

## Use of marginal materials in road works

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### Abstract

Hard stone is being used as a road construction material for all categories of roads in the country. Sources of conventionally used hard stone are depleting very fast and in many parts of the country, the leads involved are very long. On the other hand there are different types of soils and low grade materials available in the country which may be used to advantage in road construction.

### Introduction

Conventionally, hard stone has been used as a road construction material for all categories of roads in the country. Although the hard stone has all the attributes of a good construction material, both in regard to strength and durability, its sources are depleting fast. Moreover, in many parts of the country, the leads involved are so long that they make the construction costs prohibitive. It is not uncommon in several areas that leads of the order of 200 kms. are involved from the nearest hard stone quarry. Therefore, it is necessary to go in for locally available low grade materials especially for low volume roads where the construction costs have to be kept low.

### Pavement Materials

All India surveys carried out for different types of soils and low grade materials encountered in the country reveal that there is a wide variety of soil types as well as gravels, moorums and naturally occurring soft aggregates which can be used to advantage in road construction.

Broadly, the soil types in the country can be categorized as under:

#### For correspondence:

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- a) Lateritic soils
- b) Moorums/ red soils
- c) Desert sands
- d) Alluvial soils
- e) Clays including black cotton soils.

Similarly, a wide variety of naturally occurring low grade materials/ soft aggregates are available in the different parts of the country. These can broadly be categorized as under:-

- a) Gravels/ moorum
- b) Kankar
- c) Dhandla
- d) Laterite
- e) Soft stone/ sand stone
- f) Brick- aggregate

### **Material surveys**

The material surveys and related laboratory investigations constitute an essential part of any road project. More so, for a road project where use of locally available materials is to be maximized. The locally available materials that can be incorporated in the pavement design should be very thoroughly and judiciously explored. In this class of materials are included various types of soils encountered; sands from streams/river beds and other sources; moorum which may even be available at shallow depths below the ground level or from other quarries; gravels, well spoils, soft aggregates like laterite, kankar , dhandla, rivers and- gravel mixes , etc. While locations of the PWD/ Zilla Parishad approved quarries of stone metal can be obtained from the district headquarters, the quarries for locally available materials like the ones listed above, are generally not known but local enquiries

from villagers etc. can help a great deal in this regard. Samples of the locally available materials like lime that could possibly be used as soil stabilizer should also be collected.

Special care has to be exercised in collection of samples of these locally available materials since these are generally quite variable in their engineering properties. So much so, the locally available moorums and gravels from the same source can give widely different strength values. This, naturally, has significant implications in the construction and performance of roads.

### **Material testing**

The samples of subgrade soils and other locally available materials collected during the field surveys should be subjected to the following laboratory tests:

- a) Atterberg limits
- b) Gradation
- c) Compaction test
- d) CBR
- e) Aggregate Impact Value

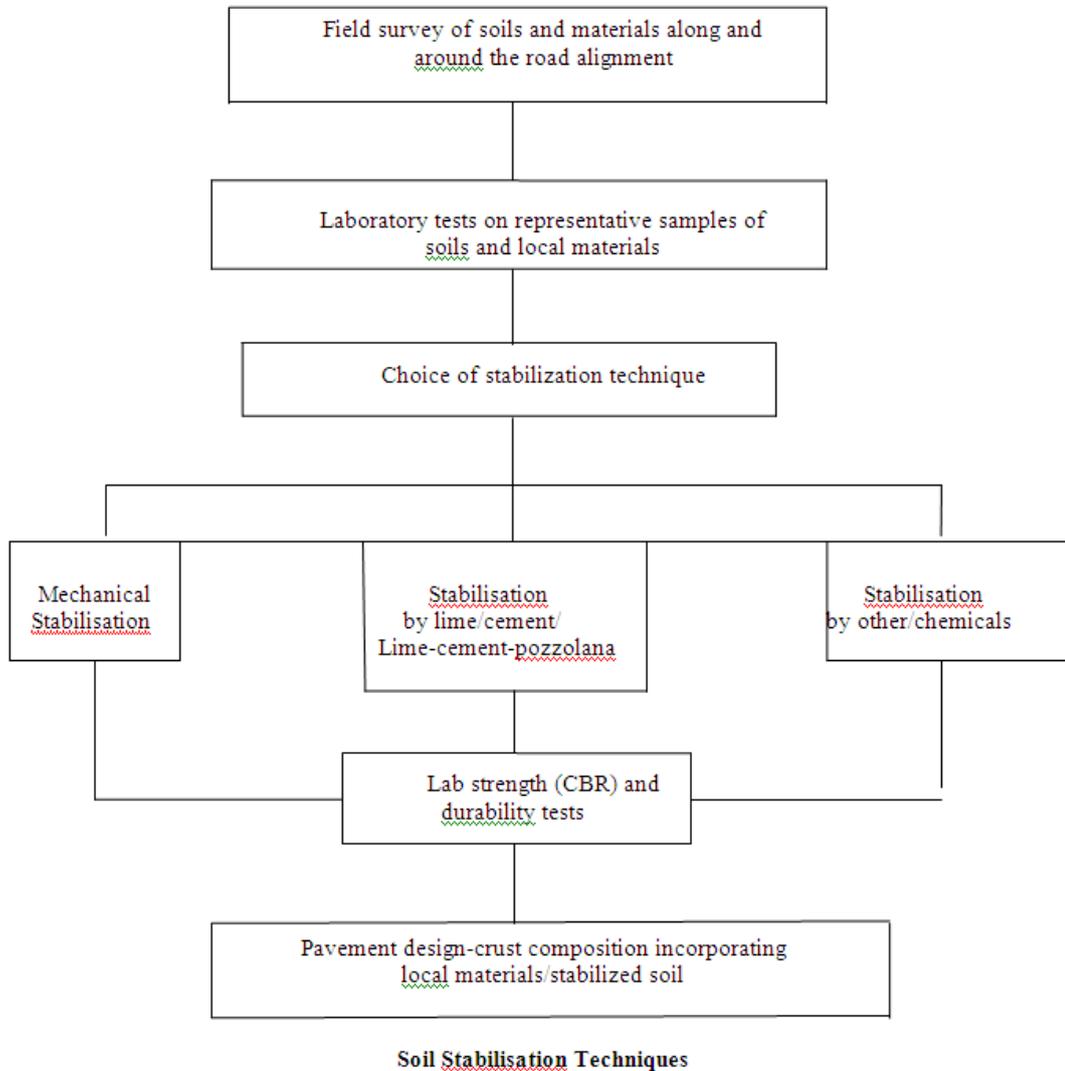
In areas infested with harmful salts like sulphates and containing organic matter, special tests to determine their approximate content need to be carried out, in addition to the above tests.

### **Suitability Criteria for material:**

The samples of soils/ soil-gravel/ aggregates collected during the material survey are tested in the laboratory to confirm their suitability for use in different pavement layers. The criteria regarding the suitability of these materials for gradation, plasticity and strength requirement have been given in IRC special publication No. 20.

In case the available materials meet the requirements, these can be used as such. Otherwise, the local materials have to be processed with a view to improve their engineering properties so that these can be

incorporated in the lower layers of road pavements. The various methods which can be adopted to improve the local soils and inferior aggregates are as under:-



**Selection of Stabiliser**

The selection of the stabiliser is based on plasticity and particle size distribution of the material to be treated. The appropriate stabiliser can be selected according to the criterion shown in table 1. Some control over the grading can be achieved by limiting the coefficient of uniformity to a minimum value of 5; however, it should preferably be more than 10. The coefficient of uniformity is

defined as the ratio of the sieve size through which 60 percent passes to the sieve size through which 10 percent passes. If the coefficient of uniformity lies below 5, the cost of stabilisation will be high and the maintenance of cracks in the finished road would be expensive. If the plasticity of soil is high there are usually sufficient clay minerals which can be readily stabilised with lime.

Type of stabilisation	More than 25% passing the 0.075 mm sieve	Soil Properties		Less than 25% passing the 0.075mm sieve		
	PI < 10	10 < PI < 20	PI > 20	PI < 6, PP < 60	PI < 10	PI > 10
Cement	Yes	Yes	*	Yes	Yes	Yes
Lime	-	Yes	Yes	No	*	Yes
Lime-Pozzolan	Yes	-	No	Yes	Yes	*

**Table 1:** Guide to the type of stabilisation likely to be effective

Cement is more difficult to mix intimately with plastic material but this problem can be alleviated by pre-treating the soil with approximately 2 percent lime.

- Plasticity Product (PP), expressed as product of PI of soil and percentage fraction passing 75 micron sieve should not exceed 60

There are many manufactured commercial products in the market that claim, when added to the soil in the proper quantities, improve some engineering characteristics of the soil such as strength, texture, workability, and plasticity. These chemical additives can be tried for construction of test sections.

### Conclusion

- In case the available materials meet the requirements, these can be used as such.
- The inferior locally available materials can be improved by using suitable stabilization techniques and used in lower pavement layers.

### Acknowledgement

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### References

1. Rural Road Manual, IRC: SP: 20.
2. Guidelines for soil and granular material stabilization using cement, lime & fly ash, IRC: SP: 89-2010.