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IMPROVING ROAD MATERIAL QUALITY TO TRAFFIC LOADS

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Annotation: *This article analyzed the various loads on highways. Technologies for developing road construction materials resistant to these loads were also studied. Additives used to increase the strength of asphalt concrete through the rheological properties of bitumen or asphalt concrete mixture, surfactants and polymers, were carried out in laboratory conditions and the results of the research are presented.*

Key words: *Pavement properties, climatic conditions, features of road operation, resistance of asphalt concrete, road surface*.

INTRODUCTION

Rapid pavement of coatings is a big problem in an ever-increasing load on the roads. Thanks to them, the following methods were developed to increase the wear resistance of asphalt: Increase in crushed stone content. As we have already noted, crushed stone is more firmly held by bitumen in the road surface. Therefore, multi-crushed stone mixtures demonstrate higher wear resistance [1]. Use of high-quality crushed stone: Crushed stone with the highest abrasion grade can significantly extend the life of asphalt concrete. True, this solution is not equally available everywhere. If a region does not have its own hard rock deposits, then local road builders have to work with what they have. Coarse Grain Design: Asphalt with grain sizes up to 40 mm (or even larger) shows excellent wear resistance. But this material also has a downside. It is difficult to lay and compact it, and voids form between its large particles [2-3]. Application of adhesive additives: Surfactants are added to bitumen or mineral filler and increase the adhesion of the mixture. Thanks to them, the binder better envelops

the grains of crushed stone and sand, improves wear , water, frost and chemical resistance of asphalt.

Figure 1. Condition of the road under the influence of the temperature.

Modification of bitumen: Polymeric and fibrous additives in the composition of the binder improve its properties and give it elasticity in a wide range of temperatures. Their impact on wear resistance is not so great, because there is little bitumen in the asphalt mix. But they have a positive effect on the physical and mechanical properties of the material: strength, shear resistance , water resistance, and others [4]. Coating treatment with protective compositions: To protect asphalt concrete from climatic factors, special phenolic and epoxy varnishes, as well as emulsion-mineral mixtures, are used. They form a thin protective layer on the pavement, which prevents water and chemicals from getting inside the asphalt and destroying it [5-6]. To summarize: The wear of an asphalt pavement depends on a number of factors: the properties of the material itself, weather conditions and the characteristics of the operation of the road.

METHOD

The wear resistance index of asphalt concrete makes it possible to approximately estimate its durability. It is determined during the Prall test . New GOSTs establish the classification of asphalt concrete by abrasion :

- Class 1 - wear up to 25 cm3 according to the Prall test
- Class 2 - wear from 26 to 35 cm3 according to the Prall test
- Class 3 - wear from 36 to 45 cm3 according to the Prall test

At the same time, in severe operating conditions, it is recommended to use material of the first class, and in normal - the second and third. For roads with low load, this indicator is not standardized. Wear resistance can be improved by increasing the proportion of crushed stone and its size, using surfactants and modified bitumen, as well as coating asphalt with protective compounds based on phenolic, epoxy and bitumen emulsions. Additionally, one of the most common and promising projects in world practice is the enrichment of bitumen composition with thermoplastics, which combine the properties of thermoplastics and elastomers. By using these thermoplastics, it is possible to improve the quality of bitumen. In order to increase the quality of bitumen, it is advisable to add polymer in the proportion of 2.5-6% of the total mass of bitumen**.**

RESULT AND DISCUSSION

One of the important indicators of road bitumen is its adhesion to mineral materials. Weak adhesive properties appear due to the effect of moisture on the road surface. This directly depends on the nature of the bitumen and mineral material. In this regard, there is a need to increase the adhesion of the binder and prevent the penetration of water between the bitumen film and the surface of the stone material. To increase the adhesion force, modifying adhesive additives (surfactants) for bitumen are used. It is known that the brittleness temperature characterizes the behavior of bitumen in road surfaces. The lower it is, the higher the quality of asphalt concrete. Due to the structured nature of bitumen with additives SD-1, SD-2, SD-3 and SD-4, it is not possible to conduct a fragility analysis. Therefore, to study the effect of the surfactant, which is part of the additives SD-3 and SD-4 on the binder, the calculated amount of surfactants was introduced directly into the bitumen separately (from 0.5 to 1%). The analysis results showed a decrease in the brittleness temperature compared to the original bitumen from -16°C to -26°C, which improves the viscoelastic

properties while maintaining the high elasticity of bitumen at low temperatures (figure 2).

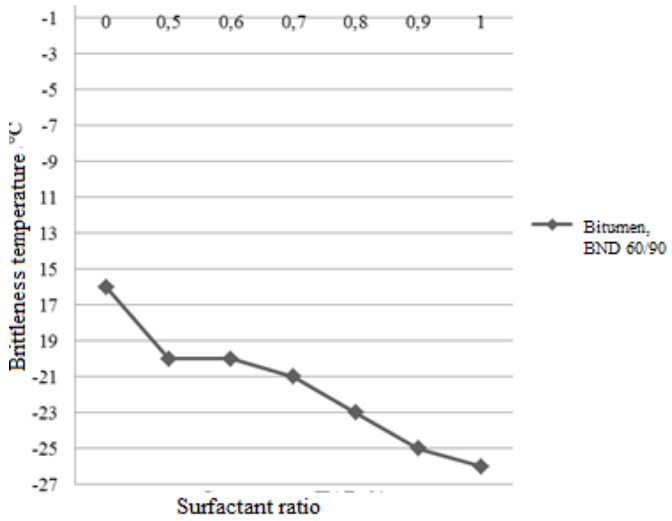

Figure 2. Addition of surfactant changes the brittleness temperature of bitumen

This effect of additives SD-3 and SD-4 on the technical properties of bitumen binders is most likely due to the structuring effect of salts of fatty carboxylic acids included in the additives. Dissolving in the dispersion medium of bitumen, their polar part is adsorbed on the surface of asphalten, and the non-polar hydrocarbon residue is distributed in the dispersion medium, intertwining with the supra-molecular structures of the resins, thereby forming an additional spatial structure. Such structures are thixotropic, they have a plasticizing and structuring effect, and high elastic properties.

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