

Use of Plastic Waste in Paver Block

Bharadva Aman Manishbhai¹ Makvana Vivek Govindbhai² Prajapati Savan Sureshbhai³ Prof. Mistry Pooja B.⁴

⁴Assistant Professor

^{1,2,3,4}Department of Civil Engineering

^{1,2,3,4}Vishwakarma Government Engineering College, India

Abstract— The plastic waste are non-biodegradable materials. So, Plastic Waste pollute our environment. The plastic wastes have proved in worldwide its affects in human life. Plastic Wastes is a big nuisance in our today’s life. So, this plastic waste should be reused and decrease the rate of plastic waste. One such reused can be in the road construction. The plastic waste can be used in Road construction it gives a good strength and durability in all sessions. Plastic paver blocks give a good strength waste is find out into the ground. The Paving block casted with Proper mix proportion and cured in the water tank. After the curing, compressive strength test and water absorption test are conducted and results are note down. The use of innovative technology in the road construction it also increased road life as well as help to improve the environment and also creating a new source of income.

Keywords: Reuse of Plastic Waste, Casting of Paver Block

I. INTRODUCTION

In current situation Plastic is the mostly used material in the present time. Today’s plastic is used in every sector of the economy. Plastic is a non-biodegradable material. It has been found that, it can remain on the earth for about 4500 years without show any sign of degraion. Plastic waste is a common in rural areas and urban areas. In human life, day to day uses of Plastic rate is increasing in tons. Number of tones of plastic wastes which includes polyethene’s, plastic bags, PVC pipes, plastic cups, plastic fumes etc... are discard every year

The Plastic wastes are polluting a land river, ocean, lake etc...When plastic wastes are burning on the land its release a toxic gas and it pollute the natural environment. In the burning process, release many toxic gases. There is chances of greenhouse effect and global warming.

As per research approximately 10 thousand tons per day of plastic waste is generated. The plastic waste can be divided into two categories: 1) Thermoplastic 2) Thermoset plastics. The thermoplastics are recyclable plastic. Which includes, Polyvinyl chloride (PVC), low density poly ethylene (LDPE), High density poly ethylene (HDPE), Polypropylene (PP), polyester (PS) etc.

PLASTIC CONSUMPTION IN INDIA		
Sr.No.	Year	Consumption (tons)
1	2015	1,35,00000
2	2016	1,47,00000
3	2017	1,50,00000
4	2018	1,67,00000
5	2019	1,74,00000
6	2020	1,89,00000

II. SALIENT FEATURES OF WASTE PLASTIC IN ROAD CONSTRUCTION:

- A road strength is twice as compare to the normal Roads.
- It does not require any extra costly machinery.
- It does not increase the cost of road construction. It is economical as compare to the normal roads.
- In the summer session, bleeding of the road less due to high temperature.
- It helps to reduce the consumption of costly materials like cement, bituminous etc...
- Burning of plastic waste could be avoided. Therefore, it is helps to protect the natural environment.
- A good resistance toward the water stagnation. Therefore, pot holes problems in the roads to be solved

III. CONCEPT OF UTILIZATION OF WASTE PLASTIC IN BITUMINOUS MIXES FOR ROAD CONSTRUCTION:

A. Materials used:

1) Coarse aggregate:

The aggregates occupy about 75% of the volumes of concrete. Properties of aggregate greatly affect the properties of concrete such as durability, workability and strength to increase the density of concrete the aggregate is frequently used in two or more sizes.

The size of aggregate is bigger than 4.75mm is called as coarse aggregate.

2) Fine Aggregate & sand:

The size of aggregate 4.75 mm and smaller is called fine aggregate.

Sand is generally considered to have a lower size limit about 0.7 mm for fill up. The selection of fine aggregate on basis of grading zone, particle shape and surface texture fine aggregate are providing a dimensional stability to the mixture.

3) Plastic:

Plastic waste is the accumulation of plastic object in earth’s environment that adversely affects wildlife habitat and also humans.

Plastic waste can be classified as,

- 1) Hard forms (polythene)
- 2) Soft forms (polypropylene)
- 3) Laminated plastic
- 4) Low density polythene (LDPE)
- 5) Polyvinyl chloride (PVC)
- 6) Acrylonitrile butadiene styrene (ABS)

4) Cement:

Cement is finely material, usually grey in colour. The most important raw material for the production of cement are limestone, clay and marl. Mixed with water, cement serves as an adhesive to bind sand, gravel and hard rock in concrete.

Generally Portland cement used in construction works.

5) *Mixing process:-*

Recycled plastic, quarry dust, sand, cement and water were the primary materials used in this study. The selected Recycled plastic were polyethylene terephthalate (PET) polymer from the mineral water bottle. The bottles were manually shredded using scissors to make the melting process easier. The shredded bottles were used either as binder or sand replacement in the paver block production depending on the methods of fabrication. In the heating method, recycled plastic acts as a binder and heated in oven before mixing it with quarry dust and sand. Whereas in the compression method, Recycled plastic was processed and became fine particles that passing 0.6 mm sieve. Fine sand was supplied by a local quarry and passed through sieve 0.6 mm. It was dried and cleaned before the sieving process to remove any unwanted materials such as roots, debris and any organic matter. Similar preparation was applied to 1.4 mm size quarry dust which was obtained from a local quarry.

6) *Design Experiment and testing:-*

Trial mixes were prepared to observe the suitable method of paver block production and mix design. There were two approaches used in paver block fabrication, namely heating method and compression method. In the heating method, shredded PET bottles were mixed with quarry dust in a mixing mould and heated together inside the oven with a maintained temperature of 250 - 300°C. After heating, the mixture was stirred thoroughly by hand to ensure well it is mixed. The mixture was then and poured into a mould and left 24 hours to cool down and harden. Another method was compression which consists of sand, cement and Recycled plastic. In the compression method, the PET bottles were shredded and then melted and then left to harden. The hardened plastic was crushed and turn it to finer particles, In this method, the plastic powder act as a sand replacement. The casting was done by pouring the mixture into a mould (Figure 1) and compressed using it the compressive strength machine. Based on observation during trial mixing the most efficient procedure was selected and employed in full scale casting.



Fig. 1:

IV. MIX RATIO:

1) *Block type 1:*

Plastic waste - 30%, cement - 10%, Aggregate - 60% (C.A-35% & F.A-25%)

2) *Block type 2:*

Plastic waste - 20%, cement - 10%, Aggregate - 70% (C.A-40% & F.A-30%)

3) *Block type 3:*

Plastic waste - 10%, cement - 10%, Aggregate - 80% (C.A-45% & F.A-35%)

4) *Block type 4:*

Plastic waste - 0%, cement -10%, Aggregate - 90% (C.A-50% & F.A-40%)

V. COMPRESSIVE STRENGTH TEST:

Compressive strength test was carried out to determine the compressive strength development of the paver block at 0, 7, 14 and 28 days. Specimens were cured by sprinkling the water on specimen every day for 28 days.



Fig. 2:



Fig. 3:

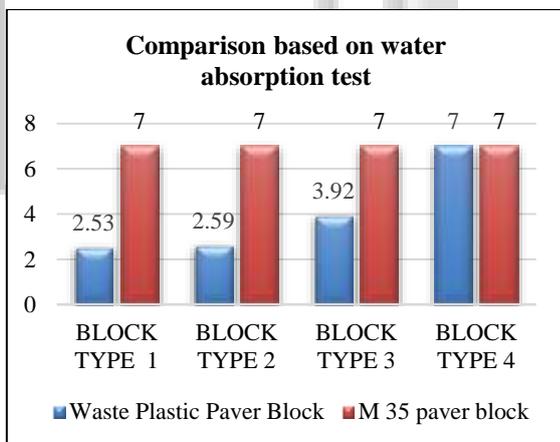
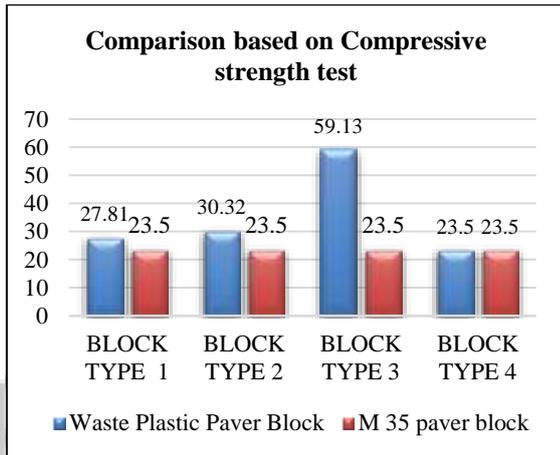
VI. WATER ABSORPTION TEST:

This test method is used to determine the rate of absorption of water by measuring the increase in the mass of a specimen resulting from absorption of water as a function of time when only one surface of specimen is exposed to water. The amount of water absorbed is calculated using the formula,

(Dry weight – Wet weight) / (Wet weight) X 100

VII. RESULT:

7 Days Result				
Ratio	Block type 1 (30%)	Block type 2 (20%)	Block type 3 (10%)	Block type 4 (0%)
Compressive strength (N/ mm ²)	27.81	30.32	59.13	23.5
Water absorption (%)	2.53	2.59	6.92	<7



VIII. ECONOMY IN CONSTRUCTION:

- Reduce the rate of cement content in construction process because the plastic wastes are used in bonding of sand and aggregate
- This type of road strength and durability is higher than the normal roads therefore, the maintenance cost of the paving surface is low.
- Approximately, reduce the cost of road construction around RS.5000/km of single lane road. Therefore, it is very economical construction.

IX. CONCLUSION:

In this project, we conclude that strength of plastic paver block is higher than the normal concrete mix paver block. Our project has compressive strength and water absorption around

1.8 times the conventional product. This project is very economical and the project will be helpful in reducing plastic waste in a useful way. We made from plastic waste material a good product developed of our project and also protect environment of nature.

REFERENCES:

- [1] Reuse of plastic waste in paver blocks, International Journal of engineering research & Technology (IJERT), ISSN: 2278-0181, Vol. 6 Issue 02, February-2017. B.Shanmugavalli, Assistant Professor, Department of civil engineering, Sethu institute of Technology, Virudhunagar.
- [2] Effective use of waste plastic as manufacturing of paver block, S.Dinesh, K.Mohamed Shalman Parishee, J.Sriram, M.Mohmed Bashith, R.Jayasankar, Final year civil engineering, Head of Department for civil engineering, A.V.C college of engineering, Mannampandal, Mayiladuthuri-609001.
- [3] Utilization of waste plastics as a replacement of cement in paver block, S.Raju, M.Anandhakumar, K.ELavarasan, A.Naveenkumar, Assistant professor, Department of civil engineering, Paavai college of engineering, Namakkal, Tamilnadu, India.
- [4] Utilization of waste plastics as a replacement of coarse aggregate in paver block, A.Panimayam, P.Chinnadurai, R.Anuradha, K.Pradeesh, A.Umar Jaffer, Department of civil engineering, Infant Jesus College of engineering, Tuticorin, India.
- [5] Plastic roads: A recent advancement in waste management Huda shafiq B.E civil engineering the university of Kashmir Srinagar, Kashmir India and Anzar Hamid B.tech civil engineering Islamic university of science & technology, awantipora, pulwana, india.
- [6] Development of paver block containing recycled plastic, Lillian Gungat, Fulgentius Anthony, Abdul Karim Mirasa, Hidayati Asrah, Nurmin Bolong, Nurul Ariqah ispal and siti Jahara Matlan