

Study on High Temperature Stability of Asphalt Mixture

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Abstract: Asphalt mixture is a kind of rheological materials, temperature stability is very important for its performance, this paper mainly analyzes some factors influencing the high temperature stability of asphalt mixture, and some caused due to the lack of thermal stability of asphalt pavement diseases, this paper has introduced the high stability of asphalt pavement rutting test method on the stability of steps, provide a reference for design and construction of asphalt pavement, in order to meet the requirements of pavement design.

Keywords: Asphalt mixture; High-temperature stability; Pavement performance; Affect factor; Rut

1. Introduction Booming

In the industry of our country highway in recent years, the national highway planning quantity is big, but because our country land area is a large country, and around the climate is different, so to the requirements of the asphalt surface is also different, under different temperature conditions has a certain influence on the thermal stability of the asphalt surface line, and the influence factors of asphalt pavement mainly includes two aspects, vehicle load factors and atmospheric factors, therefore, in order to ensure that asphalt pavement under the condition of higher temperature and the driving load repeatedly function, does not produce a series of pavement diseases, asphalt pavement will need through a variety of methods to improve the high temperature stability of asphalt surface.

In a series of road diseases, rutting is one of the common disasters of asphalt pavement, which seriously affects the performance and service life of asphalt pavement. The strength of its deformation degree has close relationship with temperature, will decrease with the rising of temperature, therefore, under the environment of higher temperature, and the role of the channelized traffic, under heavy traffic load is very easy to diseases such as rutting, the pavement damage. In this paper, from a range of factors which influence the stability of asphalt mixture high temperature expansion analysis to explore, from the internal and external two aspects analyzes the performance of the asphalt surface, through the results, the analysis method of relatively suitable to improve the high temperature stability of asphalt mixture, avoid rutting of asphalt pavement diseases such as production, in order to improve the pavement performance, the asphalt road surface maintenance to reduce costs, improve the utilization rate of road[1].

2. Influence Factors of High Temperature Stability of Asphalt Mixture

2.1. Properties of bituminous materials

Some physical or property of asphalt itself may also directly affect the high temperature stability of asphalt mixture, this is because the asphalt itself is a kind of mixture, with different material physical properties and chemical properties of different materials, on the one hand, different grade asphalt high temperature stability of asphalt mixture can be a relatively big impact, for example, the high temperature of asphalt viscosity, stiffness of these physical properties and the adhesive quality of stone[2]. On the other hand, the use of asphalt can have a serious effect on the high temperature stability of the mixture. When asphalt is overmuch, can cause the aggregate state of suspension, so in the high temperature condition and the common role of vehicle load cases, asphalt flow phenomenon occurs, will eventually produce plastic deformation, reduce pavement performance. Of course, we can also add modifiers to improve the high temperature stability of the mixture. At the same time, the content of asphalt if too low, the rutting resistance performance than asphalt mixture content appropriate mixture performance is much lower, according to the related research found that Marshall method is used to determine the optimum asphalt content than is used to control the rut of optimum asphalt content is about 0.4%[3].

2.2. Influence of aggregate performance

Aggregate effects on the high temperature stability of asphalt mixture is also very obvious, to rank high in terms of the high road, in the process of construction, we have to aggregate demand will also is very strict, aggregate must adopt hard enough, good stability,

surface roughness, crushing, aggregate particles close to the cube shape. The roughness of aggregate is particularly important to make the aggregates a compact skeleton model[4].

In a word, the mixture must have enough nesting force and friction. At the same time, the aggregate surface should be clean enough, should not contain any impurities such as dirt attached to the surface or mixed among them, the aggregate should be accord with the requirement of specification, in conditions allow, should use broken artificial sand as far as possible, use less as far as possible natural sand. Whether coarse aggregate or fine aggregate, we should try to use alkaline materials because the chemical properties of the materials can also have important influence on the high temperature stability of the mixture.

2.3. Effects of aggregate mismatch

Embedded between the different graded aggregate to squeeze in a different way, as a result, the mixture of close-grained degree is also different, high temperature stability of asphalt mixture, asphalt mixture under the action of vehicle load resistance is repeated compression deformation and lateral flow ability, therefore, to form a good embedded skeleton crowded structure on the high temperature stability of asphalt mixture is particularly important. If the coarse aggregate is too little, the fine aggregate too much, can not form a good skeleton function, easy to break[5]. To ensure that the air void of asphalt mixture between the value at the right moment, otherwise will seriously affect the asphalt roadbed stability, for example, if the void ratio is too large, the mixture of waterproof performance will reduce, if the void ratio is too small, the high temperature stability of asphalt mixture will reduce. Therefore, we can only design suitable asphalt mixtures according to actual requirements.

2.4. The impact of climate factors

Stability of asphalt mixture high climate were the main influencing factors of temperature, humidity, sunshine, radiation and other factors, such as wind and rain, asphalt pavement surface appear dark, very easy to absorb heat under direct sunlight, then the asphalt pavement temperature rise rapidly, when the temperature of the asphalt inside than the outside under the condition of high temperature, and it is very difficult to heat release. In this case, under the repeated action of vehicle load, asphalt mixture flow and deformation, occurs over time constant will form the rut disease, thus reduces the high temperature stability of asphalt surface.

2.5. The influence of traffic conditions and other factors

Traffic volume and traffic diversion way will have influence on the stability of the asphalt surface temperature, vehicle load, and the vehicle speed is different, there are factors such as the number of vehicles will be the different degrees of impact. When heavy load vehicles are more driving conditions, and the more serious position of channelized traffic can produce rutting diseases, it can reduce the high temperature stability of asphalt pavement.

2.6. Impact of construction conditions and construction technology

During the construction of asphalt pavement, many factors can influence the high temperature stability of the mixture. From raw materials to aggregates, the mixing process of mixing materials, temperature control during construction is also very important. The most important part of stability should be the compaction of the road surface. If the mixture is not up to the required construction temperature during the process of pressure operation, it may result in insufficient compaction and excessive void, which can affect pavement performance. Compaction machinery without reasonable compaction, the compaction method or compaction times is not enough, the void ratio is too large, a series of problems such as water proofing property is bad, will eventually led to the decrease of the high temperature stability of asphalt surface, affect the service life of pavement[6]. So we pass of construction, guarantee the standardization of the construction and quality assurance, the paving of asphalt mixture has very good embedded squeeze effect and bonding performance, in order to improve the high temperature stability of asphalt concrete pavement.

3. The Form of Pavement Damage Caused by Low Temperature Stability of Asphalt Pavement

The high temperature stability of the asphalt is generally the ability of asphalt mixture to resist permanent deformation under repeated loads. The lower stability situation of asphalt pavement, often happen under the condition of high temperature, low load rate, and under the condition of shear resistance decrease, in other words: the asphalt surface stiffness under the condition of relatively low.

One common disease types mainly include: goes on, such as package, washboard, cause the disease of asphalt pavement is the main factor in the level of heavy load repeatedly function and shear strength is reduced, the disease is often in the table, penetration, advanced the intersection of the asphalt road mix order, or changing slope sections[7].

3.1. Hazards of ruts

Rut disease is one of the serious problems of the high temperature stability of asphalt pavement damage one of them, under the condition of relatively high temperature, and vehicle load effect under the condition of repeatedly, very possible longitudinal permanent deformation. This is one of the performance of high temperature stability of asphalt pavement. Under the action of channelized traffic, ruts are easy to occur[8].

According to the cause of the rut, it can be divided into three types.

(1)The lost rut. This kind of rut is the main aspect of current asphalt pavement performance research. The reason for this is that the asphalt pavement structure is under the repeated action of the wheel load, and the flow of the inner material of the asphalt pavement causes the aggregate to move in the horizontal direction. This disease is often produced at the wheel.

(2)Structural rut. This kind of rutting is caused by the road structure which causes the whole structure to be permanently deformed under the repeated conditions of heavy traffic load. The main reason of this deformation is that the subgrade deformation is transferred to the surface layer.

(3)Wear a rut. Due to asphalt pavement structure in the surface of the material and direct contact with the car tyres, so the wheel wear and natural environmental factors under the condition of dual role, pavement aggregate continuously lost, especially when the car after the cold winter adopted anti-skid device, this kind of rutting is more easy to produce.

In the three types of ruts, the rutting is the most serious of the three ruts, followed by the ruts. Because most in the construction process of asphalt pavement will adopt semi-rigid base materials, therefore, the structural rutting is relatively less, therefore, we say normally type rut is instability rutting.

The formation process of ruts mainly consists of three stages, the first phase is the gradual compaction process, the second stage is the stabilization process, and the third stage produces shear damage.

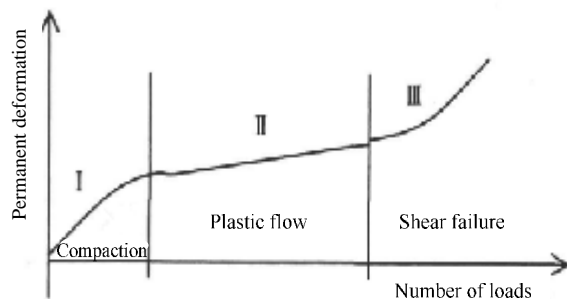


Figure 1. The three processes of rutting development under the repeated action of the asphalt pavement

In the process of paving and compaction, the asphalt pavement gradually forms the skeleton structure and the asphalt mixture is compacted and compacted. But the actual compaction can not achieve the design compaction density. So the opening in the asphalt pavement, in under the action of vehicle load, especially under the action of heavy load, asphalt pavement will be a gradual process of compaction, this is the first rut formation stage, the furrow of the second stage is the shaping of asphalt mixture flow, after the compaction process, continuously under the action of high temperature and load, asphalt roadbed damage skeleton structure, make the pavement produces irreversible compression deformation. The third stage of the rut is the shear damage, which mainly shows the rearrangement of the mineral aggregate and the destruction of the mineral skeleton. Network skeleton structure of asphalt mixture, after losing stability of mixture of aggregate skeleton is gradually began to assume the role of the load, and asphalt lubrication, the hardness of the relatively large aggregate particles under the direct effect of load can slide along the interface between the mineral aggregate, lead to asphalt and asphalt mortar to its enrichment region flow gradually, that the free surface flow mixture, especially when the skeleton between asphalt and rubber paste is more, this process will be more obvious[9].

Therefore, the rutting is caused by the structural damage of asphalt mixture, mainly due to the impact of load and temperature and the damage caused by high temperature stability.

4. Study on High Temperature Stability of Asphalt Pavement

The research methods of high temperature stability of asphalt mixture are also varied. Different methods have advantages and disadvantages. The main methods are the method of confining compressive strength, Marshall method, triaxial test, creep test, rut test and shear test. In this paper, we mainly investigate the steps of rutting test to study the high stability of asphalt pavement, which is intuitive and effective.

First, the selection of materials, mainly asphalt and aggregates. To make the material meet the requirements of the specification, the test is carried out with different levels, and the results are representative. Through Marshall test to determine the optimal dosage of asphalt, asphalt mixture and then under the optimum asphalt content of mixture density as control standard, made into appropriate size plates, rutting test under the condition of 60 °C. Then the test results are analyzed and the high temperature stability of asphalt mixture is studied from different aspects to meet the actual requirements.

5. Summarize and Improve Measures

The high temperature stability of asphalt mixture is proposed in this paper, analyzed the influence the various effects of high temperature stability of asphalt pavement, from asphalt materials to all sorts of gravel aggregate, gradation, traffic factors, climate, construction, etc. The influence of various aspects. Followed by most damage caused by high temperature stability of the "ruts", summarizes the formation process of rutting, rough rut formation of the three stages are analyzed, and simple to understand the high temperature stability of asphalt mixture test methods.

Generally speaking, high temperature stability of asphalt mixture is of great importance to pavement performance. We need to take this very seriously. On one hand we can choose a better pitch to improve it, or add modifier, increase the high temperature stability of asphalt mixture, asphalt dosage is appropriate, too little or too much use of asphalt content of them are good for asphalt roadbed stability, the scholar thinks, slightly lower than the optimum asphalt content may be more beneficial to the asphalt surface high temperature stability of asphalt pavement. , on the other hand, choosing appropriate coarse aggregate and fine aggregate is also very important, choose hard, good texture, angular gravel were favorable for the formation of mixture skeleton structure, to maintain the cleanness of aggregate, adjust measures to local conditions, in the process of batch mixing with appropriate grading macadam, and this can be a very good form the asphalt surface space frame structure, improve pavement performance and high temperature stability.

In the end, we should comply with the standard requirements in the construction process, meet the suitable mixing temperature, the factory temperature and the spread temperature. In the compaction process, the compaction criterion is followed, and the compaction of the compaction is sufficient to meet the compaction density of the design requirements. In short, the practicability of asphalt pavement in high grade highway is very strong, the asphalt surface also has a lot of, high temperature stability is also very important, but we can

gradually in the process of paving and production to improve it, make him satisfy our actual requirements.

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