Using plastic waste with reconstructed plastic

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Abstract. After events such as rain and floods, sidewalks are deformed in various ways. Rain and flood waters seep under the paving stones, soften the soil and cause the soil layer to collapse. This situation on the sidewalks hinders people's easy movement. It completely restricts the movement of wheelchairs and strollers. By using the recycling of plastic waste in the production of "Techica", we prevent rain and flood waters from seeping under the paving stones and deforming them, and by organizing the efficient use of plastic waste, we have the opportunity to protect our world from plastic pollution.

1 Introduction

Floods are significant flooding of an area resulting from a rise in the water level in a river, reservoir or lake. The causes of floods are heavy rainfall, intensive snowmelt, breakthrough or destruction of dams and dams. Floods are accompanied by human casualties and significant material damage. In terms of frequency and distribution area, floods rank first among natural disasters, and in terms of the number of human casualties and material damage, floods rank second after earthquakes. Neither in the present, nor in the near future, it is not possible to prevent them entirely. Floods can only be reduced or localized.

When there is a threat of flooding, preventive measures are taken. First of all, this is informing the population about the emergence of a threat of flooding, strengthening monitoring of the water level, alerting the forces and means intended to combat the elements and to evacuate the population. The condition of dams, dams, bridges is checked and the identified shortcomings are eliminated. Additional embankments are being erected, drainage ditches are being dug, and hydraulic structures are being prepared. As can be seen in Figure - 1, this problem caused by water seeping under the paving stones causes various forms of deformations in piled pavements. Sidewalks are where we all usually use to go somewhere. However, this situation on the sidewalks prevents people from moving comfortably. It even completely restricts the movement of wheelchairs and strollers. The reason for this is that the soil used for paving is washed under the pavement by water for various reasons.

About 1000 cases of tsunamis are known, of which more than 100 had catastrophic consequences that caused complete destruction, washing away of structures and soil and

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vegetation cover (for example, in 1933 off the coast of Japan, 1952 in Kamchatka, etc.). 80% of tsunamis occur on the periphery of the Pacific Ocean, including the western slope of the Kuril-Kamchatka Trench. Based on the patterns of occurrence and spread of tsunamis, the zoning of the coast is carried out according to the degree of tsunami threat. Measures for partial protection against tsunamis: creation of artificial coastal structures (breakwaters, breakwaters and embankments), planting forest strips along the ocean coast. IN THE USA. Japan and Russia have created services to warn the population about the approach of a tsunami, based on advanced registration of earthquakes by coastal seismographs.

2 Materials and methods

2.1 Causes of floods, Flood consequences

- Long rains. Occur mainly in summer and autumn, in regions with a humid climate. They lead to flooding of territories caused by the overflow of rivers, mainly. This is due to the fact that rivers collect water over vast areas. Precipitation has a strong influence on the water level in them.
- Melting snow. In the spring, a huge amount of snow accumulates in many regions. Due to warming, it is melting, and streams of water can flood everything around. True, this does not lead to catastrophic consequences.
- Accumulation of precipitation. Due to the accumulation of precipitation in some parts of the rivers, the bottom rises. This causes the water level to rise.
- Tsunami. A tsunami wave brings with it a huge amount of water, which causes flooding on the coasts. True, it has a short duration.
- Destruction of dams. In the event that the dam for some reason is no longer able to contain the pressure of water, it breaks. This causes short-term, but quite severe flooding.
- Natural phenomena. Some natural phenomena can also lead to flooding of territories. For example, earthquakes and landslides can block rivers. And storm surges can sometimes be like tsunamis, only much weaker than them.
- Types of floods
- High water - a gradual, but rather long rise in the water level in the rivers, caused by precipitation or snowmelt. Can lead to catastrophic consequences.
- Flood - a strong, but short-term rise in the water level, also caused by snowmelt or precipitation, but very powerful.
- Congestion - blocking the river channel, leading to flooding of territories.
- Wind surge - short-term, but severe flooding caused by the impact of strong winds on the water surface.
- Other types. Caused by a variety of reasons.

Most of the floods that occur are relatively minor. They cause not very large material damage, depending on the strength of the phenomenon and the characteristics of the terrain. They can also occasionally lead to the evacuation of people, although they usually do not flood houses (unless they are in depressions in the relief). In general, such floods do not pose a particular danger. Sometimes very severe or even catastrophic floods occur. They are capable of flooding entire settlements, causing enormous material damage. In such cases, a mass evacuation of the population is carried out, but people still often die. Fortunately, such dangerous flooding is quite rare (Figure 1).

2.2 Description of the problem

Fig. 1. Deformed pavements.

We have not found a research that measures the state of crisis according to the relationship in the world, but this situation is a problem that our wife has experienced recently. Usually, sidewalks are made during the repair of the driveway. The solution to the problem that has occurred is also usually done as maintenance during the repair of the main road.

Although there are many different models of paving stones globally, we have not found an alternative solution for this problem in pavements. In some countries, plastics are used by turning them into paving stones, but they are no different from standard stones. That is, they just changed the production material, but they could not solve the problem. We have tried to solve this problem with the paving stones we have prepared.

3 Results and Discussion

The paving stones we make allow the water on it to be transported through the pavement like a connected pipeline to the sewers or to the tankers we make on the sides. We can use the water collected in the tankers to water the trees on the roadside.

As we plan to produce “Techica” stones by recycling plastics, we think this is a worthwhile solution both in terms of cost and contribution to the environment.

We can list the solutions we found with the “Techica” stone as follows:

- Prevents the accumulation of water on the pavements.
- By washing the soil, it prevents water from passing to the floor and deformation of the pavement.
- Thanks to the locking mechanism, it prevents the stones from coming out of place.
- It is economical to produce.

To overcome these difficulties, we produced new “Techica” stones with the help of 3D printing technology.

Using recycling of plastic waste in the production of “Techica”, we prevent the deformation of paving stones after leaks, and we get the opportunity to protect our world from plastic pollution by organizing the efficient use of plastic waste [1].

Techica stone V1, which we designed with Fusion 360 software, we used the entire pavement as a pipeline thanks to the perforated surface and the voids inside.

This will send the water on the “Tamet stone” to the sewer line without sending it to the ground [2]. In this way, we will ensure the use of pavements without deformation for many years (Figure 2).

Fig. 2. View of different states of the 3D model.

After several trial prototypes, we arrived at the final version of the model whose dimensions in figure 4 are suitable for testing (Figure 3).

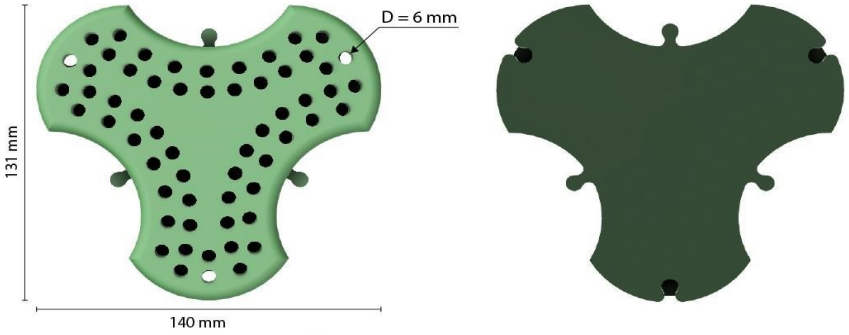

Fig. 3. Dimensions of the model suitable for testing.

Before moving to the production stage, we continued the R&D work of our model with a 3D printer to a certain stage [3]. Then we determined the desired stability, size corrections in the model, resistance to different weather conditions by various testing methods. In Figure 4, you can see our models printed from a 3D printer.

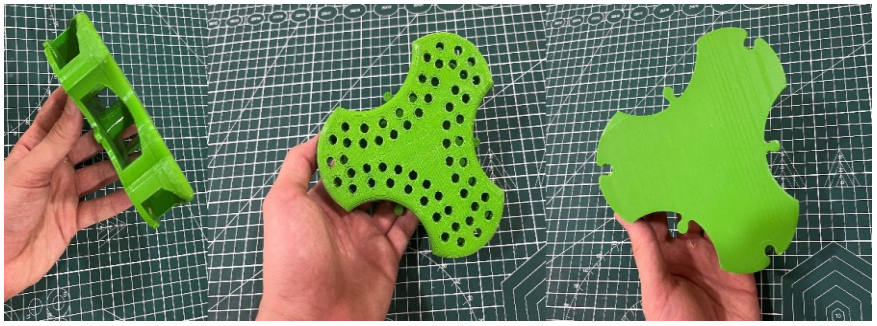

Fig. 4. View of the 3D Printed model in different situations.

The main reason we use PET-G filament in the 3D printing process is that the plastics around us are also polyurethane from PET [4]. PET plastics both decay very slowly under natural conditions and are readily available.

By making the production of our general model versions with 3D printing technology, we get our prototypes both quickly and cost-effectively [5]. So far, we have tested the various hot-cold temperatures, objects falling on it, and resistance to weight. After finishing our test process, we will clean the collected plastics from extra waste and cut them into small parts using a chopper to prepare our raw material stock. After preparing our desktop injection machine and molds, we will produce our small volume samples and start the application on roads. Based on the results obtained from here, we will make adjustments if necessary and proceed to the mass production process.

In our tests so far, we have done a weight test, a drop test, a -20 degree durability test, and a high-heel shoe test. The results of the tests were very successful. So we will be able to guarantee the longevity of paving stones.

Pavement deformation problems are usually repaired when resurfacing the road.Səkinin deformasya olma probleminə çarə tapmaq bir yana ənənəvi metodlarla normal halına gətirmək üçün şikayətlər etməyimiz lazımdır. Apart from finding a solution to the problem of deformation of the pavement, we need to make complaints to make it normal with traditional methods (Figure 5).

Fig. 5. Heel shoe drop test.

Companies that manufacture plastic paving stones usually collect plastics in a mixed manner. Then crush them into sand, glass, etc. they add. They produce a standard stone look from the purchased materials. Some produce colored stones by sorting them according to their colors. Although the raw material changes, the stone they produce does not. As a result, pavements are again deformed for the same reason (Figure 6).

Our Techica stones solve this problem with the following innovations:

- Transportation of water from the sidewalk to sewers or tankers.
- Easy to use design.
- Recycling of plastic waste.
- Colorful design.
- Low financial costs.

Fig. 6. Dropping object test.

4 Conclusion

After events such as rain and floods, sidewalks are deformed in various ways. Rain and flood waters seep under the paving stones, soften the soil and cause the soil layer to collapse. This situation on the sidewalks hinders people's easy movement. It completely restricts the movement of wheelchairs and strollers. By using the recycling of plastic waste in the production of “Techica”, we prevent rain and flood waters from seeping under the paving stones and deforming them, and by organizing the efficient use of plastic waste, we have the opportunity to protect our world from plastic pollution.

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