LABORATORY INVESTIGATION ON MUNICIPAL INCINERATOR WASTE AS A FILLER MATERIAL IN DENSE BITUMINOUS MIX FOR ROAD CONSTRUCTION

Project Reference No.: *47S_BE_1167*

College ***:*** *Alva's Institute of Engineering And Technology, Moodabidri*
Branch ***:*** *Department of Civil Engineering*
Guide(s) ***:*** *Prof. Shankargiri K S*
Student(S) ***:*** *Mr. Mangal Thoiba Irengbam*
Ms. Pragati T Naik
Mr. Salam Marin Singh
Mr. Shivakumar K N

Keywords:

DBM, HMA, Marshall, MoRTH, OBC, VMA, VFB

Introduction:

Introduction/background: Incinerator wastes refer to the residual materials left after the combustion of municipal solid waste. It includes ash, slag and other by-products of the incineration process. Incinerator waste is typically disposed of in landfills or used in construction applications. Incinerator waste is a by-product of waste management systems.

The use of incinerator wastes in bituminous mixtures, referred to as waste to energy or waste to resources practices, involves incorporating certain types of waste materials generated from incineration processes into bituminous mixes used in road construction and pavement applications. This approach aims to both manage waste effectively and enhanced the properties of bituminous mixtures.

Objectives:

1. To collect the incinerator waste sample from Moodabidri Municipality Wastes disposal site and to study the physical and engineering properties of incinerator wastes, aggregates and bitumen.
2. To obtain job mix formula as per Rothfutch's method.
3. To obtain OBC by Marshall method for Dense Bituminous macadam Grade-1
4. To find Marshall properties of Bituminous mixes prepared with incinerator waste.
5. To find the solution for reducing wastes by converting into eco-friendly materials.

Methodology:

1. Collection and Characterization of Municipal Incinerator Waste:

Collection of representative samples of incinerator wastes from Moodabidri Municipality Waste disposal site.

Performing detailed characterization including particle size distribution, chemical composition and moisture content.

2. Dense Graded Bituminous Mix Design:

Marshall method of mix design procedure is followed to determine the optimum bitumen content for dense bituminous mix Grade 1.

Developing various mixtures incorporating different proportions of municipal incinerator waste as a filler material.

3. Laboratory Testing:

Conduction of comprehensive laboratory tests, including Marshall Stability, flow, air voids, and bulk density, to assess the mechanical properties of the mixtures.

Evaluating the impact of municipal incinerator waste on the rutting resistance, fatigue life, and other performance indicators.

4. Volumetric Properties Analysis:

Investigating volumetric properties such as void content, air voids, and bulk density to understand the compactability and workability of the mixtures.

5. *Comparison with Standard Mixtures:*

Comparing the performance characteristics of dense graded bituminous mixtures containing municipal incinerator waste with traditional mixtures.

Analysing economic implications and potential cost savings associated with using waste materials.

6. Durability Testing:

Subject specimens to aging and moisture susceptibility tests to simulate real-world conditions and assess the long-term durability of the mixtures.

7. Environmental Impact Assessment:

Evaluating the environmental benefits and challenges associated with the incorporation of municipal incinerator waste, considering factors like reduced landfill use and carbon footprint.

8. Statistical Analysis:

Performing statistical analyses to determine the significance of observed differences in test results.

Conclusion:

Based on Laboratory Studies conducted by varying Municipal Waste Incinerator on DBM Grade I, the following conclusion may be drawn.

1. The physical properties of materials determined in laboratory are fulfilling the requirements as per MoRTH specifications.
2. The Optimum Bitumen content obtained is 5% and its Marshall Stability value is 3501 kg which satisfies the specified value (900kg minimum).
3. Sieve analysis results of incinerator waste is satisfying the criteria of filler material as per MoRTH specification.

4. By considering Marshall Parameters of moulds prepared with latex modified binder, by adding 2% of municipal incinerator waste we got higher stability value 2529 kg. As the laboratory investigation carried up to 8% (2, 4, 6 & 8%), the Marshall properties satisfying the requirements.
5. The municipal incinerator waste upto 8% in bitumen mixes shown all required Marshall properties.
6. The use of municipal incinerator waste also can reduce the amount of filler material which otherwise are considered to be a threat to the hygiene of the environment.

Scope for future work:

In this study, Marshall properties of DBM mix have been studied by using VG 30 grade bitumen with a municipal incinerator waste content till 8%. There are still several aspects about this technology need to be evaluated before it is implemented particularly in respect of the engineering properties such as fatigue properties, resistance to rutting, dynamic indirect tensile strength characteristics and dynamic creep behavior.

1. The fatigue properties of Marshall moulds with municipal incinerator waste can be evaluation.
2. Various other types of aggregate grading, filler, binder can also be considered for further studies.
3. Optimization of mix design can be done for cost analysis.