INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact Factor: 6.078
(Volume 7, Issue 4 - V7I4-1183)
Available online at: https://www.ijariit.com

Cold mix technology using granite waste and rubber waste in road construction

Shreyas Anil Patane
shreyaspatane31@gmail.com
Vivekanand Education Society Polytechnic, Mumbai, Maharashtra

Gavrav Pandurang Bavdhane
Ce2018.gavrav.bavdhane@ves.ac.in
Vivekanand Education Society Polytechnic, Mumbai, Maharashtra

Dhiraj Pradip Joshi
ce2018.dhiraj.joshi@ves.ac.in
Vivekanand Education Society Polytechnic, Mumbai, Maharashtra

Omkar Sunil Chavan
ce2018.omkar.chavan@ves.ac.in
Vivekanand Education Society Polytechnic, Mumbai, Maharashtra

Sanika Kandalekar
sanika.kandalekar@ves.ac.in
Vivekanand Education Society Polytechnic, Mumbai, Maharashtra

Abstract: Hot Mix Asphalt is used as paving mix for many decades in road construction. In India, 90 percent of roads is constructed by bituminous pavements only. Certain Imitations associated with hot mix asphalt using are Re emission of greenhouse gases from hot mix plant, that down of plants during the rainy season, problems in maintaining the paving temperature when hauling stances are more, There for to overcome the disadvantages of hot mix asphalt there is an increasing trend for using cold mix design with bitumen emulsion all over the world because of several advantages such as elimination of heating of hinder and aggregate while producing mixes, this helps in protection of environment and energy conservation.

Keywords— *Cold mix technology, Emulsion, Aggregate, Anti-striping Agent- Rubber Waste*

1. INTRODUCTION

Due to vast fuel consumption because of hot mix technology in road construction, there is increase in environmental pollution. This causes the various harmful effects on the environment as well as on human health and also poses a loss to the country's economy. So, measures should be taken for improving this situation. Therefore, this article mainly focuses on the improvements which can be made to tackle this situation by adopting the cold mix technology instead of hot mix technology in road construction. The following are the disadvantages of hot mix technologies:

- High level of noise and air pollution.
- Emission of greenhouse gases. Compromise with the durability of bitumen due to aging during heating
- High energy consumption. Unsafe for the maintenance crew.

Another form of bituminous binder is the cutback bitumen, which is brought into a fluid state by adding petroleum solvents such as naphtha or kerosene oil. In the field, the solvent evaporates as the curing of cut-back bitumen takes place. This technology has limited applications due to its inherent disadvantages and it is not environment friendly. The third type of bituminous binder, which is rapidly growing is the cationic bitumen emulsion. It available in a fluid state at ambient temperature and is prepared by microscopic dispersion of solid or semisolid bitumen in water using colloidal null and chemical emulsifiers.

The emulsion was developed for the first time in the 1900s and its use in pavement applications started in the 1920s. The early use of bitumen emulsion was restricted to only spray applications and as dust palliatives. Over the years, with the development of new types, grades, specifications, and availability of improved construction equipment and practices, emulsion-based cold mix technology offered a wide range of solutions for the construction and maintenance of roads.

Basically, the cold mix is a mixture of unheated aggregate and emulsion or cutback and binders. The main difference between HMA and cold mix is that aggregates and emulsion are mixed at their natural room temperature without any heating process (10°C-30°C) and in hot mix

the binders and aggregates are mixed at very high temperature (138°C-160°C) When cold mix used as paving mix can offer the following advantages:

- It eliminates the heating of aggregate and binder.
- It is environmentally friendly and conserves energy. Cold mix pavement can provide energy savings of over 50% compared with hot mix. So
- It can be considered as the green bituminous mix for rural road construction.
- It can be easily prepared or made using a small setup on-site. It can be also produced manually for small-scale jobs.
- This paving mix is suited for the road's construction in remote and isolated areas of a country where plant-produced hot mix may have set before reaching the site.
- Cold mix can be laid during wet or humid conditions also
- It is economical and high production is possible with low investment.

2. SCOPE AND OBJECTIVE OF PROJECT

- To know the suitability of granite when partially in cold mix mixture. used.
- To determine the amount of binder required for the mix
- To determine the water resisting property of the cold mix mixture
- To derive or find out the formula of a long-lasting cold mixture when used in pothole repairs and maintenance.

3. UTILIZATION OF RUBBER WASTE

For a country like India, an efficient and durable with low maintenance cost road network is necessary for national integration and industrial development. Due to improvement in living standards of the people, the use of vehicles has increased over last few years, that results in rise in the vehicular density on roads. As vehicles are used frequently the wear and tear of their tires is obvious. Due to the wear and tear of tires, the life of tires reduces at last it becomes useless. The disposal of dese tires has become a serious problem. These tires are disposed of easily by either burning or by dumping. Disposal of tire by burning causes air pollution and dumping causes valuable land to be wasted for stacking up the tires. So it is very important to dispose of these tires safely and economically.

4. DESIGN OF COLD MIX

Properties of cold mixes are varied by many parameters like; aggregate source, curing condition and time period of curing, etc. hence there is no universally accepted mix design method for cold mixes. But Marshall Method is popularly used to design Method emulsified mixes. Marshall Met for emulsified asphalt aggregate design is based on the research conducted at the University of Illinois. This method is applicable to base course for low Traffic volume road. Cold mix is used in surface Courses also for low to medium traffic volume road.

4.1 Aggregates Selection

In India, aggregates should confirm the physical requirement laid by the MORTH specification (2001). Testing of aggregates using various test given by IS standard like sieve analysis, specific gravity, aggregate impact value, and soundness is necessary. The use of tested, sized, and graded aggregates will ultimately result in good quality materials for the maintenance and construction of roads and high durability. It is not the only item one must consider, but in consideration of the other factors that provide for a good road, well-prepared, sized, and graded aggregates must be especially emphasized.

Table 1 Grading of Aggregate in Design Product

Sr no	IS Sieve Size	Weight (gm.)	Percentage of Aggregate Pass
1	12 mm	96	100
2	10 mm	420	92
3	8 mm	204	57
4	4.75 mm	324	40
5	600	60	13
6	300	36	8
7	200	36	5
8	75	24	2

4.2 Emulsion Selection

Selection of waste emulsion depends on aggregate type And aggregate gradation and ability of an emulsion to coat the aggregate. According to IS 8887:2004 specifications there are total five grades of the emulsion; RS-1, RS-2, MS, SS-1, and SS-2 are used to prepare the cold mix. For selection and gradation of emulsion the Quality tests should be carried out according to IS 8887:2004.

4.3 Determination of Initial Emulsion Content

Centrifuge Kerosene Equivalent test (C.K.E) is used to estimate initial residual bitumen content. If C.K.E equipment is not available, emulsified asphalt content designated as P can be estimated using the Asphalt Institute empirical formula given below (Asphalt Institute, 1989).[12] P-(0.05A 0.18 0.5C) Where,

4.4

P-% Initial emulsion content

A=% of aggregate retained on sieve 2.36mm

B=% of aggregate passing sieve 2.36 mm and Retained on 0.075 mm,

C=% of aggregate passing 0.075mm and retain on pan.

Table 2 Observation Table for Emulsion content Determination

Sr no	A	B	C	D	Average
1	14.4	79.6	6.0	11.68	
2	120	86.25	1.7	10.075	10.08
3	32.0	66.55	1.4	8.955	
4	26.85	71.0	23.5	9.62	

3.4 Determination of Optimum Moisture Content

Different samples of aggregates and Lion mixes are prepared to keep the quantity of emulsion constant (as determined from the equation) and to vary the water content. The coated Aggregates are then visually observed for coating of the aggregate by the binder. The optimum water is the water content at which maximum Coating of

aggregate occurs. This water content is taken as the premixed water content in designing the cold mixed BM or cold mixed SDBC.

The optimum water content for our product found is 2% of the weight of aggregate used in mix The optimum water content for BM or SDBC is visually found to be 2 to 3 percent by weight of aggregate. However, this quantity may vary depending on the weather condition (temperature, humidity, and wind velocity) and properties.

3.5 Marshall Mix design criteria for Emulsified Mix

Marshall Mix design criteria[MORTH] specification (2001) for emulsified mixes are given in Table 1. more criteria cannot be met, the mix should be Dered inadequate

Table 3 Mix Design Criteria for Emulsified Mix

Properties	Value
Marshall stability	2.2 KN
Minimum flow (in 0.25mm units)	2
Air voids (VA in)	3-5
Percent maximum stability loss on waking	50

3.6 Marshall Mix design criteria for Emulsified Mix

Marshall Mix design criteria [MORTH specification (2001)] for emulsified mixes are given in Table. If one or more criteria cannot be met, the mix should be considered inadequate Procedure as below:

1. The dry aggregate was blended into 1200g batches the different aggregate sizes to thereby combining the desired gradation
2. The aggregate was used cold (at room temperature) 3. The moisture content was added to the aggregate and mixed thoroughly. The mix was left for 10-15 minutes at room temperature before adding bitumen emulsion
4. The emulsion was added cold to the wet aggregate and mixed thoroughly for about 2 minutes. The suitability of the mix and degree of cooling was then evaluated.
5. After mixing the mixture was kept in the oven at 40 degrees e for 72 hours. At the end of 72 hours, the specimens were taken out from the oven and poured into the cold pre-oiled Marshall mold.
6. In my study done the compaction of the mixture by the Marshall Compaction hammer on each side of specimen 75 blows
7. The prepared samples were extruded after 24 hours & Alter 24 hours the sample was tested in Marshall Stability instrument

4. CONCLUSION

- We found that granite waste used as the main material in the cold mix mixture is giving a good stability value as compared to basalt and granite plus basalt.
- The 0% of water absorption in mix design is giving good stability to final product.
- It was found that granite used with rubber is good for road construction, maintenance and repair works for the road with heavy as well as medium traffic.

5. REFERENCES

[1] J. Suda, J. Valentin, and J. Zak, "Cold bituminous emulsion mixtures laboratory mix design, trial section job site and monitoring", Department of Road Structures, Czech Technical University in Prague, Faculty of Civil Engineering,Praha Vol.1, Issue 3, pp 1-8-2016

[2] O P. Yadav and K.R. Manjunath, "Cold Mix Design of Semi Dense Bituminous Concrete". International Organization of Scientific Research Journal of Mechanical and Civil Engineering Vol.1,Issue.6. pp 9-16-2016

[3] Choudhary, A. Mondal, and H. S. Kaulgud, "Use of Cold Mixes for Rural Road Construction International Conference on Emerging Frontiers in Technology for Rural Area, pp 9-15-2012

[4] Menu, P.Banger, and A.K Duggal "A Review Paper on Warm Mix Asphalt Technologies" International Research Journal of Engineering and Technology Vol 02 Issue 5.pp 1-5-2015

[5] RSahu and R.Joshi "Economic Construction of Bituminous Road by Utilization of Waste Tyre Rubber CRMB" International Journal of Science Technology and Engineering, Vol. 1 Issue 12 pp 8- 16-2015

[6] D. Baraiya "Use of Waste Rubber Tyres in Construction of Bituminous Road - An Overview International Journal of Application or Innovation in Engineering and Management Vol. 2, Issue 7, pp 12-18-2013

[7] M.Priyanka "Laboratory Evaluation of Usage of Waste Tyre Rubber in Bituminous Concrete" International Journal of Scientific and Research Publications, Vol. 3, Issue 9, p 9. pp 7-13-2013

[8] R. Chhabra "A Review Literature On The Use Of Waste Plastics And Waste Rubber Tyres In Pavement International Journal of Core Engineering and Management, Vol. 1, Issue 1.pp 10-15-2014

[9] IRC SP 100-2014 "Use Of Cold Mix Technology In Construction And Maintenance Of Roads Using Bitumen Emulsion" January 2015.

[10] MORTH "Specification for Road and Bridge Work" Fifth Edition, Published By the Indian Roads Congress, on Behalf of the Govt. of India Ministry of Road Transport & Highways [1]Asphalt Institute Manual Series No.14 (MS-14). "Asphalt cold mix manual". Third Edition, Lexington, KY 40512-4052 USA. Part IV, Appendix F, pp 106-122, 1997.

