Study on the Application of Separation and Regeneration Technology of Waste Asphalt Mixture in the Network Era

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Abstract. Road engineering is one of the key projects supported by our country. As we all know, the road construction needs asphalt mixture as the main construction material of subgrade. After each renovation of the old asphalt road, there will always be a lot of old asphalt. In addition, after the construction of each road project, there will always be some asphalt mixture left behind. With the passage of time, the remaining asphalt mixture has become waste engineering materials. With the theme of energy conservation and emission reduction being put forward, the recycling technology of waste asphalt mixture has become one of the main ways of road maintenance and reconstruction in China. In this paper, the application of waste asphalt mixture based on thermal regeneration technology is deeply studied, and the final conclusion is drawn.

Keywords: Network Age, Asphalt Mixture, Separation and Regeneration

1. Introduction

In the process of reconstruction and renovation of the old asphalt lane, there will always be a lot of old asphalt mixture. If it is discarded at will, the asphalt mixture will pollute the environment and groundwater. It will occupy a lot of land resources. It will also cause waste of resources and economic losses. Gradually, people found that the old asphalt mixture also has the useful value[1].

The recycling technology of asphalt mixture means that it can be reused in road engineering by treating the old asphalt mixture. The recycling technology of asphalt includes the process of digging, crushing, screening and reorganization of asphalt pavement. The regenerated asphalt material can be repaved into various construction layers of pavement[2]. At present, asphalt recycling technology has been recognized by many countries and regions in the world.

2. Classification of asphalt recycling technology and analysis of main difficulties

Generally speaking, asphalt recycling technology is mainly divided into plant mix hot recycling
technology, plant mix cold recycling technology, on-site hot recycling technology and on-site cold recycling technology. Plant mix hot regeneration technology has been unanimously praised by researchers. It has good adaptability. According to a large number of studies, it can be applied to the construction of various types of rotten pavement[3]. After strict adjustment of mix proportion, the performances of recycled asphalt are not lower than those of newly prepared asphalt mixture. Fortunately, its road performance can also meet the useful requirements of advanced road.

Through a large number of experiments and practices, it is found that the main difficulties of the hot recycling technology of asphalt mainly include the variability of the old material, the modulation and screening of the recycling agent, the design of the mix proportion of the recycled asphalt mixture and the comprehensive evaluation of the cracking resistance and durability of the recycled asphalt mixture.

3. Key steps in the recycling technology of old asphalt mixture based on network technology

3.1. Performance analysis of waste asphalt mixture

Before using the old asphalt, we need to analyze the main properties of the old asphalt, the content of asphalt and the mix proportion of the remaining raw materials. By analyzing the softening point, ductility and viscosity of the old asphalt, researchers can easily identify the aging degree of the asphalt. The determination of aging degree can help researchers to find suitable regenerant. In addition, the analysis of asphalt content can provide the corresponding data support for the new mix proportion of recycled asphalt mixture[9].

3.2. Selection of regenerant for waste asphalt mixture

As we all know, the aging of asphalt pavement is caused by various oxidation reactions and polymerization reactions. These chemical reactions turn unstable compounds in asphalt into stable compounds. Asphalt mortar gradually becomes asphalten. The asphalt became stiffer. The plasticity of asphalt decreases. The brittleness of asphalt increases. The viscosity of asphalt decreases. Generally speaking, the comprehensive performance of asphalt becomes worse. The regeneration process of asphalt can be operated in two ways. One way is to mix new asphalt with old asphalt. Another method is to mix the regeneration reagent with the old asphalt. The main component of regeneration reagent is mineral oil with low viscosity and low saturation. It should contain good dissolved asphalten. Regenerant should be able to reduce the non-Newtonian liquid properties of asphalt[5].

3.3. Crushing of old asphalt mixture and screening of details

The crushing and screening of old asphalt is an important step in the regeneration process of old asphalt. The breaking of asphalt should be divided into two main stages. One stage is on-site crushing and on-site pre crushing. The other stage is the breakdown of the factory. The simple asphalt screening process needs a single-layer screening network to control the largest particle diameter of the recycled material. The diameter of particles can be controlled by double screen in detail screening process. The old screening materials produced by two types of screening methods need to meet the specification requirements of pre-selected materials.

3.4. Mix design and performance analysis in asphalt recycling technology
The key technology of the old asphalt recycling technology is the mix proportion configuration. Mix proportion refers to the mixture proportion selection of old asphalt and new asphalt and the dosage selection of regeneration agent. The common ratio standard is that the smaller the aging degree of the old asphalt is, the larger the proportion of the old asphalt should be. Continuous double drum mixing equipment and intermittent mixing equipment can be used for mixing equipment selection. The former is of high thermal efficiency but imprecise. The latter is inefficient but accurate. After determining the mix ratio of the old asphalt, we need to determine the mix ratio of the new asphalt. We can use Marshall method to select the mixing proportion of new materials (see Table 1). After that, through the analysis of splitting strength and dynamic stability, we can ensure that all kinds of properties of recycled asphalt can meet the standard of common asphalt.
Table 1. Marshall test results of recycled asphalt

| Project                  | AC-20 | AC-30 | Specified standard |
|--------------------------|-------|-------|--------------------|
| Marshall stability       | 9028  | 8015  | >7500              |
| Stream value             | 28.2  | 27.8  | 20-40              |
| Void age                 | 3.5   | 3.1   | 3-6                |
| Saturation of asphalt    | 76.2  | 75.8  | 70-85              |
| Residual stability       | 87.3  | 84.1  | >75                |

4. Analysis of regeneration method of old asphalt mixture

According to the incomplete statistics of road engineering material production, the plant mixing hot recycling mode of old asphalt mixture mainly includes continuous recycling mode and intermittent recycling mode. The thermal efficiency of continuous regeneration is very high. Its productivity is very high. It has little pollution to the environment. But its measurement accuracy is very low. The calculation accuracy of intermittent regeneration is very high. The quality of its products is relatively stable. Intermittent regeneration is generally accepted[6].

In addition, in the process of asphalt thermal regeneration, the control of temperature and heating temperature is very important. Low temperature will lead to poor quality of asphalt. Too high a temperature will make it easier for asphalt to stick to the machine. Based on the experience of road material production, the researchers think that the temperature is generally controlled at 70 °C. The heat should be kept constant. The difference between the upper and lower limits of temperature should not be too large.

5. Analysis of the economic and social benefits of the separation and regeneration technology of the waste asphalt mixture based on the network technology

In conclusion, the economic benefits of asphalt recycling technology are mainly reflected in the saving of materials and the saving of asphalt transportation costs. The reuse of old asphalt can save a lot of land and mineral resources. Moreover, we can organize the old asphalt to destroy our environment by using the remaining old asphalt. Its social benefit is very obvious.

The mixture of old asphalt and new asphalt can save a lot of cost in road engineering. Road engineers can use part of the budget for materials in other projects. Therefore, its economic benefits are also very considerable.

6. Conclusion

With the continuous progress of our society and the continuous update of science and technology, the traffic area of our country is more and more broad. On this basis, the construction of our country's road engineering has also received the attention of the state. Generally speaking, the recycling technology of waste asphalt mixture will greatly reduce the material consumption and energy waste. This recycling
technology is in line with the theme of energy conservation and emission reduction in China. It is worth promoting.

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