Research on the Noise Reduction Performance of Asphalt Pavement

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Abstract: In this paper, the research results of the noise reduction performance of asphalt pavement at home and abroad are carried out based on the field noise test.A review. Research shows that the speed is relatively high, the traffic composition of the truck is relatively small sections, the reasonable choice of road materials to reduce the traffic noise is more obvious. It is generally believed that the open graded anti sliding wear layer (OGFC) and asphalt rubber pavement have excellent noise reduction performance; the same type of asphalt mixture, the smaller the nominal maximum size, the better the noise reduction performance. Therefore, it is necessary to systematically study the noise reduction performance of asphalt rubber A SM pavement and asphalt rubber pavement with different gradation types.

Keywords: Asphalt pavement; Noise reduction performance; Field noise test

1. Introduction

Traffic noise is one of the important sources of environmental noise pollution, which seriously affects people's study and work. With the rapid development of transportation, traffic noise pollution is becoming more and more serious, which has become a hot issue in the research of the people. Traffic noise is mainly composed of vehicle noise and tire road noise. In the past, it is generally believed that when the car is more than 40 to 50km/h, and the truck is more than 60 to 70 km/h, the tire road noise will be the main part of the traffic noise. With the development of the automobile industry, the dividing speed is gradually declining. At present, the speed of the dividing line in Europe is: the car is 30 km/h, the truck is 50 km/h, and there is still a trend of decrease. Most of the vehicle speed is greater than the limit speed, which indicates that the tire road noise has become the main source of traffic noise.

Pavement materials have a great influence on the tire road noise, and it is significant to select the appropriate pavement materials to reduce the traffic noise. In recent years, the noise reduction performance of asphalt pavement has been widely concerned by researchers in various countries. In this paper, the research results of the noise reduction performance of asphalt pavement at home and abroad are reviewed in this paper.

2. Noise Reduction Performance of Asphalt Pavement on the Spot Test Contrast

2.1. Field noise test method

There are 3 main methods used to measure traffic noise at present:

statistical method. The microphone is positioned at a certain distance and height of the measured Road, the noise generated by the vehicle is measured, the type and the speed of the vehicle are recorded, and then the data are analyzed by the statistical method. This method is time-consuming, and it is strict to the environment of the testing site, and the test result is influenced by the external conditions.

control over the process. Leave the measured road some distance and height placed microphones, using the selected vehicle, in the measured sections to the given speed driving, measuring cycling through the noise, measurement of vehicle acceleration noise. Because the vehicle and the speed are defined, the influence of the external conditions on the test results is reduced.

Near field test method. This method uses a special Trailer Test to test the noise from the tire road surface contact, Mike Wind is located near the tire road contact surface. This method can fully reflect the situation of tire road noise, which can provide a more reliable means for the evaluation of road noise, and the test is simple and easy to operate. The diversity of traffic noise test methods and the test results are vulnerable to various factors, which bring some difficulties to the testing data of different research institutions.

2.2. Comparison of noise reduction performance of common asphalt pavement on site test

In 1995 s.Meia Rashi and so on by cycling through the law of different porosity and different thickness of drainage asphalt road interview test road test, tests were used to cars, light trucks and heavy trucks under different speeds and with dense graded asphalt pavement were compared. For the car, the pavement drainage noise is

dense graded asphalt pavement low 0 ~ 5dB; for light trucks, and medium truck reduced values were 2 ~ 4 dB and 2 ~ 5 dB; in the gap rate is more than or equal to 20% and intensity noise no longer with clearance rate changes, the thickness of the pavement only on the truck noise influence, influence range is 1 ~ 2 dB.

In 2003 R.Go lebiew ski and so on the cycling after Poznan (Poland) in the city street reconstruction and noise were tested and compared, the transformation of the former for dense graded asphalt pavement, after the transformation for porous asphalt pavement, testing the use of the six different cars were conducted in 20, 40, 60km / h speed. The results show that the noise is obviously decreased after the transformation, and the higher the speed is, the more obvious the noise reduction is, the speed is 60km/h, the noise is reduced by 5 dB.

In 2004 the National Center for asphalt technology using CPX t railer of Colorado in 2002 and 2003, the construction of asphalt mastic macadam pavement, open graded anti sliding wear layer and SX type high performance asphalt pavement noise were compared with that of the test. Under the nominal maximum particle diameter of, little difference between the noise of SMA and OGFC, Superpave SX, SMA pavement, Superpave SX pavement, ultra-thin hot asphalt wear layer and cement concrete pavement noise respectively, as compared with that of OGFC pavement high 1.2, 0.4, 1. 7 and 2.5 dB, the study found. Spectral analysis showed that the peak of the spectrum of OGFC pavement noise appeared in 600 SMA, Hz, SX Superpave, achip Ty peC Nov PCC, road noise spectrum in the peak appeared in 1000 Hz. In Arizona, Nevada, Colorado and Alabama OGFC pavement test showed that the mixed material void ratio, pavement thickness and size of pavement noise has a certain impact, which porosity of mixture and pavement thickness mainly affects the frequency greater than 1 200 Hz, and the graded thickness mainly affects the frequency is less than 800 Hz, noise as graded thinner and reduced. And because the OGFC road noise is the most part of the frequency of 600 Hz, so the use of fine grade noise reduction effect is more obvious.

In 2004 Rebecca s.McDaniel etc. for nominal maximum particle diameter of 9. 5 mm of new permeable wear, SMA and s UPE rpave conventional hot mix asphalt pavement noise based on compared, tests were conducted with near field test and control through the law, which CPB test used two cars and a light truck. Under the other conditions are the same, CPX method measuring results is higher than that of the CPB method, two kinds of test results is consistent, CPX testing method in SMA Pavement and HMA pavement noise respectively compared with PFC pavement high 4. 8, 3. 6 dB, CPB method, speed 90km / h of SMA Pavement and HMA pavement noise respectively, compared with PFC pavement high 5. 9, 4.2 dB.

In 2004 p s.Kandhal of American and world road and the European Union's multiple national test results were compared and analyzed, although the test data of many countries is different, but the road noise general rule is: OGFC <SMA <HMA <PCC, OGFC and SMA pavement noise respectively than the HMA pavement low 4 dB and 2 dB, the noise of PCC pavement, HMA pavement is 3 dB.

In 1996 October king Zuomin etc. in August 1996 in Zhejiang Hangzhou (state) - Xiao (Hill) secondary highway built through waterway interview examination of road noise test test was conducted by the after method was used to measure the speed of cars at 60 km / h and 80 km / h, the noise control. In March 1997, the same section of the road was tested by statistical method, and the two tests were compared with the common asphalt pavement. The first test results show that at 60 km / h and 80 km / h, permeable pavement noise were compared with ordinary asphalt pavement low 5, 4. 8 dB; found in the second test, the truck through water surface denoising performance is not obvious; for car, compared with ordinary asphalt pavement noise reduce 3 dB.

In 2000, Wang Xudong used Fukang car brand of, Hebei Province, Beijing Shanghai Expressway noise test sections and Shihuang Expressway on the SMA Road and gradation adjustment and doped Gabor Neave (Bo) niFiber polyester fiber SAC16 type of stone asphalt concrete sections for the noise test, test respectively in 80, 100, 120 and 140 km / h speed. In order to study the durability of various road noise reduction capacity, in 2001, the same method was used to test the noise reduction test road of Beijing Shanghai Expressway, the speed of the test was 80 and 120 km/h. The two tests were compared with the AC16 type asphalt concrete pavement.

The test results show that the nominal maximum size of the mixture has a significant effect on the road noise, and the road surface noise increases with the increase of the nominal maximum size. Noise reduction performance of OGFC is better, but due to the void is gradually filling the noise reduction ability decreased rapidly and the type UTAC6 ultra thin asphalt concrete pavement, SAC13 and SAC16 type stone asphalt concrete pavement noise reduction capability and low attenuation.

The research results show that the performance of pavement noise reduction is better than that of cement concrete pavement. The noise reduction performance of OGFC pavement in asphalt pavement is more obvious, as a low noise road surface, in Europe and America and Japan and other countries have a wide range of applications. For the noise reduction performance of SMA pavement, there are some differences between different research institutions in various countries, which needs further research. Because of the wide variety of types of dense graded asphalt pavement, the differences in the performance of the noise reduction, plus different re-

search institutions between test data than the poor and difficult of the noise reduction performance have a unified evaluation. The effect of nominal maximum size of asphalt mixture on pavement noise is obvious, and the same type of mixture, the smaller the nominal maximum particle size, the better the performance of noise reduction.

3. Noise Reduction Performance of Asphalt Rubber Pavement

Rubber asphalt is in high temperature under the asphalt and recycled tire rubber particle mixed together, through high speed stirring, rubber particles asphalt react fully and the expansion of the mixture (sometimes also use some additives), which rubber content is 18% of the total mass ~ 22% (not less than 15%). Rubber asphalt in the 30s of the 20th century, after nearly half a century of development, the 1970s began in Arizona, California and other places as the bonding material to be used in road engineering, then Canada, Australia and some European countries have also started the application. At present, the asphalt rubber is widely used in the asphalt mixture as the aggregate material. Practice has proved that the asphalt rubber pavement not only has a lot of excellent performance, but also has excellent noise reduction function. Since 1981, after the discovery of the superior performance of asphalt rubber pavement, asphalt rubber has attracted the attention of many countries, and as a noise reduction measures to promote.

The attenuation performance of asphalt rubber pavement has been concerned by people. In Oak City, California, researchers using statistical through method of eight sections transformation denoising performance attenuation were studied. Eight sections respectively in 1991 transformation completed, six section of the rubber asphalt, 2 period the ordinary asphalt. July 1992 test showed that the use of asphalt rubber modification of the 6 sections, the noise reduction of 3 ~ 7 dB, compared with the use of ordinary asphalt transformation of the road, the noise reduction of 2 to 5 dB. In July 2002, the researchers again to the eight sections were tested, sections of the noise reduction performance has declined, but using sections of the transformation of asphalt rubber, noise is than the transformation of 1 ~ 3 dB and at higher speeds and trucks less, than the use of transformation of ordinary asphalt road noise small 1 ~ 2 dB.

4. Conclusions

Tire road noise is one of the sources of traffic noise. In the same condition, the choice of pavement material can change the noise of tire road surface. Speed is relatively high, the traffic composition of the truck is relatively small sections, the reasonable choice of road materials to reduce the role of traffic noise is more obvious. Study at home and abroad show that OGFC pavement and asphalt rubber pavement has excellent performance on noise reduction, and OGFC pavement has good drainage and skid resistance, rubber asphalt pavement is also has excellent road performance, is an ideal noise reduction pavement material.

The nominal maximum size of aggregate has obvious influence on the road surface noise, and the same type of asphalt mixture, the smaller the nominal maximum size, the better the noise reduction performance. Although there are differences between different research institutions on the noise reduction performance of SMA pavement, SMA pavement is still recommended as a noise reduction material, so it is necessary to conduct in-depth study of the noise reduction performance. The research on the noise reduction performance of asphalt rubber pavement, seldom mentioned the type of gradation, the noise reduction performance of different gradation types of asphalt rubber pavement needs further study.

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