

Research on the Present Situation and Problems of Warm Mix Asphalt Mixture

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Abstract: Compared with the traditional hot mix asphalt mixture, the mixing and compaction temperature is relatively low. At the same time, the hot mix asphalt reduces energy consumption and exhaust emissions, and has good road performance. So the warm mix asphalt is a new type of energy saving and environmental friendly road material. There are some problems encountered in the development and application of warm mix asphalt. In order to promote the application of warm mix asphalt mixture and realize the sustainable development of the industry, this study analyzes the warm mix asphalt mixture principle and status quo based on summing up the characteristics of warm mix asphalt mixture on, and analyzed the existing warm mix asphalt mixture in question.

Keywords: Warm mix asphalt; Mixing temperature; Technical principle

1. Introduction

At present, energy shortage and air pollution are the two major challenges facing mankind. In order to protect the ecological environment, all countries in the world strictly control the emission of carbon dioxide and other harmful gases. Energy saving and environmental protection has become the focus of attention of the whole society, energy saving and environmental protection is also a measure of a mature or not the key indicators of the application of [1]. The application of warm mix asphalt technology will save energy cost and reduce the pollution to the environment. So warm asphalt has become a new promising technology in the field of asphalt pavement in recent years [2].

2. Overview of Warm Mix Asphalt Mixture

The production of asphalt mixture is a large energy consumption in road engineering [3]. The traditional hot mix asphalt is a hot mix paving material, it requires higher in mixing, paving and rolling of the temperature, so the production and construction process should not only consume a lot of energy, but also a large number of exhaust gas and dust. The traditional hot mix asphalt mixture will affect the surrounding environment quality and the health of the construction workers, while the asphalt will produce thermal aging and affect its road

performance. Especially in the construction of long tunnel asphalt pavement, the high temperature and harmful gas environment caused by hot mix asphalt mixture in the tunnel is more harmful to the construction personnel and equipment. Although cold mix asphalt has some advantages in environmental protection, energy consumption, but because of its unstable road performance, it is generally used only for pavement maintenance [4,5].

In order to reduce energy consumption and exhaust emissions, people began to develop a new type of energy saving and environmental protection asphalt mixture, which is warm mix asphalt mixture. The characteristics of asphalt mixture are shown in table 1. W MA is a kind of energy saving environment friendly asphalt mixture, which is mixed with hot mix asphalt mixture (150-180°C) and cold mix asphalt (10 -40°C), and its performance can reach (or close to) hot mix asphalt mixture. As far as the technical level is concerned, the mixing temperature of W MA is generally maintained at 110-120 DEG C, and the paving and compaction temperature is 80-110. We can see that the temperature of W MA is reduced by more than 30 MA with H [6,7]. Compared with other asphalt mixture, warm mix asphalt mixture has the characteristics of high performance, low emission, low energy consumption and so on [2].

Table 1. Comparison of Warm Mix Asphalt and other Asphalt Mixtures

	Cold Mix Asphalt	Hot Mix Asphalt Mixture	Wma
Mixing temperature	10-40°C	150-180°C	110-120°C
Performance	Road performance instability	Good performance	Good performance
Energy consumption	low	High	Small gas emissions

Harmful gas	Almost no	Large gas emissions	Small gas emissions
Standard	Standard Test methods and specifications	Standard Test methods and specifications	No standard
Economic cost	low	Commonly	Compared to HMA about \$3 /t
Construction	Convenient	Time distance is limited	Convenient
Application	Generally used for road maintenance	Extensive technical maturity	At the exploratory stage

3. Technical Principle of Warm Mix Asphalt Mixture

The adhesion and lubrication of asphalt is an important factor which affects the adhesion of asphalt and aggregate. The binding of asphalt makes the mixture easy to form without loosening, and the lubrication of the asphalt causes the mineral particles to be in place without being crushed. The mixing temperature and compaction temperature of asphalt mixture affect the adhesion and lubrication of asphalt [8]. Warm mix asphalt mixture mainly through a certain technical measures can be at a relatively low temperature well wrapped in the aggregate. Warm mix asphalt has good adhesion and lubrication, so that asphalt can be mixed at relatively low temperature and construction, while maintaining the performance of the mixture is not less than H MA. Current warm mix technology can be roughly divided into 2 principles:

When the mixture is mixed, a large amount of steam is generated by the contact of the carrier or the direct introduction of the water and the hot melt asphalt to cause the volume expansion of the asphalt to form the

foam asphalt. Asphalt and workability increase so that it can be fully wrapped at low temperature aggregate, so as to achieve mixing and mixing of materials at low temperature. The main influencing factors of this technology are: the amount of water added, the way of adding water and the temperature of asphalt. Table 2 gives an example of the production of warm mix asphalt by different manufacturers. [9]

Adding a low melting point of organic additives to the asphalt or mixture (see Table 3), which can change the viscosity temperature curve of the asphalt, while reducing the mixing temperature. The melting point of the organic matter is generally at 90 °C, so the mixing temperature of the mixture can only be reduced to above the melting point of organic matter. Organic matter must be careful to select [9, 10], because the highest temperature must be higher than the melting point of the organic environment, otherwise easy to produce permanent deformation of asphalt pavement. Also consider whether organic matter will make asphalt in low temperature brittle and low temperature cracking resistance of asphalt pavement.

Table 2. Technology for preparing warm mix asphalt by producing foam

Name	PQ	Technical Principle	Cooling Effect
Advera	Hubbard	Partial aggregate moisture foaming	25 -30°C
Aspha-Min	Fairco	Partial aggregate moisture foaming	20-30 °C
LEA,EBE	Nynas	Partial aggregate moisture foaming	<100 °C
EBT	Shell	Add water containing filler	90 °C
LT Asphalt	Mead Westvaco	Soft asphalt and water	110-120 °C
WAM-Foam	Astec	Using emulsified asphalt to produce foam	85-115 °C
Evotherm	Shell	Improve the equipment directly add water to produce foam	116-135 °C
Double Barrel Green	Mead Westvaco	Improve the equipment directly add water to produce foam	110-120 °C
Terex Warm	Astec	Improve the equipment directly add water to produce foam	20-30 °C
Mix Asphalt	Terex	Improve the equipment directly add water to produce foam	25 -30 °C
Ultrafoam GX	Gencor	Improve the equipment directly add water to produce foam	110-120 °C

4. Development Status of Warm Mix Asphalt Mixture

The "Kyoto Protocol" stipulates that by 2010, emissions from all developed countries, carbon dioxide methane, Nitrous Oxide and other 6 kinds of greenhouse gases

than in 1990 reduced by 5.200, so it is the requirement of environment protection and promote the development of W MA. After the first time in the 2000 International Conference on the European Asphalt W MA, countries around the world began to study and apply W MA. Production of warm mix asphalt mixture is growing rapidly, from 2001 to 2003 only 3 years the amount is increased by nearly 4 times, in 2005 only the mixture quantity production of Evotherm warm mix technology has already exceeded the level in 2001 at the same time. In 2005, a total of only 3 kinds of W MA technology, and to the use of Evotherm warm mix technology production in 2007 has been more than the number of mixed t 100 thousand, which shows that the development of warm mix technology is very rapid. By 2008 W MA technology has reached dozens of species. It can be seen that the future development and application prospect of W MA can be seen from the substantial increase in the usage of WMA.

5. Problems in Application of Warm Mix Asphalt Mixture

5.1. Design specifications need to develop

At present, warm mix asphalt mixture is generally used in the design method of hot mix asphalt mixture, but its technical principle is different from that of hot mix asphalt. The technical requirements of the material, the design of the mixture ratio of the test and other indicators, such as the calculation method, test indicators and methods should be carried out according to the characteristics of warm mix asphalt. At present, domestic and foreign are preparing to make the design of asphalt mixture gradation design and performance test, which is helpful to the application and popularization of warm mix asphalt mixture.

5.2. Sources of raw materials to be expanded

The raw material of warm mix asphalt is very narrow. At present, warm mix asphalt mixture is usually only used with good performance, and the application of low quality aggregate and solid waste in the warm mix asphalt mixture is rare. With the support of green idea, research and development and application of renewable

green pavement materials, low energy consumption, light pollution of pavement materials has become one of the construction of a resource-saving and environment-friendly harmonious society inevitable road. Green building materials is one of the characteristics of its production of raw materials as little as possible with natural resources, but a large number of tailings, waste residue, waste and other waste. Therefore, the future development of different solid waste in the application of warm mix asphalt, on the one hand can reduce the cost, but also conducive to the sustainable development of road materials.

6. Conclusions

Resource conservation and environmental friendliness are the objective requirements of economic and social development, and also the inevitable choice for sustainable development of road industry. Warm mix asphalt mixture is a kind of green, energy saving and environmental protection new road material. With the development of science and technology, warm mix asphalt has a broader development and application prospects.

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