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Tel: 00852-28150191
Fax: 00852-25445670

Contents

Analysis of Anti Sliding Mechanism and Influence Factors of Asphalt Pavement

Li DAI
School of Civil Engineering, Chongqing Jiaotong University, Chongqing, 400074, CHINA

Abstract: This paper firstly introduces the surface characteristics of asphalt pavement, and analyzes the mechanism of tire road friction. At the same time, the influence factors of the internal and external factors are analyzed. Analysis: against external sliding performance significantly but significant variations in different regions of different sections with different external conditions to reasonable quantitative analysis; the internal cause is the effect of anti slide performance of the most direct factor, can through the effective means of control, should be the focus of research. At the same time, it is concluded that the micro structure and macro structure are the intrinsic characteristics of asphalt pavement skid resistance, and the aggregate and gradation of asphalt mixture is an important factor to affect the structure characteristics. Therefore, the experimental study on the anti sliding performance of aggregate and gradation is of great significance to understand the nature of the anti slide performance of asphalt pavement.

Keywords: Road engineering; Asphalt pavement; Anti sliding mechanism; Influencing factors

1. Introduction

With the rapid development of modern transportation industry, to ensure that the vehicle can be more safe and fast, the road surface skid resistance performance is higher. The anti sliding performance of the road is to ensure that vehicles can be basic requirements for safe driving, is refers to the tire braking slip along the road surface generated enough friction, so that the vehicle can in a variety of environmental conditions within a reasonable distance braking [1]. In general, surface friction occurs on the contact surface of the road surface and the tire surface. Therefore, the anti sliding performance is seen as the surface characteristics of the road surface, and the friction coefficient or adhesion coefficient between tire and road surface is [2]. Through to the asphalt pavement anti slide mechanism and influencing factors analysis, contribute to understanding of the asphalt surface structure is how to influence the tire road friction state, which is helpful to understanding of asphalt pavement anti slide performance attenuation of nature.

2. Pavement Anti Sliding Mechanism

2.1. The surface feature analysis

The research shows that the surface texture of asphalt pavement has important influence on the surface properties of [3]. The following four aspects are mainly from the following aspects: the micro structure, the macro structure, the large structure and the uneven structure.

1) Microstructure

Micro structure refers to the aggregate surface rough degree of resistance and polished, using petrologic detection aggregate method and measurement of roughness of aggregate resistance polishing method has been widely used in the evaluation of the microscopic structure of pavement. Microscopic structure can improve the coefficient of engagement between the tire and the road surface, the water on the road can pierce the water film, and improve the pavement anti slide performance.

Theory and practice indicate that the [4], pavement friction ability is not only vehicle driving tire on the road driving force generated by the size of and is function of a tire speed related, friction values from zero (when the tire rolling) rose to a peak, in the speed increase to a rapid decline. Experimental study on display [5]: good pavement micro structure to in vehicle speed (less than 60km / h) driving produced higher friction, and under high speed driving, effect is not obvious; good pavement macro texture in the vehicle runs at a low speed of the tire produced low friction, but at high speeds (more than 60km / h) can generate high friction.

In summary, the micro structure plays a key role in the low speed running of the vehicle, and it is very important to have a good microstructure in order to provide a good anti sliding ability.

2) Macro structure

Macro structure refers to the irregular pavement horizontal direction with viscous effects and the wavelength 0.5~50mm rough texture, voids in pavement macro texture larger irregular and mixture about, which depend on rough set data size, shape, angularity, spacing and the gradation factors [6].

The macro structure can provide the ability of the flow direction of the water flow to the groove in the contact

between the tire and the road surface, thereby reducing the ability of the sliding of the tire, and the rough texture of the vehicle is of great significance to the safety of the vehicle during wet weather. At present, large particles aggregate roughness is mainly attributed to the to a set of aggregate gradation, or man-made surface groove, because the set of material surface roughness can reduce the wet pavement under the condition of the water film thickness, thereby reducing the possibility of skidding.

3) Large structure

By site construction method does not conform to the construction process or operation does not regulate the irregular surface caused by tectonic description, generally by the ruts and potholes, road repair, wear and tear on the surface of the stone and the main joints and cracks caused by, the wavelength in the direction of the road level of 50mm ~ 500mm, the of road noise and rolling resistance than the influence of pavement anti slide performance impact.

4) Uneven structure

Uneven structure is refers to and influence of rolling resistance, quality and vehicle operating costs of constructing a large traveling compared, with greater surface irregularities and road horizontal wavelength is larger than 500mm will, in general, which is used to measure the overall situation of asphalt pavement, usually by the international roughness index (IRI) to calculate.

Large and irregular structures have no influence on the performance of the pavement, and the overall quality of the road surface is a key part of the structure and the uneven structure.

2.2. Tire road friction mechanism

The friction between tire and road surface can be divided into: sliding friction, rolling friction and lubrication friction [7].

Tire and road adhesion and tire rubber by hysteresis loss caused by sliding friction, on dry pavement, tire and road surface friction to adhesion friction, in the wet road to hysteresis loss. The volume effect and surface effect have great influence on the rolling resistance, the increase of the sliding force and the occurrence of the adhesion effect can cause the rolling friction resistance. Lubrication friction mainly produces a layer of water film after the rain, when the tire will occur after the lubrication and friction, tire and road adhesion coefficient will be significantly reduced.

The tyre is a composite structure composed of rubber and its composite material. In the rolling process of the tire, rubber on the deformation of the viscoelastic resistance, this resistance has become the main part of the tire rolling resistance, research shows that the friction of the friction of the friction of the 10% or so [8].

Due to the rough surface, when the tire and the road surface, the actual contact only occurs in the tire rubber and the surface layer of the road surface layer of stone between the micro roughness peak of the contact, which is important to determine the performance of the road [9]. The adhesive friction is about 90% of the total friction force [10].

The slip ratio is the proportion of the sliding component in the wheel motion [11]. In the course of driving, the greater the slip ratio of the tire, the greater the coefficient of adhesion, the smaller the road friction coefficient of the road surface to provide the same adhesion needs to increase the tire slip rate.

3. Analysis on the Influence Factors of Anti Sliding Performance

Pavement anti slide performance depends on the contact characteristics between tire and pavement, asphalt pavement anti slide performance affected by the asphalt mixture's own characteristics, the tire and vehicle operation characteristics and natural environment, from the point of view of asphalt pavement is the result of combined effect of internal factors and external factors.

1)The internal cause is mainly reflected by the impact of raw materials

①Ore material quality

Surface micro structure of mineral aggregate of pavement anti slide performance has a great influence, is more pronounced at low vehicle speed and road macro structure in order to ensure the high-speed driving anti sliding ability is of decisive significance. Therefore, it is important to ensure that the microstructure of the ore and the macroscopic structure of the road surface are maintained at a certain level for a long time, and it is a very important point to improve the anti sliding property of the pavement. "Highway asphalt pavement design code" (JTJ014-97) requirements of the anti slip road must be selected high polished stone, and the stone of the wear and impact values are put forward. These two indexes are used to evaluate the ability of ore materials to resist wear, impact and shearing under the action of load. Ministry of transportation highway research the United States to introduce the DORRY aggregates accelerated wear testing machine of our country 5, 67 kinds of representative aggregate test and find our set of material of the anti abrasion ability is good, especially andesite, basalt, gneiss and sandstone.

②Asphalt binder

The quality of asphalt has a certain influence on the road surface. The friction coefficient of different kinds of asphalt is also different. When the viscosity of asphalt mixture is too low, it is easy to form the free flow smooth, endanger traffic safety. The wax content of asphalt is high temperature sensitivity is poor, prone to cracking and bleeding in winter summer adhesion and the aggregate difference. When the ratio of voids in the mixture is larger, some external factors lead to premature aging of

asphalt, which can shorten the life of the anti sliding surface. Therefore, the anti slip surface selection of asphalt type and grade must be combined with the location of the project climate temperature.

The best asphalt content should also be reasonable, when the actual amount is too large, an increase in the quantity of free asphalt aggregate between, poor adhesion between particles, resulting in poor structure stability, reduce the friction coefficient of pavement, on pavement anti slide performance caused by adverse effects. A small asphalt content although will not reduce the pavement macro structure and micro structure, but because the collection material between the cohesive force difference and easy have loose, peeling and other diseases, making the path table and durability deterioration, can not meet the requirements of driving comfort.

③Influence of shape and gradation of ore

Asphalt pavement is coarse and fine aggregate material and mineral fillers of asphalt film wrapping adhesion and compaction of viscoelastic structure layer, coarse and fine aggregate exposed on the surface and the formation of the pavement of the macroscopic and microscopic structure. Therefore, pavement aggregate shape and gradation affects anti slide surface of the aggregate degree of nudity, size, distance between each other, thereby affecting the pavement skid resistance size. Practice has proved that in the construction of high grade asphalt anti slip surface and aggregate should require hard, angular, similar to the shape of a cube. At the same time, between the coarse and fine aggregate and filler should according to the theory of combination collocation, use the right amount of asphalt as binder, and to meet the requirements as a means of control, to produce the excellent performance of the asphalt mixture.

2) The external causes include many aspects, such as road surface pollution, traffic condition, climate condition, driving speed and construction technology

①Road pollution

Pavement pollution will seriously reduce the anti slide performance of asphalt pavement, the pollution of the most prominent slippery. Through the value of pollution the slipperiness monthly changes in the show that even if the original pavement macro - and micro - structures are very good, put value can reach more than 50BPN, but by clay pollution, put the value of only 25 ~ 34BI'N, extremely easy to cause traffic accident on a rainy day. And pollution of slippery to repeated watering scour 12 ~ 26 times to completely remove, so in clay area the problem is can not be ignored. Prevent slippery pollution of the most effective method, is to cut off the sources of pollution, on the shoulder and highway entrances and exits to be treated and protected.

②Traffic conditions and climatic conditions

Due to the increasing frequency of the heavy duty vehicles, the micro structure and the aggregate of the micro scale are easy to be polished, the road surface is smooth, and the road surface is smooth. The new road opened to traffic in the early anti sliding ability decreases the rate of the larger, usually in the opening of about 1 ~ 2 years after the stable.

When the road surface is dry, the polishing degree of traffic volume plays a leading role, but when the road surface is wet, the roughness of road surface will be restored to a certain extent. As a result, the season has obvious influence on the skid resistance of pavement, and the influence of the size of the same surface layer is related to the properties of the aggregate.

③Speed

The impact of moving vehicles on the pavement skid resistance is mainly reflected in the grinding and compaction of the road surface. The higher the speed is, the more obvious the impact of the wheel on the road surface and the friction effect. Due to the increasing number of heavy vehicles, the higher the speed of the unit time through the number of vehicles increased, which led to the depth of the road to reduce the depth of the road construction. All of these greatly reduce the effect of the anti sliding surface, the reduction of the magnitude of the same set of the nature and composition of the relevant.

④Construction technique

In order to ensure the durability of asphalt pavement in the course of two, we must ensure the full compaction of the mixture in the construction process. Otherwise, in under the action of repeated rolling traffic, the road is further embedded in the squeezed dense, void content decreases, reduce the depth of pavement structure, will make the original, higher anti sliding ability of rapid decay, also in the process easily lead to flooding of pavement damage, directly affecting the pavement durability.

4. Conclusions

Based on the introduction of the surface characteristics of asphalt pavement, this paper analyzes the tire road contact behavior, and then describes the mechanism of tire road friction. At the same time, the anti sliding performance of the understanding of the impact of factors, from two angles of the internal (raw materials) and external (road surface pollution, traffic and climate conditions, speed, construction technology, etc.) against detailed analysis of the factors affecting the performance of the slider.

Through the analysis, the external factors against sliding performance has a significant impact, but significant variations in different regions of different sections has different external conditions, it is difficult to make a reasonable quantitative analysis; internal factors (raw materials) are direct factors affect the slip resistance performance, by means of effective control, should be the focus of the study.

Combination of asphalt pavement anti slide mechanism, microscopic structure and macroscopic structure is the internal representation of asphalt pavement skid resistance, and asphalt mixture aggregate and gradation are important factors affecting the structural characteristics, therefore, based on set material and gradation of the anti slide performance experimental study on, has the important meaning.

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