# UTILIZATION OF PLASTIC FIBRES IN CONCRETE TILES

## A MAJOR PROJECT-I REPORT

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF

## BACHELOR OF TECHNOLOGY

(Civil Engineering)

**SUBMITTED TO**

**TECHNO INDIA NJR INSTITUTE OF TECHNOLOGY, UDAIPUR**

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# DECLARATION

I hereby certify that the work which is being presented in the B.Tech. Major Project – II Report entitled **"UTILIZATION OF PLASTIC FIBRES IN CONCRETE TILES"**, in partial fulfilment for the award of the **Bachelor of Technology in Civil Engineering** and submitted to the Department of Civil Engineering of Techno India NJR Institute of Technology, Udaipur, Rajasthan is an authentic record of our own carried out during a period

from **Mar-2022 to Jun-2022 (8th Semester)** under the supervision of **Jitendra Choubisa, Civil Engineering Department.**

The matter presented in this Report has not been submitted by me /us for the award of any other degree elsewhere.

**Signature of students**

Vaibhav Nikhil Sanjay Pearl

This is certify that the above statement made by the students is correct to the best of my knowledge.

**Signature of Supervisors**

**Date:** 18/06/2022

**Head**

**Civil Engineering Department**

Rakesh 25/06/2022

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# CERTIFICATE

This is to certify that entitled **"UTILIZATION OF PLASTIC FIBRES IN CONCRETE TILES"**, is submitted by Vaibhav Tamboli, Nikhil Kumawat, Sanjay Prajapat, Pearl Bhanawat in partial fulfillment of the requirements for the award of the Bachelor of Technology in Civil Engineering during a period from Mar-2022 to Jun-2022 (8th Semester) from Techno India NJR Institute of Technology affiliated to RTU Kota is approved for award of the degree.

**Principal/ Director**

**Techno India NJR Institute of Technology**

**Udaipur, Rajasthan**

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# CHAPTER 1

# INTRODUCTION

The increase of population in world has led to the generation of large amount of waste products such as waste plastic. These waste plastics will remain in the environment for hundreds of years, this has become inevitable problem in the present world. There is an immediate need for solution for such problem. To bring down the waste products many methods has been proposed and one of them is usage of these waste plastic in concrete which may reduce the environmental problems up to certain extent.

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. In many industries flooring is done by concrete tiles, in order to reduce cost, easy manufacturing & installation. The materials provided between machines and floor to avoid damages due to vibration from machines to floors becoming important one. This paper is about to adding dampers such as waste plastic bottles directly with concrete tiles to increase its flexural strength which minimally acts in a concrete tile.

Plastic can be reused in various sectors like marketing, manufacturing, transportation etc. In construction sector, we can use the plastic waste on plastic is a very useful substance in our dailylife work, but after the use of plastic it is very difficult for us to dispose of it because it is a non- biodegradable substance. After its usage it is a hazardous material. 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. The properties of plastic are very unique and it can mix with every kind of material. Plastic is a composition of synthetic and semi synthetic organic compounds. They are malleable and ductile and remold into any solid substance. Plastic is used in various objects which we use in our daily life like polythene, plastic cups, furniture, bags, packaging of food and other accessories, drinking containers, bottles, frames, basins etc. We need to use better advance techniques and methods to dispose plastic waste properly; otherwise, the time is not too far away where we see it as a big challenge for us to dispose it. In India, we use incinerators to dispose the plastic waste in which plastic waste burns on high temperature. The gases which evolve during this burning process pollute air and water. Due to this, a large number of people get affected and suffer from many harmful diseases. Researchers suggest that if plastic isn't disposed of soon, it can sustain for 4500 years without degradation. Now, these days the rate of plastic use keeps increasing. So the collection of plastic waste increasing at a rapid a very large scale after recycling it, which means the problem of plastic waste, can be removed for a long time period. It seems to be more practicable and efficient method to solve this problem. In construction field, many types of tiles are used like - clay tiles etc. In this project we try to us plastic based tiles which have better characteristics than any other type of tiles. Plastic sand tiles are cheaper than normal tiles.

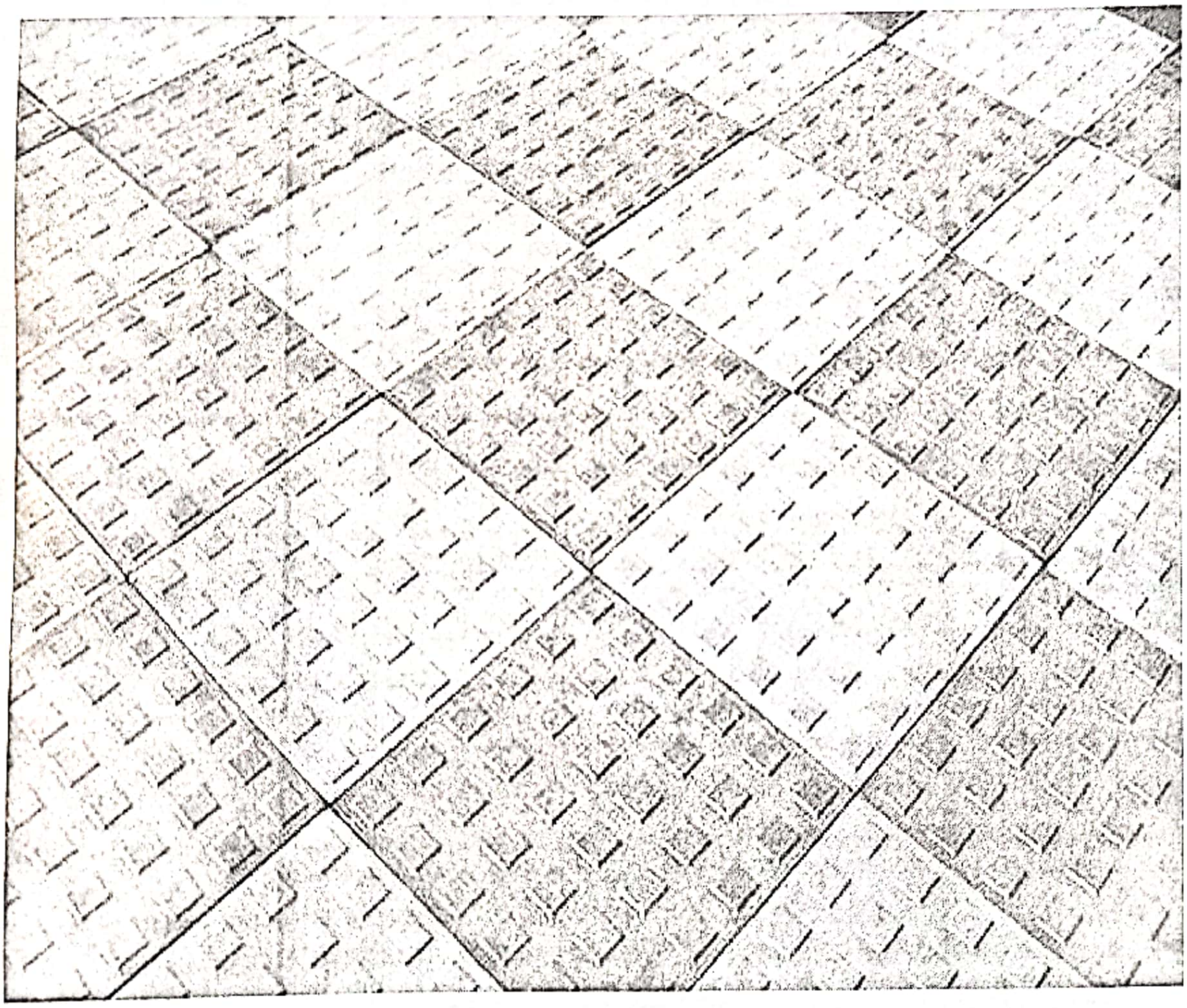

**Figure 1: Concrete Tiles**



Concrete is a composite material composed of various constituents, including cement, sand, coarse aggregates, additives and water . Conventional concrete has shortcomings in terms of its tensile strength, ductility, energy absorption, shrinkage cracking and crack resistance.

In order to address these shortcomings, concrete mixtures have begun to incorporate various types of fibers. The incorporation of fibers in concrete is generally intended to improve its mechanical performance for many applications, such as bridge decks, concrete roads, slabs and buildings. However, recycled-waste fibers are gaining the attention of researchers to enhance the performance of concrete. Fibers are frequently used in the production of lightweight cement-based composite (CBCs), which have a minimal density and a higher thermal insulation capacity, and self-compacting concrete (SCC), which can attain good compaction devoid of mechanical vibration.

These wastes (plastic) are almost non- degradable in the natural environment even after a long period of exposure. So, plastic waste is now a serious environmental threat to the modern way of living. It is not feasible touse waste plastic for land filling, which require huge land space area and as well land loses its fertility. In this consequence, big attention is being focused worldwide on the environment and safeguarding the natural resources through recycling of waste plastic materials in the recent years.

It is possibility of disposal of these wastage in mass concrete such as in heavy mass concreting in PCC in pavements where the strength of concrete is not a major criterion under consideration. The waste plastic is one component of Municipal Solid Waste (MSW). Since the plastic is very low biodegradable material the disposal of the waste plastic causes big problems to the environment. As from many years the research concern that the use of by-products from industry may augment the properties of concrete. In the modern decades, the use of by-products such as silica fume, glass culvert, fly ash, ground granulated blast furnace slag (GGBS) etc., efforts have been made to use in civil construction. The application of the industrial by- products in concrete is as partial replacement of cement or partial replacement of aggregate. The use of these waste plastic in concrete can control the environmental problems or constraints if safe disposal of these products.

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## CHAPTER 2

## OBJECTIVE

In many industries flooring is done by concrete tiles. Damping materials such as rubber is provided between machines and floor to avoid damages due to vibration from machines to floor. Solid waste management is becoming as an materializing area by the impact of plastic waste. The used PET bottles (Polyethylene Terephthalate Bottles) are also one of the major solid wastes. There are numerous products polluting the environment and harming wildlife. The concept of reduce, recycle and reuse is promoted presently for the better solid waste management. The fibers from the PET bottles waste taken by many of the researchers, and proves that flexural capacity of the concrete can be enhanced. Many industrial units has been introducing new techniques to incorporate recycled products into their materials. This paper is about to adding dampers such as waste plastic bottles in the form of fibers incorporated with concrete tiles to increase its flexural strength which slightly acts in a concrete tile.

**Figure 2: PET Bottles**

# CHAPTER 3

# LITERATURE REVIEW

The work aims to study the possibility of disposing waste plastic as fine aggregate in concrete. In this study waste plastic mix concrete is also reinforced with polypropylene fiber to get the advantages of fiberreinforced concrete. For this, an experimental study was carried out with three different grades of concrete (M20, M25 & M30) to evaluate mechanical and durability properties of waste plastic mix concrete with and without the addition of fiber. Sand is substituted with plastic waste at a dosage of 15% by volume which is the optimum percentage without considerable reduction in strength. Results show that adding polypropylene fiber we can improve the quality of waste plastic mix concrete. The compressive strength of WPC was lowered by the addition of plastic, the reduction being in the range 4 to 7 %. But this loss was compensated to a certain extent by the addition of polypropylene fibers to WPC whereby the loss percent reduced to around 3 %. The flexural strength of WPC was lowered by the addition of plastic, the reduction being in the range 10 to 18 %. But this loss was compensated to a certain extent by the addition of polypropylene fibers to WPC. There will be an increase in flexural strength around 25 % when compared to Normal concrete. These results suggest that plastic waste mix concrete may be a useful cementation composite with better durability characteristics than normal concrete.

The paper presents the results of an investigation to study the performance of concrete prepared with E- plastic waste as part of coarse aggregate. An effort hasbeen made to detail a systematic study of compressive strength of concrete with various proportions of E- waste as coarse aggregate in concrete. The test results showed that a significant improvement in compressive strength was achieved in the E-plastic concrete compared to conventional concrete. The tests were also designed to evaluate the internal pore structure, its chemical resistance to environmental agents and reactivity with some components of the cement. The results indicated that the E-plastic aggregate up to 15% weight of the coarse aggregate and replacement of cement with fly ash (10% by weight) can be used effectively in concrete and thus results in waste reduction and resources conservation.



Experimental investigation was done using M20 mix and tests were carried out as per recommended procedures by relevant codes and also Hair is used as a fibred reinforcing material in concrete as partial replacement of cement. Tests wereconducted to determine the properties of plastic aggregate and human hair such as density, specific gravity and crushing value. Experiments were conducted on concrete cubes with various percentages of human hair i.e. 0%, 0.5%, 1%, 1.5%, 2%, and 3% by weight of cement and with constant percentage of plastic aggregate as 20%. The percentage of human hair weretaken as 1%, 1.5%, 2%, 2.5%, 3%The percentage of human hair were taken as 1%, 1.5%, 2%, 2.5%, 3% itwas found that the compressive strength was increased for 3% compared to normal concrete. Industrial wastes from polypropylene (PP) and polyethylene terephthalate (PET) were studied as alternative replacement of a part of a conventional fine sand of concrete. Four replacement levels, 20%, 40% & 60% by volume of aggregates were used for the preparation of the concretes. The results of this research suggested that PP and PET can be used in concrete containing 40% by volume of PP and PET as fine sand replacement give satisfactory result. The concrete for M20 grade has a nominal compressive strength is 20 N/mm2. Replacement of natural river sand by plastic waste material in 20% and 40% increase in the compressive strength of concrete up toacceptable limit.

- Concrete is economical in the long run as compared to other engineering materials. Except cement, it can be made from locally available coarse and fine aggregates.
- Concrete possesses a high compressive strength, and the corrosive and weathering effects are minimal. When properly prepared its strength is equal to that of a hard natural stone.
- The green concrete can be easily handled and molded into any shape or size according to specifications. The form work can be reused a number of times of similar jobs resulting in economy.
- It is strong in compression and has unlimited structural applications in combination with steel reinforcement. The concrete and steel have approximately equal coefficients of thermal expansion.
- The concrete is extensively used in the construction of foundations, walls, roads, airfields, buildings, water retaining structures, docks / harbours, dams, bridges, bunkers and silos, etc.
- Concrete can even be sprayed on and filled into fine cracks for repairs by the guniting process.
- The concrete can be pumped and hence it can be laid in the difficult positions also.

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# CHAPTER 4

# CRITIQUE

## DURABILITY OF CONCRETE

A durable concrete is one that performs satisfactorily in the working environment during its anticipated exposure conditions during service. The materials and mix proportions specified and used should be such as to maintain its integrity and, if applicable, to protect embedded metal from corrosion. One of the main characteristics influencing the durability of concrete is its permeability to the ingress of water, oxygen, carbon dioxide, chloride, sulphate and other potentially deleterious substances. Impermeability is governed by the constituents and workmanship used in making the concrete. With normal-weight aggregates a low permeable concrete is achieved by having adequate cement content, sufficiently low water/cement ratio, by ensuring complete compaction of the concrete, and by adequate curing. The factors influencing durability include: i. The environment; ii. The cover to embedded steel; iii. The type and quality of constituent materials; iv. The cement content and water/cement ratio of the concrete; v. Workmanship, to obtain full compaction and efficient curing; vi. The shape and size of the member. The degree of exposure anticipated for the concrete during its service life together with other relevant factors relating to mix composition, workmanship, design and detailing should be considered. The concrete mix to provide adequate durability under these conditions should be chosen taking account of the accuracy of current testing regimes for control and compliance as described in IS 456.

The potential of crushed tiles as coarse aggregate in concrete. Test result of bulk, saturated surface dry and apparent specific gravities bulk unit weight water absorption resistance to abrasion percentage of voids and grading on two types of crushed tiles were compared with the results of the conventional crushed stone aggregate. Also

included are results from tests on concrete cylinders under uniaxial compression split tension and beam under flexural to determine the influence of variables of test age on concrete strength type of tiles and ratio of volume of crushed tile to the total volume of coarse aggregate in concrete. Recommendation for use of crushed tiles as coarse aggregates in concrete.This study examines the suitability of ceramic industrial wastes and huge amounts of basaltic pumice as a possible substitute for conventional crushed fine aggregates. Experiments were carried out to determine abrasion resistance, chloride penetration depths and the compressive strengths of concrete with crushed ceramic waste and basaltic pumice fine aggregates and to compare them with those of conventional concretes. Test results indicated that ceramic wastes and basaltic pumice concretes had good workability. Furthermore, it was found that abrasion resistance of crushed ceramic (CC) and crushed basaltic pumice (CBP) concretes was lower than that of conventional concretes. Test results also showed that maximum abrasion rate was obtained from specimen control (Mo), while minimum abrasion rate is obtained from M3 (60% crushed ceramic concrete) specimens. Abrasion resistance was increased as the rate of fine CC was decreased. Abrasion resistance of concrete was strongly influenced by its compressive strengths and CC and crushed CBP content. The crushed ceramic addition percentage decreased as the chloride penetration depth increased. Results of this investigation showed that CC and CBP could be conveniently used for low abrasion and higher compressive strength concretes.

On the other hand, several studies on the use of WRSF in concrete STS have reported inconsistent results. Rubber particles attached to WRSF were intended to have a negative influence on the STS of concrete. Rubber is a soft material by nature, as opposed to the dense matrix of cement, which resulted in an elastic inequity and acts as voids due to the minor resistance to the load . The rubberized concrete with WRSF was investigated, and it was noted that the STS of the concrete decreased by 50% as a result of the addition of rubber, although the WRSF addition was beneficial in achieving strength, and it reduced the strength loss of the composite. Similarly, the improvement of STS was noticed in recycled aggregate concrete with a 3% addition of WRSF. The influence of WRSF extracted from various tire scraps with different aspect ratios on the concrete STS was examined. No major enhancement in STS was noticed by adding WRSF. Moreover, WRSF was at risk of corrosion in the high chloride environment, which reduced the fibers' mechanical strength; as a result, the STS of the concrete decreased. A study was conducted on high-strength concrete beams with waste PET plastic bottle fibers of varying lengths and volume contents. The STS of the concrete was reduced with increasing the fiber amounts, and the lowest drop in strength was nearly 3.67% compared to the control sample when different hybrid 40 mm long and 20 mm short fibers were used, with a total fiber content of 0.75%. Thus, it was stated that 0.75% fiber content is the optimal ratio. The researcher observed similar results when varying the volume content of WRPF; these findings may indicate a weakness in the fiber–cement matrix interface. Similarly, a reduction in the STS of cement mortars was noted with varying volume contents of

WRPF. Additionally, a concrete mixture containing 0.4, 0.75 and 1.2% WRPF was investigated. Two types of fibers were used in accordance with the aspect ratio. The outcome demonstrated the enrichment of STS by incorporating fibers into the concrete. The 0.4% fiber content was determined to be optimal for the maximum STS. Additionally, it was stated that varying the aspect ratio has little effect on the STS. Similarly, a study was conducted to determine the effect of WRPF on the MPs of conventional concrete and binary cement concrete. Furthermore, a study was conducted on cement mortars utilizing a range of waste PET fiber volume fractions. The results indicated that the addition of 0.5% fibers increased the STS to 16%. Additionally, the ability of the novel concrete composite to provide resistance against the stresses of tensile forces was observed. Additionally, other studies reported that the STS improved as the fiber length and aspect ratio increased. Further investigation revealed that adding 0.5% and 1.0% of type C WRPF to concrete increased its STS by nearly 21% and 33%, respectively. The STS enhancement of fiber types A and B was addressed sequentially in comparison to fiber type C. Enhancements in the STS of 15.5% and 24.9% were noticed with the addition of 1.0% ofPET fibers with varying aspect ratios of 35 and 50, respectively.

According to several scholars, the STS improvement of concrete with WRPF was greater with the addition of fiber percentage contents ranging from 0.25% to 2.0% by volume. A 12.5% increase in STS was observed in comparison to the PC when 1% waste recycled PET fibers were used. Additionally, another study reported that concrete with WRPF had the highest STS increment with a fiber content of 0.5%. Moreover, the highest STS enhancement was observed when a 0.75% volume of WRPF was added to the concrete. It was observed that when the WRPF content was increased in the composites, the STS improved significantly. Increases of 16.5%, 24%, 25.5%, 19% and 14.4% were noticed with WRPF fiber contents of 0.25%,0.50%, 0.75%, 1.0% and 1.25%, respectively, compared to the normal concrete. The optimal WRPF content was determined to be 0.75%. This effect could be attributed to the increased interaction between WRPF and the cement matrix. Moreover, the presence of fibers in the concrete enhanced the barrier to oppose to indirect tension, increased the strain capacity of concrete, and resulted in a greater STS. A study was conducted on the MPs of concrete using WRCF. It was observed that increasing the fiber content improved the STS of concrete at various curing ages. Increasing the fiber content by 0.5%, 1.0%, 1.5% and 2.0% resulted in an increase in STS of 9%, 18.2%, 27.3% and 15.2% after 1 day of curing. Additionally, it was found that the highest increase in STS appeared when the volume content of fiber 1.5% of the concrete. It was reported that specimens of green concrete containing WRPF performed significantly better than the control mix. At 28 days of age, the different fiber volume fractions of 0.25%, 0.50%, 0.75%, 1.0% and 1.25% improved the STS by 17.2%, 26.2%, 20.3% and 17.2%, respectively, compared to the control mix. The optimal fiber content for the STS was 0.50%. Similarly, the addition of WRCF enhanced the STS of CBCs. The effect of fiber bridging on the splitting portions of the samples acts as a stress transfer from the constituents of the concrete to the fibers, which is why it sustained the total splitting tensile stresses gradually and eventually improved the STS of the samples. Moreover, at 180 days of age, an increase in STS of 15.4%, 17.9%, 19.2%, 11.55% and 7.7% was observed with fiber fractions of 0.25%, 0.50%, 0.75%, 1.0% and 1.25%, although this strength was slightly greater than that from 91 days of age. Furthermore, the greatest STS increase was observed at the fiber proportions of 0.75% and 0.50%, at 180 and 91 days, respectively. Similar outcomes for enhancements in STS were also stated in numerous studies

**Figure 4: Concrete Tiles in Rubber moulds**

The influence of MSF and WRSF on STS of SCC. The mixed M0, M01, M02 and M03 represent self-consolidating concrete with MSF contents of 0, 0.5, 1.0 and 1.5% respectively. The mixes M11, M12 and M13 represent self-consolidating concrete with WRSF contents of 0.5, 1.0 and 1.5 %, respectively indicates that a rise in STS was recorded at 7 days with WRSF when compared with the normal SCC, which further improved at later ages. A significant rise in STS can be observed with the addition of MSF fiber. A maximum of 50% improvement can be seen with the addition of WRSF at 7 days with 1.5% fiber content (M13), which was further improved at later ages. When compared to plain SCC without fibers, WRSF and MSF exhibited superior tensile behavior at later ages. The inclusion of WRPF with various fiber aspect ratios resulted in a drop in the STS ranges from 9 to 16% when compared to the normal concrete.

# CHAPTER 5
# PROBLEM STATEMENT

Our project is about to compare the results of normal concrete tile to the concrete tile with addition of waste plastic fibers. These kinds of tiles reduce cost and wastage. In addition of that they are easy in manufacturing and installation process in industries for flooring and reuse them in innovative way by modern techniques.

Solid waste management is the most pressing environmental challenge faced by urban and rural areas of Nigeria. Nigeria, with population exceeding 170 million, is one of the largest producers of solid waste in Africa. (Bioenergy consult 2016). There is rapid growth in the Nigerian population and the increase in population comes with increase in waste generation. Nigeria generates around 32 million tons of solid waste annually, out of which only 20-30% is collected (Bio-energy consult 2016). The waste are disposed in open spaces, road sides and within residential buildings. Sorting plastic waste and using it in construction will reduce waste accumulation to a great extent. There are construction stages that does not require normal concrete or heavy load and alternatively lightweight can be used on the building or structure.

The continues rise in solid plastics waste and cost of building materials over the years in Nigeria and the world at large, forced researchers to look for ways of addressing the problem. Plastics waste which is one of the non-bio-gradable materials as stated earlier causes a lot of environmental pollution, and there is the need to find solution to such menace. It was reported that recycling of waste materials can be economical and as a consequence reduces pollution and contamination.

The problem with cement concrete are in terms of low tensile strength, permeability to liquids, corrosion of reinforcement, prone to biological or chemical attack, poor freeze/thaw resistances. Research and Development has a new dimension in the use of affordable local building materials in addressing the concrete drawbacks, such as the use of waste plastics and other admixtures for improving the performance of concretes.

Cement and sand are tested as per IS standards and verified. he recycled plastic was used with partial replacement of fine aggregate at 5%, 10%, and 15% for making the concrete specimen. The plastic aggregate with size of less than 4.75mm are used.

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To accomplish the above set objectives in the present study the mix design for strength was developed basedon trial batches. Numbers of tiles each with 15%, 20%and 25% 30% 35%, replacement of cement by waste plastic have been cast for assessing the compressive strength of concrete. Then six numbers of tiles shouldbe with the replacement of cement by waste plastic have been cast for assessing the compressive strengthof concrete tiles. The Table 3.1 represents the concrete mix proportion. Figure 3.1 and 3.2 represents the waste plastic and plastic hot gel used in the present investigation.

The primary focus of this research is on environmentally friendly construction materials. Furthermore, this state-of-the-art study examines the influence of RFs on the MPs of CBCs. The key aim of this review is to evaluate and thoroughly examine the existing literature on the impacts of various kinds of RFs on the overall behavior of composites. The compressive, flexural and tensile strength, and the durability of RF-reinforced CBCs are analyzed. This study will provide a baseline for future studies on RF-reinforced CBCs. Researchers will benefit from the study's comprehensive overview of RF output characteristics.

# CHAPTER 6

# MATERIALS AND METHODOLOGY

Ordinary Portland Cement 33 grade were used to make concrete tile to compare with fiber added concrete tile. The river sand and 10mm coarse aggregate were to be taken for specimen casing.

## Properties of Materials

Initial setting time = 30 minutes for sample cement Final setting time = 10 hours
Fines modulus = 1.754

Specific gravity of cement = 3.10 g/cc Specific gravity of fine aggregate (G) = 2.44
Percentage of water absorbed = 5.21 %

Specific gravity of coarse aggregate (G) = 2.58 Percentage of water absorbed = 1.71 %

## Mix Ratio

Mix design of normal concrete tile is 1:1.5:3 Mix design of concrete tile with plastic fiber is having 5%, 10%, and 15% of plastic fiber with respect to weight of cement.

Table no. 1

| DIMENSIONS OF TILES | | |
|---|---|---|
| LENGTH (mm) | BREADTH (mm) | DEPTH (mm) |
| 457 | 457 | 10 |

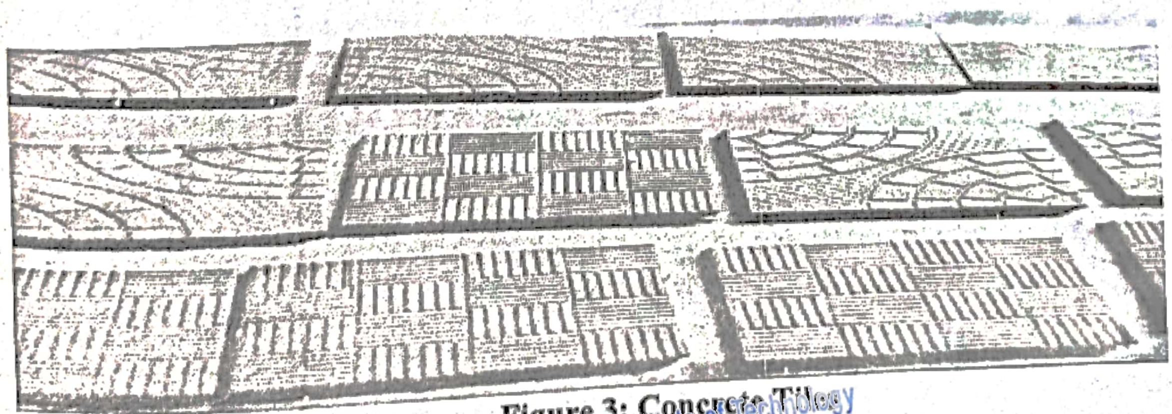

Figure 3: Concrete Tiles

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**Experimental Investigation**

Preparation of mold: 300mm*300mm*10mm size mold were prepared for casting of tile specimens. The tiles were casted with manually.

Preparation of mold (Rubber and Plastic): 300mm*300mm*20mm size mold were prepared for casting of tile specimens.

The waste RFs used in CBCs are broadly classified into three categories, namely, WRPF, WRCF and WRSF. In order to produce WRPF, post-consumer plastics are processed and washed before being sliced manually through a paper shredder or a compact disk (CD) cutter device. The bottom and neck of the plastic bottles are removed for other uses. Other scientists have used long plastic chips made of machined steel waste pieces in commercial vehicle plants. In technological plants, plastic fibers are produced. Wasted polyethylene terephthalate (PET) bottles are used as raw materials for the replication of plastic fibers; after spinning, stretching, stabilization, winding and polygraphing, the process begins with crystallization, drying and a pneumatic conveyor, and then progresses to the dose, extrusion and filtering. The fibers have tensile forces between 263 and 550 MPa, and a specific gravity of 1.34 $kg/m^3$. Some scientists used maleicon hydride grafted polypropylene to cover the surface of the WRPF for the de-bonding among the fiber and concrete. This enhances the distribution of RF. The waste carpet recycling process begins with the sorting of waste carpets according to fiber type and production, and then progresses to mechanically separating the fibers from the backing using a series of screening, shredding, cutting, tearing, screening, sifting and cleaning tools. The end product can finally meet the quality management standards. A portion of the waste recycled carpet fibers used in concrete come from waste carpet recycling plants. The majority of WRSFs are produced from expired vehicle tires. WRSF can be separated mechanically from expired tires through shredding and cryogenic methods; it can also be produced through anaerobic thermal degradation, such as microwave-induced and conventional pyrolysis.

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## MATERIAL PROPERTIES

Ordinary portland cement 33/43 grade were used to make concrete tile to compare with fiber added concrete tile. The river sand/M sand and 10mm coarse aggregate were to be taken for specimen casing.

- Cement - 1bag(50kg)
- Fine aggregate - 125kg
- Course aggregate:-
  - 10mm - 180kg
  - 6 mm - 60kg
- Water - 60 litre
- Plasticizers/ Water reducer- 400ml

We can also add color according to our requirement and red & yellow is common color used in tiles.

The properties of each materials used to produce High Strength Concrete are discussed below in the followingsub-section.

### Cement

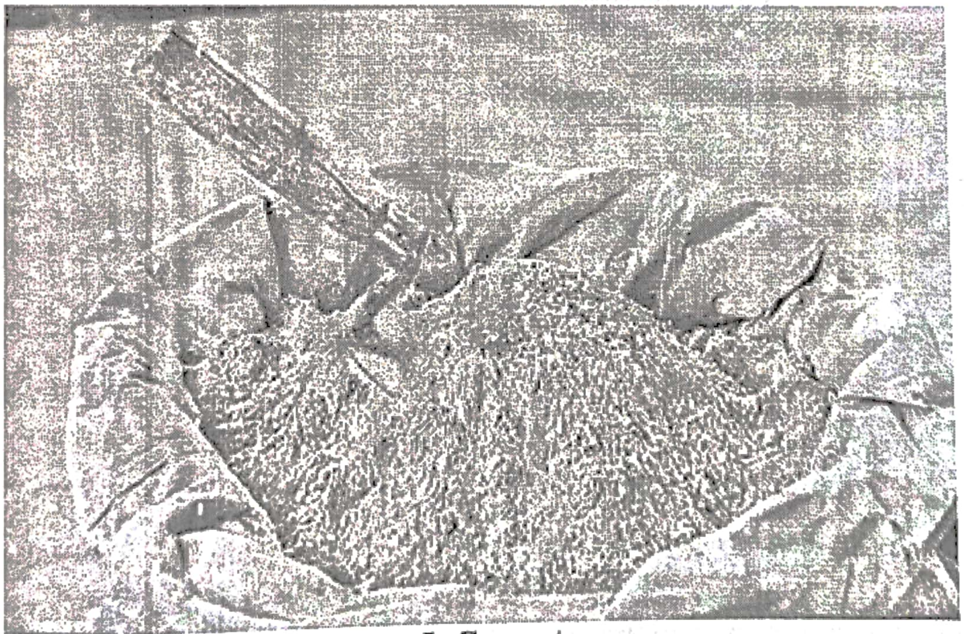

**Figure 5: Cement**

The Portland pozzolana cement is a kind of blended cement which is produced by either intergrading of OPC clinker along with gypsum and pozzolanic materials separately or thoroughly blending them in a certain proportions. Pozzolana is a natural or artificial material containing silica in a reactive form. It may be further discussed as siliceous and aluminous material which in itself possesses little or no cementations properties, but it chemically react with calcium hydroxide at ordinary temperature to form compounds possessing cementations properties. Portland pozzolona cement produces less heat of hydration and offers greater resistance to attack of aggressive waters than ordinary Portland cement.Pozzolona cement shall comply the requirements of IS 1489. 53 grade Portland pozzolona cement with brand name Shankar Cement was used in this project.

The addition of silica fume (SF) creates a dense and compact cement matrix, and increases the bond strength among the fiber surface and the surrounding matrix, thereby improving the CS and ductility of WRSF concrete. However, increasing the fiber content beyond the threshold value has a detrimental effect on the cement matrix structure, ultimately resulting in the fall of the concrete's CS. This investigation was conducted using WRSF fibers with varying volume contents up to 0.75%. The results indicated a 5% increase in CS with a 0.5% fiber content, but an unfavorable impact of fiber incorporation was noted when the WRSF was 0.75% content by volume, resulting in non-uniform fiber dispersion and a non-homogeneous cement matrix; this inconsistency in the composites matrix eventually resulted in an 8% decrease in CS. Similarly, 3% of WRSF by mass was recommended as the optimal dosage for higher roller-compacted concrete's CS. With a fiber volume content of 0.46%, a decrease in CS from 33.61 to 31.60 MPa was observed, and it was determined that the random distribution of WRSF in CBCs might cause fiber congestion, resulting in a small decrease in CS. Another study discovered an optimal content of hybrid WRSF and ISF. By combining 30% ISF and 70% WRSF with a total content of 1%, the CS improved by 5–10%, while a fiber fraction of 1.25% resulted in a CS loss of 5%. The shape of the fibers, their surface morphology, and the quantity of rubber affixed to the WRSFs from waste tires all significantly affect the concrete's CS. With the addition of 0.46% of rough and randomly distributed WRSF, superior resistance was observed against crack occurrence, as well as a 25% increase in the CS. The existence of rubber attached to the surface of WRSF, on the other hand, has a negative impact on the concrete's CS. The hydrophobic nature of rubber and the lack of adhesion to the surrounding matrix has an unfavorable influence on the performance of concrete. The results indicated that the CS value decreased from 135.5 to 130.2 MPa, but WRSF without any rubber attached to the surface increased the CS value from 135.5 to [illegible].3 MPa (4.3%). The increased mechanical bonding caused by frictional stress created by the corrugated surface and the geometry of the WRSF results in a rise in CS. The WRSF provides resistance to cracks through a bridging effect and lateral crack resistance, resulting in theenhanced CS of CBCs

In general, the addition of WRPF resulted in the decreased CS of CBCs.The loss of CS was documented in several studies carried out to investigate the MPs of CBCs comprising PET waste fibers of varying content and length. When 1% PET waste fiber was incorporated into cement mortars, no CS enhancement was observed, while 1.5% PET waste fiber content reduced the CS. Numerous researchers have investigated the incorporation of metalized WRPF into CBCs. A study used waste fibers with varying.

lengths (5, 10 and 20 mm) and volume contents (0.5, 1.0, 1.5 and 2.0%). Their findings indicated that adding 1% fiber volume resulted in a slight decrease in CS; however, adding more fiber volume resulted in a greater decrease in CS. Increased the fiber length increased the CS loss. Another study examined the effect of high-density polyethylene RFs on the MPsof concrete. Fibers of 0.4, 0.75 and 1.25% content and two different sizes were used. There was no effect on the CS of concrete with the addition of the fibers. Similarly, another study was performed on the MPs of concrete beams using PET waste RFs produced from bottles. Various concentrations of waste fibers ranging from 0.25 to 2.0% were used, and the results indicated a slight increase in concrete CS up to a proportion of 1% fiber. A decrease in CS was observed as the amount of fiber increased. The improvement in CS could be attributed to the fibers' proper dispersion within the mix. Furthermore, the fibers reduced the propagation of microcracks, lengthening the time before they fail, and the samples required extra load to expand the cracks. Additionally, the reasons for the decrease in CS for more than 1% fiber addition are related to the production of bulk and the segregation of fibers. The same results were also observed in another study. It was noted that the addition of 1% PET waste fiber increased the strength of concrete by approximately 5.2 and 7.3%, when two different aspect ratios of 35 and 50 were utilized in the concrete as reinforcement, respectively. Comparable results have been observed in other studies when different kinds of WRPF were used in CBCs. Another study conducted on concrete containing straight and deformed WRPF of varying lengths and volume content reported a CS decrease of approximately 0.5–8.5% for both straight and deformed fibers. The CS loss was greater for straight fibers in a smaller quantity, whereas the deformed fiber's negative effect was greater at higher quantities.

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The influence on MPs of concrete incorporating distinct amounts of WRCF ranging from 0.25 to 1.25% was investigated. It was discovered that increasing the fiber content decreased the CS. However, this decrease was not excessive, and the CS remained within the permissible limit for structural applications. The results indicated that the concrete CS decreased by 2.14%, 6.14%, 10.23%, 14.8% and 20.76% at fiber fractions of 0.25%, 0.50%, 0.75%, 1.0% and 1.25%, respectively. The decrease in CS was possibly due to the presence of porosity and voids within the matrix because of the WRCF's addition and the existence of a weak bond at the fiber-matrix transitions. Similarly, a further study on the creation of eco-friendly concrete containing varying proportions of WRCF was carried out. A slight decrease in the CS was found as the WRCF proportions were increased. At 91-days of curing age, the reduction range was 1.6–20.8% compared to the reference mix. While comparing the CS with the age of concrete, the 91-day CS of WRCF concrete was increased by 2.8–21.3% from 28-days, and by 9.7–23% from 7-days of age. Additionally, the researchers investigated the combined influence of WRCF and palm oil fuel ash on the CS of eco-friendly concrete. It was discovered that substituting 20% palm oil fuel ash for cement and 0.5% WRCF reduced the CS by 18.2%, 16.3% and 5.4%, at 7, 28 and 91-days age, respectively, compared to the reference sample. The use of WRCF showed a considerable reduction in CS by 15%, 35%, 23% and 51% at 0.5%, 1.0%, 1.5% and 2.0% fiber contents, respectively, at 1 day of curing age. This reduction was mitigated to some extent as the curing age of the concrete samples increased. The same results were obtained when WRCFs of varying shapes and volume contents were used. A slight decrease in the CS was noted when waste-recycled nylon fiber from carpets was incorporated into the CBC. Furthermore, it was observed that adding 1% waste propylene carpet fibers had discernible adverse effect on the CS of CBCs.

In the comparison of the CS of mixes, a control mix containing natural coarse aggregate only represented by CNC, and a control mix containing natural fine aggregate only represented by CNF with and without fibers. The water cement ratio is 0.34 for the CNC and CNF mixes. The figure indicates that the mix CNF has a higher CS than CNC at all ages. Finer aggregates enabled a more dense pore structure and improved the interface amongst the cement matrix and aggregate. Moreover, fiber addition enhanced the CS of the mixes compared to the control mixes. This improvement was greater with the effect of manufactured steel fiber (MSF) and WRSF on the CS of SCC. The mixes M0, M01, M02 and M03 represent self-consolidating concretes with MSF contents of 0, 0.5, 1.0 and 1.5%, respectively. The mixes M11, M12 and M13 represent self-consolidating concrete with WRSF contents of 0.5, 1.0 and 1.5 %, respectively. Figure 4a indicates that the 7-day CS of WRSF has no substantial variation in comparison with the control mix (M0). However, at the later ages, i.e., 28, 60, and 90 days, there was a significant improvement in the CS of self-consolidating concrete with the addition of WRSF (M11, M12, M13) compared to the control mix, which was minutely smaller than the self-consolidating concrete with micro–SF depicts the percentage variation in the CS of fiber WRSF composites with respect to the control mix. A CS increase of 37.68% was observed at 1.5% content by volume of MSF after 90 days, in comparison with the control mix. The enhancement in CS with WRSF at 1.5% content by volume was only 26.22% after 90-days. The CS was found to be relatively equivalent at 60 days for 0.5 and 1% MSF and WRSF in self-consolidating concrete, respectively. However, when specimens were investigated for their compressive performance, it was discovered that WRSF was more efficient than MSF at resisting cracks and delaying a smooth failure of specimens devoid of high damage, i.e., the broken matrix remained attached to the WRSF depicts the ultimate CS of the control concrete and WRPF reinforced concrete. Whereas the ultimate CS of concrete means its maximum compressive strength, the CS of the control concrete was 30.8 MPa, which is 6% higher than the average of all of the WRPF reinforced concrete samples. Additionally, the variation in CS of WRPF reinforced concrete compared to the control concrete was greater at higher fiber contents than the lower fiber content. Moreover, the reduction in CS was related to the aspect ratio of the WRPF fiber; samples with longer fibers performed worse than those with shorter lengths. Considering the results and their variation intervals, it could be concluded that the addition of fibers to concrete does not significantly affect its compressive strength. the addition of SF than the waste plastic fiber due to the increased mechanical strength of SFs. Additionally, the improvement in CS was more noticeable in FRCs with age, where the CS at 90 days was 25% greater than the CS at 28 days. The increased CS of FRCs may be attributed to a strengthened fiber–matrix bond caused by continuous hydration at later ages represents the CS of FRCs containing two types of fibers, including textile waste (TW) and control kraft pulp (CTR) fibers at 6, 8 and 10% contents by weight of cement. TW with 6, 8 and 10% mixes with 0.42, 0.44, 0.44, 0.40, 0.5, 0.5, 0.45, 0.4 and 0.45 water:cement ratios for the ages of 7, 28 and 56 days were observed. CTR with 6, 8 and 10% mixes with 0.43, 0.44, 0.44, 0.42, 0.42, 0.35, 0.45, 0.39 and 0.35 water:cement ratios for the ages of 7, 28 and 56 days were observed. The CS decreased significantly as the fiber content increased with each type of fiber composite with 6% fiber content had the highest CS, between 85.8 and 119.1 $N/mm^2$ at 7 and 56 days. The composite with 10% TW fibers had the lowest values, between 43.2 and 88.9 $N/mm^2$ at 7 and 56 days. This decrease may be explained by the fact that increasing the fiber fraction results in an increase in voids, which weakens the material.

Numerous research studies found an increase in FS when WRPF was added to the concrete. A study was conducted to determine the effect of waste high-density polyethylene fibers on the MPs of concrete. Two distinct sizes of fiber and content in the range from 0.4 to 1.25% were utilized. The results revealed a steady rise in the FS of the CBCs. The specimens with smaller fiber lengths and diameters resulted in a greater FS than the specimens with longer fibers and higher diameters. Similar results were observed in numerous studies on cementitious composites containing distinct fiber quantities and sizes. The effect of WRPF addition on the MPs of cement mortar was examined. The improvement in FS was observed at a 30% volume content after 28 days, and at a 50% volume content after 63 days. The factors contributing to the increase in the FS of the concrete composites are the presence of fibers in the concrete tension zone, which resist tensile stresses and microcracks for a small period of time, thereby increasing the microcrack bridging action. Several studies reported that the maximum FS improvement achievable with WRPF-reinforced concrete is at 0.5% fiber content in CBCs. Another study reported FS improved by 19 and 7% when the fiber proportions were 0.5% and 1.0%, respectively. On the other hand, metalized WRPF was added to the green CBCs to investigate its effect on the concrete's various properties. It was found that an increasing amount of fiber in the concrete composite resulted in an increase in FS, with the maximum value observed at 0.5% fiber content. Additionally, increasing the fiber content to 0.75% resulted in a decrease in the concrete FS, but it remained higher than the control mix. Similarly, another study reported that WRPF reinforced concrete with a 0.4% fiber dosage exhibited the highest FS enhancement. At the age of 28 days, concrete samples with a waste fiber content of 0.2 and 0.4% had an improved FS of 23.8 and 35.6%, respectively, compared to the reference sample. Increased fiber dosages resulted in a decrease in concrete strength. Additionally, the presence of waste fibers may act as a barrier to crack growth, and may move across the cracks to transfer interior forces, increasing FS. Some authors described the effect of crimped and smooth WRPF on the properties of cement-based materials. The samples with crimped fibers exhibited better strength than the samples with smooth fibers. The results of an experimental study revealed that, with fiber

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content increments, a slight decrease in FS was noticed for different fiber sizes. Furthermore, a 9% reduction in FS was observed as an average value between all of the WRPF-reinforced concrete samples compared to the samples of plain concrete (PC). The same results were also observed by other researchers. At a curing age of 28 days, the FS was reduced by 4.6%, 7.2% and 12.4% when WRPF was used proportions of 0.5%, 1.0% and 1.5% in concrete, respectively. Additionally, some researchers reported a decrease in FS when various lengths and volume contents of WRPF were incorporated.

The FS might decrease due to the improper pouring and placement of concrete, which results in the formation of voids and pores within the matrix. Different volume contents of WRCF with identical fiber sizes were incorporated. It was observed that increasing the fiber amount improved the FS to a certain extent. At 28 days of age, the FS of the FRCs were between 3.64 and 4.11 MPa, with 0.70% fiber content having the highest FS. The enhancement was more significant than that of the PC specimen. Likewise, the addition of WRCF influences the MPs of CBCs. The volume content of WRCF fiber was varied between 0.5 and 2.0%, with a 0.45 mm fiber diameter and a 30 mm fiber length. The results indicated an increase in FS due to the addition of fibers. At 1 day of curing age, all of the specimens containing fibers had a greater FS value than the PC specimens. On the other hand, at 7 and 28 days of curing age, a slight reduction in FS at 1.0% of fiber content was noted. At 28 days, the maximum FS was 6.25 MPa with a 0.50% fiber content. The strength was 17.9% greater than the PC, whereas the FS was reduced by approximately 17% as a result of the addition of 2.0% WRCF. It has been reported that the addition of WRCF up to 1% content improved the FS of CBCs. Furthermore, another study on the manufacture of ecofriendly concrete with a WRCF of 0.25–1.25% and a length and diameter of 20 mm and 0.45 mm was carried out. It was discovered that incorporating RFs into concrete at 0.25, 0.50, 0.75, 1.0 and 1.25% proportions increased the FS by 11.23, 24.7, 20.22,

11.23 and 10.11%, respectively, at 28 days, in comparison with the plain control mix. A fiber content of 0.50% was optimal for the maximum FS. The increase in FS was due to the crack-arresting process of the fibers. A similar improvement in FS in CBCs with the addition of RF was also stated by other researchers.

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### Sand

Natural river-bed sand was collected and used. Clean and sharp sand was collected from Lagos State. It has a specific gravity of 2.65 and fitness modulus 0.4. It was oven dried at the Civil Engineering Department of the FederalPolytechnic.

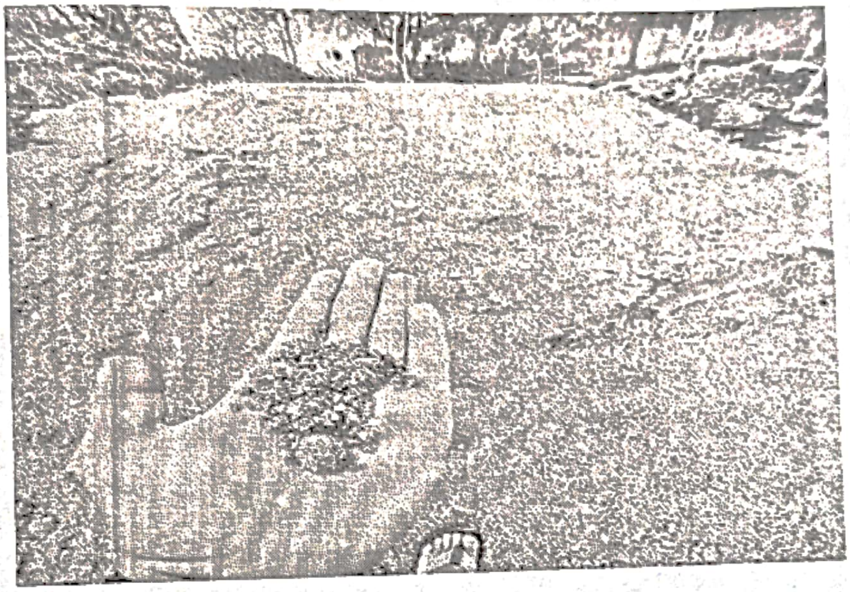

Figure 6: Fine Aggregate

### Granite dust

Granite dust was collected from local stone crushing unit from Offa, Kwara state (Figure 3). It was dry at the point of collection and was sieved by IS: 4.75mm sieve at the Civil Engineering Department, Federal Polytechnic, It has specific gravity of 2.57, fitness modulus of 2.41, density of 1.85gm/cc and void ratio of 0.42.

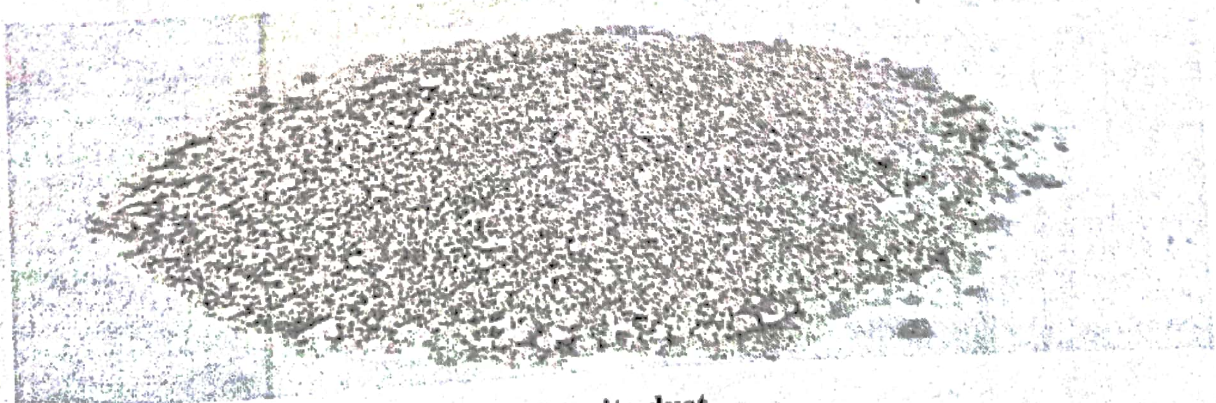

Figure 7: Granite dust

## Clay Cement and Aggregates Mix Ratio

Clay was collected from a hand dug well in Lagos and it has a specific gravity of 2.7. The clay was sun-dried and pounded (to loosen the particles) to a fine powder.

## Plastic Materials

The plastic materials (PET, HDPE and LDPE) were sourced from Lagos State. They were washed and then shredded into very small pieces by a grinder at a plastic processing outlet. Other materials used are hand gloves, nose masks, safety boots, 1 melting barrel, a spade with a metal shaft for staring of hot mix, Industrial gas as source of heat, mold (200mm x 100mm x 75mm), used engine oil for lubrication, metal tablefor mold placement, hand trowel, and aPyrometer.

**Figure 8: PET Bottles**

## METHODS

All the pavement block samples produced for this research work were molded from a metal mold measuring 200mmx100mmx75mm. 80 Pavement block samples were produced for each of the different mix ratios. Clean shredded plastic waste materials were melted at a temperature of about 180-250°C and mixed in different proportions by volume.

Figure 9: Vibration Table

**Plastic Melt and Granite Dust**

Pavement blocks were produced by mixing plastic melt and granite dust in three different proportionsby volume in ratios of 50:50, 40:60 and 30:70.

**Plastic Melt and Sand Mix Ratio**

Production of pavement blocks by mixing plastic melt and sand in three different proportions by volume in ratios of 50:50, 40:60 and 30:70.

**Plastic Melt and Clay Mix Ratio**

Production of pavement blocks by mixing plastic melt and clay in three different proportions by volume in ratios of 50:50, 40:60 and 30:70.

The materials (cement, sand and granite dust in the ratio 1:2:4 respectively) were mixed thoroughly with a shovel until a uniform mix was obtained.

-Water was added in a ratio not exceeding 0.6 tocement.

-The resultant mix was hardened and cured

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## TESTS

### Laboratory Tests

Five tests were conducted for the study namely; Compression test, Water absorption test, Flexuraltest, corrosion and Oven test. Comparison was made based on all except the oven test which was undertaken to determine the temperature at which the products would fail.

### Compressive Strength Test

The Universal Testing Machine was used to measure the load that crushes each sample. The compressive strength was calculated using the following formula:

Compressive strength=Load/Area;

where the surface area for each sample is 200mm×100mm =20,000mm$^2$

### Water Absorption Test

The weight of each oven dried sample was measured as weight dry - The weight of each sample soaked for 24hours was measured asweight wet.

The water absorption rate was calculated using the following Formula water absorption rate =(weight wet - weight dry)/weight dry ×100%

### Flexural Test

The flexural test was carried out using an automatic Universal Testing Machine. By this test, the amount of force at breaking point ofeach sample was determined.

### Oven Test

The oven test was carried out by placing plastic derived paver blocks in the oven and recording the points at which they fail.

### Acid Test

Block samples were digested with a weak sulfuric acid (H2SO4) with pH value of 6. Bothcompressive and flexural tests were carried out onthe block samples after 10, 20, 30, 40, 50, 60, 70, 80, 90, and 100 days. These test results were compared to results obtained before activation with acid.

### Data Analysis

The mean values of three specimens of everysample were taken at every instance to represent the sample for each test carried out and presented in tables. Simple Bar graphs were usedto present the data from each test.

## RESULTS AND DISCUSSION

### Compressive Strength Test

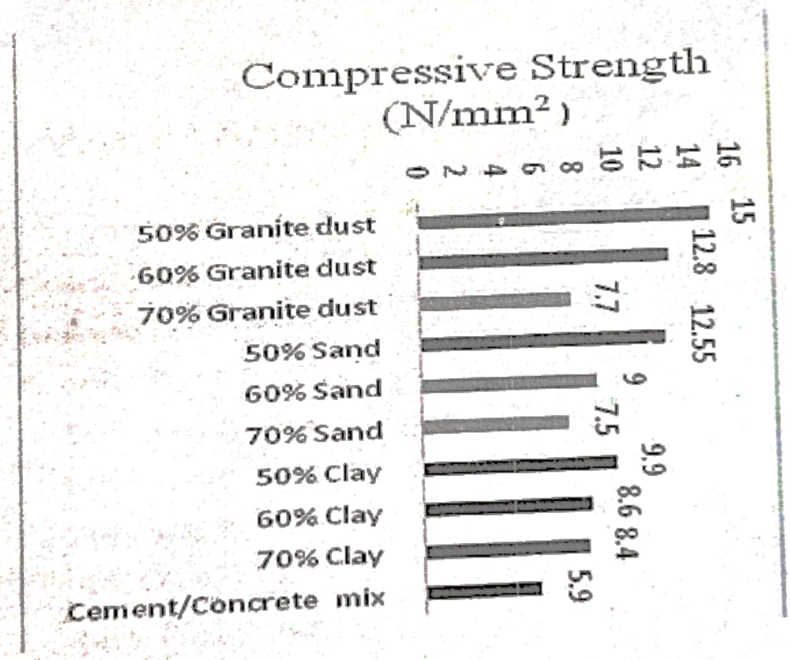


figure 1 shows the result for the compressive strength of the different samples represented on

**Figure 1: Compressive Strength**

**Figure 1:** Table showing the Compressive Strength of each of the 10 Sample Blocks. while other mix ratios equally have their degreesof variation.

## Water Absorption Test

The Compression test shows that the mix ratio All the sample blocks produced from plastic melts have water absorption (WAR) values ranging from between 1.59% to 2.01% (Figure 5). All these values are abysmally lower than the WAR 17.33% value of the cement pavement block. This means disintegration of the cement 50:50 (plastic melt: granite dust) has the highest compressive strength of 15.0N/mm$^2$ (Figure 4), a value which is almost three times the 5.9 N/mm$^2$ value of the cement derived pavement block,

pavement blocks by alternate wetting and drying is more likely than in the plastic derived pavement blocks. It also means underscores the reason why cement paver blocks support the growth of algae, spirogyra and mosses on its surface [26-27].

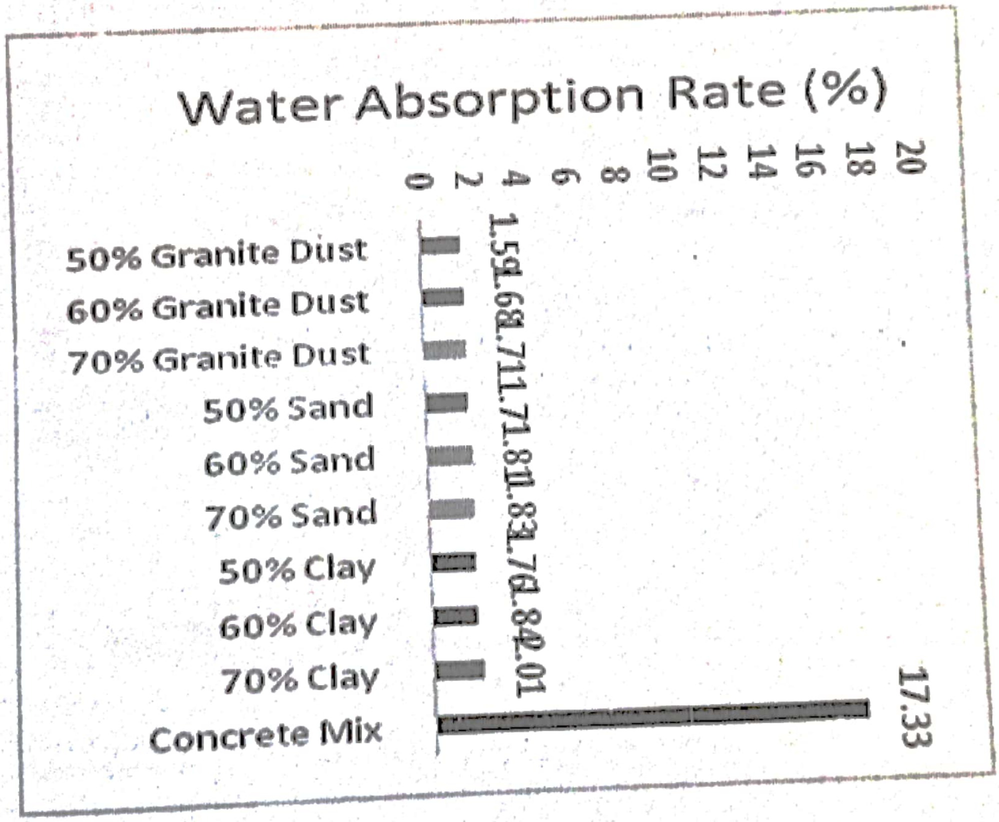


**Figure 2: Water Absorption**

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### Flexural Test

The Flexural test result shows that the mix ratio 70:30 (sand: plastic melt) has the highest flexural strength of 14.28 kN, a value which is above seven times the 1.98 kN value of the cement pavement block.

The comparisons above show clearly that all the mix ratios of plastic derived pavement blocks could withstand greater forces (aggression) before breaking than the cement derived pavement blocks.

**Table 2:** Breaking points of Geo-materials at Different Ratios

| Samples | Force at Breaking point(N) |
|---|---|
| 50% Granite Dust | 12,640 |
| 60% Granite Dust | 10,400 |
| 70% Granite Dust | 8,360 |
| 50% Sand | 9,470 |
| 60% Sand | 10,085 |
| 70% Sand | 14,280 |
| 50% Clay | 8,690 |
| 60% Clay | 6,072 |
| 70% Clay | 4,480 |
| Concrete Mix | 1,980 |

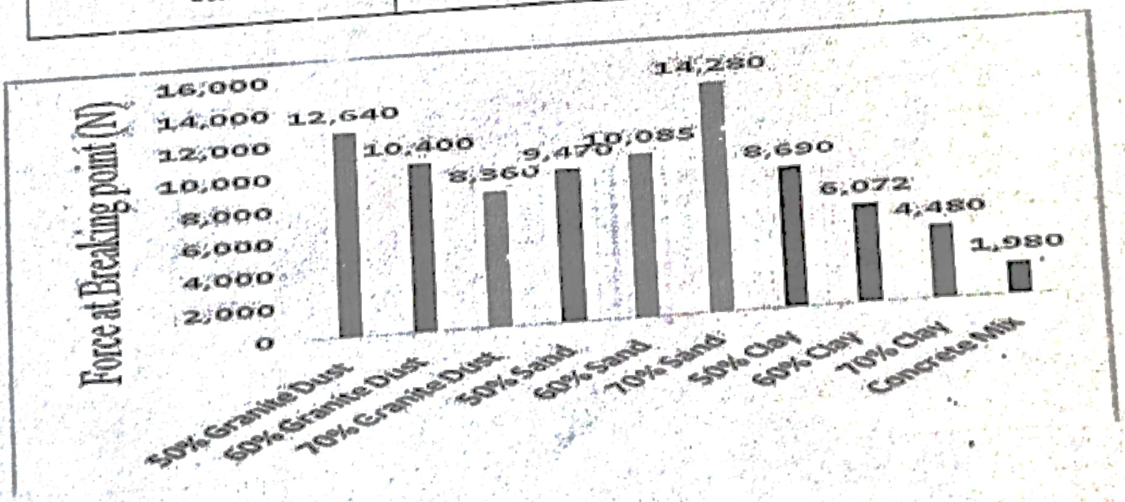


**Figure 3: Force Breaking Point**

**Figure 3:** Bar Chart of Breaking Points of Geo-materials at Different Ratios.

## Oven Test

Table 4 shows the result of the over test of the samples. The oven test was carried out to ascertain the temperature at which each pavement block fails. The results obtained from the oven test shows that there was no visible change in the shape, size and rigidity of all the plastic derived pavement blocks at a temperature below 180°C.

**Table 4:** Compressive Temperature Falling Pointfor Plastic Paver Block (°C).

| Samples | Temperature of Failure (°C) |
|---|---|
| 50% Granite Dust | 180.00 |
| 60% Granite Dust | 185.00 |
| 70% Granite Dust | 185.00 |
| 50% Sand | 180.00 |
| 60% Sand | 185.00 |
| 70% Sand | 185.00 |
| 50% Clay | 200.00 |
| 60% Clay | 205.00 |
| 70% Clay | 210.00 |

# CHAPTER 7

# RESULTS

The average of three samples was taken as the representative value of compressive strength ofconcrete tiles for each batch and is tabulated in Table

From the Table 4.1 it can be concluded the compressive strength of normal concrete tiles as when waste plastic is replaced with cement in percentages, the compressive strength increases with increase in percentage of replacement of waste plastic. Up to the replacement of 35% of waste plastic by cement the compressive strength increase. Further the replacement of waste plastic there no formation of tilestake place.

Figure 10: Concrete Tiles

# CHAPTER 8

# CONCLUSION

Our aim of this experiment is to examine the possibility of plastic fiber added concrete tile has more values than normal concrete tile while the depth is 20mm.

Thus the tested property of concrete tile with 10% & 15 % of plastic fiber added has more values than normal concrete tile while the depth is 10 mm. This kind of tiles are easy to manufacture and easy to install & replace in industries for flooring. These tiles are used to avoid providing dampers in industries between machines and floor while the plastic fiber strength is directly provided to tile.

**Figure 11: Rubber Moulds**

These tiles are used to avoid providing dampers in industries between machines and floor while the plastic fiber strength is directly provided to tile.

The compressive strength and workability of waste plastic mix concrete with and without addition of waste plastic was investigated and the following conclusions were obtained,

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1. Addition of waste plastic gives high compressive strength as compared to normal tiles

2. The compressive strength increases up to 45% by replacement of cement by waste Plastic and voids should be partially filled

3. It was found that workability with 5% & 10% of replacement of cement by waste plastic was not possible.

4. It was noticed that there was reduction of compressive strength in waste plastic concrete tiles of about 45% above compared to normal concrete tiles.

There was increase in compressive strength up to 35% of replacement of waste plastic by cement in concrete tiles.

The present study has efficiently and effectively demonstrated the application of waste plastic into useful constructional materials as well as reducing its menace in our surrounding. The plastic wastes littered all over the environment can be converted to useful constructional materials more economical than cement.

on the outcome of the results of the various tests carried out, the study has clearly established that the plastic derived paver blocks are more rugged, tougher, durable, heat-, and corrosion-resistant compared to the paver blocks produced from conventional cement.

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