the ideal combination is Moorum with 3% cement and 2% emulsion, followed by a durability test to ensure the stability of the stabilised mixture.

Only beneath the asphalt hull, sub-level is defined as a compacted soil layer, for the most part of typically occurring neighbourhood soil, estimated to be 300 mm thick. It provides the asphalt with a good foundation. As a result, it is critical to improve the quality of sub-evaluation soil, whether by replacing fantastic dirt or adjusting current soil. As a result, a study was conducted to improve the quality of Moorum by adding cement and bitumen emulsion to it, allowing it to be used in the sub-base course of low-volume roads. The preceding research have led to the following conclusion.

The bearing limit of Moorum is properly increased by adjusting it with cement and bitumen emulsion. As a result, the number of suitable proportionate standard axle loads (ESAL) has increased significantly, and the road's lifetime has increased as well. As a result, it is evident that this type of change could be useful in improving the condition of a low-volume route. This adjustment allows for a high point of confinement of stacking in an area where conventional material is not available.

A. Work Scope in the Future

1) Use any other soil test, such as I.T.S. or modulus of elasticity, to determine the strength of Moorum.
2) Experiments with SS-1 or MS emulsion can be carried out in the same way.
3) The same experiments can be carried out with a mixture of lime and emulsion to see how the results differ.
4) Cut back bitumen and cement or lime might be used in the same tests.

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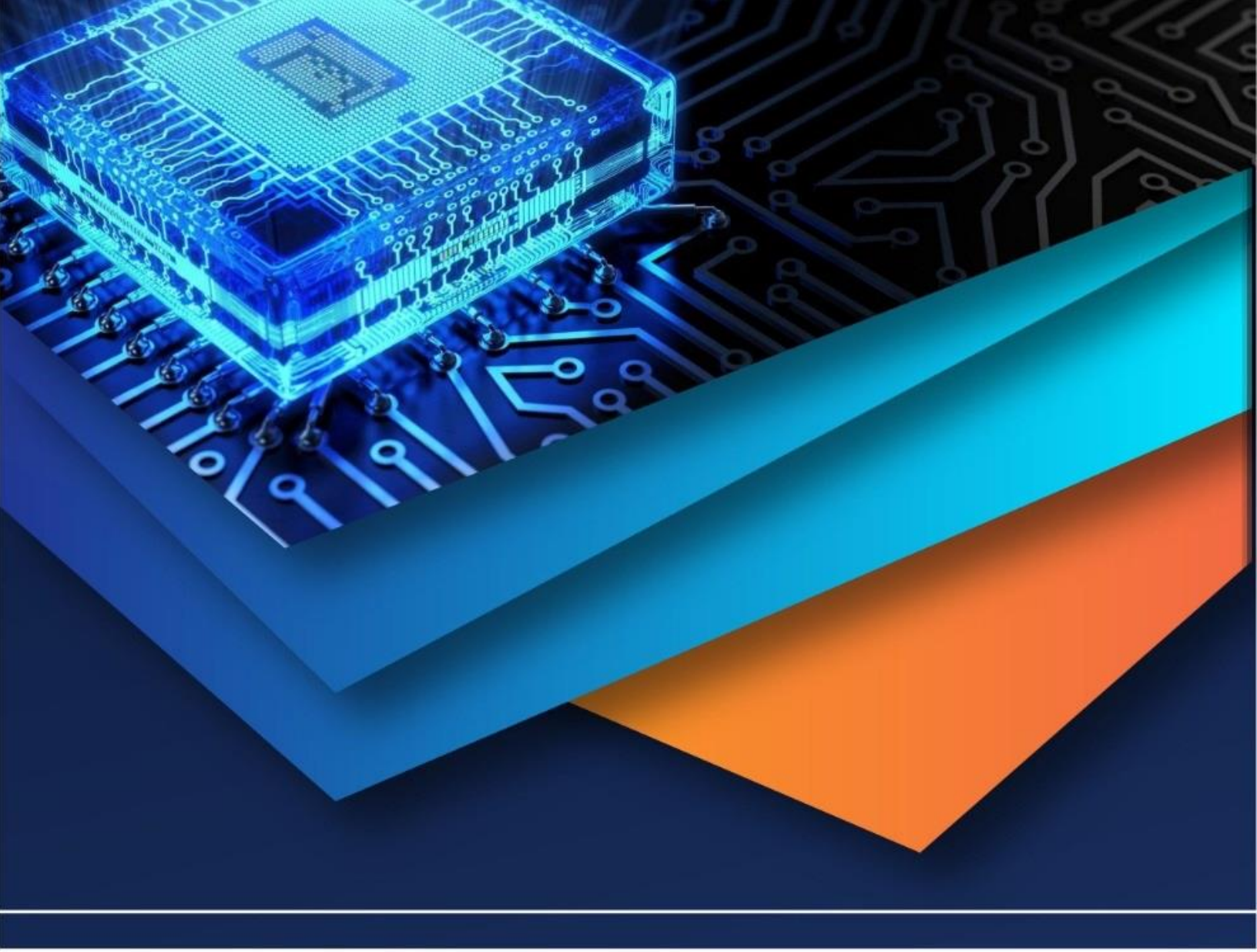

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