

Research of Factors Affecting Water Stability of Salt Asphalt Mixture

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Abstract: With AC-16 salt SBS modified asphalt mixture for an object, relying specification water stability evaluation, based on existing research data, analyzing influence of different salinization matter, different salinization contents and soak time for water stability of the salt asphalt mixture. The results showed that two typical Salt was the impact of water stability of Asphalt, although the difference, but the difference is not great ; different dosage effect water stability of the Salt asphalt mixture is particularly significant ; the soaking time was affecting water stability of Salt asphalt mixture another major factor.

Keywords: Salt asphalt mixture; Different salt content; Soaking time; Water stability

1. Introduction

Transportation is the artery of the national economy, Road is an important part of transportation facilities ; road and urban road construction and normal operation plays an immeasurable role for the entire national economic development. China is a big country of highway, the developed transport system to protect the rapid growth of China's economy. But 3/4 of our country belongs to the area of winter snow and ice, In the case of road ice and snow, Reduction of road adhesion, The driving force and safety of the vehicle is extremely unfavorable. These issues have become a major hidden danger of road traffic safety and people's lives and property. Therefore, clean snow and ice on the road to become an urgent problem to be solved. Chemical freezing check pavement is to add a certain amount of chemical ant freezing material (such as salt)to asphalt mixture, constructing a road with the inhibition of the freezing function. Because of its low cost, simple construction technology, the method is simple, easy to promote, Therefore, Abroad has been widely studied and applied, In 1990s, the United States, Britain, Germany, Canada, France, Switzerland and other countries have developed the design and construction standards for this road surface anti icing materials. The research of this aspect in our country starts late, however the geographical position of our country, the construction standard have big gap to foreign, need to form a material performance evaluation system suitable for China's national conditions. Our country ordinary asphalt mixture paved often due to the presence of water, the wheel load generated by the hydrodynamic pressure and vacuum suction, aggregate crumbling, and loose, rutting, cracking disease. And salinization of asphalt mixture with water, precipitation of low valent cation solution, significantly reduced the stability of the resulting chemical adsorption

layer between asphalt and set, the asphalt and aggregate to make more easy to peel, reduces the water stability of mixture. So it is necessary to research on water stability of salt antifreezing asphalt mixture.

The AC-16 salt SBS modified asphalt mixed material as the research object, depending on the specification of asphalt mixture water stability evaluation index; Density volume replacement method was used to modify the gradation. Through the change of different salt modifier, the same salt of different content and different soaking time, of above three factors of mixed feed water stability was investigated.

2. Raw Materials

Asphalt binder for shell of SBS modified asphalt, coarse and fine aggregate products of Shaanxi Xianyang basalt, powder by limestone grinding, salt modifier for the typical modifier, At present the application of salt change agent is divided into three categories: (1) cement solidification type, namely through the cement curing salts into different particle size of granular, spherical objects, the replacement mixture of coarse and fine aggregate, add about 8%; salt after paving mixture slowly dissolve out, play melting ice and snow melting, improve the melting snow

persistence.(2) surface coated with oil type, fine aggregate salt in the form of particles, surface coated with oil after the replacement mixture, add the weight of about 5%, by oil on the surface of the water repellent, slow in contact with water and salt, the active ingredients slowly precipitation, improving snowmelt persistence, on representative of products: V-260.(3) powder and porous structure of igneous rock package salt, grinding into powder particle replacement mixture of filler and salt fully dispersed in the mixture, active ingredients gradually from the pavement surface precipitation so as to con-

tinue to play a freezing inhibition effect, adding amount was 6% ~ 8%, on behalf of products have Mafilon (MFL). In this paper, the selection of surface coated with oil and powder in the typical modifier, MFL and V-260. Economic and technical indicators are as follows Table 1 and Table 2.

Table 1. V-260 economic Technical index

Technical index	technical parameter
proportion	1.75g/ml
Particle size	0.1-5mm
Melting point	175 °C/260°C
PH value of solution	11-12
Apparent density	0.82g/ml
Shake density	0.87g/ml

Table 2. MFL economic Technical index

Technical index	Range value	Test result
density	2.25-2.35	2.302 (g/cm ³)
Salt content	55±10%	57.10%
PH value	8-8.5	8.3
moisture content	<5%	0.32%
Particle size composition	<0.6mm	100%
	<0.15mm	90.20%
	<0.075mm	76.90%

The properties of raw materials can meet the technical requirements of raw materials.

3. Influence of Water Stability of Different salt Antifreezing Asphalt Mixture

Salt modifier as additive materials instead of thick, fine aggregates or powder, due to the modifier and sets the density of the material or powder has great difference, if the gradation correction, amounts to replace will enable the hybrid material porosity occurred great change. Therefore, the density volume replacement method is used to carry out the gradation correction. Considering some research shows that: the key sieve through rates and types of filling of ordinary asphalt mixture material freeze-thaw splitting strength ratio has great influence, therefore, studying water stability performance of different types salt asphalt mixture is very necessary. Add the amount of modifier salt as the aggregate and powder 6%; Because the particle size of V-260 and aggregate difference is not big, the addition of the addition, MFL need to modify the gradation through the density volume replacement method. According to the < highway engineering asphalt and asphalt mixture test procedures >. The trial test pieces were divided into three groups. First group for not adding modifier of asphalt mixture, the second group for asphalt mixture mixed with V-260. The third group is mixed into the MFL of asphalt mixture. Test results as shown in Figure 1 and Figure 2.

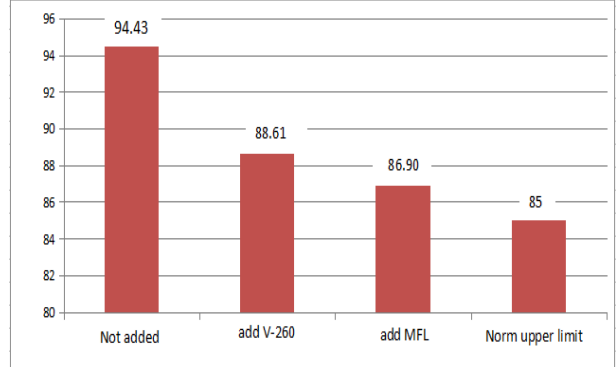


Figure 1. The residual stability of different Salt Mixtures

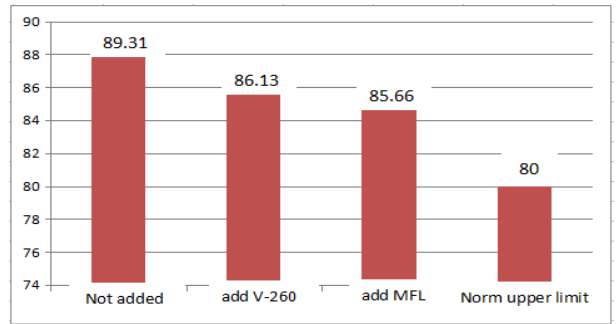


Figure 2. The Freeze-thaw splitting strength ratio of different Salt Mixtures

Test results show that: After adding V-260 or MFL, the residual stability and freeze-thaw splitting strength ratio of the asphalt mixture decreased, but all the upper limit of the specification was satisfied ; The performance and the two kinds of salt are basically the same. The influence of water stability of mixture is not significant. Analysis reason: Two salt although added with different form into the mixture, void percentage no significant changes and because of the influence of gradation and aggregate are almost the same, although have reduced the water stability of mixture, but the difference is not great. Since the research is confined to two kinds of typical salt modifier, The common law can not represent all salt modifier material influence the water stability of asphalt mixture; Therefore, Need further research effect of modifiers on salt antifreezing asphalt mixture water stability under different salt.

4 Effect of dosage on stability of water

Asphalt mortar formed after mixing mineral powder and asphalt, enhanced adhesion; Salt incorporation will replace all or part of mineral powder, effecting asphalt rheological properties and bonding. In this paper, through adding different amount of MFL, on the same salt with different dosage on asphalt mixture water stability, the results are as follows Figure 3 and Figure 4.

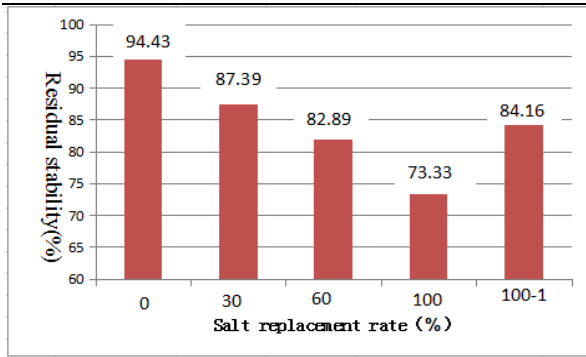


Figure 3. The residual stability of Different content

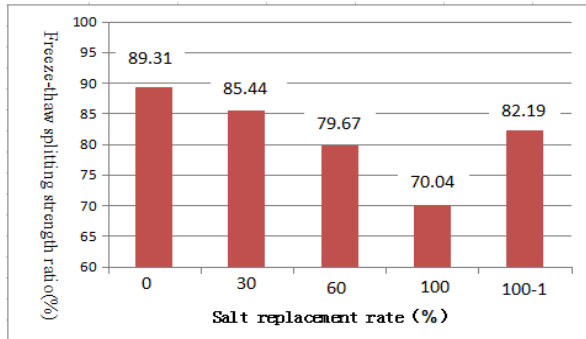


Figure 4. The Freeze-thaw splitting strength ratio of Different content

Note: in figure 100 (a) as a result of the addition of anti stripping agent; 100 (b) as a result of the addition of 0.4%PA-1 type anti stripping agent

Results show: Immersion residual stability and freeze-thaw splitting strength ratio increase with salt content decreased when the salt replacement powder, Not adding anti stripping agent, salt antifreezing asphalt mixed material residual stability and freeze-thaw splitting strength ratio has been unable to meet the current specification requirements. Therefore, in order to ensure the anti water damage ability of salt antifreezing asphalt mixture, add salt to be controlled. Think analysis, The properties of aggregate include surface chemical properties, porosity, specific surface area and so on. These properties have influence on the water stability of the mixture; Aggregate surface containing iron, calcium, magnesium, aluminum and other high valence cations, these high valence cations and the formation of the chemical action of the asphalt stable adsorption layer. And the incorporation of salt change agent properties and material properties are very different and containing sodium, potassium and other low valent cation, because the low valent cation and asphalt chemical adsorption forming instability of the adhesive layer, when meeting water is easy to be emulsified. Therefore, when the powder is replaced, the rheological properties of asphalt binder and adhesive properties will be affected to varying degrees. According to the experi-

mental results, replace all salt powder, mixture water stability is lower than the standard requirements. When adding a certain amount of anti stripping agent, water immersion residual stability and freeze-thaw splitting strength ratio to meet the specification requirements. Therefore, in the construction process of mixed materials can not meet the stability of water, can be added to a certain amount of anti stripping agent, and enhance the ability of water resistance of the mixture.

5 Effect of soaking time on the stability of water

Salt antifreezing asphalt mixed material in the summer rainfall and winter weather, snow and ice, salt will gradually from the mixture to seep out. The wheel load generated by the hydrodynamic pressure and capillary water conditions, slow release, formation of soluble salt solutions gathered inside the pavement structure. It is well known that aggregate and slag asphalt mixture are commonly used in alkaline substances, the higher the basicity, and asphalt adhesion is better. And for salt anticoagulation ice asphalt pavement, the precipitation of soluble salt solutions belong to acidic, due to its existence, reducing the alkaline aggregate, will enable the adhesive in the set of the asphalt mixture gradually and aggregate separation, and even the emulsified asphalt peeling. Furthermore, the common asphalt concrete pavement by paving compaction after, void ratio changed little; but for adding melting snow salt of asphalt pavement, asphalt mixture of the salt in the water to soak slowly precipitation loss, so that mixture gradation with the passage of time also made some changes, pavement structure change, porosity increased, compared with the ordinary asphalt pavement void rate is too large. In this paper, by incorporation and incorporation of salt two groups of asphalt mixture specimen, At room temperature under different conditions, and then take out the relevant test according to the requirements of the specification, study The variation law of water stability of mixture. The results are as follows: Figure 5.

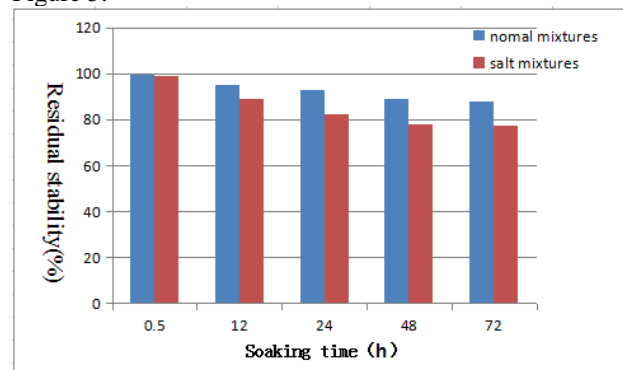


Figure 5. The residual stability of different soaking time

Results show that the ordinary asphalt mixture and salt antifreezing asphalt mixture immersion residual stability degree with the extension of soaking time and smaller.

Compared with ordinary asphalt mixture, salt antifreezing asphalt mixture residual stability decreased significantly, indicating that produced by the precipitation of salt of acidic solution and cause voidage increases of mixture water stability performance has significant subduction. Therefore, pavement design and construction, should promptly remove the road surface water, improve the durability of the pavement.

6. Conclusion

Different salt modifier due to the nature of differences, influence on the water stability performance of asphalt mixture is different, but the difference is not great. The paper studies two typical salt modifier of asphalt mixture water stability was investigated, and not representative of all salt modifier. Therefore, further study on the effect of different salt modifier on the water stability of asphalt mixture are needed.

With different amount of salt is particularly significant influence on water stability of mixture; volume increases, water stability is weak. By adding the anti stripping agent to improve the water stability of salt antifreezing asphalt mixture.

Salt antifreezing asphalt mixed material in salt solution immersion would lead to reduce the water stability, which is due to the analysis of salt to produce salt solution, so that the formation of the asphalt and aggregate

bond layer viscosity weakening, the wheel load dynamic water pressure and aggregate in the combined action of capillary water conditions, aggregate constantly peeling the pavement disease; Therefore, In the road design and construction, should promptly eliminate surface water, improve the durability of the pavement.

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