

TITLE OF THE PROJECT
ROADS WITH PLASTIC

STUDENT LIFE

Abstract

The main perception of this report is to analyse aspects related to plastic roads. Identification of the challenges played an important role in this report and the implication of a technological factor enhanced solutions to manage plastic roads. The report is highlighted the challenges and issues of bituminous and asphalt concrete roads. Moreover, the report has evaluated the challenges that are

leads to take the initiative of Macrebur to make the plastic roads. The report has evaluated the results of the challenges which have influenced the company to make the plastic roads.

Nomenclature: *plastic roads, plastic melting, hot bitumen, regular asphalt concrete*

Introduction

The study emphasises on the sustainable goal of constructing roads using plastic to minimise the waste generation and at the same time reduce the use of asphalt concrete roads. In this context, it can be stated that with the help of plastic in form of bitumen, roads can be constructed with high durability and less pollution. Government with an aim of zero carbon emission to the environment can recycle plastics by using them to construct roadways thereby ensuring effective waste management and less usage of coal and other fuels. The study gives a detailed description of the issues that are taking into account for making roads with plastic a sustainable approach followed by different solutions and emerging technologies to it.

Assess and evaluate the chosen challenge

The hard asphalt concrete road **reduces the long lasting of roads** in different seasons. Asphalt and bituminous decreases the solidarity of roads that leads to collapse [5]. Therefore, it can be said that the involvement of asphalt and bituminous is an essential issue for the construction of roads. In this context, asphalt concrete roads **are able to absorb water** in rainy seasons, which leads to making the

concrete weaker [7]. Accordingly, the water stored in the holes of the pitches leads to collapse during the winter season. On the other hand, the involvement of asphalt and bituminous **makes roads rougher** for which companies and governments need to provide high maintenance every year. Moreover, the use of asphalt in making roads **increases the cost and resources**. In addition, petroleum has been used in asphalt concrete roads, which is healthier for the environment.



Figure 1: Difference between roads made using asphalt and concrete

(Source: [7])

The involvement of asphalt and bituminous roads **increases the emission of carbons** in the nature that creates harmful activities in the environment. Asphalt increases the amount of VOC and CO emissions [4]. In this context, the high emission of CO pollutes the environment severity, which is scary for living things. Accordingly, the use of asphalt concretes is unable to absorb the sounds that create issues for transport on the roads. On the other hand, bituminous and asphalt

decrease durability of roads which leads to accidents in transport [9]. Moreover, the improper weather condition can make the **bituminous roads slick and soft** which requires daily maintenance. It is important to note that daily maintenance of the roads is very expensive and difficult for companies and governments. In addition, the involvement of Bitumen in roads is **unhealthy for living beings, as it causes cancer** on human bodies on this earth.

EMERGENCY OVERVIEW:

A black or dark brown highly viscous liquid. Heated bitumen can cause severe skin burns and eye injury. Eye, skin, gastrointestinal, and respiratory tract irritation can occur. Poisonous hydrogen sulfide gas may accumulate in confined spaces.

ROUTE OF ENTRY: Skin contact, Eye contact, Inhalation, Ingestion

EFFECTS OF ACUTE EXPOSURE:

EYES: Hot bitumen and bitumen fumes may cause severe irritation and burns. Cold bitumen may cause slight irritation. Bitumen dust may cause irritation characterized by burning, redness, swelling and watering.

SKIN: Hot bitumen and bitumen fumes may cause moderate to severe irritation and burns. Cold bitumen may cause moderate irritation. Bitumen dust may cause irritation characterized by redness and occasional drying and peeling.

INGESTION: Irritation of gastrointestinal tract, vomiting and a danger of aspiration. Aspiration can develop into potentially fatal chemical pneumonitis.

INHALATION: Bitumen fumes may cause moderate to severe irritation of the nose, throat and respiratory tract. May cause headache, nausea, sore throat, nasal congestion, dizziness and nervousness. Confined spaces may accumulate hydrogen sulfide gas. Hydrogen sulfide may cause respiratory tract irritation, nausea, headache, dizziness, pulmonary edema, loss of consciousness, brain damage and death.

weak due to the impurities of Bitumen in the roads, which may result in **loss of volatiles**. In this context, the bituminous elements create holes in the concretes that start cracking in the season-changing time. Therefore, it can be said that bituminous is harmful to roads and transport. Accordingly, bituminous and asphalt roads **have less tensile strength** which prevents the roads to be stretched in different seasons [8]. For instance, plastic roads are very efficient in maintaining the roads as they consist of high tensile strength, which the company are using, in their business operations. On the other hand, the bituminous and asphalt mixture roads need to maintain in a daily manner for reducing the accidents of transport [6]. Accordingly, the involvement of bitumen decreases the reliability of pavements in weather-changing situations that create difficulty for drivers to drive on bad-conditioning roads. In addition, the melting point of bituminous is high that leads to damage to the roads consequently. Therefore, it can be said that there is a need to include plastic roads for mitigating the challenges.

Figure 2: Hazards that can be caused due to use of Bitumen in roads

(Source: [9])

The addition, of Bitumen in the roads leads to **polluting the soil** which creates erosion in the soft areas. The soil can be



Figure 3: Use of plastic in road construction

(Source: [11])

Based on the above analysis, it can be stated that Plastic-bitumen mixture roads are much more resistance than the standard asphalt concrete roads. This is because in the season of monsoon, Plastic-bitumen composite roads are less prone to observe water and get loosen resulting to potholes. Standard asphalt roads have more potholes due to their high tendency of absorbing water and getting softened. However, roads that are made of plastic are more flexible and therefore repair and maintenance of such is not a costly affair. Further, issues have arisen where standard asphalt concrete roads are considered to be much more dangerous in comparison to plastic-bitumen composite roads. These roads are considered to be much smoother

and sound absorbent [11]. Issue of global warming, increasing plastic wastage and lack of proper waste management techniques for developing countries have compelled government to come up with such sustainable initiatives that can insure proper recycling and reusing of waste products especially plastic material. However, due to lack of investment in technologies, proper recycling and reusing plastic for manufacturing and constructing roadways have been difficult. This slow process is one of the major issues to the sustainable initiative and therefore needs to be checked. At the same time, improper collection of waste and local areas for dumping plastic waste are less regulated in high populated countries. This is because sustainable initiatives needs to be emphasised on only one other social issues like poverty and unemployment eradicated [10]. This sustainable approaches also needs to be made aware so that people become self-conscious about the importance of plastic recycling.

Identify and propose your solution to this challenge

Discussion on results of own evaluation

MATERIALS USED:-

➤ AGGREGATE:-

- Aggregate of 20mm, 10 mm.
- Stone Dust and Lime as Filler



➤ BITUMEN:-

- 60/70,80/100grade bitumen.



➤ WASTE PLASTIC:-

- Waste plastic in the shredded form.(PVC is not Used)



Figure 3: Materials required in construction of roads using plastic

(Source: [11])

Based on above evaluation of challenges, it can be said that the involvement of bituminous and asphalt is much harmful to the roads and environment positively. In this context, the pitch of bituminous and asphalt decreases the effectively of roads severely that leads to accidents frequently. Therefore, it can be observed that plastic roads will be effective and reliable roads as it has more durability than bitumen roads. In this context, the company can face financial issues for having the bituminous roads as it requires daily maintenance for less durability. On the other hand, plastic roads are more reliable and have an extra tensile strength that

helps roads to be stretched in extreme weather conditions. The plastic roads are able to stick in extreme weather conditions and do not absorb water in the rainy seasons. It is important to note that the unable to absorb the water can make the roads very strong and durable for transport. Hence, it can be observed that the use of plastic roads will be appropriate for the company in terms of making the roads.



Figure 4: Overall process of using Bitumin mix for road construction

(Source: [11])

S.No.	Properties	Plastic Road	Ordinary Road
1.	MARSHALL STABILITY VALUE	MORE	LESS
2.	BINDING PROPERTY	BETTER	GOOD
3.	SOFTENING POINT	LESS	MORE
4.	PENETRATION VALUE	MORE	LESS
5.	TENSILE STRENGTH	HIGH	LESS
6.	RUTTING	LESS	MORE
7.	STRIPPING(POT HOLES)	NO	MORE
8.	SEEPAGE OF WATER	NO	YES
9	DURABILITY OF THE ROADS	BETTER	GOOD

Figure 5: Comparison between Bituminous roads and Plastic

(Source: [7])

Plastic roads have better wear resistance than standard asphalt concrete roads. In this context, bituminous roads are not reliable and create pollution in the environment. On the other hand, the plastic roads do not create much pollution and emit Zero carbon into the environment [7]. Accordingly, the use of plastic roads can make the business of the company more sustainable by recycling plastics. It is important to note that the recycling of plastics can reduce the amount of pollution in the soils and pitches. Moreover, the involvement of waste plastics makes the

roads highly durable and reliable in terms of adjusting to the weather-changing situation. Therefore, it can be said that the company need to make plastic roads rather than bituminous roads. In addition, the involvement of waste plastics can make the roads smoother and wider for the drivers which can lead to fewer accidents. The involvement of waste plastic will be better. In this context, the companies need to include emerging technologies to make the roads appropriate with the waste plastics. For instance, the **Grid Mat technique** is effective for plastic roads as it reduces the melting point of the roads. The technological advantage can be effective for the company to make plastic roads in the road-making project. The company need to make a team with high knowledge of technologies in order to make plastic roads. Plastic has the ability to make roads more reliable and smooth rather than bituminous and asphalt concrete roads. Therefore, it can be said that the company need to utilise emerging technologies effectively in order to include waste plastic in road-making operations. In addition, the company can reduce the number of accidents on the roads by including waste plastics in the road-making process.

Propose a solution for chosen challenge

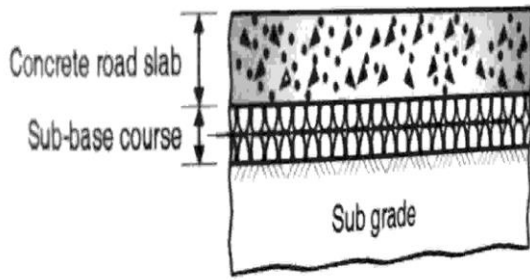


Figure 6: Procedure of road construction using Grid Mats in the sub-base course

(Source: [3])

“The Grid Mats technique” is an effective technology to develop plastic with roads. In order to develop roads with this technology first plastic melting is necessary at around 170°C. Afterwards, the company tends to add hot bitumen to develop a mixture of plastic. The next stage to develop roads with plastic requires a mixture of regular asphalt concrete. Managing efficiency in developing plastic roads can manage this mitigation strategy. Incorporation of this technology will help in *managing long-lasting treatment* for roads. Mixing this with a concrete solution can manage the efficiency of these roads in this case [3]. It will help in reducing the water-absorbing nature of these plastic roads effectively. In addition, it is effective in managing tactics of plastic roads. The company needs to lay a road using this product to mitigate the challenges generated by plastic roads. Usage of

recycled polypropylene might help in managing sustainable plastic roads.

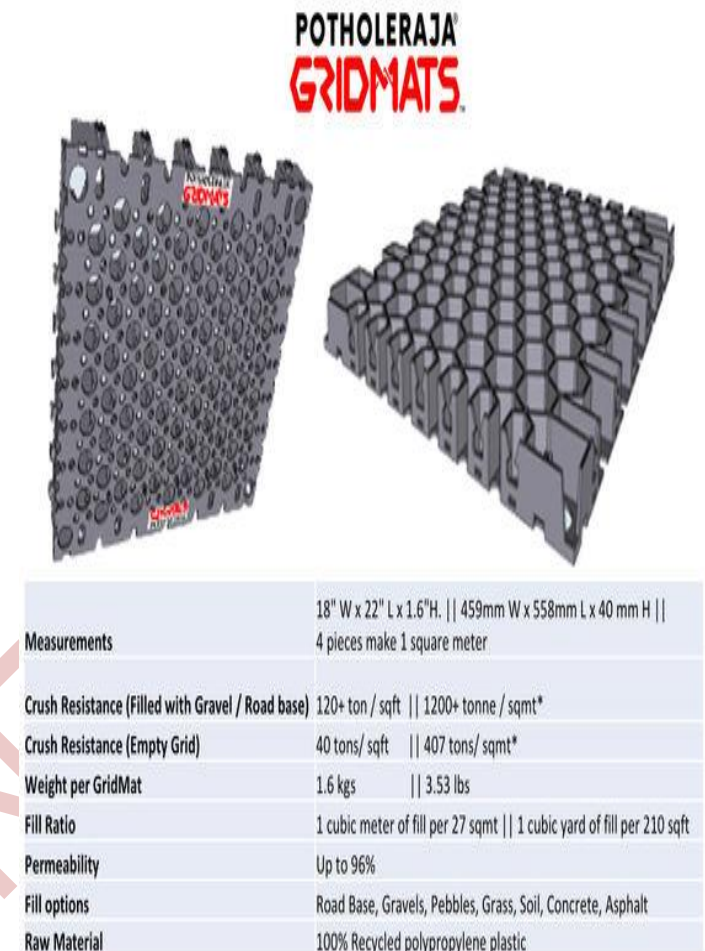


Figure 7: Specifications of GridMats to be used in road construction

(Source: [1])

GridMats might help in managing sustainability of plastic pavements. Macrebur uses this technology due to its ability to manage the usage of steel [1]. It does not require a huge amount of usage of steel to develop plastic roads. It acts as a convenience provided by this technology to plastic roads. Usage of bitumen and concrete can develop roughness in roads, thus usage of this technology might help in managing over roughness of roads. Over

roughness of roads requires a huge amount of money for maintenance purposes. Thus, usage of *“The Grid Mats technique”* can reduce maintenance expenses for plastic roads. **Increased rate of carbon emission** is a major challenge generated by plastic roads; usage of recycled materials might decrease the rate of carbon emissions. Macrebur can use this as a cover for drainage systems.

Production of this technological factor does not require huge carbon emissions, thus it is beneficial. It can simultaneously increase durability of plastic roads and can reduce ranges of pollution. As a result, it can effectively reduce the number of road accidents caused by short-term durability of plastic roads. Improper implication of components can make previously developed plastic roads slick and soft. Thus, to mitigate this challenge it is necessary to incorporate aspects of *“The*

Conclusion

This study concludes with the importance of ensuring sustainable approaches for constructing roadways using plastic in place of standard asphalt. The major challenge that has been centred as the reason behind using plastic for roads is the high tendency of standard asphalt roads to absorb water, resulting to weaker construction and potholes. Using plastic as a raw material for construction roads is

Grid Mats technique” technology. It will help in managing daily maintenance functions for plastic roads developed by the company.

Recycled materials can redirect the ratio of polluted soil, thus this considered technology can be beneficial for plastic roads. It might help in managing proper strength of plastic roads. It can manage the consistency of these roads on behalf of this company. Apart from this, it will manage the pollution caused by the mixture procedure with proper effectiveness. It can help in managing loopholes developed by plastic roads. It will develop plastic roads by dividing them into multiple grids [2]. Thus, it can reduce potholes and erosions generated by plastic roads simultaneously. It can manage the long-lasting nature of roads and maintain low maintenance expenses.

helpful in terms of its low cost and maintenance. These roads are much sustainable for a longer time period thereby ensuring safety and sustainability to people. Additionally, emerging technologies like ***The Grid Mats***

technique can be used for recycling plastic into road making projects. Organizations like Macrebur have also been highlighted for coming up with the usage of recycled polypropylene for managing plastic road.

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