The American Journal of Engineering and Technology
ISSN 2689-0984 | Open Access

TYPE Original Research
PAGE NO. 247-249
DOI 10.37547/tajet/Volume07Issue08-19

Construction of cement-concrete pavements of highways in dry hot climatic conditions

Professor Khamidov Adkhamjon

Namangan State Technical University, Uzbekistan

OPEN ACCESS

SUBMITTED 21 June 2025
ACCEPTED 17 July 2025
PUBLISHED 19 August 2025
VOLUME Vol.07 Issue08 2025

CITATION

Professor Khamidov Adkhamjon. (2025). Construction of cement-concrete pavements of highways in dry hot climatic conditions. The American Journal of Engineering and Technology, 7(8), 247–249.
https://doi.org/10.37547/tajet/Volume07Issue08-19

Abstract: A dry hot climate negatively affects freshly laid concrete pavements of highways. Under the influence of solar radiation, high temperature combined with low humidity, and the presence of dry winds, intensive evaporation of mixing water occurs, leading to insufficient strength gain of concrete. This article highlights the problems of constructing cement-concrete pavements of highways in dry hot climates and suggests ways to address them.

Keywords: Dry hot climate, road, construction, cement-concrete, pavement, asphalt, quality, experience, conditions, problem.

Introduction: Dry hot climate conditions are characterized by summer air temperatures of 35–40 °C with relative humidity of 10–25%, intense solar radiation, and frequent winds. The combination of these climatic factors leads to rapid dehydration (drying) of concrete, which slows down or even stops the hydration process of cement.

When concrete dries too quickly, its strength is reduced by almost 50% compared to concrete cured under normal temperature and humidity conditions. Intensive early dehydration causes the formation of capillaries directed toward the evaporating surface, which worsens the pore structure of the concrete and, consequently, reduces its durability. Drying also leads to peeling of the outer layers of concrete structures [1].

Therefore, it must be noted that dry hot climate conditions complicate the construction of highway pavements.

In the Decree of the President of the Republic of Uzbekistan "On measures for the deep reform of the road sector of the Republic of Uzbekistan" (December 9, 2019, No. UP-5890), it is stated: "The development of a modern network of highways, taking into account the geographical location of the republic, is a top priority for increasing the competitiveness of the national economy, developing the transport potential of the republic, and expanding export opportunities" [2].

Much attention is being paid to road construction in Uzbekistan. Road construction is one of the most important areas of the transport sector, providing connections between cities and remote settlements of Uzbekistan [3].

Over the years, a number of measures have been implemented to improve the road and transport infrastructure, construct modern highways, and increase comfort and safety of traffic in accordance with international standards.

Growing demands for the reliability, durability, and strength of road pavements are due to the increasing load capacity of vehicles and the intensity of traffic. Over the last decade, the number of vehicles in Uzbekistan has grown several times, and according to road specialists and designers, traffic intensity on some roads exceeds the permissible limits for that road category by 1.5–3 times.

International and domestic experience shows that cement-concrete pavements best meet these growing requirements [4].

Advantages of cement-concrete pavements:

- Durability. Their service life is much longer than that of other pavements (resistance to temperature fluctuations, absence of potholes, rutting, and cracks).

- Cost-effectiveness. Maintenance costs during service life are minimal.

- Environmental impact. Lower carbon emissions, reduced "heat island" effect.

- Safety. High skid resistance and better lighting.

According to data, cement-concrete pavements make up 60% in the USA, 38% in Germany, 46% in Austria, 3% in Russia, while in Uzbekistan the percentage is not very high.

In Uzbekistan, numerous projects are being developed to expand the international and local road network and improve traffic convenience. For example, with the participation of the Asian Development Bank, the project "Construction of local roads with cement-concrete pavement" will be implemented. Within this project, 841 km of roads with cement-concrete pavement will be built in Karakalpakstan and 86 districts of Uzbekistan, covering 272 neighborhoods with a population of over 770,000 people. The ADB will provide $240 million for this project [5].

It is known that the main factor hindering the widespread use of cement-concrete pavements is their relatively high cost. Concrete pavements are 1.5–2 times (about 70–80%) more expensive than asphalt pavements.

However, according to studies by the Moscow Automobile and Road Institute, in the long run, the costs of these pavements are nearly equal. Based on comparative calculations by Doctor of Technical Sciences, Professor V.V.Ushakov, after about five years, the total operational costs of cement-concrete and asphalt-concrete pavements equalize, and later, concrete becomes cheaper [6].

Our observations show that asphalt-concrete pavements require maintenance and repairs 2–3 years after commissioning, including sealing cracks and filling potholes. In contrast, a properly constructed concrete pavement requires virtually no repair in the first 10–12 years of service and may last 50 years or more.

Nevertheless, constructing cement-concrete pavements requires a special approach, advanced technical equipment, high qualification of specialists, and well-organized construction management.

Despite the obvious advantages of cement-concrete pavements, monitoring and observation of their construction by local organizations and foreign companies in Uzbekistan indicate serious problems hindering their widespread application, especially when built domestically.

Problems

The following main problems exist in constructing high-quality concrete pavements in Uzbekistan [7,8]:

- relatively high initial costs;
- lack of modern facilities for producing concrete mixtures, machinery for laying concrete, and high-performance auxiliary equipment for cutting joints;
- shortage of specialists capable of operating concrete roads;
- unacceptably low level of construction organization and starting work without proper technical preparation;
- unjustified rushing of construction deadlines without considering real conditions, such as material supply, seasonal shortages of fuel, severe natural conditions, and economic impracticality of working during the hottest (june–august) and coldest

(november–march) periods;

- lack of qualified engineers and workers with sufficient practical experience in cement-concrete pavement construction;
- insufficient study of local climatic, geological, and engineering conditions;
- low-quality design and insufficient competence of designers;
- inefficient quality control system in construction and operation of pavements; inadequate laboratory testing;
- absence of a proper maintenance and repair system during operation;
- absence of legally approved methodology and regulatory documentation;
- lack of effective methods for curing freshly laid concrete under dry hot climatic conditions.

It becomes clear that these problems cannot be solved without a comprehensive and systematic approach.

SOLUTIONS

The first step for local organizations to widely implement cement-concrete pavement construction should be to thoroughly study the experience of foreign companies working in Uzbekistan. Collecting valuable technical information and experience in building pavements under Uzbekistan's challenging climate is crucial.

To acquire necessary knowledge and skills, as well as to raise qualifications, groups of specialists and workers should be trained. A coordinating body should be formed to manage recruitment, assign tasks, and systematize collected data.

Specialists should be selected for different purposes, for example:

- researchers — to collect information and factual data for developing regulations and recommendations;
- designers — to study the peculiarities of constructing pavements in dry hot climates;
- laboratory specialists — to study quality assurance issues based on foreign experience and testing methods.

In dry hot climates, quality concrete can be obtained by applying technological measures that ensure proper cement hydration. Special attention should be paid to material selection. For concretes placed in hot dry conditions, rapid-hardening but low-shrinkage Portland cements should be used. Ordinary Portland cement may be used with calcium chloride additives. Slag-Portland and pozzolanic cements are not recommended, and clinker-free binders (such as lime-slag or lime-ash cement) are prohibited.

It is also necessary to develop effective methods for curing freshly laid road concrete.

CONCLUSIONS

In the future, it will be possible to establish a specialized research and experimental organization for cement-concrete pavement construction, equipped with advanced technical tools and qualified personnel trained in leading foreign companies.

Designing cement-concrete pavements of highways, taking into account dry hot climate conditions, can pave the way to creating specialized organizations capable of building high-quality concrete roads in Uzbekistan.

REFERENCES

A.Khamidov, M.Mukhitdinov, D.Khamidov. Osobennosti tekhnologii betonnykh rabot v usloviyakh sukhogo i zharkogo klimata pri ispol'zovanii plonkoobrazuyushchikh pokrytiy. Monografiya - Tashkent Izdatel'stvo Lesson press, 2019, - 128 str (in Russian).

Ukaz Prezidenta Respubliki Uzbekistan «O merakh po glubokomu reformirovaniyu sistemy dorozhnogo khozyaystva Respubliki Uzbekistan» ot 9 dekabrya 2019 g., № UP-5890 (in Russian).

R.kh.Sulaymanov, A.Khamidov. Problemy ustroystva tsementobetonnykh pokrytiy avtomobil'nykh dorog. Nauchno-tekhnicheskiy zhurnal Ferganskogo Politekhnicheskogo instituta, 2013 god №1 (in Russian).

A.I.Khamidov, I.G.Akhmedov, R.KH.Sulaymanov, N.E.Sharibayev. Zarubezhnyy opyt tekhnologii i organizatsii stroitel'stva avtomobil'nykh dorog. Monografiya – Tashkent, Izdatel'stvo Lesson press, 2021, - 164 str (in Russian).

Postanovleniye Prezidenta Respubliki Uzbekistan ot 15 aprelya 2024 goda №pp-157 «O proyekte «Stroitel'stvo dorog s tsementobetonnym pokrytiyem» s uchastiyem aziatskogo banka razvitiya» (in Russian).

V.Ushakov. Prezident, Assotsiatsiya betonnykh dorog; prorektor po nauchnoy rabote, Moskovskiy avtomobil'no-dorozhnyy gosudarstvennyy tekhnicheskiy universitet (MADI). Tsementobeton. 13.04.2023 (in Russian).

A.Khamidov, R.KH.Sulaymanov Aktual'nyye voprosy obespecheniya kachestva tsementbetonnykh pokrytiy avtomobil'nykh dorog Monografiya – Toshkent. Lesson press nashriyoti, 2020, -148 str (in Russian).

A.I.Khamidov. Tekhnologiya i organizatsiya stroitel'stva avtomobil'nykh dorog. Monografiya/ A.I.Khamidov. — Moskva: Nash mir, 2023. – 160 s (in Russian).