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THE INFLUENCE OF MODIFIERS ON INCREASING THE DURABILITY OF ASPHALT CONCRETE PAVEMENTS

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Annotation

This article shows the use of increasing the durability of modified asphalt concrete formed with the addition of polymers "Kraton D1186" and surface-forming additives SFM "SP-OEP" with long-term water saturation, which is influenced by the main parameters of asphalt concrete, concrete is also considered in terms of frost resistance, corrosion resistance and crack resistance.

Keywords: "Kraton D1186", water resistance, modification, cracking resistance, freezing, water saturation, stress.

Аннотация

В данной статье показано применение повышения долговечности модифицированного асфальтобетона, сформированного с добавлением полимеров «Кратон Д1186» и поверхностиобразующих добавок СФМ «СП-ОЭП» при длительном водонасыщении, на которое влияют основные параметры асфальтобетона, также рассматривается бетон по морозостойкости, коррозионной стойкости и трещиностойкости.

Ключевые слова: «Кратон Д1186», водостойкость, модификация, стойкость к растрескиванию, замораживание, водонасыщение, напряжение.



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Introduction

Water resistance during long-term water saturation is one of the main properties of asphalt concrete, which is associated with its resistance to frost, corrosion, cracking. The resulting water, as well as its freezing and an increase in the volume of asphalt concrete pores, leads to the peeling of bitumen films from the surface of mineral materials, the appearance of internal stresses. As a result, the strength decreases and the destruction of asphalt concrete coatings accelerates. It is most appropriate to increase water resistance by increasing the adhesion strength of bitumen layers to the surface of mineral particles of asphalt concrete [1,2].

With insufficient adhesion of bitumen to the surface of mineral particles, water penetrates into the pores of asphalt concrete through defects in the structure of mineral grains and peels off the bitumen films from the surface, which leads to a weakening of structural bonds and facilitates its destruction. The adhesion of bitumen to the surface of mineral materials, which reduces the water resistance of asphalt concrete during prolonged water saturation, is increased by introducing the SFM "SP-OEP" structural additive. This increases the adhesion and cohesiveness of bitumen to mineral materials, thereby increasing the water resistance of asphalt concrete.

Materials and Methods

Since the service life of asphalt concrete pavements is a violation of the permissible level of traffic and operational condition of the road, the calculation of road surfaces should be carried out not only by the criterion of road safety. The strength of the road surface in the elastic stage is also related to the criteria for preventing the loss of stability of the surface due to the formation of irreversible deformations that violate the evenness of the surface and, accordingly, reduce the speed of vehicles [3,4].

A significant increase in heat resistance and water and frost resistance of asphalt concrete requires the use of high-quality modified bitumen. Therefore, thorough

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research on increasing the heat, water and frost resistance of asphalt concrete using Kraton D1186 polymers and the addition of SFM SP-OEP surface-forming additives is of great interest.

Analysis of Results

Figure 1 shows the dependence of the water resistance of asphalt concrete based on Kraton D1186 polymers on the amount of SFM SP-OEP admixture during long-term water saturation. As can be seen from the figure, with the combined use of polymers and structural additives, water resistance increased from 10 to 18%, and with long-term water saturation from 15 to 23%, as well as a significant improvement when using Kraton D1186 polymers.

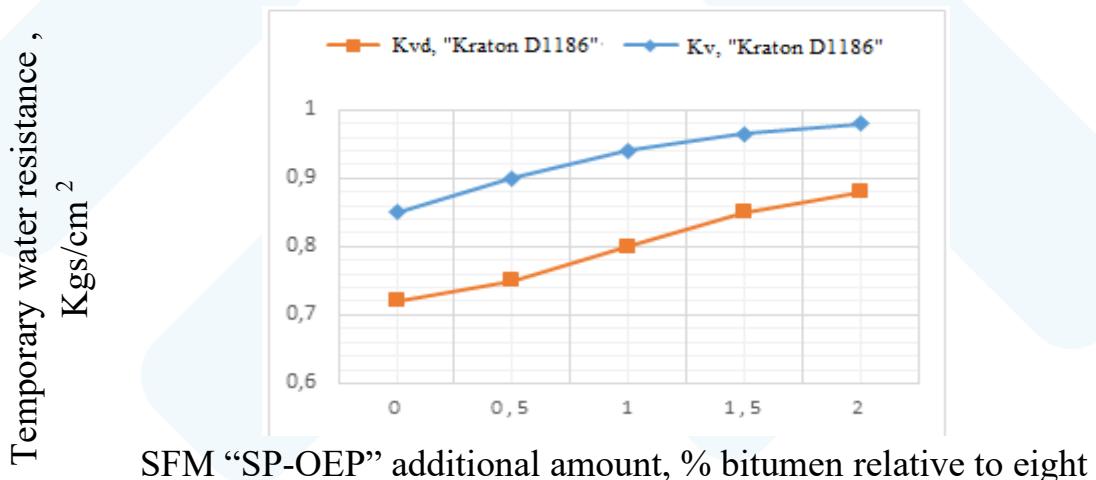


Figure 1. Dependence of water resistance (Kv) of modified asphalt concrete on the long-term water saturation (Kvd) and the amount of the "SP-OEP" SFMs additive.

The study of the effect of the recommended additives of polymers and SFMs on the water resistance of asphalt concrete during prolonged water saturation showed that the results, first of all, contribute to increasing its effect on the properties of bitumen, improving its adhesion to basic and acidic rocks, increasing its cohesion



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and flexibility, reducing its temperature, increasing frost resistance, corrosion resistance and cracking resistance of asphalt concrete pavements.

The ability of asphalt concrete to resist cracking under the influence of climatic factors and transport loads is one of the important indicators. The preparation and testing of sample asphalt concrete was carried out in accordance with GOST 12801. The cracking resistance of asphalt concrete using polymers and their effectiveness have been proven in the research of many scientists [5.6].

Research on increasing the crack resistance of asphalt concrete with the addition of "Kraton D1186" and the structure-forming additive SFM "SP-OEP" is of great interest.

The results of the study of the effect of the recommended polymer additives on the cracking resistance of asphalt concrete when testing samples depending on the amount of SFM "SP-OEP" showed, mainly, the effect of polymers on the properties of bitumen, improving its adhesion to mineral substances. The increase in viscosity and, accordingly, the decrease in the strength of the bond, the decrease in the fracture temperature of bitumen are associated with the effect of the recommended SFM additives.

The cracking resistance of asphalt concrete based on Kraton D1186 polymers depends on the amount of added SP-OEP SFMs. The addition of SP-OEP SFMs to the polymers together with the addition of polymers also helps to increase the cracking resistance by 20 to 25%. This means that the plastic properties of bitumen are preserved and its brittleness is reduced. A small change in the softening temperature during thermostating of bitumen modified with structural additives is explained by the significant preservation of the fatty fraction, which was shown in the group chemical analysis of the compositions [7,8].

The fact that asphalt concrete roadbeds used in road construction do not comply with the basic GOST requirements, and in turn, the service life of asphalt concrete roadbeds does not meet economically justified indicators, is one of the important reasons. As a result, instead of sharply developing the demand for the road



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network in our country, a significant part of the efforts and funds allocated for the needs of the road sector are spent on repeatedly repairing the transport and operational condition of the road network in order to maintain it at a satisfactory level .

The indicated shortcomings of GOST 9128-97 do not allow, when designing asphalt concrete mixtures, to determine compositions that fully correspond to the design solution adopted in the project and the climatic conditions of the road location area. This is one of the reasons for the rapid development of damage to road surfaces during subsequent operation.

Requirements for bituminous binders used in road pavements:

- 1) the strength of bituminous binders meets the requirements of the climatic and operational conditions of use in the place of use
- 2) uniformity of properties
- 3) heat resistance
- 4) resistance to service life
- 5) adhesion to materials consisting of mineral substances.

To ensure the durability of asphalt concrete road pavements, it is necessary to control the bituminous binder parameters present in the pavement after the influence of technological and operational factors [9,10].

The ability of asphalt concrete to resist cracking under the influence of climatic factors and transport loads is also an important indicator. Tests were carried out to prepare and test sample asphalt concrete using GOST 12801. As a result of scientific research, the cracking resistance of asphalt concrete using polymers and their effectiveness have been proven[11-30] .

The study of the effect of the recommended additives of polymers and SFMs on the water resistance of asphalt concrete during prolonged water saturation showed that the results, first of all, contribute to increasing its effect on the properties of bitumen, improving its adhesion to basic and acidic rocks, increasing its cohesion



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and flexibility, reducing its temperature, increasing frost resistance, corrosion resistance and cracking resistance of asphalt concrete pavements.

Conclusion

In the research work, testing asphalt concrete samples with “SP-OEP” SFMs resulted in an increase in their shear stability at high temperatures. It was found that residual deformations in plastic flows much smaller than critical forces using “SP-OEP” SFMs were several times lower in asphalt concrete. The increase in shear resistance of asphalt concrete using “SP-OEP” SFMs is mainly due to an increase in the viscosity and heat resistance of bitumen. “Kraton D1186” helps to save bitumen and polymer.

The above studies show that the addition of SP-OEP SFM to the bitumen composition from the Kraton D1186 polymer leads to the addition of individual effects from each additive, which is consistent with our theoretical understanding. We can see that the structure and properties of the modified bitumen are correlated with the performance of asphalt concrete pavements at high positive temperatures, providing resistance to cracking at low temperatures and resistance to corrosion and water.

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