# Research on Uniformity Analysis and Evaluation Standard of Paving Asphalt Mixture Based on Big Data Technology

| Qi Lin | Tian Yaogang | Jia Kan | Huang Xianlong |
|--------|--------------|---------|------------------|
| College of Materials | College of Materials | College of Materials | College of Materials |
| Chang'an University | Chang'an University | Chang'an University | Chang'an University |
| Xi'an, Shaanxi, 710064 | Xi'an, Shaanxi, 710064 | Xi'an, Shaanxi, 710064 | Xi'an, Shaanxi, 710064 |

**Abstract**: The regional geographical environment where the Mongolians live is extremely unique, so they have gradually formed a distinct national aesthetic consciousness in their long-term life, which is clearly reflected in Mongolian leather products. The Mongolian people have long mastered the method of using sewing technology to make various leather products, and their technical level has been continuously improved, gradually becoming a unique craft of the Mongolian people. Most of the Mongolian leather products are made from various animal fur in nature. The method of applying Mongolian traditional leather technology to the modern leather design with national cultural characteristics in Inner Mongolia has been studied, and the design method developed by the author's design practice and theory research to verify, and to design creative tourist souvenirs with Mongolian cultural characteristics that conform to Mongolian traditional aesthetics and modern aesthetic standards.

**Keywords**: Uniformity Analysis, Evaluation Standard, Paving Asphalt Mixture, Big Data Technology

## 1. INTRODUCTION

The development of the national economy and society is closely related to the transportation industry, which provides a fast and convenient road for economic development. After the reform and opening, my country has vigorously developed the transportation industry, and the results have been remarkable. As of December 2019, the total mileage of expressways in my country exceeded 140,000 kilometers, approaching 150,000 kilometers. During the "13th Five-Year Plan" period, expressways will continue to be built. It is estimated that by the first year of the "14th Five-Year Plan", the total mileage of expressways will reach 169,000 kilometers. In the traditional asphalt mixture design system, the research steps of pavement performance are cumbersome, and a series of complex and expensive indoor tests are required. With the continuous requirements of high quality and high efficiency in engineering construction and the development of modern technology, the traditional asphalt mixture design method has been unable to meet the design needs.

Since the launch of the SHRP program in the United States, more and more researchers have realized that the microstructure inside the asphalt mixture has an important influence on its road performance and have obtained a new asphalt mixture by means of experiments and classical mechanics methods. The engine of the asphalt paver is equipped with a supercharger. The flywheel end of the engine drives four axial variable pumps for walking and distributor through the transfer case, and the output of the fan end drives the vibrating beam variable pump. To prevent system overload and overheating, hydraulic pumps are equipped with pressure cut-off devices. There are also two hydraulic pumps for the scraper conveyor, a fixed displacement gear pump to control the screed lift cylinder and hopper retraction cylinder, and another variable displacement hydraulic pump to drive the screed to oscillate.

The computer's processing of images is essentially to obtain reasonable results through data operations. To make the operation process simple, the images are converted into digital forms in the computer without affecting the processing effect, and the maximum possibly Make sure the image is not distorted. This requires two processing methods of sampling and quantization. Converting a continuous image f into a form that can be processed by computer language is to convert f into a digital form. Digitizing the coordinate x and coordinate y is called sampling, and digitizing the secondary value f is called quantization. Such area division Not only is it beneficial to simplify the calculation of parameters used to characterize the homogeneity of the internal structure of asphalt mixture specimens, but also lay a foundation for improving the identification accuracy of the internal structure uniformity of asphalt mixture specimens.

According to the density and area ratio of coarse aggregate, asphalt mortar and voids in each small area of the digital image, calculate the uniformity evaluation parameters of each area in the single-layer section of each component, and use it as the basic parameter for uniformity evaluation. The evaluation parameters that characterize the internal structure uniformity of asphalt mixture are obtained. By comparing HIMDI with the existing recognition methods for the internal structure uniformity of asphalt mixture, it is found that HIMDI can not only effectively evaluate the internal structure uniformity of asphalt mixture. Under the structural parameters and operating parameters of the distributor, the uniformity of asphalt mixture paving may be affected. On the one hand, it is the macroscopic performance of the uniformity of the mixture paving, and on the other hand, it is the movement of the asphalt mixture during the spreading of the screw distributor. Microscopic manifestation of characteristic parameters.

## 2. THE PROPOSED METHODOLOGY

### 2.1 Uniformity Analysis of Paving Asphalt Mixture Based on Image Recognition

Use CFX post software is used to study the velocity distribution and time-average velocity distribution of the

auger distributor sports field, and to perform dynamic analysis of the asphalt mixture paving sports field under different screw diameters, different screw pitch structural parameters and different speed paving operation parameters. The standard deviation is the arithmetic square of the variance, which can reflect the degree of dispersion of a set of data, the coefficient of variation can eliminate the influence of the measurement scale and dimension and is used to reflect the degree of dispersion of the data. The calculation method of the coefficient of variation is the ratio of the standard deviation to the average. In the binarized image of paving asphalt mixture, according to the calculation formula of variation coefficient, this paper calculates the quadrilateral static moment dispersion coefficient CVGI of the i-th aggregate in the digital image and the ideal distribution of the corresponding archive and based on this to characterize the degree of dispersion of the aggregate, also known as the uniformity index. The basic idea of the design theory is to measure the characteristic values such as the void and pore volume of the main skeleton mineral material, and then make the asphalt mortar contain mineral powder and asphalt mortar the total amount of the mixture with fine aggregate and the design void volume of the mixture is equal to the void volume of the main skeleton, and finally determines the optimal asphalt dosage of the asphalt mixture.

The advantage of this design method is to ensure the embedding ability of the main aggregate, and at the same time make the asphalt mortar fully fill the gap space of the main skeleton. During the paving operation of the auger distributor, the screw diameter of the auger distributor affects the paving uniformity and paving efficiency of the asphalt mixture. To analyze the paving effect under different screw diameters, the auger distributor of a certain type of paver is used as a model, and different screw diameters are used as objects to study the velocity distribution and turbulent kinetic energy distribution of asphalt mixture in the motion field of different screw diameter structure parameters Impact. According to the design plan, a representative group was selected from 27 kinds of simulation tests for analysis, in which the amount of asphalt mixture at the entrance was 115%, the rotational speed was 60r/min, the screw pitch was 280mm, and the screw diameters were 480mm, 420mm and 360mm respectively. .

Through the analysis of the correlation between the particle size of the aggregate and the structural parameters of the mixture, it is determined that the coarse aggregate has a greater influence on the segregation of different types of asphalt mixture, and the weight coefficient of each grade of the coarse aggregate is calculated, and finally the calculation method of uniformity index of paving asphalt mixture based on digital image. By analyzing the calculation results of 300 images of AC-13, AC-20 and AC-25 asphalt mixtures, it is found that the obtained results are consistent with the actual observation results. Therefore, the volume parameters of the asphalt mixture and the parameters obtained from the Marshall test become the main parameters to characterize the Marshall design method. The volume parameters of the mixture in this design method include W, VFA and VMA. The essence of these parameters is the macroscopic performance of the content and spatial distribution of each component in the internal structure of the mixture. The parameters obtained through the Marshall test include stability (MS) and flow value (FL), which reflect the mechanical properties of the mixture.

## 2.2 Research on Evaluation Index of Paving Asphalt Mixture Uniformity Based on Digital Image

Use CFX. Post software is used to study the velocity distribution and time-average velocity distribution of the auger distributor sports field, and to perform dynamic analysis of the asphalt mixture paving sports field under different screw diameters, different screw pitch structural parameters and different speed paving operation parameters. The standard deviation is the arithmetic square of the variance, which can reflect the degree of dispersion of a set of data; the coefficient of variation can eliminate the influence of the measurement scale and dimension and is used to reflect the degree of dispersion of the data. The calculation method of the coefficient of variation is the ratio of the standard deviation to the average. In the binarized image of paving asphalt mixture, according to the calculation formula of variation coefficient, this paper calculates the quadrilateral static moment dispersion coefficient Cvi of the i-th aggregate in the digital image and the ideal distribution of the corresponding archive and based on this to characterize the degree of dispersion of the aggregate, also known as the uniformity index. The basic idea of the design theory is to measure the characteristic values such as the void and pore volume of the main skeleton mineral material, and then make the asphalt mortar contain mineral powder and asphalt mortar the total amount of the mixture with fine aggregate and the design void volume of the mixture is equal to the void volume of the main skeleton, and finally determines the optimal asphalt dosage of the asphalt mixture.

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parameters obtained through the Marshall test include stability (MS) and flow value (FL), which reflect the mechanical properties of the mixture.

# 3. CONCLUSION

Based on digital image processing technology, the image of paving asphalt mixture is analyzed and studied and based on the algorithm of four-side static moment of paving asphalt mixture image, the stepwise weighted four-side static moment dispersion coefficient is proposed as the evaluation index of asphalt mixture uniformity and given. The calculation method of the dispersion coefficient Cv is proposed, and the significance of the influence of the gradation type and the forming method on the calculation accuracy of the overall calculation of the void ratio of the mixture specimen under the standard compaction work condition is analyzed by using the single-variable multi-factor analysis of variance method. The analysis shows that the two factors have a significant impact on the calculation accuracy of the overall void ratio of the mixture specimen, and the impact of the gradation type is more significant than that of the forming method.

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