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Modified Bitumen with Addition of Fly Ash in Different Proportions

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ABSTRACT- Modified Bitumen with addition of fly ash is a material used in road construction and roofing. Fly ash is a byproduct of coal combustion and has been utilized in various construction applications due to its properties like pozzolanic activity and low cost. The addition of fly ash to bitumen increases its strength, durability and reduces its temperature sensitivity. In this study, modified bitumen was prepared with different proportions of fly ash to investigate its impact on the properties of bitumen. The results showed that with increasing fly ash content, the viscosity of bitumen decreased and its softening point increased. Additionally, the addition of fly ash improved the resistance to rutting, fatigue cracking and low-temperature cracking. Moreover, the results indicated that the optimum amount of fly ash that could be added to bitumen is between 5-10%. Beyond this limit, there was a significant reduction in the properties of modified bitumen. Furthermore, the addition of fly ash also improved the environmental performance of modified bitumen as it reduces the generation of greenhouse gases.In conclusion, the addition of fly ash to bitumen is a promising technique for improving the properties of bitumen. The modified bitumen with fly ash can be utilized in various applications such as road construction, roofing and paving. However, it is important to note that the optimum amount of fly ash that could be added to bitumen should be determined based on the specific application requirements.

KEYWORDS- Bitumen, Modified Bitumen, Ash, Fly Ash

I. INTRODUCTION

Since commuters can easily access their desired destinations thanks to the road network, it has evolved into one of the fundamental pillars of movement between locations as different classes of society's lifestyles change. People began using the road system long ago, before other forms of transportation had even been developed. Road transportation has grown the greatest in the last 50 years. Freight and passenger transportation. The majority of the roads built in a network of roadways have flexible pavement. Typically, flexible pavement has four layers.[1]:

- Soil sub grade
- Sub base course
- Base course
- Surface course

Increased traffic on the roads across the world has had an impact on the pavement's ability to withstand severe loads. However, conventionally used high-grade classic asphalt concrete and unmodified bitumen have failed to meet the rising demand and anticipated stage of the show.[1]

Due to fatigue, severe rutting, and thermal cracking caused by this inadequacy, the service life is reduced (Isikyakar, 2009). Numerous scholars and organisations with an interest in the subject have been drawn to it in an effort to find ways to improve the bitumen's qualities and address issues with pavement distresses.One of the methods which have recently received [3]

Modifying the bitumen with other substances known as admixtures deserves greater focus. If thoroughly included, some admixtures have been reported to boost the binder characteristics of bitumen by acting as modifiers. These admixtures can either be incorporated into the aggregate containing the bitumen mixture or directly applied to the bitumen mixture as a bitumen modifier.[6]

II. MATERIAL USED

A. Aggregates

Crushed Argillaceous and siliceous aggregates were used in this study which is obtained from the lab of Kashmir Government College Ssinagar. The gradıuation of aggregates used is Grade II as per MORTH speciflcation for bituminos concrete. The gradatian of aggregates sed in the preparatlon of the bituminous [11].

Table 1: Various physical properties of aggregates

S No.	Property	Results	Specifications for BC	Test Method
1	Abrasion Value	23.33%	30%	IS 2386 Part 5
2	Impact Value	16.37%	24%	IS 2386 Part 4
3	Crushing Value	18.18%	30%	IS 2386 Part 4

B. Bitumen

The bitumen used in the study is VG-40 obtained from the

Sidco industries Srinagar. The various physical properties of bitumen given in the table 2:

Table 2: Physical properties of bitumen

S No.	Physical properties	Results	Specification	Test Method
1	Penetration Test @25^{0}c	41.5	Min 35	IS 1208-1978
2	Ductility Test @27c	89	Min 27	IS 1208-1978
3	Specific Gravity Test @220^{0}c	1.02	Min 0.99	IS 120-1978

C. Fly Ash

One of the most intriguing conservation methods for natural resources is the utilisation of divided, finely ground coal combustion byproducts from the manufacturing process. The combustion chamber's exhaust gas is transferred here. Over 61 million metric tonnes (68 million tonnes) of fly ash were produced in 2001.[4] For coal-based energy generation, fly ash and steam are produced. Typically, the combustion chamber of a pulverised coal boiler will burn, producing heat and leaving behind melted minerals. boiler tubes, boiler, ash, and the sense of molten rock after chilling the flue gas. [9]

III. METHODOLOGY

It is described as a viscoelastic liquid or solid hydrocarbons and derivatives that are soft to heat slowly and fundamentally sufficient to trichlorethylene soluble.[2] It has waterproofing and adhesive qualities and is either black or brown. obtained from the refinement of petroleum, and it is coupled with the mineral to form natural asphalt in the form of a deposit or composition.This chapter provides information on the materials utilised and testing techniques used to evaluate the materials and mixtures in the current investigation. [10] The combination is made into a variety of purposes. Fly ash as a bituminous converter analysis ratio Pitch variations are the primary focus of current research. Pitches that have been damaged change in properties. To assess different experimental tests When compared to order modifications, the general characteristics of the pitch changed His property is the rigid/virgin bitumen connection. [8]

IV. ANALYSIS OF RESULTS

A. The Marshall Test's Determination of the Data Obtained by Using Fly Ash

According to ASTM D 1559, this test is conducted to determine the bituminous mixture's Marshall stability. This method measures the cylindrical specimen's resistance to plastic deformation while it is loaded at a 5 cm per minute peripheral rate. The Marshall method uses standard test specimens of 63.5mm height by a 101.6mm diameter. In this test we added fly ash 4%,6%,8% in bitumen at different proportations like 4.5,5,5.5 of grade VG-40 as shown in table no. 3 and figure no. 1,2,3,4 and 5.

Table 3: Characteristics of a Marshall test using Modified bitumen

Bitumen content	Fly ash content %	Unit density gm	Air void % VV	Vbf %	Stability kg	Flow mm
4.5	4	2.30	11.9	58.73	55.8	6
4.5	6	2.285	12.7	55.973	69.2	6.5
4.5	8	2.64	13.4	55	76.1	7.9
5	4	2.264	7.6	68.94	60.53	4.3
5	6	2.35	9.1	64.48	74.8	6.2
5	8	2.35	9.1	64.48	74.8	6.2
5.5	4	2.35	9.2	65.05	70.73	3.24
5.5	6	2.32	9.6	63.27	75.83	4.2
5.5	8	2.295	11.3	58.90	78.1	6.1

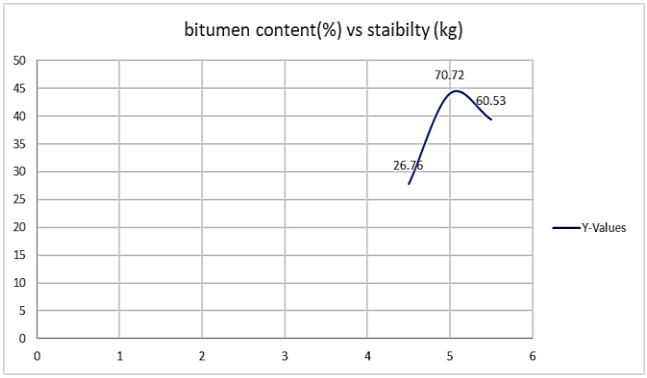

Figure 1: Stability of bituminous mix with 5% bitumen

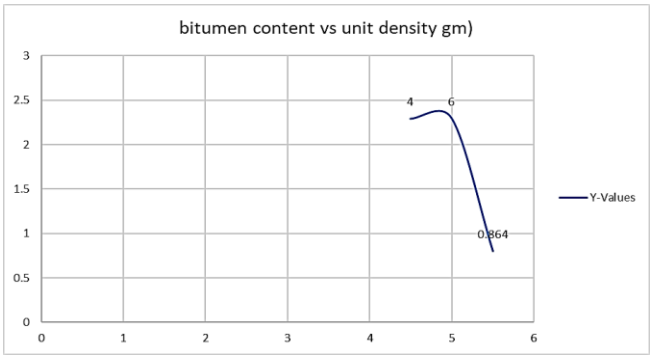

Figure 2: Unit density of bitumen mix

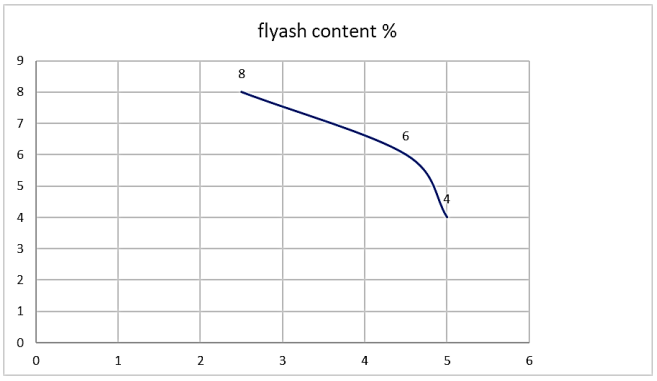

Figure 3: Flow bituminous mix with 5% bitumen

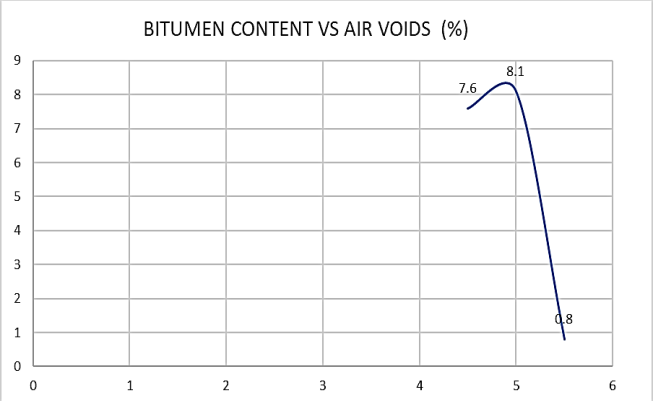

Figure 4: Percent Air voids of Bituinous Mix with 5%

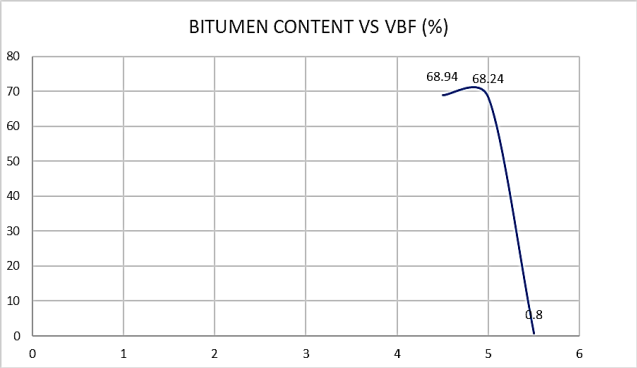

Figure 5: VFB of Bituminous Mix with 5% bitumen

B. Procedure

- Specimens are heated to 60 ± 1 °C either in a water bath for 30 - 40 minutes or in an oven for minimum of 2 hours.
- The specimens are removed from the water bath or oven and place in lower segment of the breaking head. The upper segment of the breaking head of the specimen is placed in position and the complete assembly is placed in position on the testing machine.
- The flow meter is placed over one of the post and is adjusted to read zero.
- Load is applied at a rate of 50 mm per minute until the maximum load reading is obtained.
- The maximum load reading in Newton is observed. At the same instant the flow as recorded on the flow meter in units of mm was also noted.

V. CONCLUSION

It is demonstrated by the outcomes of the experimental study that we carried out on the average
and the Modified bitumen, which modifies virgin bitumen with varying amounts of fly ash. These are the conclusions that follow:

- The bitumen will get stiffer as a result of the fly ash % rise because the ductility value dropped.
- Through the application of various fly ash percentages. As a result, lower grade bitumen can be adapted to withstand heavier weights because it has a lower penetration value.
- When using the Marshall stability test, we discovered that the stability values rose as the fly ash content did. More gaps between the aggregate grain's grains are filled by fly ash. As a result, in this scenario, the mixture will maintain its grain strength, increasing the bituminous mix's stability.
- By utilising the modified binder, bituminous mixes are created with a lower density as the amount of fly ash in the bitumen rises.
- As the fly ash content of the binder increases, the Marshall flow value does as well. This will also demonstrate how the addition of fly ash to bituminous mixes improved their resistance to persistent deformation.

REFERENCES

[1] U.S. Environmental Protection Agency (EPA 2005).
[2] William Harmer Goetz & John Francis McLaughlin (1957).
[3] International journal of emerging trends in engineering and development, Vol. 1, J. Alam and M. N. Akhtar (2011) ".
[4] "Mechanical properties of bituminous aggregate mixture prepared with fly ash as a filler replacement," M. Jovanovich, A. Mujkanovic, and A. Seper (2011).
[5] (2005) American coal ash association "Information about fly ash for highway engineering.
[6] Lakshmi Keshav and Mangairkarasi (2012), "Effect of fly ash on a soil for expansion flexible style.
[7] IS 1209-1978 "standard test procedure for determining a material's specific gravity.
[8] "Standard Test Method for Evaluating Ductility Test," IS 1208-1978.
[9] American Society for Testing and Materials, "test technique adopted to calculate penetration in bitumen."
[10] "Specification of Road and Bridge Work, Fourth Edition," North & H (2001), Ministry of Road.
[11] highways and transportation Indian Road Congress, India, New Delhi.
[12] "Test Method Adopted to Calculate Penetration in Bitumen" in ASTM D 1559 United States society.