



EVALUATION OF STABILITY DUE TO WASTE GLASS POWDER IN ASPHALT CONCRETE

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Abstract-

This study evaluates the suitability of two waste materials used as fillers in place of conventional material in bitumen concrete mix. The waste materials which is considered are glass powder. The cement is treated as conventional filler. These waste materials were obtained from industries to enhance the properties. The study involves the investigation of properties of asphalt concrete in which fine aggregate is partially replaced by glass powder i.e., 4 %, 5.5 %, 7 % respectively. The method used for mix-design is Marshal method. The marshal properties such as stability have been evaluated. The result states that 5.5% is the Optimum bitumen content obtained for glass powder-asphalt mix. However, due to high amount of silica content in the glass powder shows poor adhesion but due to its fine nature the glass powder, has better moisture resistance property.

Keywords: Bitumen, Glass Powder, Marshal

1. Introduction

In recent years, reclaim, reuse, and recycling of wastes in place of virgin materials have become a recurring theme of growing importance. Transportation infrastructures play a key role in this context, as any new construction or rehabilitation consumes a huge amount of natural materials [A. Gupta, 2015]. Utilization of wastes as alternative to virgin materials solves two important issues: the issues regarding the ecofriendly disposal of wastes as well as fulfilling the need to find suitable alternative to conventional/virgin materials. Global pavement network majorly consists of flexible pavements which use asphalt concrete mixes as their surface and base courses. Asphalt mix is a heterogeneous multiphase material which primarily comprises aggregates of various shapes and sizes, asphalt binder, and filler. Asphalt mixes are extensively adopted in flexible pavements around the world as surface and binder courses which are with the combination of aggregates and asphalt binder. Various sizes of mineral aggregates in the asphalt mixes make up a rigid skeleton while the asphalt binder behaves as an adhesive. &e aggregate portion which passes through the No. 200 sieve (75 μ m) is termed as filler, which influences the mechanical behavior and durability of the asphalt mix [J. Choudhary, 2019; A. Kuity, 2014 ; B. Barra , 2014]. &e filler present in the asphalt mix combines with asphalt binder to form asphalt mastic. &e filler activity in the mastic is due to the physical hardening and chemical interaction.

1.1 Objective

To utilize and the study the properties of the waste glass powder partially replaced by fine aggregate for making bitumen concrete mixes without negotiating with the engineering, economical and suitability of mix.

2. Material

The waste glass powder used in this research work are collected from Raipur district, Chhattisgarh. The rest material such as coarse aggregate, fine aggregate, cement, bitumen is obtained from the local market for the continuation of the work. Each materials have such physical properties which is to be studied to produce bitumen concrete.

3. Case Trials for the Considered Study

In this study, the specimens were utilized for testing to identify the properties. The design is been carried by Marshall Mix-design in which four basic requirement is evaluated for Stability, flow test.

Table 1 Case Trails for the Study (All Values are in percentage)

Test Specimen Case Id	Coarse Aggregate	Fine Aggregate	Filler (Cement)	Waste Glass Powder	Bitumen Asphalt
Case 1	34	50	6	4	3
Case 2	33	50	6	5.5	4
Case 3	32	50	6	7	5

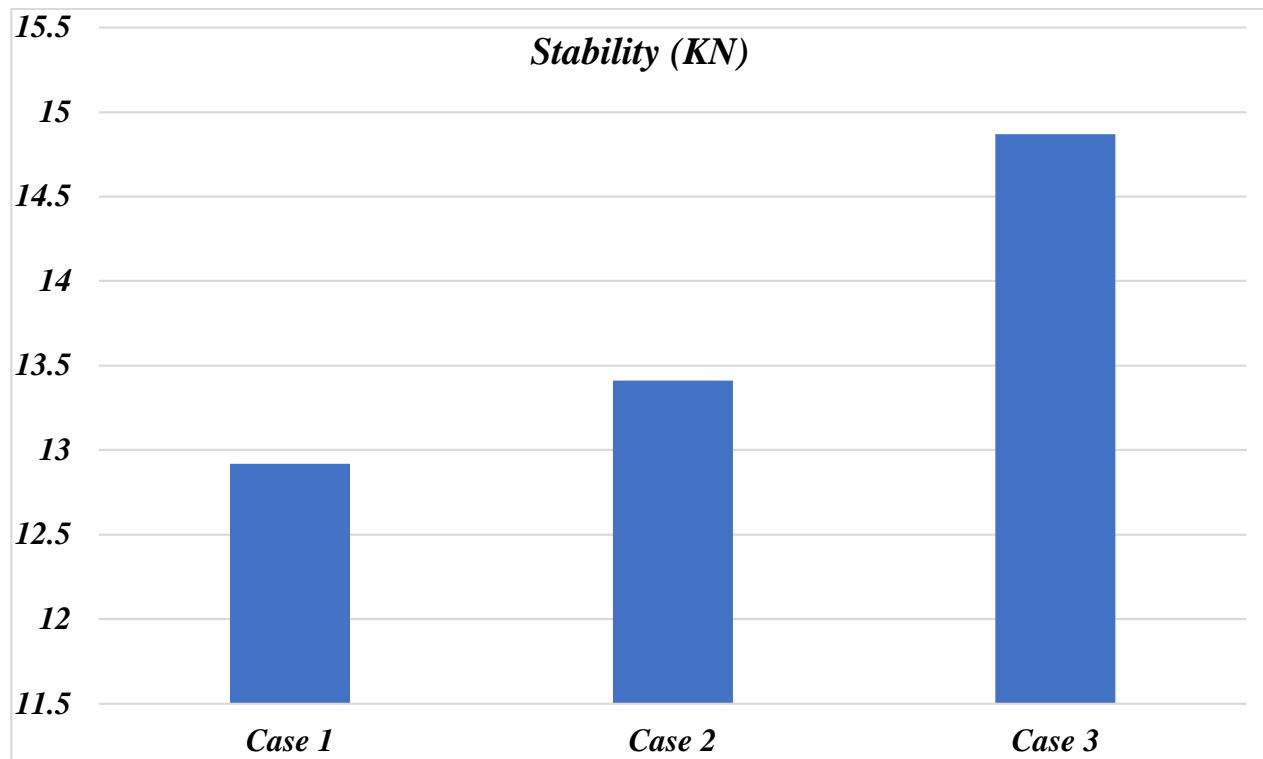
4 Stability Test

The result values according to the test are given in table and graph below in which the stability is calculated as per equation-

$$G_{mm} = \frac{W_f + W_b + W_{ca} + W_{fa} + W_{fs}}{\frac{W_f}{G_f} + \frac{W_b}{G_b} + \frac{W_{ca}}{G_{ca}} + \frac{W_{fa}}{G_{fa}} + \frac{W_{fs}}{G_{fs}}} \dots\dots\dots(1)$$

Table 2 Marshall Stability

Case Id	Glass Powder (in %)	Asphalt Content (in %)	Stability (KN)
Case 1	4	3	12.92
Case 2	5.5	4	13.41
Case 3	7	5	14.87



Graph 1 Observation of Stability having Glass Powder

Discussion for the Stability: In past [Alidadi, M. \(2016\)](#) has established that the stability increase as the waste content increases up to certain extent. The current study, the maximum stability is shown by Case 3. It has been seen that stability increases as the asphalt content increases up to 5 %. Whereas for the glass powder the maximum stability is shown by Case 3 case. The result shows that the stability of Case 3 case (i.e., 7% GP and 5 % AC) is having maximum stability of 14.87 KN. It has been seen that stability increases as the asphalt content increases up to 5 %. ([Moreo , 2018](#) ; [Rahman,2012](#) ; [Hassan 2010](#))

5. Conclusions

The maximum Marshall stability is obtained for the mixture having 14.87 KN for the mixture with glass powder. The stability first increases with increase in bitumen content reach the extreme point then reduces. This states that the optimized bitumen content is about 5 % according to the current study.

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