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REVIEW STUDY: ON REPLACEMENT OF FINE AGGREGATE BY FOUNDRY SAND IN A PAVEMENT

Prof. A.G.Chaudhari [1] Priyanka.S.Patekar [2] Jamil.K.Khan
[3] Vaishnavi.J.Rokade M [4] Aquil.S.Siddiqui [5]

[1] Assistant Professor, Guru Gobind Singh College of Engineering and Research Centre, Nasik
[2, 3, 4, 5] BE Students' Department of Civil Engineering,
Guru Gobind Singh College of Engineering and Research Center, Nasik

ABSTRACT

The construction of pavement requires a precise engineering design as well as large investment. Roads are very important national investment and require maintenance to keep them in a satisfactory condition and ensure safe passage at an appropriate speed and with low road user cost. Thus finding an alternative to the conventional asphalt road can reduce the cost as well as increase the durability. The waste or by products from the industries turnout to be useful as they have show the similar material properties as the conventional material used. Large amount of waste is generated in metal casting industries called as "foundry".This foundry waste in the form of sand particles can be useful for flexible as well as rigid pavement. The study shows how it will be suitable for road construction and hence can be recommended for the construction. The study involves the partial replacement of fine sand with the foundry sand in the flexible pavement.. To find the alternative to the conventional material is a need as there is increase in the cost as well as the decrease in workability.The experimental study will reveal that replacement of foundry sand has improved the properties of bituminous mix.

Keywords: Flexible Pavement, Foundry Sand, Marshall Stability Method

I. INTRODUCTION

Roads are of the important structures which connects the places. They need maintenance, care for proper long term functioning and ensure safe passage to the users. A precise engineering design can save the investment as well as the reliable performance of in service pavement can be achieved. To increase the workability and reducing the cost of pavement need to be achieved due to regular increase in cost of materials. The use of waste products from the industries can be beneficial after studying their properties and their availability. Thefoundry sand is a byproduct from metal (ferrous and non-ferrous) industry, where it is used as moulding material because of its properties. After use of foundry sand as molding material it becomes a waste product which is generated at casting industry. It can be recycled and reuse. It has a uniform size, clean in nature and high quality silica in it. There can be lot of applications for use of foundry sand in engineering field like for making bricks and tiles, land filling material, as fine aggregate in concrete , sub base backfills , etc. there is limited available study on use of foundry sand in flexible pavements/highway . Available literature review for use of foundry in highway is limited.

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The study proposes the use of foundry sand in road construction. The optimum percentage of the foundry to be replaced with optimum percentage of bitumen shall be found out by using MarshallStability method. Different mix proportions are to be designed for different percentages.

II . LITERATURE REVIEW

2.1The Use Of Foundry Sand As An Aggregate: This digest gives us the information on investigation of use of foundry sand in United States and Europe as an aggregate which is widely done. Greensands and chemically bonded sands are types of waste sands which can be reused and has applications. For re use purpose, foundry needs to be screened and process to the required size. The composition of greensand and chemically bonded sand are being given in the digest. The case studies of asphalt manufacture, concrete block manufacture, roofing felt are discussed briefly. However, environmental considerations shall be studied properly and then the use of sand can be beneficial and advantageous.

2.2K. Aravind And Animeshdas: In this paper, the study of different by products and their possible usage have been but forward. The material acceptability criterion has been discussed. It is seen that some materials are suitable for the highway construction but environmental effects after use needs to be studied.

2.3Tuncer B. Edil: The paper has mentioned the extensive study of the foundry sand .The proportion, characteristics, and uses and its uses in infrastructure. They have briefly discussed the design consideration for highway sub base, embankment, retaining wall, flow able fill, Portland cement concrete. They have discussed the environmental aspects regarding foundry sand.

2.4 Craig H. Benson And Sabrina Bradshaw: This paper focuses on the guidelines for usage of foundry sand in green infrastructure. They have briefly discussed the physical properties, mechanical properties, Mineralogical and Chemical Properties. The design consideration for highway sub base says that the foundry sand can be used if higher compaction is used. It is also seen that the foundry sand resist winter conditions better than any other material.

2.5 Mr. Sagar B. Patil, Prof. Dhananjay S. Patil: Pavements represent an important infrastructure facility in all countries. Two important parameters for good pavements are pavement design and materials. A good design of bituminous mix is expected to result in a mix which is adequately strong, durable and at the same time environment friendly and economical in order to maintain the pavement. This work is undertaken to prepare cost effective material for maintenance of flexible pavement. By using industrial wastes steel slag and foundry sand as a replacement material for fine aggregate in bituminous mix and ground granulated blast furnace slag as a replacement material for fillers in bituminous mix. Fillers play an important role in engineering properties of bituminous paving mixes. Conventionally stone dust, cement and lime are used as fillers.

2.6 Dr. Suji D, Poovendran S, Prabhakar P: In this experimental study, the foundry sand is used for conventional materials. The use of waste foundry sand has reduced the cost as well as the environmental impact by using it in the pavement. Various percentages 0, 25, 30,35,40,75 were replaced and new mix design was formed and testing was carried out. The Marshall Stability test has been carried out to find optimum percentage of foundry sand and bitumen. The result reveals that foundry sand has significant improvement on bituminous concrete mix.

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III . METHODOLOGY

3.1 Dr. Suji D, Poovendran S, Prabhakarp: The paper focuses on the working methodology of Marshall Stability method. As per ASTM D 1559, Marshall Stability testing setup was used. Tests were carried out to determine MarshallStability, flow value, optimum bitumen content and amount of bitumen required for different types of mixes containing different percentages of waste foundry sand. The different percentagesofsand were taken on the basis of previous studied done. Hence they were used as filler material in asphalt paving mixes.

3.2 K. Aravind And Animeshdas: In this paper, the use of industrial waste in highway is proposed. Material acceptance is an important parameter for the selected work. For the conventional materials numbers of tests are to be performed. The parameters like particle size, permeability, durability, hardness, toughness, etc. are to be taken into account. But these parameters are not the same for the industrial wastes. Hence, it will be inappropriate to use the same criteria. Proper tests are to be selected rather than directly to perform.

3.3 Mr. Sagar B. Patil, Prof. Dhananjay S. Patil: The paper focuses on the experimental study materials like steel slag,Ground granulated blast furnace slag, Foundry sandused in the pavement. The tests were performed on the materials and analysis was done by using Marshall Stability method. Cost comparison is done with the conventional material and results are put forward.

3.4 The Use Of Foundry Sand As An Aggregate: In this paper the characteristics of foundry sand are discussed in deeply. Design considerations for different structures and different materials are discussed.According to AASHTO, design of asphaltic pavement shall be done. The use of foundry sand in infrastructure and its possible uses and design criteria are given.

IV. CONCLUSION

1. **Dr. Suji D, Poovendran S, PrabhakarP**: They have stated that 35%replacement of waste foundry sand with quarry dust can be used. The replacement increase by 5% for bitumen above 25%of sand. They also concluded that the foundry sand has potential for excellent performance in bituminous concrete with proper mix design. It is seen that some of industrial waste are suitable for construction purpose but environmental consequences are need to be studied.. Hence, there is a scope for further research work on the topic.

2. **K. Aravind and AnimeshDas:**they proposed that by using foundry sand in the pavement construction, environmental effects and disposal problems can be solvedand cost saving can be achieved.

3. **Department of the Environment, Transport and the Regions Research Contract MP0623 Digest no. 067 (2:6/99) Symonds**: For hot rolled asphalt, greensands are suitable to use as they reduces the bleeding of bitumen. Chemically bonded sands can be used as fillers in road sub bases.

In view of the conclusions obtained from the above papers on WFS as a replacement for construction material, research on this subject is necessary. Unfortunately, an extensive review of the literature reveals that the amount of laboratory and field data on the properties and performance of this material for highway purposes is very limited. In order to develop constructive uses of foundry sand, a substantial database on their properties is needed.

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This study presents a review of available information on the WFS, used as replacement material for sand in flexible pavement.

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