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**NEW CONSTRUCTION SOLUTIONS AND MATERIALS  
FOR PANELS OF ROAD PAVEMENTS**

**Balashova Yuliia**, Dr. Sc. (Tech.), Assoc. Prof.; **Demianenko Viktor**, Dr. Sc. (Tech.),  
Assoc. Prof.; **Sankov Petro**, Dr. Sc. (Tech.), Assoc. Prof.;  
**Lukianenko Vladislav**, Master's degree  
*State Higher Education Institution*  
*"Prydniprovska State Academy of Civil Engineering and Architecture"*

**Problem statement.** Plastic waste and its recycling are a serious threat for the environment leading to the pollution and global warming. The huge amount of waste plastics inevitably enters the environment; each year, more than 8 000 000 tons of plastic fall into the oceans. Scientists around the world are looking for ways to minimize the harmful effect of waste plastics on nature. The use of plastic waste for the construction and repair of roads is innovative and ecological solution to recycle plastic. The alternative use of waste plastics in bitumen mixtures improves their properties as well as increases their strength.

This affordable and patented engineering solution for recycling waste plastics by their reuse for asphalt road paving was developed by Rajagopalan Vasudevan, Professor of Chemistry in Thiagarajar College of Engineering in Madurai [1–4].

The search for optimal solutions to use plastic for road repairs continues. The research to determine the effect of incorporating waste plastic bottles (Polyethylene Terephthalate (PET)) on the engineering properties of stone mastic asphalt (SMA) mixture is highlighted in the paper [5]. Many researchers consider various combinations of plastic in order to improve its properties. The technology of mixing the polymers High density polyethylene (HDPE) and Polypropylene (PP) in Conventional AC-20 graded bitumen, at various plastic compositions has been studied in the paper [6]. The application of various plastic waste mixtures and their use in road construction have been considered in the papers [7; 8]. The use of waste plastic and crumb rubber as binding material in flexible pavement has been considered in the papers [9, 10]. All of the above-listed studies are aimed at using waste plastics in the upper part of the road pavement. The Dutch Company KWS Inrta proposed to use plastic for road panels, by which a complete replacement of the roadway can be performed. The PlasticRoad concept was developed by VolkerWessels, KWS, the largest road-building company in the Netherlands in 2015.

Currently, three industry giants KWS, in collaboration with Wavin and Total, combined their knowledge, experience, and resources to build the first road made from 100 % recycled plastic [11]. Their research has been crowned with success and at present time, the first path entirely made of recycled bottles, cups and packaging opens in Zwolle. The 30-metre path, made of recycled plastic equivalent to more than 218 000 plastic cups, is expected to be three times as durable as an asphalt alternative. The concept of PlasticRoad is completely in sync with environmental initiatives like Cradle to Cradle (C2C) and The Ocean Cleanup. A second path is to be installed in Giethoorn in Overijssel, and Rotterdam is the city most likely to take up the technology [12].

One of the world's largest plastic producers, Dow Chemical, is building roads with recycled plastic as a way to reduce waste. The company isn't the only one piloting the concept. In March, the UK plastic road company MacRebur opened an entire factory dedicated to turning plastic waste into an asphalt mixture for roads, car parks, and driveways [13]. The road pavement in Ukraine is presently in a poor state. The reason for this is, above all, climatic conditions. The frequent and dramatic change in weather conditions (frequent

crossing the zero point, changing periods of over-wetting), as well as low-quality materials lead to the premature destruction of road pavements. Analyzing the international experience in the design and construction of plastic roads, the search for optimal solutions of plastic roads in Ukraine continues [14; 15].

**Purpose of the study:** search for new constructive solutions of plastic polymeric panels, as well as optimal materials for road pavement structures under the conditions of Ukraine.

**Results.** Polytetrafluoroethylene (PTFE) plastic material was chosen for the research. This material was chosen, because Fluor plastics are characterized by the very high chemical, radiation and corrosion resistance, and also have the excellent weathering resistance, heat resistance and frost resistance. The studies [14] proved the possibility of using PTFE as a material for plastic road pavement panels.

As far as is known, the most common plastic in the world is Polyethylene terephthalate (PET). Packages made from this plastic are used for water, soft drinks, salad sauces, jams, peanut butter and in some types of consumer electronics. Therefore, the amount of waste from Polyethylene terephthalate (PET) exceeds many times the amount of waste from other plastics.

Thus, we chose two types of plastic for subsequent studies: Polytetrafluoroethylene (PTFE) and Polyethylene terephthalate (PET).

The designed model of the road polymeric pavement panel was tested for strength in SOLID WORKS software environment.

The model with the above characteristics was created in SOLID WORKS software environment in the form of a solid body. In this program, there is a function of SimulationXpress targeted at simulating the work of the created object under specific conditions. In our case, the road polymeric pavement model was used for studies with the assumption that the load applied to each point of the surface will come into contact with wheels of vehicles. The applied load is equal to 10 tons.

**Conclusion.**

1. In the course of studies performed, the optimal geometrical parameters of prefabricated polymeric panels for road pavements were obtained. The obtained parameters of polymeric panels will allow ensuring the reliable and durable functioning of roads, as well as convenience in their further operation.

2. The designed model has the removable contact layer, which provides comfort when moving, and in case of damage, can be replaced with a new one without time and labor consuming. If necessary, one can replace the whole panel with a new one without stopping the operation of the road. Cavities inside the panel can be used for laying utilities supply lines in the urban area.

3. The application of prefabricated polymeric pavements will be highly efficient and economically sound solution for problems associated with the operation of road pavements in difficult environmental conditions, with the anthropogenic pollution of the environment.

4. It is necessary to perform a large amount of works in improvement of the idea to use the polymeric pavement in order to put it into practice. However, the prospect of building durable roads with a minimum of harm to the environment, using polymeric materials to be recycled, is worth the effort.

5. The analysis of the factors having influence on the level of ecological security of the residential environment, both in the conditions of new construction of roads and in their reconstruction, allows arguing that the solution of the ecological security problem should become an integral part of the integrated system for managing the process of organization and functioning of building structures, including the integrated system for managing the quality of building materials, structures and construction projects as a whole [16].

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