

# A Case Study on Utilization of Waste Plastic and fly ash In Paving Blocks

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**Abstract:** Fly ash is created in a large amount particularly by warm power plants. Plastics are generated in large amount with increase in population. Disposal of waste materials including waste plastic bags has become a serious problem. The waste plastics in house hold is large and increases with time. Both cause severe environmental problems. The main aim of our project is to utilize those plastics and fly ash in the manufacturing of bricks. In this paper, the fly ash bricks are casted and plastics were powdered and added up to 20% with an interval of 5%. Fly ash bricks are manufactured with plastics and undergo compressive strength test, water absorption test and efflorescence test. Here the strength properties of plastic bricks comprising of waste plastics, fly ash as the constituents and the design considerations for pavement block incorporating waste plastic bags is presented. It will be definitely cost economical when compared with the normal fly ash bricks. Manufacturing of fly ash bricks and Experiments conducted on fly ash bricks for this project, strictly follows specification given under IS 12894: 1990.

**Key words:** Fly ash, Lime, Water Waste Plastic Powder, Compressive Strength, Water absorption and Efflorescence.

## 1. Introduction

Fly Ash bricks are cleared of fly ash, lime, gypsum and sand. These can be effectively occupied in all building constructional activities just like the common burnt clay bricks. The fly ash bricks mostly found lighter in weight and more potential rather than common clay bricks respectively. Since fly ash is rapidly being picked up as waste material (Toghroli *et al.*, 2018), in huge quantity near thermal power plants and producing severe environmental pollution problems, similarly waste plastics are produced in large amount due to the increase in population and also cause severe environmental problems when they are taken for disposal, the main job of the raw material in the manufacture of bricks will not only provide ample opportunities for its proper and useful disposal but as well helps in environmental pollution control to a great extent. In expectation of superior quality and eco-friendly nature, the support of government has increased for the demand of Fly Ash Bricks. Aim of the present study is to use waste like waste plastic powder and Fly ash remains furthermore development of properties of fly ash lime bricks utilizing waste plastic powder, likewise it can fulfill the Indian Standard Provisions. The main scope of the current study is that cost of the bricks is minimized, properties of bricks can have altered furthermore by using waste plastic and fly ash.

## 2. Review of literature

**1) S. Revathi *et al.* (May 2015)** The main objective of this paper is to use waste products like groundnut husk ash for the production of Paver Blocks which will be useful in construction. Use of concrete Paver Blocks in road pavements is more common nowadays. Concrete Paver Block is a better option in road construction when compared to the conventional road which is made by bitumen and gravel from the point of view of cost and better suitability. As India is a developing country, construction of roadways and buildings plays an important role. In the present investigation paver blocks were prepared using M40 mix using 10 mm Coarse aggregates, Portland Pozzolana Cement and Fine Aggregates. The dimension of the paver block is 215 x 170 x 55 mm. The fine aggregates were partially replaced using Groundnut husk ash in percentage of 0, 10, 20, 30, 40, 50, and 60. Density of paver blocks is within the range of 1888-2202 kg/m<sup>3</sup>. Density values decrease with increase in Groundnut husk ash.

**2) Joel Santhosh *et al.* (April 2015)** In this paper investigation, concrete paving blocks may be produced with locally available cement, aggregates, fly ash and waste glass powder as the mineral admixture. Different mix proportions are prepared using cement replaced by equal quantity of fly ash and waste glass powder. The study indicated that fly ash and waste glass powder be used as cement replacement without substantial change in strength. The increase in strength up to 20% replacement of cement by fly ash and glass powder may be due to pozzolanic reaction of fly ash and glass powder. Fly ash increases in strength over time, continuing to combine with free lime. Increased density and long term pozzolanic action of fly ash which ties up free lime results in fewer bleed channels and decreases permeability. Fly ash combines with alkalis from cement that might otherwise combine with silica from aggregates, thereby preventing destructive expansion. The ball bearing effect of fly ash in concrete creates lubricating action when concrete is in its plastic state. Waste glass when ground to a very fine powder, SiO<sub>2</sub> react chemically with alkalis in cement and form cementitious product that help contribute to the strength development. Thus it can be concluded that 20% was the optimum level for replacement of cement with fly ash and glass powder.

**3) R. C. Yeole *et al.* (Oct. 2014)** This paper on study concrete paving blocks are ideal materials on the footpaths and roads for easy laying, better look and finish. In this paper, a parametric experimental study for producing paving blocks using waste steel aggregates (the form of rounded bearings of size 6.35 mm) is presented. Waste steel bearings are added in

concrete of paver blocks in various percentages. Rubber pads are also used below the paver blocks. Impact strength of paver blocks with various percentages of waste steel aggregates and using rubber pads is investigated. Test results show that combination of using rubber pads and adding various percentages of waste steel aggregates in paver blocks gives upto 50% more impact strength than ordinary paver blocks.

**4) Som Nath Sachdeva et al. (2014)** This paper discusses the use of fly ash in concrete paver blocks is aimed at reducing cement content and heat of hydration leading to better economy and durability.

Results of an experimental study conducted on Fly Ash Concrete with the aim to report its suitability for concrete paver blocks. In this study, the effect of varying proportions of fly ash, 20% to 40%, on compressive strength and flexural strength of concrete has been evaluated. The mix designs studied are M-30, M-35, M-40 and M-50. It is observed that all the fly ash based mixes are able to achieve the required compressive and flexural strengths. In comparison to control mixes, the compressive and flexural strengths of the fly ash based mixes are found to be slightly less at 7-days and 28 days and a little more at 90 days.

**5) B.K. Kashiyan et al. (May 2013)** In this paper study addition of polypropylene fibers in paver block to show the change in the Abrasion Resistance and Flexural Strength of paver blocks with compare to standard paver block and reduces the maintenance cost of paver block. Also it's helpful to improve the life span of paver block. In this paper represent the results of the concrete paver block with the mix proportion of 1:3 (Cement: dolomite powder) and polypropylene fibre with the different percentage rate in the top layer of paver block and 1:1:2:3.75 (Cement: Fine aggregate: Semi Grit: Quarry dust) in the bottom layer of paver block. In only both layers contain the polypropylene fiber (PPF) of 0.1%, 0.2%, 0.3%, 0.4%, and 0.5% in each mixes proportion by weight. Both tests were determined at 28 days. Test results indicate that by the addition of PPF by 0.3% and 0.4% it gives good results for abrasion resistance and flexural strength at 28days respectively. The paper also shows the cost comparison per block for the each mix proportion.

**Table: 1. 1 Recommended Grades of Paver Blocks for Different Traffic Categories**

Sr. No	Grade. Designation of-Paver Blocks	Specified Compressive Category Strength of Paver Blocks at 28 Days N/mm	Traffic Category	Recommended Minimum Paver Block Thickness mm	Traffic Examples of Application
1	M-30	30	Non-traffic	50	Building premises, monument premises, landscapes, public gsrndendparks, domestic drives, paths and patios ,embankment slopes, sand stabilization area, etc.
2	M-35	35	Light-traffic	60	Pedestrian plazas, shopping complexes ramps, car parks, driveways, farmhouses, beach sites, tourist resorts local authority footways, residential roads, etc
3	M-40	40	Medium-traffic	80	City streets, small and medium market roads, low volume roads, utility cuts on arterial roads, etc
4	M-50	50	Heavy Traffic	100	Bus terminals, industrial complexes, mandi houses, roads on expansive soils, factory floor, service stations, industrial pavements, etc
5	M-55	55	Very Heavy Traffic	120	Container terminals, ports, docks yards, mine access roads, bulk cargo handling areas, airport pavements, etc.

### 3. Shapes and Classifications

There are four generic shapes of paver blocks corresponding to the four types of blocks as below and figure 1.1 shows the different shapes of paving blocks:

a. **Type A:** Paver blocks with plain vertical faces, which do not key into each other when paved in any pattern,

b. **Type B:** Paver blocks with alternating plain and curved/corrugated vertical faces, which key into each other along the curve/corrugated faces, when paved in any pattern,

c. **Type C:** Paver blocks having all faces curved or corrugated, which key into each other along all the vertical faces when paved in any pattern and

d. **Type D:** 'L' and 'X' shaped paver blocks which have all faces curved or corrugated and which key into each other along all the vertical faces when paved in any pattern.

#### 4. Waste Materials

**Definition of waste:** "Wastes materials are substance or objects, which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law"

Solid waste is the unwanted or useless solid materials generated from combined residential, industrial and commercial activities in a given area. It may be categorized according to its origin (domestic, industrial, commercial, construction (Gautam *et al.*, 2018) or institutional); according to its contents (organic material, glass, metal, plastic paper etc. or according to hazard potential (toxic, non-toxin, flammable, radioactive, infectious etc.

Waste is any substance which is discarded after primary use, or it is worthless, defective and of no use. If the large amount of waste materials generated were used instead of natural materials in the construction industry there would be three benefits:

- Conserving natural resources.
- Disposing of waste materials (which are often unsightly).

##### ➤ Solid type waste

Solid Waste from our homes and Industries is generally collected by our local authorities through regular waste collection, or by special collections for recycling. Within hot climates such as that of the Caribbean the waste should be collected at least twice a week to control fly breeding, and the harboring of other pests in the community. Other factors to consider when deciding on frequency of collection are the odors caused by decomposition and the accumulated quantities. The following are the various waste materials (Toghroli *et al.*, 2018) used as ingredient in concrete are:-

##### • Fly ash-

The beneficial use of fly ash in concrete is the preferable option for safe and economical utilization of millions tons of fly ash. There is a critical need to find new methods for using fly ash for its highest and best use. The major obstacle in use of bottom ash in a concrete is that the chemical properties of coal bottom ash are different from place to place and are depends upon the origin of the raw material.

##### • Steel Aggregates and Rubber Pad-

Rubber products are everywhere to be found, though few people recognize rubber in all of its applications. Rubber is used in radio and T.V sets and in telephones. Electric wires are made safe by rubber insulation. Rubber forms a part of many mechanical devices in the kitchen. It helps to exclude draughts and to insulate against noise. Sofas and chairs may be upholstered with foam rubber cushions, and beds may have natural rubber pillows and mattresses.

##### • Waste marble:-

Marble processing industry generates around 7 million tons of wastes mainly in the form of powder during sawing and polishing processes. These are dumped in the open which pollute and damage the environment

##### • Plastic Waste;-

The distribution of plastic debris is highly variable as a result of certain factors such as wind and ocean currents, coastline

geography, urban areas, and trade routes. Human population in certain areas also plays a large role in this. Plastics are more likely to be found in enclosed regions such as the Caribbean. Plastic pollution, more so in the forms of macro- and mega-plastics, potentially serves as a means of distribution of organisms to remote coasts that are not their native environments.

##### • E- waste:-

E waste describes loosely discarded, surplus, obsolete, broken, electrical or electronic devices. Rapid technology change, low initial cost have resulted in a fast growing surplus of electronic waste around the globe. Generation of e-waste is a very serious issue in world. In year 2014 produce near about 650000MT of e-waste in India that includes all waste electronics and electrical equipment (TVs, computers, sound systems, refrigerators etc.) .This waste not dispose properly finally they affect environment and human health and also create storage problem

##### • Paper:-

Plantation timber, not native forests, is the source of most paper-making pulp. Stronger, better quality paper is made from hardwoods. Softwoods produce shorter fibres suitable for paper such as newsprint. Good quality paper is in demand with recyclers to produce a variety of recycled paper products such as printing and writing paper, office supplies such as envelopes, toilet paper and tissues. Lower grade paper is usually used to make products such as cardboard and insulation. Demand for old newspapers can fluctuate. The short fibres in newsprint make it unsuitable for recycling uses other than packaging material, insulation material or being recycled back into newsprint.

##### • Glass waste:-

Glass makes up a large component of household and industrial waste due to its weight and density. The glass component in municipal waste is usually made up of bottles, broken glassware, light bulbs and other items. Adding to this waste is the fact that many manual methods of creating glass objects have a defect rate of around forty percent. Glass recycling uses less energy than manufacturing glass from sand, lime and soda.

Glass makes up a large component of household and industrial waste due to its weight and density. The glass component in municipal waste is usually made up of bottles, broken glassware, light bulbs and other items. In many cases it is not only easy to recycle, glass it can be recycled indefinitely with no loss in quality or purity. Making new glass from old glass saves energy because recycled glass is processed at a lower temperature than glass made from raw materials.

#### 5. Summary

In glass products all glass materials are not recyclable some glass products such as light bulbs, window panes, glassware and mirrors Ovenware (including Pyrex glass) Opaque white rum, black wine, and green beer bottles with ceramic tops, Pottery, Vases, Crystal, Dishes, Drinking glasses etc. such type of glass waste Disposed in a landfill involves burying the waste and this remains a common practice in most countries. Landfills were often established in abandoned or unused quarries, mining voids or borrow pits. A properly designed and well-managed landfill can be a hygienic and relatively inexpensive method of disposing of waste

materials. Older, poorly designed or poorly managed landfills and open dumps can create a number of adverse environmental impacts such as wind-blown litter, attraction of vermin, and generation of liquid leachate.

For avoiding this use of the recycled glass as aggregate in concrete has become popular in modern times, with large scale research being carried out at Columbia University in New York as well as The use of waste glass as a substitute for fine aggregates in mortar mix is one option that can alleviate waste glass disposal problem and has been studied widely in recent years. Due to the limited landfill space available and stringent environmental regulations, many waste glasses are attempting to develop efficient, economic and environmental sound alternatives for utilizing this waste glass. Therefore, the civil engineers have been challenged to convert this waste glass, in general, to useful building and construction materials. This greatly enhances the aesthetic appeal of the concrete. Recent research findings have shown that concrete made with recycled glass aggregates have shown better long term strength and better thermal insulation due to its better thermal properties of the glass aggregates.

## 6. Conclusion

We can conclude from the above discussion that the use of plastic can be possible to improve the properties of concrete which can act as a one of the plastic reusable method. [1] Eco friendly By using waste plastic in paver block 20 – 40% of plastic may reduce, it is also dangerous to environment and wildlife [2] Strength increases up to 30-35% Strength could be increased by using this plastic in the paver block by 30 to 35% by normal paver block and also help in reducing waste by 20 to 40%.

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