

## DURABLE PLASTIC PAVER BLOCK BY USING NON-BIODEGRADABLE PLASTIC WASTE: A RELIEF TO ENVIRONMENT

Marm Manvar\*<sup>1</sup>, Rhydham Manvar\*<sup>2</sup>, Shivrajsinh Rayjada\*<sup>3</sup>

\*<sup>1,2</sup>Shree K.G. Dholakiya School, English Medium, Gujarat State Higher Education  
Board, Rajkot, Gujarat, India.

\*<sup>3</sup>Associate Professor, Shree K.G. Dholakiya School, English Medium,  
Rajkot, Gujarat, India.

DOI : <https://www.doi.org/10.56726/IRJMETS34091>

### ABSTRACT

The present investigation aims at manufacturing Floor Tiles using waste plastic in different proportions with sand, without use of cement and comparing it with the normal cement tiles. Use of plastic has become more common as it is use in wrapping shopping, garbage bags, Fluid container etc. With the increase in the production of plastic and its usage the waste plastic is also increased drastically So we come up with the solution and we make this floor tile so we can reuse the waste plastic Waste plastic can use in place of concrete blocks in construction .According to one survey every person eat 5 grams of plastic every week .Since 1950 around 8.3 billion ton plastic waste has produce Usually the concrete tiles have some problems such as small size, heavy mass, high water, absorption, leakage, non-heat preservation, construction being difficult and so on. The cost is low, the concrete tiles lack enough weathering resistance.

**Keywords:** High Durability, Water Proof Paver Block, Strength Full Paver Block, Paver Block.

### I. INTRODUCTION

Plastic is non- biodegradable substance it takes thousands of year to decompose it create land as well as water pollution. Accumulation of such waste can result into hazardous effect on both human as well as plant life. Plastic pollution is one of the biggest environmental problems that the world is currently facing. It is estimated that 100 million tons of plastic produce every year. Around 8.3 billion MT tons of plastic produce since 1950. In Australia alone 2.24 million tons of plastics waste was generated in 2008 which comprised 16% of the municipal waste stream. Both informal and households sectors together covered a generation rate of 6.5–8.5 million tons/year of plastics waste in India. By definition plastic can make too different shapes when they are heated. There are many properties of plastic such as light weight; transparency, flexibility etc make its use more common. Plastic waste which is increasing day by day becomes eyesore and in turn pollutes the environment, especially in high mountain villages where no garbage collection system exists. A our world population continues to increase, the usage of plastic is also increase since it's the preferred packaging material for foods and beverages. Thus, the plastics waste is considered as one of the major environmental problems due to its hazards effects and difficulty for disposing. According to Fiber-Reinforced Plastic, David Henshers, a professor at the University of Duke, plastic can be used as a concrete admixture. Plastics are widely used as packaging materials but their waste can be used in the construction industry to manufacture building products, such as roof tiles, building blocks, etc. Factors such as population growth, low production cost, wide varieties and applications results in an increased production of plastics Plastic wastes, for example, can be combined with sand to manufacture building materials. So we make this floor tile to reuse the waste plastic that is accumulating every day in huge amount. This is one of the best ways to avoid the plastic waste. This floor tile will help INDIA to get rid of plastic waste.

### II. LITERATURE SURVEY

**Process safety and environmental protection [RidhamDhawan, Brij Mohan Bishit, Rajeev Kumar, SorojKumari, S.K. Dhawan]** This plastic is non-biodegradable and can add to ground and water pollution. This factor makes their disposal a topic of major concern. Waste plastic persist for long time as the natural degradation requires more than 500 years thus making it the most visible constituent of waste dumps and landfills.

**Use Of, Plastic Waste for Floor Tiles [Yogesh Londhe<sup>2</sup>, Prof. Kashinath Zamare<sup>3</sup>, Prof. Laxman Lahange]**

In many industries flooring is done by concrete tiles. We are in the fast-growing infrastructure and the need of the industries and residential buildings. The need of building materials also plays a role development of infra with minimum cost. Plastic is defined as synthetic or semi synthetic materials which are polymeric and are composed of large molecules of organic substances known as monomers.

**Plastic Floor Tiles.** [Asif Abdul Razak Momin, Dr. R.B. Kadiranaika, Siddarooda Talavara, Nagraj.] **Properties of plastic-** Plastic can also use as building material instead of concrete Reason behind the more use of plastic.

**Reuse of plastics waste for the production of floor tiles [Mr. Puttaraj M H<sup>1</sup>, Basavaraj Parangi<sup>2</sup>, Gagan M S, Shivu S, Manjunath SHallur]** Researchers suggest that if plastic isn't disposed of soon, it can sustain for 4500 years without degradation. Plastic is a new engineering material in which researchers take more interest to invest their time and money because it has a wide scope to enhance the usage of plastic in different work.

**Development of sand-plastic composites as floor Tiles using silica sand and recycled thermoplastics mixture from post-consumer products – A sustainable approach for cleaner production.** [Ashish Soni, Pankaj Kumar Das.] Plastics are widely used in household, industry, institution, construction, and vehicle, etc. and had replaced many conventional materials and products. In Australia alone 2.24 million tons of plastics waste was generated in 2008 which comprised 16% of the municipal waste stream Both informal and households-sectors together covered a generation rate of 6.5–8.5 million tons/year of plastics waste in India.

**Utilisation Of, Waste Plastic In, Manufacturing of Bricks and Paver Blocks [Dinesh Sellakutty, Kirubakaran. K, Dinesh]** Plastic waste which is increasing day by day becomes eyesore and in turn pollutes the environment, especially in high mountain villages where no garbage collection system exists. A large amount of plastic is being brought into the tourist trekking regions are discarded or burned which leads to the contamination of environment and air. Recycling the plastics has advantages since it is widely used and has a long service life, which means that the waste is being removed from the waste stream for a long period.

**Research on Mechanical Performance of Roof Tiles Made of Tire Powder and Waste Plastic [Yong Liu, Weimin Yang, Mingfeng Hao]** The typical roof tiles made from soil or clay will be limited because it destroyed the farmland. Usually, the concrete tiles have some problems such as small size, heavy mass, high water absorption, leakage, non-heat preservation, construction being difficult and so on.

**A review paper on economic tiles using plastic waste [Sourabh Jadhav, Ravindra Sangale, Sujeet Gupta, Pramod Patil]**

- **Physical properties of plastic –**

1. a. Lightweight with a high strength-to-weight ratio.
2. b. Can be manufactured inexpensively and mass produced.
3. c. Water resistant.
4. d. Shock resistant.

- **Chemical properties of plastic –**

1. Plastic has high flammability.
2. Plastic has low permeability and temperature resistance.
3. Plastic has superior puncture.
4. Plastic has more rigid and stronger than LDPE.
5. good impact resistance and they do not rust.

**A review on preparation of roof tiles using industrial waste and fibres.[Arun Kumar Sharma, Prashant Baredar, Anil Kumar Dubey]** Due to burning of plastic the CO<sub>2</sub> content is going to rise in the atmosphere resulting in global warming the biggest threat to life of human race. This increases the Green-house gases in the atmosphere resulting in global warming.

**Mechanical properties and durability of pet waste aggregates in roof tiles production.[Omosibi Taiwo O, Noor Faisal Abas]** Managing plastic waste is a global challenge that challenges the protection of our ecosystem due to its high rate of generation and its non-biodegradability. Plastic waste can be recycled into new usable

building materials. In this analysis, shredded PET waste aggregate from a recycling center was heated at 230 0C and used as a binding aggregate incomplete replacement of cement with river sand to produce floor tiles.

**Experimental study on the use of waste polyethylene terephthalate (pet) and river sand in roof tile production.** [G. O. Bamigboye, B. U. Ngene, D. Ademola, J. K. Jolayemi]. According to a recent study, a million plastic bottles are bought every minute across the world and only 7% are recycled, the rest end up in landfills or in water bodies.

**Recycling Plastic Waste as Pavement/Roof Tiles.** [Tamojit Datta] Plastic waste is becoming the scourge of the earth. Containers, bags, soda and all types of plastics either are burned, they end up in landfills or in our oceans. Mostly single use plastics such as polythene bags, water bottles, cups etc. are thrown out and they are not recycled, especially in rural areas of India.

**Review on low-cost roofing tiles using agricultural wastes.**[JagrutiBhatt, Dr. Rashmi Bade, SahilMeshram, Ayankhan, Nutan Runghe] Roof tiles are designed mainly to stay out rain, and are traditionally made up of locally available materials such as terracotta or slate.

### III. METHODOLOGY

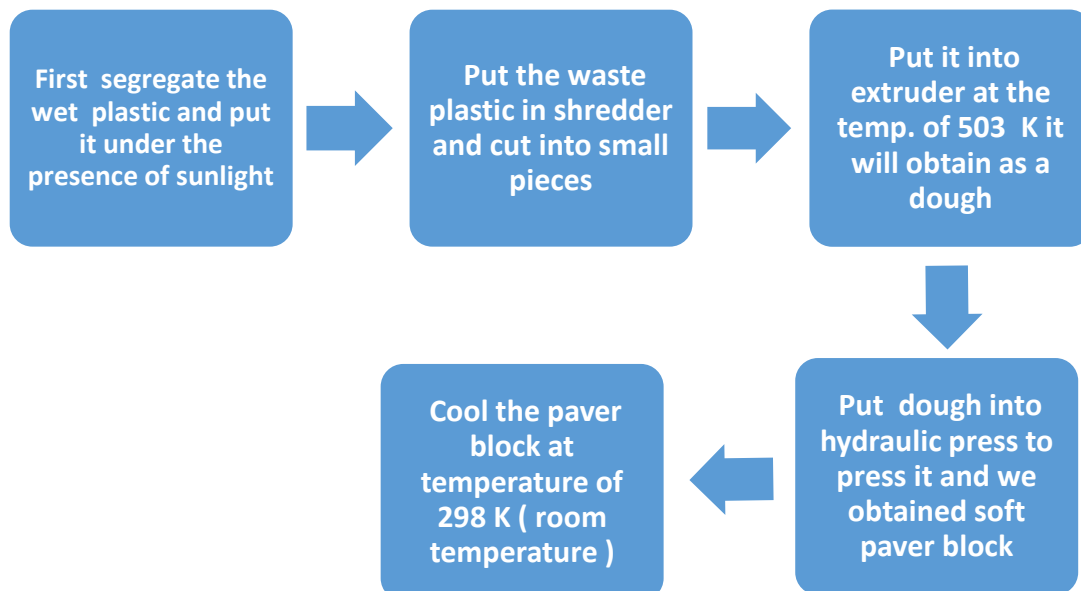


Figure 1: Flow Chart

First find waste plastic and segregate the wet plastic waste.

And put the plastic under the presence of sun light.

Then put the plastic in shredder and it cut into several pieces around the size of 1-2 mm.

Then put the plastic pieces in the extruder at the temperature of 573 K to 673 K. Then it will come out as dough.

Will cool the tile at 298 K and the tile is ready to use.

### IV. OBJECTIVES

Plastics waste comprises of 8–12% of the municipal waste stream and approximately 190 million tons generated annually.

The plastics waste is considered as one of the major environmental problems due to its hazards effects and difficulty for disposing.

Decrease the accumulation of plastic.

Make a new eco-friendly building material

#### CLASSIFICATION OF PLASTIC

Polyethylene Terephthalate (PET or PETE)

High-Density Polyethylene (HDPE)

Polyvinyl Chloride (PVC or Vinyl)

Low-Density Polyethylene (LDPE)

Polypropylene (PP)

Polystyrene (PS or Styrofoam)

### V. MODELLING AND ANNALYSIS

Plastic [polyethylene terephthalate]:-

Polyethylene terephthalate (PET)

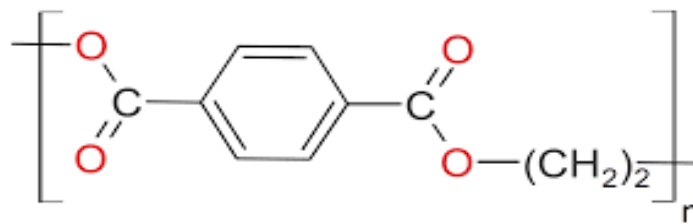


Figure 2: Polyethylene Terephthalate

The molecular formula is:  $(C_{10}H_8O_4)_n$  or  $C_5H_4O_2$  for short. The density of PET is  $1.397 \text{ g/cm}^3$ ,

**Sand:-**

We use the coarse sand that is easily available in market.

The price of this sand is 38 Rs per cubic feet.

The size of this sand is between 0.2 – 2 mm.



Figure 3: Sand

**Shredder: -**

There are three types of shredder:-

- 1] Strip cut shredder
- 2] Cross cut shredder
- 3] Micro cut shredder

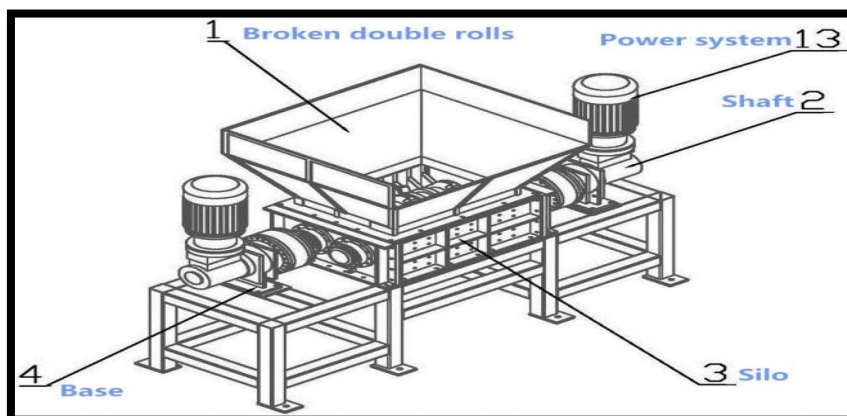


Figure 4: Shredder



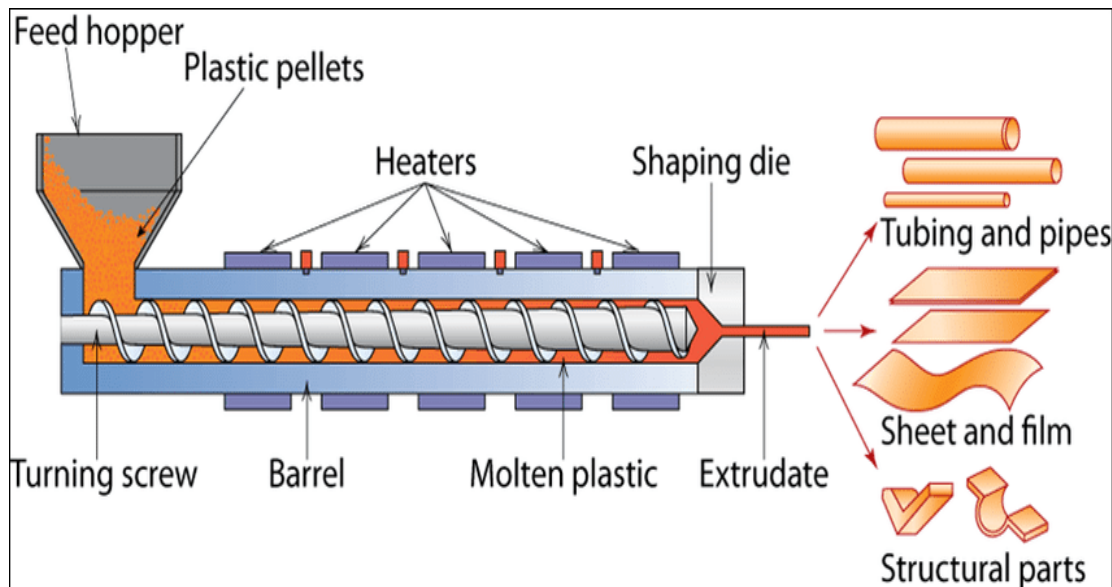
**Figure 5:** Shredded Pieces Of Paper

**Extruder: -**

This process starts from a hopper into the barrel of the extruder. The material is gradually melted by the mechanical energy generated by turning screws and by heaters arranged along the barrel. The molten polymer is then forced into shaping dye and it come out from extrudate.

There are three types of extruder:

- 1] Single screw
- 2] Twin screw
- 3] Multi screw



**Figure 6:** Extruder

**Hydraulic presser:-**

A hydraulic press works on the principle of Pascal's law, there is a piston that works as a pump.

There are five types of hydraulic press:

- 1] The Movable Table Hydraulic Press.
- 2] The Movable Frame Hydraulic Press.
- 3] The Air Operated Hydraulic Press.
- 4] Double Acting Hydraulic Press.
- 5] The Manual Hydraulic Press.

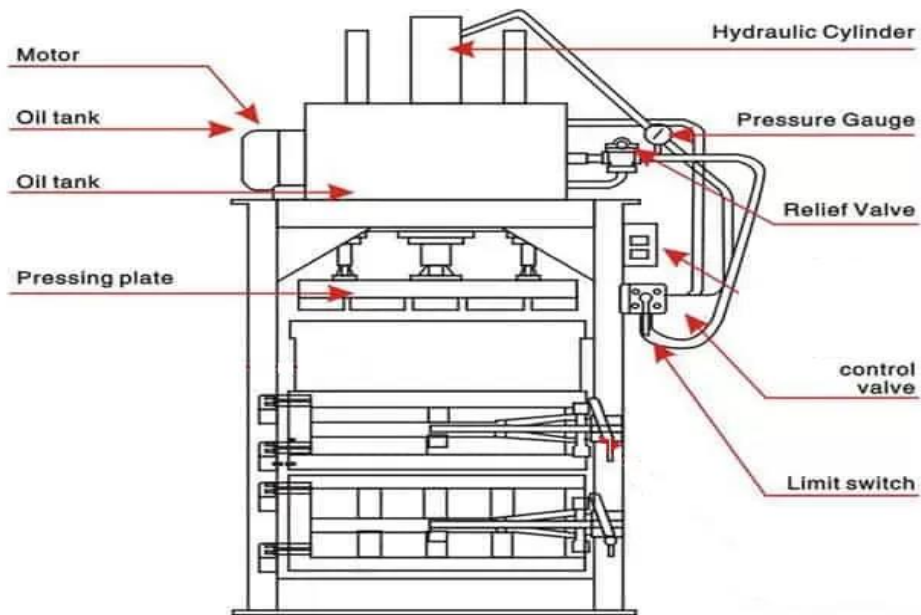


Figure 7: Hydraulic Presser

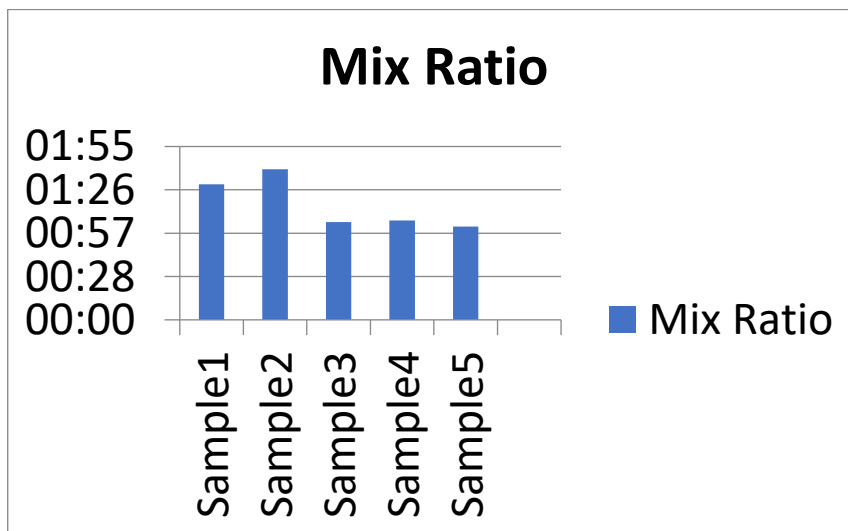


Figure 8: Analysis Of Mix Ratio



Sample1



Sample2



Sample3



Sample4



Sample5

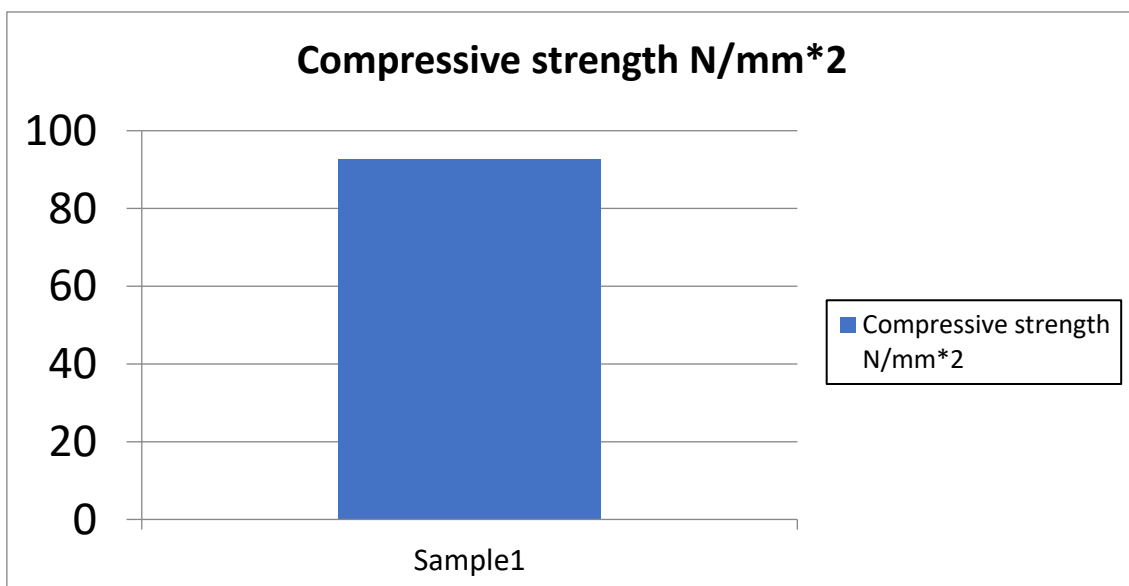


Figure 9: Analysis Of Compressive Strenght

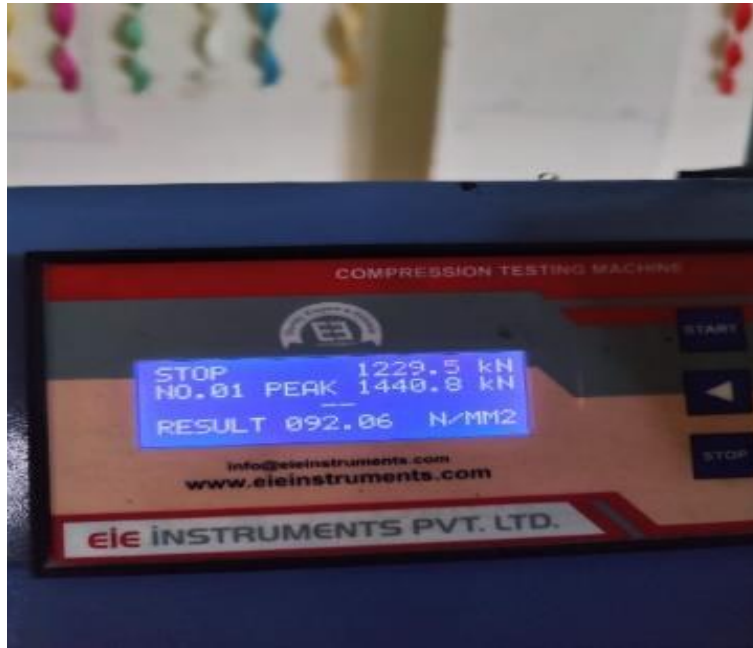


Figure 10: Result Of Compressive Strength



Figure 11: Result After Compressive Strength

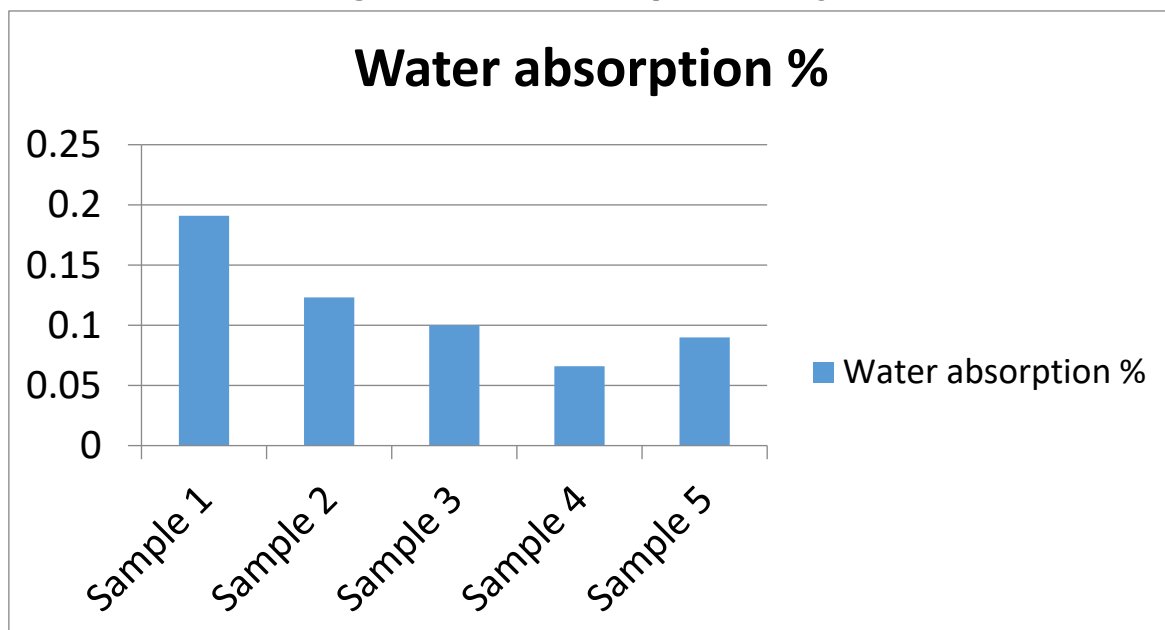
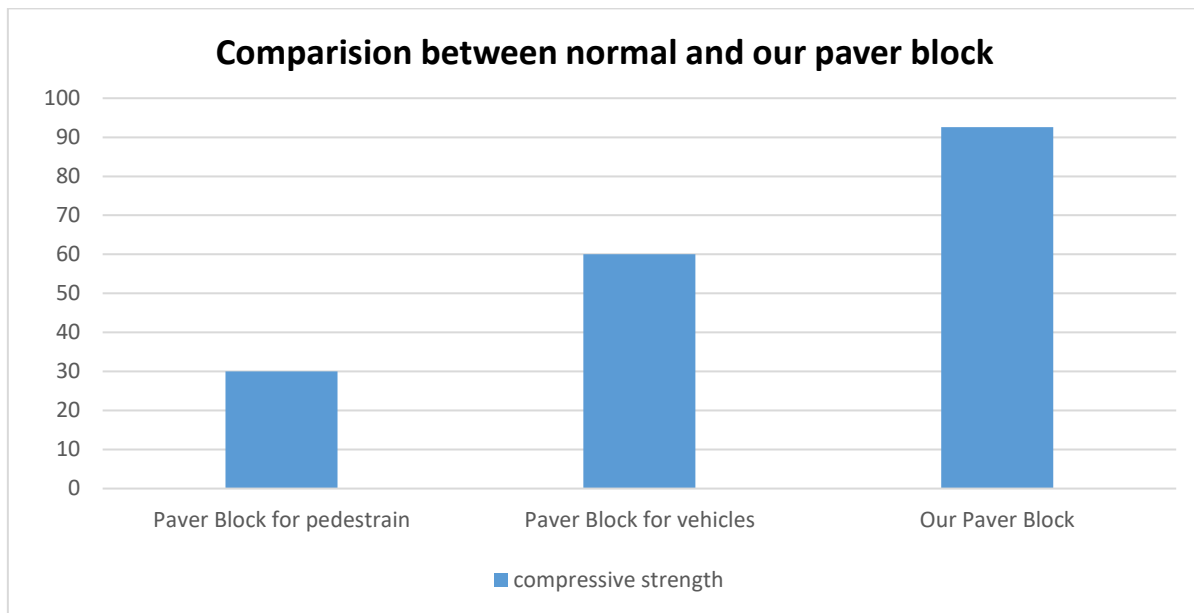


Figure 12: Analysis Of Water Absorption



## VI. RESULTS AND DISCUSSION



**Figure 13:** Analysis Of Comparision Between Normal And Plastic Paver Block

From the above table we conclude the result that normal concrete paver block for pedestrian has the strength of 30 N/mm<sup>2</sup> and for the vehicle has the strength of 60 N/mm<sup>2</sup> and after compressive strength we get the strength of 92.6 N/mm<sup>2</sup>. we get the high in very small thickness and the normal paver has very high thickness. Sometimes due to the thickness house remain under the road. We have also done the water absorption test we get the lowest absorption rate in our model.

### ADVANTAGES OF PLASTIC

#### Physical properties of plastic:

- Lightweight with a high strength-to-weight ratio.
- Can be manufactured inexpensively and mass produced.
- Water resistant.
- Shock resistant.
- Thermally and electrically insulating.

#### Chemical properties of plastic:

- Plastic have high flammability.
- Plastic has low permeability and temperature resistance.
- Plastic has superior puncture.
- Plastic has more rigid and stronger than LDPE.
- Good impact resistance and they do not rust.

### WORKING AND APPLICATION

Its working is that it will not allow water to pass through it and it will help India to get rid of waste plastic that accumulating every day in huge amount. Its main work is that to recycle plastic and make it a useful thing It mainly used in compound. Also, it is used in making roads. If we change its mould it will also use as a roof tile in the region experiences heavy rainfall and snowfall, if we change its mould then we will use it as floor tile and if we change its mould into brick then it can be used in building also. if we make interlocking then we can use it as slab also from these we do the slab in 2-3 days because in earlier times we are supposed to complete the slabs in one day so that is one advantage.

### TYPES OF PAVER BLOCK

- Brick Pavers
- Concrete Pavers

- Flagstone Pavers
- Bluestone Pavers
- Marble Pavers
- Travertine Pavers
- Cobblestone Pavers
- Porcelain Pavers
- Rubber Pavers

#### ADVANTAGES

- It is durable.
- It is light weight.
- It is fire resistance.
- It is easily available in nature.

#### VII. CONCLUSION

It doesn't allow water to pass through it. Its water absorbing percentage = 0.935, Compressive strength is = 96.2 N/mm<sup>2</sup>, Density of floor tile is = 1800kg/m<sup>3</sup>. This method is suitable for the countries which has the difficult to disposal the plastic waste. The manufacturing cost should be reduced by replacing the coarse sand with fly ash or other waste products.

#### ACKNOWLEDGEMENTS

Many thanks go to the guide **Shivrajsinh Rayjada** who has given their full effort in guiding the team in achieving the goal as well as their encouragement to maintain a progress in track.

I would like to express my gratitude an appreciation all those who gave me the possibility to complete this paper special thanks to our principal **Geeta Bhambhani** whose help, simulating suggestion and helped me in all time of fabrication process and in writing this paper. I also sincerely thanks for time spent proofreading and correcting mistakes.

#### VIII. REFERENCES

- [1] Dinesh S, Dinesh A, Kirubaran K (2016) "Utilization of waste plastic in manufacturing of bricks and paver blocks" International Journal of Applied Engineering Research, Vol. 11 No.3 (2016).
- [2] "Application Of Waste Plastic As An Effective Construction Material In Flexible Pavement", International Research Journal of Engineering and Technology (IRJET) SasaneNeha.B., Gaikwad Harish, Dr. J R Patil and Dr. S D Khandekar e-issn: 2395 -0056, p-issn: 23950072 Volume: 02 Issue: 03 | June-2015 www.irjet.net PAGE 1943-1948
- [3] Ganesh Tapkire, Satishparihar, Pramod Patil, Hemraj R Kumavat (2014) "Recycled Plastic Used in Concrete Paver Block" IJRET: International Journal of Research in Engineering and technology.
- [4] ArvindSinghal, Dr. OmprakashNetula, Utilisation of plastic waste in manufacturing of plastic sand bricks"3rd International Conference on New Frontiers of Engineering, Science, Management and Humanities (ICNFESMH2018).
- [5] Noel Deepak Shiri, P. VarunKajava, Ranjan H. V, Nikhil Lloyd Pais, Vikhyat M. Naik (2015) "Processing of Waste Plastics into Building Materials Using a Plastic Extruder and Compression Testing of Plastic Bricks" Journal of Mechanical Engineering and Automation
- [6] HamidMir AZ (2015) Use of Plastic Waste in Pavement Construction: An Example of Creative Waste management.
- [7] Gidley James S and Sack William A (1984) Environmental Aspects of Waste Utilization in Construction. Journal of Environmental Engineering. 110 (6): 1117-1133, [https://doi.org/10.1061/\(ASCE\)0733-9372\(1984\)110:6\(1117\)](https://doi.org/10.1061/(ASCE)0733-9372(1984)110:6(1117))
- [8] V.Kasselouri-Rigopoulou, S. Gavela, S. Koliass"Use Of Polymeric Wastes in The Concrete Production" Polymers in concrete: a vision for the 21st century, Cement & Concrete Composites 21: (1999) 449-452.

- 
- [9] MadanMohan reddy, k, ajitha .B and Bhavani (2012) "Melt- Densified Post-Consumer Recycled Plastic Bags Used as Light Weight Aggregate in Concrete", International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 Vol. 2, Issue, pp.1097-1101.
- [10] L.C. Roma Jr., L.S. Martello and H. Savastano Jr.: Construction and Building Materials, Vol. 22, Issue 4, (2008), P 668.\