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Use of Waste Foundry Sand in Flexible Pavement

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Abstract: ***Rural roads are essentially low cost roads, the specifications for pavement materials in various layers should be as economical as possible, consistent with the traffic expected to use the road and the climatic condition. In this angle, the local materials which are cheaper and involve minimum haulage should be used to maximum extent feasible. In present scenario safe disposal of different wastes produced from Industries is a great problem. These materials cause environmental pollution in the vicinity because many of them are non-biodegradable. In recent years, industrial wastes have been utilized in road construction in developing countries.***
The two types of pavement structures generally used are I) Flexible II) Rigid. Wastes from different sources can be collected and the materials such as foundry sand, iron slag, steel slag, glass waste, ceramic waste etc., can be used. The necessary specifications should be formulated and attempts are to be made to maximize the use of solid wastes in different layers of the road pavement. The possible use of these materials should be developed for construction of low volume roads (Rural roads) in different parts of our country.
This study promotes use of waste foundry sand in flexible pavements as replacement to filler material used in flexible pavements. Various mix proportions were prepared and tested by MARSHALL STABILITY for varying percentage replacement of Filler material by Waste foundry sand.
Keywords*:* ***Waste Foundry Sand, Highway Engineering, MARSHALL STABILITY, Flexible Pavement, Industrial Waste***

I. INTRODUCTION

In recent years, industrial wastes have been utilized in road construction in developing countries. The use of these materials in road making is based on technical, economic, and ecological criteria. The lack of traditional road materials and the protection of the environment make it imperative to investigate the possible use of these materials carefully. India has a large network of industries located in different parts of the country and many more are planned for the near future. Several million metric tons industrial wastes are produced in these establishments.

Traditionally soil, stone aggregates, sand, bitumen, cement etc. are used for road construction. Natural materials being exhaustible in nature, its quantity is declining gradually. Also, cost of extracting good quality of natural material is increasing. Concerned about this, the scientists are looking for alternative materials for highway construction, and industrial wastes product is one such category.

Metal foundries use large amounts of the metal casting process. Foundries successfully recycle and reuse the sand many times in a foundry and the remaining sand that is termed as foundry sand is removed from foundry. This study presents the information about the civil engineering applications of foundry sand, which is technically sound and is environmentally safe. Use of foundry sand in various engineering applications can solve the problem of disposal of foundry sand and other purposes. Foundry sand consists primarily of silica sand, coated with a thin film of burnt carbon, residual binder and dust. Foundry sand can be used in concrete to improve its strength and other durability factors. Foundry Sand can be used as a partial replacement of cement or as a partial replacement of fine aggregates to achieve different properties of Bituminous Concrete.

If these materials can be suitably utilized in highway construction, the pollution and disposal problems may be partly reduced. In the absence of other outlets, these solid wastes have occupied several acres of land around plants throughout the country. Keeping in mind the need for bulk use of these solid wastes in India, it was thought convenient to test these materials and to develop specifications to enhance the use of these industrial wastes in road making, in which higher rate of returns may be possible. Various mix proportions were prepared and tested by MARSHALL STABILITY for varying percentage replacement of Filler material by Waste foundry sand.

II. AIM AND OBJECTIVE

Post construction pavement performance studies are done for these waste materials for construction of low volume roads with twofold benefits:

A. An experimental work has been done to improve the properties of bituminous concrete pavement using WFS.

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B. Optimum bitumen percentage replacement in the BC mixes.

C. This study promotes the usage of industrial wastes to reduce the cost of construction of flexible pavements and helps in preserving the natural reserves.

D. This study presents a review of available information on the WFS (Waste Foundry Sand), their generation process including molding and casting processes, potential variables, environmental concerns and beneficial uses of waste foundry sand.

III. MATERIALS

A. Materials used in the present study are the following:

1) Waste Foundry sand

2) Aggregates

3) Bitumen

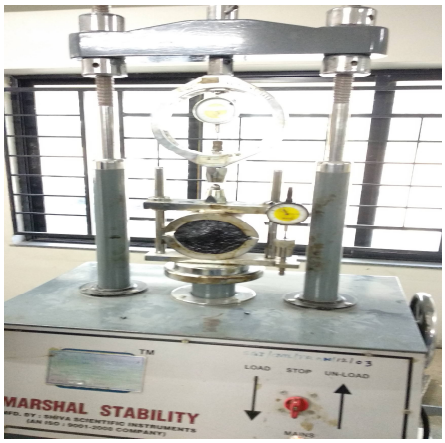
IV. METHODOLOGY

A. The various mixes were made according to Marshall Mix designs.

B. A specimen is prepared according to MORTH specifications Section 500.The principle of this test is that Marshall Stability is the resistance to plastic flow of cylindrical specimen of a bituminous mixture loaded on lateral surface.

C. It has the load carrying capacity of the mix at 60 °*C* and is measured in kg.

Fig: Marshall Testing Apparatus



V. RESULTS OBTAINED.

TABLE 1
OPTIMUM BITUMEN CONTENT

BITUMEN PERCENTAGE	STABILITY (in Kg)	FLOW VALUE (in cm)
4.0 %	1150	2.12
4.5 %	1240	2.45
5.0 %	1332	2.84
5.5 %	1634	3.7
6.0 %	1855	3.5
6.5 %	1561	4.4

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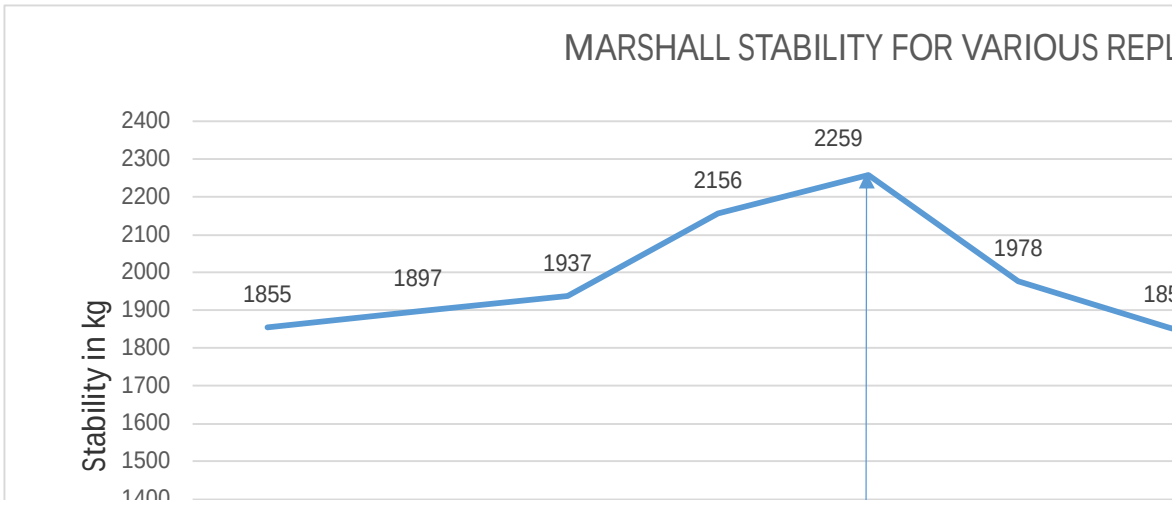
Table 2
Marshall stability values for % replacement

PERCENTAGE REPLACEMENT	STABILITY (in Kg)	FLOW VALUE (in cm)
0%	1855	3.56
10%	1897	3.81
20%	1937	4.17
30%	2156	4.8
40%	2259	3.58
50%	1978	3.97
60%	1854	3.87
70%	1745	3.7
80%	1720	4.08
90%	1687	3.8
100%	1677	3.9

Graph 1
Marshal stability **vs.** percentage replacement of foundry sand



VI. CONCLUSION

A. From the result and analysis of various properties of foundry sand it is found that these materials can be used as fine aggregates as replacement for natural sand and can be used as filler material as replacement for stone dust in bituminous mix.
B. The Optimum replacement percentage of foundry sand as filler material is 40% of traditional mix.
C. Bituminous mixes prepared using conventional mix at different bitumen content gives the optimum bitumen content as 6.0%.
D. By using foundry sand in bituminous mix environmental effects from wastes and disposal problems of waste can be reduced.

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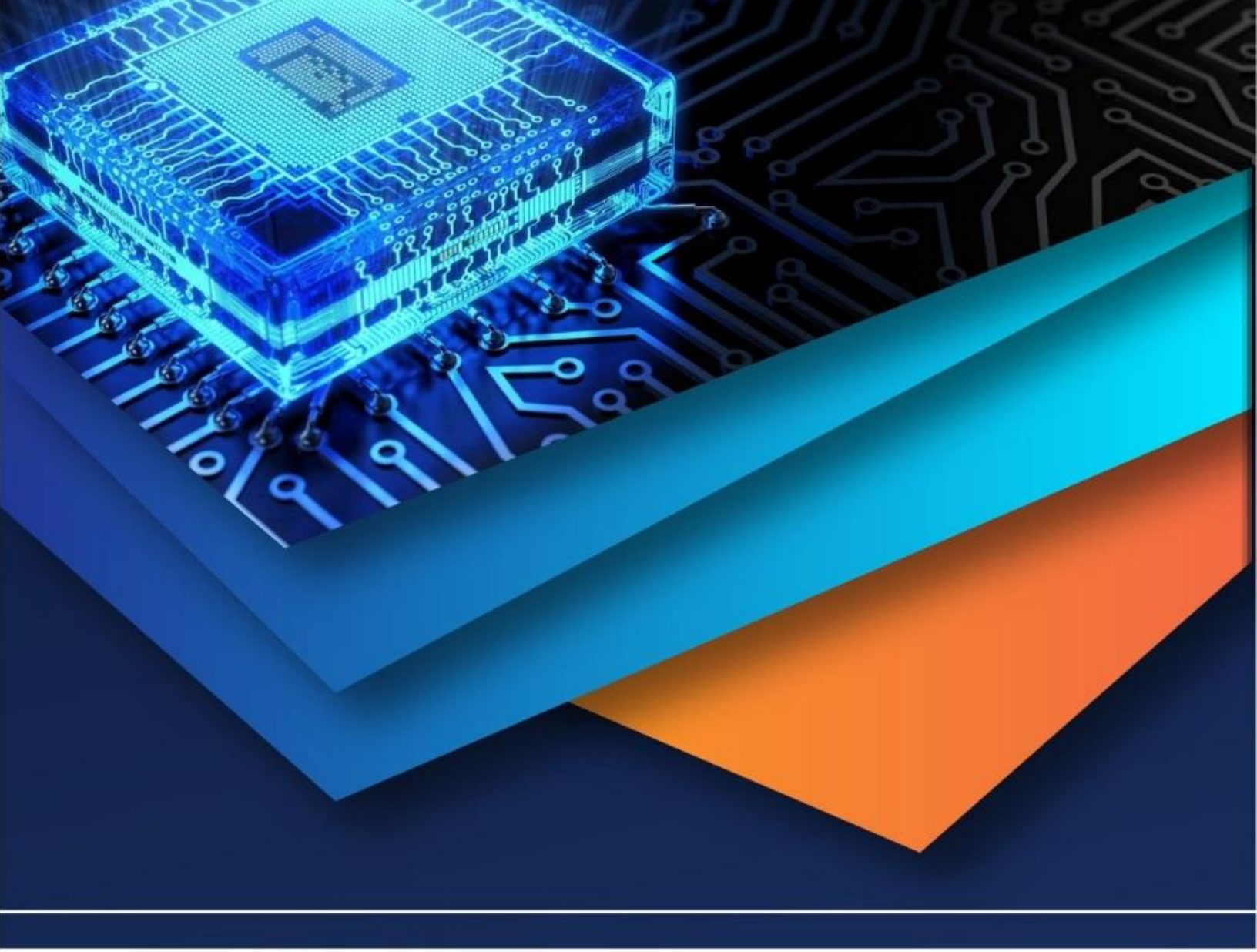

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