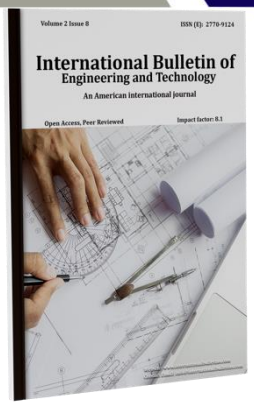

CONSTRUCTION OF WEAR LAYERS USING THE METHOD OF SURFACE TREATMENT OF BITUMEN EMULSIONS.

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https://doi.org/10.5281/zenodo.12624728

Summary: The article presents. Device for treating road surfaces, using thin-layer coatings, preparing stable bitumen emulsions. Based on the results of the analysis, the effects of lime-containing mineral powders in bitumen emulsions for road surfaces were studied.

Key words: protective road coverings, bitumen emulsions containing Ca O in mineral lime powder.

Introduction: The functionality of highways largely depends on the quality of their maintenance. During the operation of highways, first of all, the top layer of the road surface wears out and collapses with the formation of cracks and potholes, making it difficult for the traffic flow to move at the designed speed and causing an emergency situation. When repairing the top layer of the road surface and carrying out patching repairs, problems arise in ensuring the integrity and solidity of road pavements while maintaining their basic performance indicators. The top asphalt concrete layer is subject to the greatest loads in road pavement. We are talking not only about the pressure from moving vehicles, but also about climatic factors. Exposure to water and ice, temperature changes, solar radiation - all these are natural “enemies” of road surfaces.

Repair of automobile pavement can be done by strengthening the pavement structure by gradually increasing layers of asphalt concrete, by installing a top base layer and covering the surface of the existing road, or by installing a surface layer. The most common repair method is surface treatment of road surfaces.

Which does not require large expenses and a huge amount of road inert materials. Bitumen in an emulsified state has found widespread use for repairing the top layers of road surfaces. Application of bitumen emulsions for surface treatment. This radically changes construction work.

-Fine distribution of bitumen for the top layer of the road surface.

-Good rollability of bitumen with mineral material.

Simplicity of technology for using the material in a cold state.

-Saving binder material

-Savings in transportation.

Surface finishing is a method of creating a rough pavement surface and installing wear layers and protective layers by pouring a thin layer of organic binder onto the substrate, spreading high-grade crushed stone and compacting it. The main work includes the spilling of bitumen, distribution and compaction of crushed stone. The process of final formation of surface treatment continues for about 10 days.

Main part:

An important task is the development of resource-saving, environmentally friendly technologies for the operation and maintenance of highways, ensuring stable roughness and a

protective layer of coatings. Bitumen emulsions are liquid bitumen dispersed (crushed) in water with the addition of an emulsifier in the form of surfactants. The main parameters are the work ability of substances. The main parameters of the work-ability of wear layers are the stability of the structure, due to the adhesion of bitumen to the mineral filler, bending strength, resistance of the structure to changes in moisture and temperature (periodic freezing and thawing) conditions, fatigue failure, and others. It is known that the destruction of road pavements when water penetrates into the structure of the material occurs due to a change in the pore space, that is, its increase, resulting in a breakdown of the bonds between binders (bitumen) and mineral materials due to the stresses that arise when water penetrates the pores. Water under the influence of pore pressure has an explosive effect on the pores, destroying the material. The use of bitumen emulsion wearing layers should reduce the penetration of moisture into pavements.

The solution to the issue of regulating the structural and mechanical properties of bitumen emulsions depends on the bitumen and mineral material. An important role in the processes of structure formation of bitumen emulsions belongs to the mineral powder included in the composition of the composite [4,21,37,38] Page. 16 11.2GL.

Combining with “bitumen, mineral powder” it is noted [36-37,57-58] that at a certain ratio of bitumen-mineral powder, the highest strength of the structured disperse system is achieved, forming with these materials. As a result, the resistance of bitumen to impact loads increases, the density of the resulting mass increases, and the strength under shear and compression stresses increases, and fragility decreases. Mineral powders make it possible to regulate deformation and reduce subsidence of road surfaces. When filling bitumen with mineral powder, the viscosity of the mixture increases and heat resistance increases. A traditional powder with a large number of positive adsorption centers and high structuring ability is limestone mineral powder [4]. Research work has found that the best are mineral powders obtained by fine grinding of limestone and dolomite. Almost everyone comes to this conclusion. Researchers working in this area [17,49-50,68]. To find the possibility of using such bitumen powders-mineral mixtures without deteriorating their properties, it is necessary to understand the mechanism of interaction between the mineral powder and the organic binder (bitumen).

An analysis of literary sources on the use of lime in heavy construction for the preparation of bitumen emulsions made it possible to establish that lime (fluff, boiling powder) and cement are considered effective and affordable mineral powders [30,85]. According to data [4,30], when the fluff lime activator is introduced into bitumen, not only better wetting and adhesion of the bitumen is achieved, but also its faster mixing with wet mineral material.

In the process of research, the authors of [142] proved that by adding slaked lime to bitumen, the adhesion of the mineral powder to the binder can be improved. Also, the addition of a water molecule to lime molecules can form a crystallization structure. Based on this, it can be assumed that when asphalt concrete pavements containing lime in the composition of mineral powder are saturated with water, physical and chemical processes will occur in the body of the composite.

Associated with the hydration of lime, leading to the formation of a stable structure. And further, it will entail an improvement in the quality, durability and performance properties of asphalt concrete in road pavement. These assumptions were the scientific hypothesis of the study.

Results and discussions:

The formation of the structure of a bitumen emulsion occurs through the adhesion of fine and coarse mineral powder to bitumen. With good adhesion, there is no possibility of tearing the bitumen from the mineral powder using mechanical force. Separation will be observed in the bitumen layer since the adhesion in bitumen is not strong enough compared to the strength of contact with the mineral. To improve the adhesion of bitumen, it is necessary to minimize the amount of free binder located in the emulsion through the use of mineral material together with bitumen.

The difference in the properties of mineral powders definitely affects the structure of the adhesion processes that act on each other with bitumen. Choosing a mineral powder with good adhesive properties is the best option for creating bitumen emulsions of good quality. As expected, the indicators of separation (desorption) of the binder remaining on the surface of the mineral powder can decrease with an increase in the amount of calcium oxide in it.

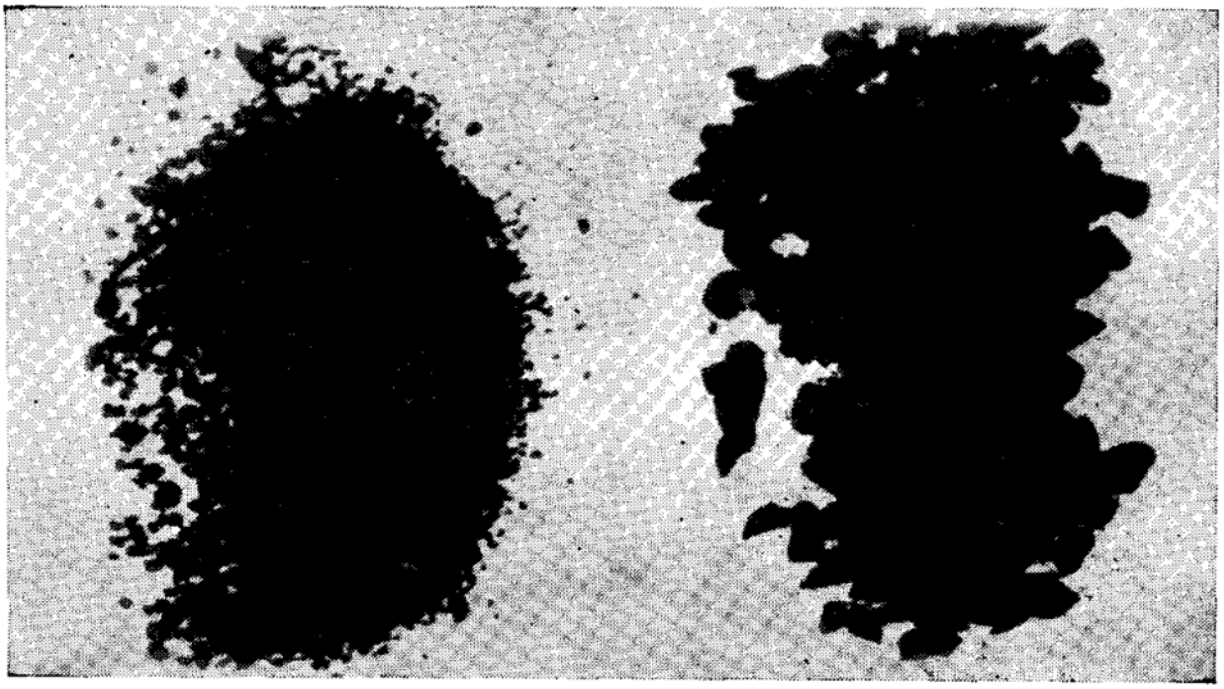
For the study, bitumen BND 60/90 and mineral powders with different compositions of calcium oxide Ca O (10% 20% 30%) and another common limestone material were taken. The experiment made it possible to observe changes in the adhesion (adsorption) properties of the studied mineral powders with different calcium oxide contents and to assess the influence of the amount of lime in the composition of mineral powders on the activity of their interaction with the bitumen emulsion. According to the literature studied, limestone mineral powder has a high adhesion (adsorption) ability to bitumen. Determination of the adhesion of emulsions to the surface of crushed stone was studied in laboratory conditions in accordance with GOST 52128-2003 “Bitumen emulsions”.

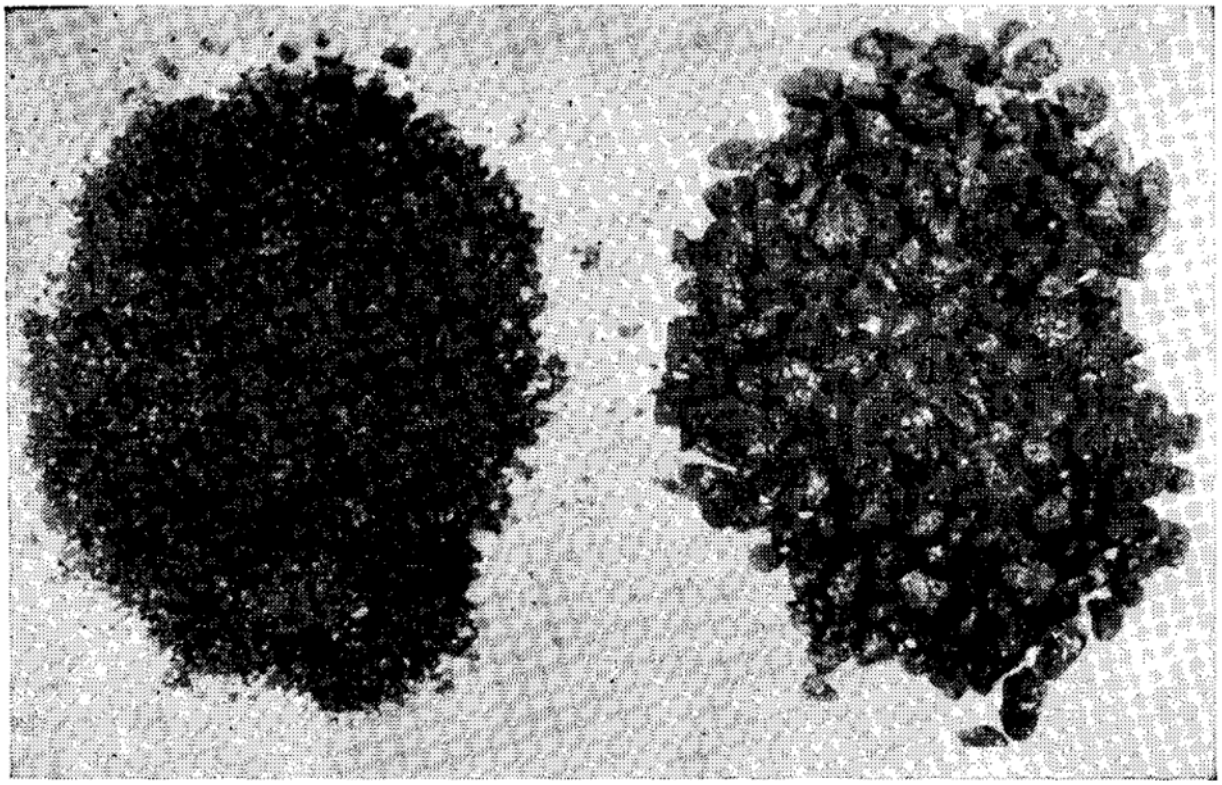
The essence of the method is to assess the degree of preservation of the bitumen emulsion film on crushed stone grains after boiling in distilled water. For the research and preparation of mineral powders, finely ground calcium building lime without additives was used. It is a product of firing marble. It should be noted that for the research, 2nd grade lime was used with an average slaking time of 20 minutes.

The nature of the interaction (adhesion) of the studied mineral materials with the bitumen emulsion, according to GOST, is assessed visually by the degree of preservation of the bitumen emulsion film on the crushed stone grains after boiling it in distilled water. For comparison, a control limestone mineral powder and lime Ca O were used in percentages of 0% 10% 20% 30%.

We immerse preheated crushed stone in a bitumen emulsion with different amounts of 0% 10% 20% 30% lime containing samples. We immerse different samples of crushed stone, treated with the bitumen emulsion under study, into boiling water for 30 minutes.

The remaining bitumen films on the crushed stone surface are taken as the test results.





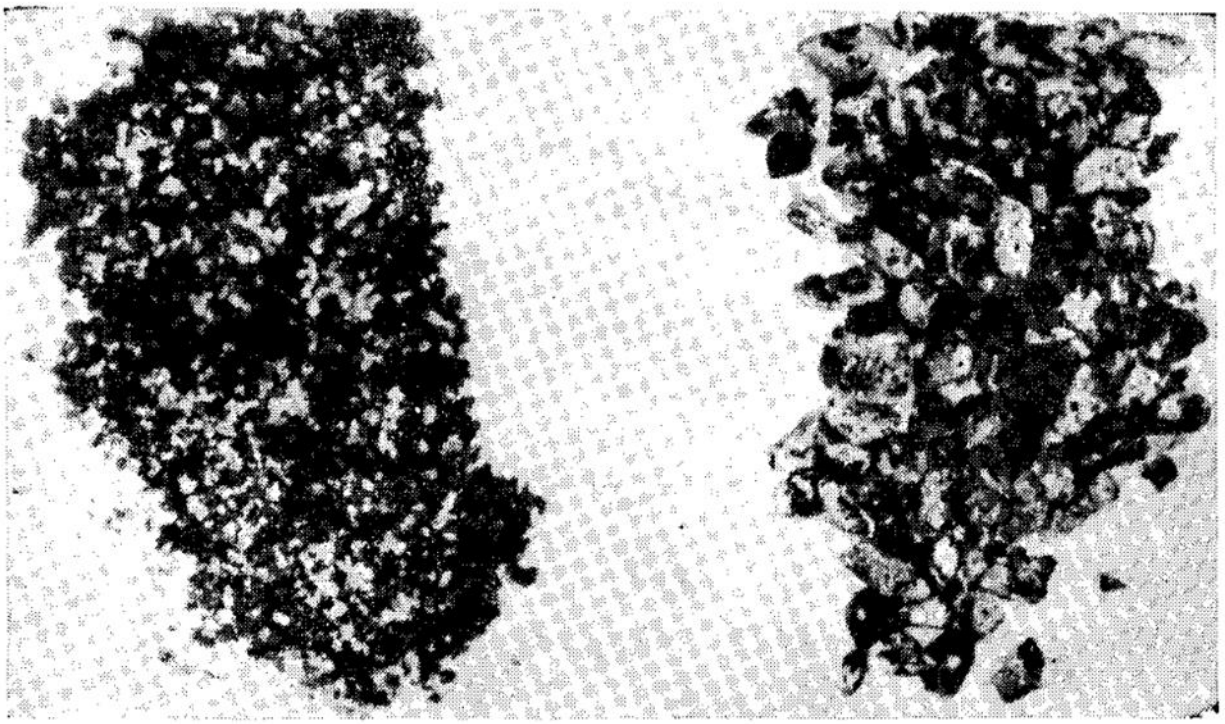


Table.

Characteristics of binder film	Ca O content in bitumen emulsion	Points
The binder film is completely preserved on the surface of the grains.	30%	5
The binder film has partially separated from the sharp corners and edges of the grains	20%	4
A binder film of more than 50% is retained on the surface of the grains.	10%	3
A binder film of less than 50% is retained on the surface of the grains.	0%	2

However, the results obtained indicate that the content of calcium oxide in mineral powder significantly improves their adsorption capacity. This indicates that during the interaction of Ca O bitumen emulsion, chemical processes occur, as a result of which strong water-insoluble bonds are formed between the "bitumen and mineral powder", preventing the separation of the emulsion from the surface of the mineral powder. This proves that when calcium oxide (Ca O) interacts with the components of the binder, chemical adsorption processes occur, and in the end, strong water-impenetrable layers are formed in the layers of bitumen emulsion, preventing the separation of bitumen from the surface of the mineral powder.

Conclusion:

Analyzing the data obtained, we can conclude that mineral powders for bitumen emulsions containing Ca O have high energy potential, which, due to external influences (water, heat), is

capable of changing the characteristics and qualitative state of the binder in a given direction. Unlike traditional limestone powders, lime containing powders have chemical and hydraulic activity, depending on the Ca O content in their composition, capable of active interaction with both bitumen and water. Based on this, the formation of the structure of bitumen emulsions on lime-containing powders will differ from traditional mineral powders.

Analysis of the data obtained allows us to conclude that a feature of mineral powders containing lime, in contrast to conventional fillers from carbonate rocks, is the formation of the structure of bitumen emulsions over time when interacting with water. As a result of such contact, the lime contained in the powder becomes tarred, which leads to the appearance of new formations in the composer's body. In addition, the formation of chemosorption bonds is possible, presumably due to the adsorption on the surface of the powders and other organic compounds of bitumen on the surface.

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