"EXPERIMENTAL INVESTIGATION ON WARM MIX ASPHALT AND RECLAIMED ASPHALT PAVEMENT (WMA-RAP) WITH ZYCOTHERM AS ADDITIVE FOR VILLAGE ROADS

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INTRODUCTION:

Approximately 3.93 million km of national, state, major district, other district, and village roads make up India's extensive road network. The majority of these roads have bituminous pavements, which necessitate ongoing maintenance. All of these operations call for massive amounts of road construction supplies, particularly stone aggregates. In addition, during resurfacing, rehabilitation, or rebuilding activities, substantial amounts of the old bituminous pavement components are often milled or removed. Using a milling machine, which can remove up to 50 mm (2 in) of pavement thickness in a single pass, milling involves removing the pavement surface. With full-depth removal, the pavement istorn and broken with a bulldozer' rhino horn or pneumatic pavement breakers. Typically, a front-end loader picks up the shattered debris, loads it onto haul trucks, and transports it to a processing plant. The RAP

is processed at this plant utilizing several procedures, including crushing, screening, conveying, and stacking. A self-propelled pulverize machine may be used to grind up old asphalt pavements on site and integrate them into granular or stabilized base courses, even though central processing plants recycle the bulk of old asphalt pavements. Reusing materials in a cycle and recycling asphalt pavement maximizes the utilization of natural resources. Because it eliminates the demand for raw aggregate, reclaimed asphalt pavement (RAP)is a good substitute for virgin materials. Additionally, a less expensive new asphalt binder is needed to produce asphalt paving mixes. A high percentage of RAP combinations may be produced using manufacturing and processing techniques, which saves money and energy. It has been concluded that the performance of pavements including up to 30% RAP is comparable to that of pavements made from virgin materials with no RAP based on an examination of pavements containing 30% RAP through the Long-Term Pavement Performance (LTPP) program. Engineers, contractors, and anyone engaged in the specification and design of asphalt mixes for flexible pavements, as well as those working to promote the best use of RAP, will find this to be of considerable interest. A by-product of crude oil is a bitumen. Elements like calcium, iron, sulfur , and oxygen are among the complex hydrocarbons that make up their composition. It is a thermoplastic substance, and temperature affects how stiff it is. It also comes from a natural source. A well-designed bituminous mix should be sufficiently

i. Strong
ii. ii. Long-lasting
iii. iii. Resistant to fatigue
iv. iv. Impervious to irreversible deformation.
v. v. Economic,

It was first utilized to help bind construction materials together due to its inherent adhesive and waterproofing properties. Warm mix asphalt (WMA), which offers more advantages than traditional hot mix asphalt, has lately gained acceptance in the road business (HMA). In contrast to HMA, WMA is normally manufactured at temperatures between 130 and 150 C. In the late 1990s, the first WMA methods were created.

OBJECTIVE:

- The main objective of the study is to find out the suitability of Reclaimed asphalt pavement (RAP) materials to be used in village roads as well as the construction of flexible pavements
- To optimize and characterize the RAP for Warm Mix Asphalt along with Zycotherm as additive
- Evaluation of the mechanical properties of bituminous mix with various proportions of the RAP.

METHODOLOGY

1. the RAP material is collected from the national highway and find out the percentage of bitumen present the mix and physical properties of the aggregates
2. The aggregates were proportioned and mixed as per JMF. The aggregates were heated to a temperature of 125-135°C for a warm mix and the bitumen up to 130°C, also an attempt was made to compare the marshal properties when aggregates (RAP+ virgin) is at 130°C and ZycoTherm Modified Bitumen (ZMB) is also at 130°C which has given a positive result. b. Required quantity of bitumen percentages in increments of 0.5%i.e., 4.5%, 5%, 5%, and 6% by total weight of aggregate (1100g) was heated and thoroughly mixed with heated bitumen at a desired mixing temperature of 130°C for the warm mix.
3. The mix was placed in a pre-heated Marshall mould of 101.6mm diameter and 63.5mmheight with a base plate and collar.
4. After leveling the top surface, the mix was compacted using a rammer of 4.54kg weight with 457mm height of fall with 75 blows on each face.
5. Three specimens each were prepared for each bitumen content trial.
6. The compacted specimens were kept overnight to allow the temperature to fall, later the specimen was extracted using a specimen extractor.
7. The mean height and weight in air and water were noted for the calculation of bulk density. h. The specimens were kept in a thermostatically controlled water bath maintained at 60°Cfor 30-40 minutes
8. Then the specimens were taken out and placed in Marshall Head and tested to determine the Marshall Stability value, which is the maximum load taken by the specimen before failure, and the flow value, which is the deformation of the specimen in mm at the maximum load. The flow meter used was calibrated with a strain rate of 50mm/minute.
9. For the determination of OBC, graphs were plotted with bitumen content on the X-axis and following values on the Y-axis.
   i. Marshall Stability
   ii. Flow Value
   iii. Bulk Density/Unit weight, Gb
   iv. Percent of Air Voids in total mix,vvv
   v. Percent Voids filled with bitumen, VFB k.

RESULTS AND CONCLUSION:

Marshall Properties of WMA Mix at 130 C of 0.1% ZT Dosage (for virgin aggregate and RAP material)

Aggregate		Bitumen content (%)	Stability (KN)	Density (g/cc)	Flow (mm)	Air voids (%)	VMA (%)	VFB (%)
RAP %	Virgin %							
10	90	4.69	10.21	1.87	2.96	12.53	15.21	73.42
20	80	4.18	10.58	2.23	3.18	10.62	13.34	70.23
30	70	3.67	12.55	2.4	3.93	12.99	19.07	62.01

1.Based on the JMF, aggregates were proportioned and mixed with ZMB (4.5%, 5%, 5.5%, and 6% by weight) to evaluate the Marshall parameters and the highest stability value was found to be 15.02 for 5% ZMB

2. OBC of virgin WMA was found to be 5.2% at 130˚C.

3. Tests were conducted on bituminous mixes with virgin aggregate and RAP of 10%,20%, and 30% to evaluate the laboratory performance of the bituminous mix.

4. The Marshall stability at 5% was to be 15.02 KN for 30-70 partial portion stability is 12.55 KN, and for 20-80 it is 10.58 KN and for 10-90, it is found to be 10.21 KN.

5. In this present project work, it can be concluded that more than 10% and less than 30% of RAP can be suitably adopted in making the village roads with the RAP.

6. Using RAP material in the construction of flexible payment reduces the construction cost.

7. Village roads are usually light traffic roads, so it carries low loads compared to other types of road. While its construction RAP materials can be used with virgin materials, they can resist the loads applied on roads

INNOVATION OF THE PROJECT:

By using RAP material we can reduce the use of virgin materials by upto 30% so that reduces the cost of construction for village roads. Village roads are usually light traffic roads,

so it carries low loads compared to other types of road. While its construction RAP materials can be used with virgin materials, they can resist the loads applied on roads.

SCOPE OF FUTURE WORK:

1. Further investigation can be carried out for more than 40% of RAP materials concerning reducing virgin aggregates and their Marshall properties.
2. ITS behavior can be evaluated.
3. Performance-based on different temperatures and the addition of other additives.
4. Tests on increased % of Zychotherm by the weight of the binder.
5. Dynamic loading and rutting tests to provide accurate results.