Western European Journal of Modern Experiments and Scientific Methods
Volume 3, Issue 12, December 2025
https://westerneuropeanstudies.com/index.php/1
ISSN (E): 2942-1896 Open Access| Peer Reviewed

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

Akhmedov Akhadjian Urmonjonovich ,
PhD, Fergana State Technique University, Fergana
(ORCID: 0000-0002-0886-1337)
axadjon03ahmedov03@gmail.com

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.
Key words: " 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 поверхностообразующих 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.

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

Western European Journal of Modern Experiments and Scientific Methods
Volume 3, Issue 12, December 2025
https://westerneuropeanstudies.com/index.php/1
ISSN (E): 2942-1896 Open Access| Peer Reviewed

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 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.

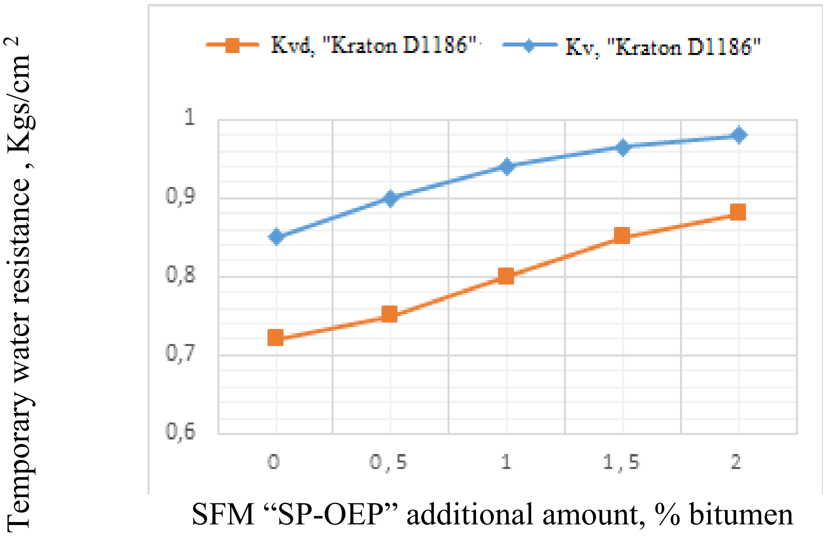

Figure 1. Dependence of water resistance (Kv) of modified asphalt concrete on the long-term water saturation (Kvd) and the amount of the "SP-OEP" SFMsi additive.

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 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].

Western European Journal of Modern Experiments and Scientific Methods
Volume 3, Issue 12, December 2025
https://westerneuropeanstudies.com/index.php/1
ISSN (E): 2942-1896 Open Access| Peer Reviewed

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 SFMsi. The addition of SP-OEP SFMsi 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 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 and flexibility, reducing its

Western European Journal of Modern Experiments and Scientific Methods
Volume 3, Issue 12, December 2025
https://westerneuropeanstudies.com/index.php/1
ISSN (E): 2942-1896 Open Access| Peer Reviewed

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.

References

[1]. Irkinivich, K. I., Umaraliyevich, K. I., & Urmonjonovich, A. A. (2019). Improvement of asphalt concrete shear resistance with the use of a structure-forming additive and polymer. International Journal of Scientific and Technology Research, 8(11), 1361-1363.

[2]. Kasimov I. I. Influence of structure-forming additive and polymer on the aging of road and roofing bitumen // International journal for innovative research in a multidisciplinary field. ISSN: 2455-0620; Scientific Journal Impact Factor (No. 23), Impact Factor: 6.497, SJIF - 2018, Issue - 1, Jan – 2019, Vol. 5. - PP. 183-186.

[3]. Irkinivich, K. I., Umaraliyevich, K. I., & Urmonjonovich, A. A. (2019). Improvement of asphalt concrete shear resistance with the use of a structure-forming additive and polymer. International Journal of Scientific and Technology Research, 8(11), 1361-1363.

[4]. Kasimov, I. I., & Akhmedov, A. U. (2021). Increasing the Shipping Strength of Deformation-Resistant Modified Asphalt Concrete Pavels. International Journal Of Advanced Research In Science, Engineering And Technology, 18076-18080.

[5]. Baxromov, M., Dusmatov, A., Akhmedov, A., & Axmedov, T. (2023). Study of negative friction forces in laboratory conditions. In E3S Web of Conferences (Vol. 452, p. 06019). EDP Sciences.

[6]. Kasimov, I. I., Dusmatov, A. D., Akhmedov, A. U., & Abdullaev, Z. J. (2019). The research of two-layers axially symmetrical cylindrical clad layers on their physic mechanical properties. Журнал Технических исследований, (2).

[7]. Касимов, И. И., Дусматов, А. Д., Ахмедов, А. У., & Абдуллаев, З. Д. (2020). Расчет асфальтобетонных дорожных покрытий. Журнал Технических исследований, 3(1).

[8]. Дусматов, А. Д., Ахмедов, А. Ў., Гаппаров, Қ. Ғ & Абдуллаев, З. Ж. (2021). Влияния на физико-механические свойство двухслойных цилиндрических оболочек в напряженно-деформированном состоянии. Scientific progress, 2(8), 528-533.

[9]. Дусматов, А. Д., Маткаримов, Ш. А, Ахмедов, А. У & Мамажонов, Б. А. У. (2022). Междуслоевые сдвиги двухслойных комбинированных бетоностеклопластиковых плит. Universum: технические науки, (1-1 (94)), 78-82.

[10]. Хамзаев, И. Х., Касимов, Э. У., Умаров, Э. С., & Ахмедов, А. У. (2019). Расчет многослойной плиты на упругом основании-Фер ПИ. I Международной научно-практической кон-и, 24-25.
[11]. A. U. Akhmedov (2024). Increasing the Strength of Asphalt Concrete Road Surfaces under the Influence of Modifiers. Miasto Przyszłości, 49, 933–937. Retrieved from http://miastoprzyszlosci.com.pl/index.php/mp/article/view/4026
[12]. Baxromov, M., Akhmedov, A., Dusmatov, A., & Axmedov, T. (2023). Study of negative friction forces in laboratory conditions. In E3S Web of Conferences (Vol. 452, p. 06019). EDP Sciences.
[13]. Madaliev, M., Yunusaliev, E., Usmanov, A., Usmonova, N., & Muxammadyoqubov, X. (2023). "Numerical Study of Flow Around Flat Plate Using Higher-Order Accuracy Scheme." In E3S Web of Conferences (Vol. 365, p. 01011). EDP Sciences.
[14]. Tojiev, R., Yunusaliev, E., & Abdullaev, I. (2021). "Comparability of Estimates of the Impact of Gunpowder and Gas-Dynamic Explosions on the Stability of Buildings and Structures." In E3S Web of Conferences (Vol. 264, p. 02044). EDP Sciences.
[15]. Madaliev, M., Yunusaliev, E., Abdulkhaev, Z., Otakulov, B., Yusupov, S., Ergashev, I., & Tohirov, I. (2024). Comparison of numerical results of linear and nonlinear turbulence models based on the rans approach. In E3S Web of Conferences (Vol. 587, p. 01003). EDP Sciences.
[16]. Tojiev R.J., Yunusaliyev E.M., Abdullaev I.N. "Gas-Dynamic Method for Monitoring Seismic Stability of Operating Buildings and Structures." Proceedings of the XXVI International Scientific and Technical Conference, YGTU, October 12-14, 2022, Yaroslavl.
[17]. Yunusaliyev E.M., Tojiev R.J., Ibragimov B.T., Abdullaev I.N. "Analysis of Fires, Damages, and Risks Caused by Seismic Effects in Residential Buildings." Uzbek Emergency Situations Ministry, Scientific-Practical Electronic Journal on Fire and Explosion Safety. Tashkent, 2022.
[18]. Irkinivich, K. I., Umaraliyevich, K. I., & Urmonjonovich, A. A. (2019). Improvement of asphalt concrete shear resistance with the use of a structure-forming additive and polymer. International Journal of Scientific and Technology Research, 8(11), 1361-1363.
[19]. Z.A. Abobakirova, S.M. Mirzababayeva, "Seismic safety issues of flexible-layered buildings," Scientific-Technical Journal (STJ FerSTU), 2025/10, Vol. 29, pp. 87–91.
[20]. Sh.A. Umarov, S.M. Mirzababayeva, Z.A. Abobakirova, "Modern methods of reducing seismic risk in buildings," Scientific-Technical Journal (STJ FerSTU), 2025/10, Vol. 29, pp. 91–94.
[21]. S.M. Mirzababayeva, Z.A. Abobakirova, "The role of parametric design elements as an innovative solution in seismic safety concept," Scientific-Technical Journal (STJ FerSTU), 2025/10, Vol. 29, pp. 127–130.
[22]. Z.A. Abobakirova, S.M. Mirzababayeva, "Ways to reduce environmental impact through construction waste recycling," Scientific-Technical Journal (STJ FerPI), 2025, Vol. 29, Special Issue No. 9, pp. 224–229.
[23]. S.M. Mirzababayeva, Z.A. Abobakirova, Sh.A. Umarov, "Active seismic protection devices to enhance the earthquake resistance of buildings and structures," Scientific-Technical Journal (STJ FerSTU), 2025, Vol. 29, No. 9, pp. 131–134.
[24]. Z. Abobakirova, S. Umarov, R. Raximov, "Enclosing structures of a porous structure with polymeric reagents," E3S Web of Conferences, Vol. 452, p. 06027 (2023, September).

Western European Journal of Modern Experiments and Scientific Methods
Volume 3, Issue 12, December 2025
https://westerneuropeanstudies.com/index.php/1
ISSN (E): 2942-1896 Open Access| Peer Reviewed

[25]. S. Umarov, S. Mirzababayeva, Z. Abobakirova, N. Goncharova, S. Davlyatov, "Operation of reinforced concrete beams along an inclined section under one-sided heating," E3S Web of Conferences, 2024, Vol. 508, p. 05001.
[26]. Y. Karimov, I. Musaev, S. Mirzababayeva, Z. Abobakirova, S. Umarov, "Land use and land cover change dynamics of Uzbekistan: a review," E3S Web of Conferences, Vol. 421, p. 03007.
[27]. X. Akramov, S. Davlyatov, S. Umarov, Z. Abobakirova, "Method of experimental research of concrete beams with fiberglass reinforcement for bending," E3S Web of Conferences, Vol. 365, p. 02021 (2023).
[28]. S. Mirzababayeva, Z. Abobakirova, S. Umarov, "Crack resistance of bent concrete structures with fiberglass reinforcement," E3S Web of Conferences, 2023, Vol. 452, p. 06023.
[29]. Z. Abobakirova, S. Umarov, R. Raximov, "Enclosing structures of a porous structure with polymeric reagents," E3S Web of Conferences, 2023, Vol. 452, p. 06027.
[30]. AJD Mirzababyeva, S. Mirzaakbarovna, Z. Abobakirova, "The role of parametric design elements in sustainable architecture and seismic resilience," Architecture. Construction. Design. Architecture and Urban Planning. Design, Vol. 3, No. 3, pp. 972–976.