INTENTION OF DENSE BITUMINOUS MACADAM USING WARMMIX ASPHALT TECHNOLOGY: A REVIEW

Mir Sumear Qadir [1], Er. Suhaib Firdous[2]

[1]M. Tech Scholar, [2]Assistant Professor
Civil Engineering Department,
Geeta Engineering College, Naultha, Panipat

Abstract: The valley of Kashmir is situated in the subtropical region but owing to its high altitude, it is cold. Due to encompassing mountain ranges, its seasons are marked by sudden changes. It attracts the western precipitation in winter mostly in the form of snowfall which covers the valley from December to March, January being the coldest month. The spring season which follows is mostly wet and the summer is humid and warm. The highland ranges prevent the western precipitation which is responsible for the snowfall in the valley from crossing over Ladakh and Gilgit region.

Due to cold temperature, the paving season remains limited to months of May, June, July and August. The problem associated with the construction of bituminous pavements in Kashmir is the control of viscosity of bituminous mixes during laying and compaction. Proper viscosity can be achieved by maintaining a proper temperature. The mixing temperature for 80/100 grade bitumen (which is recommended for Kashmir) should be in the range of 140 C – 155 C which can be easily controlled in the hot mix plants. Minimum laying and compacting temperatures of 115 C and 138 C respectively have to be ensured at the working site. If the bituminous mix is overheated at the mixing stage it loses the important volatiles resulting in loss of its basic binding property. Because of the large distance of hot mix plants from most of the working sites in Kashmir and generally low atmospheric temperatures it becomes difficult to maintain the minimum requisite laying and compacting temperatures. Sometimes the bituminous mix is overheated in the hot mix plants to ensure the minimum laying and compacting temperatures which is, as said already, very detrimental for the mix and the resulting pavement surface.

INTRODUCTION

Indian road transportation infrastructure is rapidly expanding with the ambitious development of road networks under National Highways Development Programme (NHDP), State Highways Improvement Programmes (SHIPs), Bharat Nirman, Pradhan Mantri Gram Sadak Yojana (PMGSY) etc. Also, other category roads and airports are largely expanded. The fast growing Indian economy will further demand for road transport network with a high quality pavement structure as the main corridors are required to cater to very heavy traffic-both in terms of number and axle loading. Road-laying under the Golden Quadrilateral project and the North-South and East-West corridors project of National budget of the Ministry of Shipping, Road Transport and Highways, Govt. of India, 5,694 km of road-laying and four-lining out of a total of 5,846 kms were targeted for completion in the present fiscal year. While these road development projects help in adding considerable infrastructural assets, their construction and subsequent maintenance phases require huge amount of suitable pavement materials

Currently, majority of the Indian roads are flexible pavements, the ones having bituminous layer/s. earlier, there used to be scarcity of cement and India went for flexible pavements with bituminous toppings. Now, flexible pavement are preferred over cement concrete roads as they have a great advantage that these can be strengthened and improved in stages with the growth of traffic. Another major advantage of these roads is that their surfaces can be milled and recycled for rehabilitation. The flexible pavements are less expensive also with regard to initial investment and maintenance.

Materials

Aggregate and bitumen are the basic ingredients of bituminous mixes. Further on the basis of size of particles aggregates are further divided into coarse aggregates, fine aggregates and filler fractions. Materials used in bituminous pavements are discussed below:-

- **Coarse Aggregate**

Impact value, abrasion value and crushing strength of coarse aggregates should be good enough to withstand the design loads within the design life span. All the stresses coming on the wheels are beard by coarse aggregates. Wear due to abrasion is also to be resisted by coarse aggregates. That portion of the mixture which is retained on 2.36 mm (No. 08) sieve according to the Asphalt Institute is termed as Coarse aggregates.

- **Fine Aggregate**

In coarse aggregates between the particles voids remain, those voids need to be filled. Those voids which remain there are filled by fine aggregates. So to fill the voids of coarse aggregates is the main function of Fine aggregates. Crushed stone or natural sand generally is termed as fine aggregates.

➢ **Filler**

After the voids are filled in coarse aggregates by fine aggregates, some of the voids still remain unfilled. Function of the fillers is to fill up the voids. Fillers used may be , stone dust, concrete dust.

➢ **Bitumen**

Bitumen is used as a water repellant material.

1.8 WARM MIX ASPHALT TECHNOLOGY

Environmental awareness has been increasing rapidly over the past years. Extensive measures like air pollution reduction targets set by the European Union with the Kyoto protocol have encouraged efforts to reduce pollution. Warm Mix Asphalt (WMA), a new paving technology that originated in Europe is one of those efforts. It allows a reduction in the temperatures at which asphalt mixes are produced and placed. Its benefits are reduction in energy consumption and reduced emissions from burning fuels, fumes and odors generated at the production plant and the paving site. Early research and marketing efforts have mainly focused on the environmental benefits and the reduced energy consumption of the technology and not as much on how it functions in cold weather paving.

In recent years, the asphalt industry has investigated the warm asphalt technology as a means to reduce the mixing and compaction temperature of asphalt mixes. WMA is an asphalt mixture which is mixed at a temperature lower than conventional hot mix asphalt. Typically, the mixing temperature of WMA range from 100-140c compared to 150-180c for HMA. Thus wma has been gaining increasingly popularity in recent years. Rising energy prices, global warming and more stringent environmental regulations have resulted in an interest in WMA technologies as a mean to reduce the energy consumption and emission associated with conventional HMA production.

Currently there are more than 30 different WMA technologies, using patented processes and products, which have capabilities of bringing reduction in mixing, lay-down and compaction temperatures of bituminous mixes in one of three different ways. These guidelines cover currently adopted Warm Mix Asphalt technologies globally, classifying them into four main categories. Currently there are altogether more than 30different WMA technologies. Although the end effect of reduction of mixing, lay-down and compaction temperatures are the same, the different technologies work in different ways.

The additives, which are either waxes or other hydrocarbon modifiers improve lubrication by reducing the viscosity of bitumen and allow a reduction of 28°C to 40°C in mixing and compaction temperature. Typical dosage amounts are 0.5 to 1 .5 percent by weight of bitumen. Sometimes these additives are also added as modifiers for increasing the stiffness of asphalt mixes, for specialty applications, such as in racing tracks.

ADVANTAGES

Warm Mix Asphalt (WMA) is the generic term for a variety of technologies that allow producers of Hot Mix Asphalt (HMA) pavement material to lower temperatures at which the material is mixed and placed on the road. It is a proven technology that can

- Reduce paving costs.
- Extend the paving season.
- Improve asphalt compaction.
- Allow asphalt mix to be hauled longer distances.
- Improve working conditions by reducing exposure to fuel emissions fumes.

SUMMARY

Evotherm technology studied by us showed decrease in the viscosity of the binder at lower mixing temperatures, which leads to fully coated aggregates at the same temperature. It reduces the mixing temperature by about 30°C than HMC. Based on Marshalls Tests, for warm mixes are compacted at 110°C, for DBM warm mixes optimum binder content is observed to be 4.7%. Based on the results from the lab testing on HMA and WMA using Evotherm, the following conclusions were made:

Satisfactory Marshalls Characteristics are observed for mixes prepared at lower temperatures at their optimum binder contents and binder compositions. The specific mix i.e. mix prepared at 4.7% binder content and 80/100 bitumen composition considered to be the most suitable warm mix which is normally comparable with normal HMA. It is found that the addition of Evotherm lowers the measured air voids in the sample for a given asphalt content than HMA increasing the density and the required quantity of bitumen.

Due to lower temperatures required during mixing the emission of harmful gases like CO2, NOx, SO2 etc. are considerably reduced, hence the warm mix will be more feasible for the environment. Also, the hauling capacity of the mixed asphalt will be augmented as high temperature for the usage of asphalt is not required.

REFERENCES

1. *Bureau of Indian Standards*, Indian Standard methods of Test for Aggregate for Concrete, IS : 2386 part

4 – 1963 (Reaffirmed 1997),

2. *Bureau of Indian Standards*, Indian Standard Method of Test for Determining Aggregate Impact Value of Soft Coarse Aggregates, IS: 5640 – 1970 (Reaffirmed 1998)

3. *Bureau of Indian Standards*, Indian Standard Specification of Coarse and Fine Aggregate from Natural Sources for Concrete, IS: 383 – 1970 (Reaffirmed 1997)

4. *Ministry of Road Transport and Highways*, Specifications for Road and Bridge Works, Fourth Revision, Indian Roads Congress, New Delhi

5. *Road Research Laboratory*, Bituminous Materials in Road Construction, DSIR, HMSO Publication, London

6. *Knight B.H, and Knight*, RG, Road Aggregates, Their Uses and Testing, Edward Arnold Co. London

7. *E.C.A.F.E*, Report of the Seminar on Low Cost Roads and Soil Stabilization, New Delhi, 1958.

8. *Ministry of Road Transport and Highways*, Specifications for Road and Bridge Works, Fourth Revision, Indian Roads Congress, New Delhi, 2001