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METHODS OF INCREASING THE DURABILITY OF ASPHALT-CONCRETE AND ROAD SURFACES

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Abstract. The issues of increasing the durability of asphalt concrete pavements in modern conditions of high-speed movement of vehicles are considered. The operation of asphalt concrete pavements in a wide frequency range is shown. The results of tests for the fatigue life of asphalt concrete at different loading frequencies are presented. Design solutions are proposed to increase the fatigue life of asphalt concrete pavements.
Keywords: asphalt concrete pavements, fatigue life, testing, design solutions.

INTRODUCTION

The continuous increase in traffic intensity on highways, the increase in the load-bearing capacity of vehicles and axles, and the increase in speed limits require a new approach to considering the issues of road surface strength. The main factors determining the strength of asphalt concrete pavements are traffic loads, the design and condition of the road surface, and climatic conditions. The development of effective methods for increasing the strength of asphalt concrete pavements should be based on the study of the properties of asphalt concrete taking into account real loading conditions.

Experimental research

Experimental studies conducted at stationary observation points made it possible to obtain information about the real dynamic stress-strain state of road structures and to conclude that the asphalt-concrete pavement is subject to dynamic effects in a wide frequency range. When the bucket moves from the wheel of the machine, bending deformations do not develop in the asphalt-concrete layer. The components of the asphalt-concrete mixture perform high-frequency vibrations that vary in phase and amplitude, and destruction occurs with the appearance of cracks in the voids formed as a result of the decomposition of the mineral material. In this process, the role of the elastic properties of bitumen decreases, and the role of adhesion between the components of asphalt-concrete increases [1-4].

To establish the effect of polymer and adhesive additives on the fatigue failure mechanism, asphalt concrete samples No. 1 (asphalt concrete mixture of type B without additives), composition No. 2 (asphalt concrete mixture of type B with 0.3% RTEP of polymer additive) and asphalt concrete mixture of type B with surfactant additive of composition No. 3 were tested. The tests were conducted at low (17 Hz) and high (50 Hz) loading frequencies. Comparison of test results at low frequencies shows a significant increase in the failure time by samples with polymer additives (2.6 times). The effect of SAW on fatigue strength, in contrast to low frequencies, was more pronounced when tested at high frequencies.

In order to objectively assess the durability of asphalt-concrete pavements in modern conditions of intensive high-speed traffic, it is necessary to switch to new methods of testing asphalt-concrete, corresponding to the repeated impact of vehicles on loading conditions. and the selection of asphalt-concrete composition taking into account the estimated number of applications of the calculated load over the entire service life.

To increase the fatigue life of asphalt-concrete pavements on roads with high traffic intensity, new design solutions are required: the use of asphalt-concrete mixtures with polymer-bitumen binders in the lower layers of the pavements; the use of an organic binder with high adhesive properties in the upper (closed) layers of the pavement (if they are absent, the introduction of

surfactant additives into the bitumen is mandatory); the use of dense mixtures with a high bitumen content in the composition at the highest tensile stresses (the lower layer of the asphalt-concrete layer "package"), as well as reinforcing layers [5-7].

The use of modified bitumen - bitumen reinforced with polymers or rubber increases the elasticity and resistance to cracking of asphalt.

Additional fillers - adding mineral powder, fibers or other reinforcing materials - increase the wear and deformation resistance of asphalt.

Improving the production and laying process

Laying at optimal temperature - the quality of asphalt concrete depends on temperature, and improper laying in extremely cold or hot conditions leads to rapid deterioration of the coating.

High-quality mixing - asphalt and filler materials must be evenly distributed.

Compaction by pressure - compaction of the asphalt coating using special roller and vibratory equipment, making it strong and durable.

Reinforcement of the main layer

Preparing a solid and dense base - the gravel, sand and geogrid layers under the asphalt concrete layer must be of high quality.

Improving the drainage system - the accumulation of water can corrode the asphalt, causing cracking and deformation. Therefore, the water drainage system must be well planned.

Maintenance and prevention

Regular maintenance - if small cracks and potholes are closed in a timely manner, they will not be allowed to grow larger.

Protective coatings - special protective coatings can be applied to the asphalt to protect it from water, UV light and chemical effects.

Preventing scratches and cracks - durability is increased by controlling the weight of vehicles and using protective layers on the asphalt surface.

CONCLUSION

In order to objectively assess the durability of asphalt-concrete pavements in modern conditions of intensive high-speed traffic, it is necessary to switch to new methods of testing asphalt-concrete, corresponding to the repeated impact of vehicles on loading conditions. and the selection of asphalt-concrete composition taking into account the estimated number of applications of the calculated load over the entire service life.

To increase the fatigue life of asphalt-concrete pavements on roads with high traffic intensity, new design solutions are required: the use of asphalt-concrete mixtures with polymer-bitumen binders in the lower layers of the pavements; the use of an organic binder with high adhesive properties in the upper (closed) layers of the pavement (if they are absent, the introduction of surface-active additives into the bitumen is mandatory); the use of dense mixtures with a high bitumen content in the composition at the highest tensile stresses (the lower layer of the asphalt-concrete layer is the "package"), as well as reinforcing layers.

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