UDC 625.7/.8

ALTERNATIVE PAVEMENTS FOR ROADS

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Environmental pollution caused by plastic waste is a very serious problem that has significant impacts on our planet and its inhabitants. Plastic waste is a pervasive and persistent form of pollution that can harm wildlife, ecosystems, and human health.

It is estimated that approximately 11,3 million metric tons of plastic waste entered the environment in 2020, according to a study published in the journal Science [1]. This includes plastic waste that entered the oceans, freshwater systems, and terrestrial environments.

Plastic waste can enter the environment through a variety of pathways, including littering, poor waste management practices, and industrial discharges. Once in the environment, plastic waste can persist for hundreds or even thousands of years, slowly breaking down into smaller and smaller pieces that can be ingested by wildlife or enter the food chain.

This can lead to a range of negative impacts, including entanglement and ingestion by marine and terrestrial animals, which can cause injury, suffocation, or death. Plastic pollution can also harm human health by contaminating water sources and food supplies.

To address this problem, it is essential to reduce the production and consumption of single-use plastics, improve waste management practices, and promote more sustainable alternatives.

The use of plastic waste as an alternative material for road pavements is a promising solution that can help address both the issue of plastic waste pollution and the need for sustainable infrastructure.

Plastic waste can be transformed into an asphalt binder additive or as an aggregate replacement material for asphalt pavements. When added to asphalt, plastic waste can improve the pavement's durability and resistance to deformation, as well as reduce the amount of bitumen required in the mix. Using plastic waste in road pavements can also reduce the need for virgin materials, which can lower the environmental impact of road construction.

In addition, using plastic waste in road pavements can also create economic opportunities, particularly in developing countries where there may be limited access to traditional construction materials. Collecting and recycling plastic

waste can create jobs and generate income while also contributing to environmental sustainability.

Overall, the use of plastic waste in road pavements has the potential to be a sustainable and effective solution, but careful consideration and evaluation of the environmental and economic impacts is necessary to ensure its effectiveness and safety.

Many leading universities around the world are conducting research on the use of plastic waste for road construction as a sustainable and cost-effective alternative to traditional construction materials.

For example, the University of California, Berkeley has been conducting research on the use of plastic waste as a partial replacement for aggregate in asphalt pavements, which has shown promising results in terms of improving the durability and longevity of the pavement. Similarly, the University of Technology Sydney in Australia [2] has been exploring the use of recycled plastic as an asphalt binder additive to improve the performance and sustainability of road pavements.

Other universities conducting research on this topic include the University of Bath in the UK, the Indian Institute of Technology Madras in India, and the University of São Paulo in Brazil, among others.

Overall, the use of plastic waste in road construction has the potential to be a sustainable and effective solution to reduce plastic pollution while improving the durability and longevity of road pavements. Ongoing research and development in this area will be critical to ensuring the effectiveness and safety of this approach.

Research to analyze the possibility of using plastic for pavement panels was conducted at the Prydniprovska State Academy of Civil Engineering and Architecture [3]. Research with increased loads is currently underway. Modeling and calculations of panels made of traditional material - reinforced concrete, as well as the most common plastic PET (polyethylene terephthalate) and the most durable plastic PTFE (polytetrafluoroethylene) were performed. The studies were performed with models of the same geometric dimensions. The analysis of the designed models was performed in the Solid Works program. Data on stresses and strains in road panels made of reinforced concrete and polymers were obtained. The physical properties of the modeled panels were compared in terms of mass, density, volume, and surface area. An economic comparison of the studied panels in terms of cost was also performed. Based on the studies, a polyethylene terephthalate (PET) panel is recommended for road pavements as the most optimal in terms of strength and cost. This model can be recommended for use on Ukrainian roads.

References

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