JIMMA UNIVERSITY
JIMMA INSTITUTE OF TECHNOLOGY
SCHOOL OF GRADUATE STUDIES
FACULTY OF CIVIL AND ENVIRONMENTAL ENGINEERING
CONSTRUCTION ENGINEERING AND MANAGEMENT CHAIR

EXPERIMENTAL INVESTIGATION ON THE EFFECT OF ADDING WASTE POLYESTER TEXTILE ON CONCRETE PROPERTIES

A Thesissubmitted to School of Graduate Studies, Jimma University, Jimma Institute of Technology, Faculty of Civil and Environmental Engineering in Partial Fulfillment of the Requirements for the Degree Master of Science in Construction Engineering and Management

BY

EFTU TSEGAYE ABDISA

FEBRUARY, 2020
JIMMA, EHTIOPIA

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Advisor Engr. Bien Maunahan (Asst. Prof.)

Co- Advisor EngrMogesGetahun(Msc)

FEBRUARY, 2020

JIMMA, EHTIOPIA

DECLARATION

I declare that this research entitled **"Experimental investigation on the effect of adding waste textile on concrete properties"** is my own original work, and has not been submitted as a requirement for the award of any degree in Jimma University or elsewhere.

EftuTsegayeAbdisa ___________________ _________________

NAME SIGNATURE DATE

As research Adviser, I hereby certify that I have read and evaluated this thesis paper prepared under my guidance, by EftuTsegayeAbdisa entitled "**Experimental investigation on the effect of adding waste textile on concrete properties**" and recommend and would be accepted as a fulfilling requirement for the Degree Master of Science in Construction Engineering and Management.

Advisor: Engr. Bien Maunahan (Asst. Prof.)_______________ __________

NAME SIGNATURE DATE

Co - Advisor: Engr. MogesGetahun (Msc) _______________ __________

NAME SIGNATURE DATE

ABSTRACT

construction material made with new innovation ideas and concept are solving environmental problems.So when we study about any work then study about recycle and reuse is necessary.The reuse of waste materials can contribute to improve the strength of materials. Concrete is multipurpose and popular construction material in the world, it is relatively brittle and weak in tension ,This days different waste materials are used in concrete in order to reduce environmental problem and improve concrete property. So an attempt has been made to achieve improved strength results using waste polystertextile.

Polyester textiles are non-degradable, affects the environment from it's production up to it's disposal and is available in abundance. Presentstudies has been undertaken to investigate the effect of waste polyster textile on concrete on the basis of workability, compressive strength, flexural strength and tensile strength.

Experiment were conducted on physical property of concrete and compressive strength, tensile strength and flexural strength for mechanical property of C-25concret.during investigation four proportions 0%, 1%, 2 %, and 3 % by weight of cementwere used.Based on the results of this study, the optimum amount of waste polyester textile to produce concrete was 1% by cement weight. Using 1% polyester textile increase flexural strength and split tensile strength,it shows a decrese in compressive strengthand workability.

Keywords: Concrete, Concrete Strength ,Environment,Waste Polyester Textile,Workablity

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ACRONYMS

ACIAmerican Concrete Institute

ASTM American Society for Testing and Materials

CA Course Aggregate

FA Fine Aggregate

FN Finness modulus

GDP Gross Development Production

GVP Growth Value of Production

OD Oven Dry

OPC Ordinary Portland Cement

PPC pozolanna Portland cement

W/C Water to Cement ratio

CHAPTER ONE

INTRODUCTION

1.1 Background

In recent years, critical issues concerning environmental damage caused by various productive sectors were the discharged of waste materials directly into ecosystems without adequate treatment. Accumulation of unmanaged wastes especially in developing countries has resulted in an increase environmental concern. Recycling of such wastes as building materials appears to be viable solution not only to such pollution problem but also to the problem of economical design of buildings. Taking into account that the construction sector carries out a high consumption of resources such as materials, energy, and water, it is imperative the use of more sustainable construction solutions. Textile waste integrates the group of reusable materials that can be included in the building construction and which have different possibilities of application. These textile wastes may have origin in the textile industry or may simply result from clothes that are no longer used.

The disposal of solid wastes is a major problem throughout the world. Recycling and use of these waste materials, is increasing worldwide, especially in the construction industry. Using these recycled materials and wastes in construction is being more popular due to shortage of natural mineral resources and increasing waste disposal costs. Textile cutting waste from the industries and tailoring shops disposed as waste product in heaps thus causing disposal problem and environmental pollution. Studies have indicated that many forms of fibers recovered from various waste streams and suitable for concrete to act as reinforcement [10].

During the past years, concrete and cement technology have attained a lot of achievements. One of the achievements is the incorporation of industrial wastes as filler or additive in cement and concrete production with technical, economic and environmental advantages [60]. Increasing population, expanding urbanization, climbing way of life due to technological innovations has demanded a huge amount of natural resources in the construction industry, which has resulted in scarcity of resources [61].

Polyester is a synthetic fabric that's usually derived from petroleum. This fabric is one of the world's most popular textiles, and it is used in thousands of different consumer and industrial applications. Chemically, polyester is a polymer primarily composed of compounds within the ester functional group. Most synthetic and some plant-based polyester fibers are made from ethylene, which is a constituent of petroleum that can also be derived from other sources. While some forms of polyester are biodegradable, most of them are not, and polyester production and use contribute to pollution around the world[12].

Construction industry plays an important role in social, economic and political development of a country with about 12%-25% of the GDP of both developed and developing countries. The sector also consumes a higher percentage of the annual national budgets[1]. The construction sector in Ethiopia, contributes to the realization of about 11.3 % of the growth value of production (GVP) and 7% of GDP [2] and 58% of the annual budget of Ethiopia[1]. Being the second-largest employer in the country, it is also an engine for technology, innovation and overall development [3].

Different materials are used for construction purposes; among them, concrete is one input material for construction industry. Concrete is an intimate mixture of cement, aggregate, water and same part to admixtures. The versatility of making concrete with locally available materials, ease in molding it into any shape and size and economy in its making has made concrete the 2nd largest consumed material on earth [4].

Concrete is relatively brittle, and its tensile strength is typically only about one tenths of its compressive strength. Plain concrete fails suddenly once the deflection corresponding to the ultimate flexural strength is exceeded; on the other hand, fiber-reinforced concrete continue to sustain considerable loads even at deflections considerably in excess of the fracture deflection of the plain concrete [5].

The science of incorporating one or more materials in concrete to improve strength and satisfy design requirements is not new. Since the 17th Century, man has been known to make composite materials to achieve the desired design strengths. Mostly concrete is reinforced with steel bars .Over the years scientists have been doing research on reinforcing concrete with fibers. The approach of replacing steel by incorporating the natural fibers in concrete is termed as Natural Fiber Reinforced Concrete (NFRC).The use of fiber reinforced concrete can be dated back since 1870„s. Since then researchers have been working on concrete reinforced with wood fiber, waste glass, sisal fibers and vegetable fibers such as elephant grass, and many more. In particular, the natural fibers are sometimes used as reinforcement together with steel in concrete so as to reduce cracking and spallingof the structures [7].

Biological fibers have been already used some 3000 years ago in composite systems in the ancient Egypt, where straw and clay were mixed together to build the walls. In the last few years, biological fibers have become an attractive reinforcement for polymeric composites from economic and ecological point of view. Here is an increase in the environmental awareness in the world which has aroused an interest in the research and the development of biodegradable materials. Biological/Natural fibers can be obtained from natural resources such as plants, animals or minerals [8].

This study focuses on expermental investigation ofPhysical and mechanical strength of concrete by using the Waste Ethylene polysterTextile. wereas, this study investigates the workability, compressive strength,tensile strength and flexural strength of C-25concrete with waste polyester textile mix.

1.2 Statement of the Problem

The disposal of solid wastes is a major problem throughout the world.One of the bio masses that is available in plenty without being potentially utilized is waste cut cloths obtained from tailoring shops[10].Polyester textile has a generally negative impact on the environment. From its production to its use to its disposal, this fabric has unfortunate environmental impacts at every stage of its use cycle [12].

Concrete is a brittle material, with low tensile strength and strain capacities[11]. Using waste Polystertextile will improve concrete property as well reduce environmental problem. And it will be a promising material in the future with the development of textile industries in our country. Therefore, it is essentialto give due attention and study the potential of Waste Polyester Textile addition in the improvement of physical and mechanical strength of concrete.

1.3 Research Questions

The research question that this study sought to answer; are as follows:

1. Does the workability of concrete affected by the addition of wasteTextile ?
2. Is there any effect on the compressive strength of concrete by adding waste Textile?
3. What are the effects of adding waste Textile on tensile and flexural strength of concrete?
4. What is the Optimum proportion of waste Textile addition for improved concrete strength?

1.4Objective of the Study

1.4.1 General Objective

The main objective of this study is to investigate the effect of Waste Textile on physical and mechanical property of concrete

14.2 Specific Objectives

1. To investigate the effect of waste Textile addition on the workability of concrete.
2. To identify the effects of waste Textile on the compressive strength of concrete.
3. To identify the effects of waste Textile on tensile and flexural strength of concrete.
4. To determine the Optimum proportion ratio of waste Textile addition in concrete.

1.5 Scope of the Study

The scope of the study is to determining the effect of Waste EthylenPolyster Textile on Workability, compressive strength , flexural strength, and Split tensile strength of C-25 concrete.

1.6Research Significance

This study will provide helpful information to various stake holders as follows

- Environmental organizations seeking to reduce Environmental problem.
- Owners, contractors and consultants will benefit from the study as a source of information.

- Other researchers will use the findings as a reference for further research on the use of Textile waste in concrete.

CHAPTER TWO

LITERATURE REVIEW

2.1Concrete

Concrete is the most widely used strongest construction material that forms the basis of our modern life. It is used in different structures, such as: dam, building, bridge, tunnels, highway etc. Starting from the past, concrete was produced by the combination of cementing materials, aggregate and water [14]. However, when the concrete technology develops, additional materials known as admixture have produced. This additional material may be added to the basic mix to develop special properties of the concrete in fresh and hardened states[15]. Admixtures are ingredients other than water, aggregates, hydraulic cement [16][17].

Concrete is one of the oldest and most common construction materials in the world, mainly due to its low cost, availability, its long durability, and ability to sustain extreme weather environments. The world wide production of concrete is 10 times that of steel by tonnage [57]. On the other hand, other construction materials such as steel and polymers are more expensive and less common than concrete materials. Concrete is a brittle material that has a high compressive strength, but a low tensile strength[58][59].

2.2 Concrete in Construction Industry

Different materials are used for construction purposes; among them, concrete is one input material for construction industry. Concrete is an intimate mixture of cement, aggregate, water and same part to admixtures. The versatility of making concrete with locally available materials, ease in molding it into any shape and size and economy in its making has made concrete the 2nd largest consumed material on earth [4].

2.3 Properties of Concrete

2.3.1 Properties of fresh concrete

The most important property of fresh concrete is its workability or flowability, because this determines the ease with which it can be placed. It is determined using a slump test, in which a standard truncated metal cone form is filled with fresh concrete. The mold is then lifted vertically, and the resulting loss in height of the concrete cone, or the slump value, is indicative of the concrete's workability. For very liquid mixes, the flow test is performed, which is similar to the slump test, except that the mean diameter of the cake formed by the fresh concrete (or mortar) is measured. A short while after casting, the concrete stiffens and loses its plasticity. The time of setting can be determined by repeatedly dropping a calibrated needle into the fresh concrete and measuring the time when the needle no longer sinks in. All properties of fresh concrete are [18].

-Workability -Consolidation

-Pump ability -Thermal gradients

-Finishing -Unit weight

-Air content

2.3.2 Properties of hard concrete

The most important property of hardened concrete is its compressive strength. Since this strength continues to increase with continuing cement hydration,.Hardened properties of concrete are such as

-Compressive strength -Absorption
-Tensile strength -Shear strength
-Modulus of rupture-Poisson's ratio
-Modulus of elasticity- Creep and shrinkage
-Stress–strain relationships-Shear-friction capacity
-Fatigue strength-Bearing strength
-Thermal properties such as the coefficient of thermal expansion, thermal conductivity, specific heat, and diffusivity.

Workability

Workabilityreflects the ease of placing, consolidating, and finishing freshly mixed concrete. Concrete should be workable but should not segregate or bleed excessively. Normal-strength concrete usually has good workability as long as concrete ingredients are used in proper proportions and an adequate aggregate gradation is used; however, high-strength concrete is often sticky and difficult to handle and place, even with the aid of plasticizers, due to its high cement content. Concrete temperature also affects workability.test usually done for workability is slump test.

Slump test

The procedure used for measuring the slump of all mixes is in accordance with ASTM C 143 Standard Test Method for Slump of Hydraulic-Cement Concrete to characterize the consistency of the fresh concrete from all the mixes. The slump cone is filled with fresh concrete in 3 equivalent layers, and rodded 25 times after every layer. After the slump cone is filled, the excess concrete will be struck off the top and removed from the area surrounding the base of the cone. Once the cone was removed, the distance between the displaced center of the samples top surface and the top of the cone mold was recorded as the slump. All slump tests were performed and measurements made by the same individual to minimize the variance between results [19].

Slump tests conducted to measure the workability or consistency of concrete. Workability is the relative ease or difficulty of placing and consolidating concrete. When placed, all concrete should be as stiff as possible, yet maintain a homogeneous, void less mass. Too much stiffness, however, makes it too difficult or impossible to work the concrete into the forms and around reinforcing steel. On the other hand, too fluid a mixture is also detrimental. The measure of the workability or consistency of concrete is its slump, which is a design consideration that is inversely proportional to the stiffness of the mix [20].

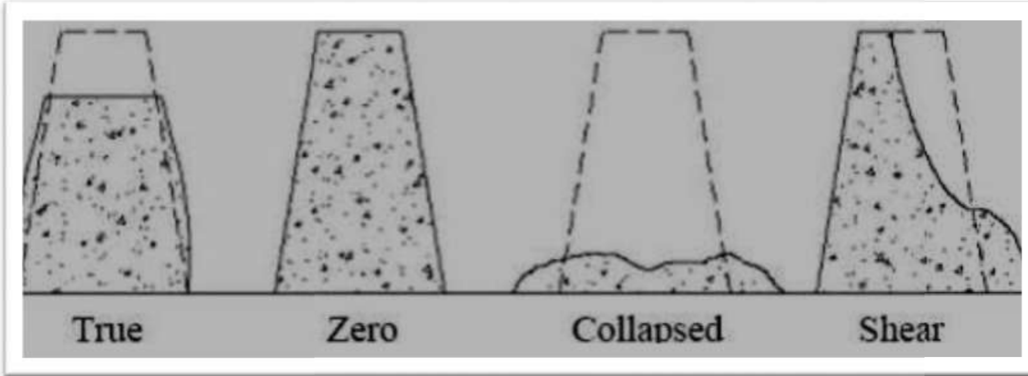

Figure 2.1Comparison of typical slumps

Compressive Strength of Concrete

The primary purpose for design concrete is to resist compressive strength in structural members, in general is the characteristic material value for classification of concrete. Test can be made for different purpose but the main two objectives of tests are control of quality and compliance with specification [21]. Two type's tests of specimens either cubes of 15 cm x 15 cm x 15 cm or 10cm x 10 cm x 10 cm depending upon the size of aggregate are used. The concrete is poured in the mold and tempered properly so as not to have any voids. After 24 hours these molds are removed and test specimens are put in water for curing. The top surface of these specimens should be made even and smooth. This is done by putting cement paste and spreading smoothly on whole area of specimen. These specimens are tested by compression testing machine after 7 days curing and 28 days curing.

Flexural Strength of Concrete

The strength of hardened concrete is fundamental in structural design, and is widely used as an index to predict other concrete properties. Flexural strength provides two useful parameters, namely: "the first crack strength, which is primarily controlled by the matrix", and "the ultimate flexural strength or modulus of rupture, which is determined by the maximum load that can be attained [22]. Flexural testing is used to determine the bending properties of a material or is the ability of a beam or slab to resist failure in bending. The flexural strength is expressed as (inch psi) (in psi) or magi Pascal MPa. Flexural Modules rupture (MR) is about 12 to 20 percent of compressive strength [23].

Tests are carried out on 100mmx100mmx500mm beams conforming to ASTM C 78 to obtain the flexural strength at the age of 28 days. In the flexural test a standard plain concrete beam of rectangular cross section is simply supported and subjected to two-point loading until failure [24]. Flexural properties of structural materials are generally important to design engineers to guide appropriate selection of materials. The load was applied without shock at a rate of 200m/s. The flexural strength was then calculated using the formula below:

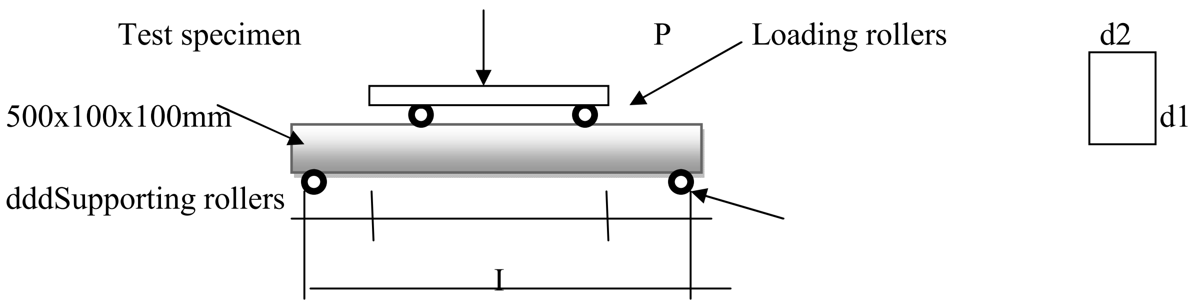

Figure 2.2:- Arrangement of loading for flexural strength [25]

The flexural strength was then calculated using the formula below:

$$\sigma = \frac{PL}{Bd2}$$

Where P- failure load (KN/m2), L-center to center distance between the support = 300 mm, b width of specimen=100 mm, d-depth of specimen= 100 mm

Split Tensile Strength of Concrete

The tensile strength is simpler to determination of the splitting tensile strength of cylindrical concrete. The tensile test applies a diametric compressive force along the length of cylindrical concrete specimen at rate that is within a prescribed rang unit failure occurs. this load induces tensile stress on the plane containing the applied lad and relatively high compressive stresses in the area immediately around the applied load. The play wood bearing strips are used so that the load is appropriate uniformly along the length of the cylinder [26]. A concrete is much weaker in tension than in compression, failure in splitting tension at a much lower load than would be required to crush the specimen in compression[27].

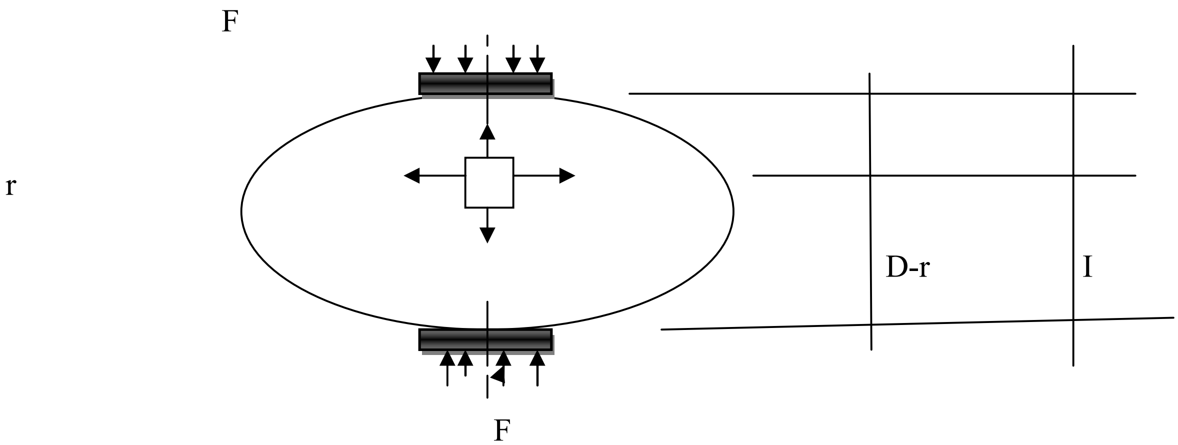

Figure 2.3:- Arrangement of loading for splitting test [14].

The tensile splitting strength was calculated as shown below.

$$T = \frac{2P}{\pi l P}$$

Where, *T* splitting tensile strength (KN/m2), P- maximum applied load (KN), l-length of the specimen (m), and d diameter or cross sectional dimensions (m).

2.4 Textile industry

The term ‘Textile’ is a Latin word originated from the word ‘texere’ which means ‘to weave’. Textile refers to a flexible material comprising of a network of natural or artificial fibers, known as yarn. Textiles are formed by weaving, knitting, crocheting, knotting and pressing fibers together[13].

The history of textile is almost as old as that ofhuman civilization and as time moves on the history of textile has further enriched itself. In the 6th and 7th century BC, the oldest recorded indication of using fiber comes with the invention of flax and wool fabric at the excavation of Swiss lake inhabitants. In India, the culture of silk was introduced in 400AD, while spinning of cotton traces back to 3000BC[13].

In China, the discovery and consequent development of sericulture and spin silk methods got initiated at 2640 BC while in Egypt the art of spinning linen and weaving developed in 3400 BC.The discovery of machines and their widespread application in processing natural fibers was a direct outcome of the industrial revolution of the 18th and 19th centuries.The discoveries of various synthetic fibers like nylon created a wider market for textile products and gradually led to the invention of new and improved sources of natural fiber.The development of transportation and communication facilities facilitated the path of a transaction of localized skills and textile art among va32rious countries[28].

In the ancient times, the most important aspect of textiles or more precisely cloth in Africa was that cloth was used as a form of money. The width of cloth strip was usually standardized in each region of Africa and therefore there used to be a regular number of such standard length cloth strips required to make a woman's wrapper cloth. This would then be used to serve as the unit of value. The cloth was a convenient form of money primarily because it was used by everybody, fairly durable and easily sub dividable.The weavers, dyers and other textile artists of Africa together make an active contribution in creating an exquisite and amazing range of textiles. African textiles usually embody a great variety of styles. Adinkara, kente and bogolan are some of the some of the African textiles which are becoming increasingly popular while some others like Yoruba, ase-oke and adire are equally beautiful but less well known[29].

2.4.1Textile industry in Ethiopia

Ethiopia's long history in textiles began in 1939 when the first garment factory was established. Based on Ethiopian country data, in the last 5 to 6 years, the textile, and apparel industry have grown at an average of 51% and more than 65 international textile investment projects have been licensed for foreign investors, during this period[13].

The growth in the textile industry is directly linked to the Government's move to set up an industrial development strategy. This step of the Ethiopian Government to prioritize designing incentives and policies to attract investment in view of worldwide competition has played a big role in the development of their economic status[30].

Ethiopia is currently home to 115 textile factories and is attracting more investment and foreign capital which will help drive the country's industrialization. Addis Ababa has launched a strategy to better exploit the potential of its already strong domestic textile industry and its growing human and material capital. Hawassa Industrial Park, Africa's largest, is 270km south of Addis Ababa and is reserved to the production of fabric and clothing. It was built by China Civil Engineering Corporation and was inaugurated in June last year. According to Ethiopia's Textile Industry Development Institute, 18factories are now up and running. Producers include American PVH Corp. (whose brand portfolio includes Calvin Klein and Tommy Hilfiger), Hong Kong-based TAL Apparel (one of the largest clothing producers worldwide), six Ethiopian companies and various Chinese, Indian and Sri Lankan companies. The industrial park currently employs 10,000 people but has a total employment capacity of 60,000. Furthermore, the government predicts that the Hawassa Park will provide around 25% of the country's textile exportations, valued at approximately USD 400m for the financial year that began on 8 July13[13].

2.5Polyester

Polyester is a synthetic fabric that's usually derived from petroleum. This fabric is one of the world's most popular textiles, and it is used in thousands of different consumer and industrial applications. Chemically, polyester is a polymer primarily composed of compounds within the ester functional group. Most synthetic and some plant-based polyester fibers are made from ethylene, which is a constituent of petroleum that can also be derived from other sources. While some forms of polyester are biodegradable, most of them are not, and polyester production and use contribute to pollution around the world[12].

The fabric we now know as polyester began its climb toward its current critical role in the contemporary economy in 1926 as Terylene, which was first synthesized by W.H. Carothers in the UK. Throughout the 1930s and 1940s, British scientists continued to develop better forms of ethylene fabric, and these efforts eventually garnered the interest of American investors and innovators. Polyester fiber was originally developed for mass consumption by the DuPont Corporation, which also developed other popular synthetic fibers like nylon. During World War II, the Allied powers found themselves in increased need of fibers for parachutes and other war materiel, and after the war, DuPont and other American corporations found a new consumer market for their synthetic materials in the context of the postwar economic boom[31].

Initially, consumers were enthusiastic about the improved durability profile of polyester compared to natural fibers, and these benefits are still valid today. In recent decades, however, the harmful environmental impact of this synthetic fiber has come to light in great detail, and the consumer stance on polyester has changed significantly. Nonetheless, polyester remains one of the most widely-produced fabrics in the world, and it's hard to find consumer apparel that doesn't contain at least some percentage of polyester fiber. Apparel that contains polyester, however, will melt in extreme heat, while most natural fibers char. Molten fibers can cause irreversible bodily damage[12].

2.6Types of Polyester

2.6.1 Ethylene Polyester

Ethylene polyester (PET) is the most commonly-produced form of polyester fiber. The primary component of PET is petroleum-derived ethylene, and in the process of creating polyester fiber, ethylene serves as the polymer that interacts with other chemicals to create a stable fibrous compound. There are four ways to make PET fiber, and the polyester production process varies slightly depending on which method is used[12]:

1.Filament: Polyester filaments are continuous fibers, and these fibers produce smooth and soft fabrics.

2.Staple: Polyester staples resemble the staples used to make cotton yarn, and like cotton staples, polyester staples are usually spun into a yarn-like material.

3.Tow: Polyester tow is like polyester filament, but in polyester tow, the filaments are loosely arranged together.

4.Fiberfill: Fiberfill consists of continuous polyester filaments, but these filaments are produced specifically to have the most possible volume to make bulky products like pillows, outerwear, and stuffing for stuffed animals.

The process of creating polyester fiber begins with reacting ethylene glycol with dimethyl terephthalate at high heat. This reaction results in a monomer, which is then reacted with dimethyl terephthalate again to create a polymer.This molten polyester polymer is extruded from the reaction chamber in long strips, and these strips are allowed to cool and dry, and then they are broken apart in to small pieces. The resulting chips are then melted again to create a honey-like substance, which is extruded through a spinneret to create fibers[12].

Depending on whether filaments, staple, tow, or fiberfill fibers are desired, the resulting polyester filaments may be cut or reacted with various chemicals to achieve the correct end result. In most applications, polyester fibers are spun into yarn before they are dyed or subjected to other post-production processes[12].

Properties of Ethylene Polyester

Physical properties of waste polyster textile [32]

Table 2.2 properties of ethylene polester

Property	Value
Tenacity	6g/den
Elongation at break	15-30%
Elastic modulus	90
Specific gravity	1.38
Melting point	250c

2.6.2 Plant-Based Polyester

The main advantage of plant-based polyester is that this fabric is biodegradable. Plant-based polyester, however, costs more to make, and it may be less durable than its PET or PCDT textile equivalents.Most types of plant-based polyester are also made from ethylene glycol reacted with dimethyl terephthalate. While the source of the ethylene used in PET and PCDT polyester is petroleum, however, producers of plant-based polyester use ethylene sources like cane sugar instead[12].

2.6.3 PCDT Polyester

While PCDT polyester isn't as popular as PET polyester, it is more elastic, which makes it ideal for certain applications. PCDT polyester is also more durable than PET polyester, so this fabric is frequently preferred for heavy-duty applications like upholstery and curtains.The process of creating PCDT polyester is similar to the process of creating PET polyester, but this polyester variant has a different chemical structure. While PCDT also consists of ethylene glycol reacted with dimethyl terephthalate, different production processes are used to make these two common polyester variations[12].

2.7Polyester Fabric Impact on the Environment?

Polyester has a generally negative impact on the environment. From its production to its use to its disposal, this fabric has unfortunate environmental impacts at every stage of its use cycle[12].

To derive the basic materials used in the production of polyester, it's necessary to obtain fossil fuels, which are limited resources that are also used for vital energy and plastics production applications. The process of refining crude oil into petroleum introduces various toxins into the environment, which can harm living things both in the water and on land.Once refineries have produced petroleum, further refinement processes are required to produce the ethylene that is used to make polyester. These extraction processes are wasteful, and they introduce more toxins into the environment[31].

The process of transforming ethylene into polyethylene terephthalate fibers produces more harmful synthetic byproducts, and the dyes and treatment processes used by polyester fabric manufacturers may also make their way into the surrounding environment and poison the area's ecosystems.Furthermore, the manufacture of polyester often has significant social and cultural costs. The vast majority of polyester producers worldwide essentially engage in slave labor, and polyester workers are exposed to toxic chemicals that may cause neurological damage, cancer, or other potentially fatal conditions. Major polyester manufacturing companies are almost always owned by major international corporations, which enrich themselves while exploiting uneducated people in impoverished countries[12].

The environmentally harmful impacts of polyester continue as this fabric makes its way into the consumer market.washing polyester fabrics by hand or in washing machines releases tiny synthetic microfibers into the water supply [33].While acrylic fabric was found to be the worst offender in terms of microfiber pollution, polyester came in as a close second. Microfiber pollution in the water supply harms the health of marine life, and it also contaminates drinking water in locations all over the world.

As they do with all types of apparel, consumers inevitably discard their polyester garments. Unlike biodegradable fibers like wool, cotton, or silk, however, polyester does not naturally degrade in the environment. While it's impossible to know exactly how long polyester will remain in the Earth's ecosystems before it degrades, environmental scientists all agree that synthetic fabrics like polyester may take centuries to fully break down due to natural environmental conditions[12].

Overall, polyester harms the environment at every stage in its production, and it inevitably accumulates in the world's ecosystems with no viable methods for removing it. The advent of plant-based polyester fiber would seem to be a step toward reversing this unfortunate state of affairs, but it's unclear whether this alternative to petroleum-based PET alternative will gain traction within the textile market significant enough to make an impact on the polluting effects of polyester.

2.8Disposal of Waste

Things that people do not need anymore and want to get rid of can be defined as waste [34]. Different types of waste can be classified as solids, liquids, or gases, according to their physical state. Different types of solid waste can be classified according to their original use (packaging waste, textile waste, food waste, etc.), materials (glass, paper, etc.), physical properties (combustible, compostable, recyclable, etc.), origin (domestic, commercial, agricultural, industrial, etc.), and safety level (hazardous or nonhazardous). Household waste and commercial waste together can be classified as municipal solid waste [35]. The world's annual waste generation amounts to 7–10 billion tones in total, approximately 2billion tones of which is municipal solid waste [36]. Hence, it is a fact that unnecessary consumption is a part of everyday life, resulting in huge volumes of solid waste [37]

Global population growth and increasing demand for new products have led to irrepressible textile production and consumption [38][39]. One of the most important reasons for textile waste generation is the idea, created by the fashion industry, that people need new products each season [38]. Large amounts of production and postconsumer fiber waste have been amassed with the growth of the world's population and rising living standards [40]. It is predicted that global fiber consumption will reach 110bmillion tones in the year 2020 [41].

2.8Textile waste

Waste was an early problem of mankind, and a growing one that is of major concern to every nation of the world[42]. It is an issue mostly witnessed in urban areas as a result of high surge in population growth rate and increase in per capita income thus posing a danger to environmental quality and human health[43]. The most common problems associated with improper management of solid waste include diseases transmission, fire hazards, odor nuisance, atmospheric and water pollution, aesthetic nuisance and economic losses [44]. In the previous old years', solid waste management systems have involved complex and multi-face ted trade-off samonga plethora of technological alternatives, economic instruments, and regulatory frameworks. These changes resulted in various environmental, economic, social, and regulatory impacts in waste management practices which not only complicate regional policy analysis, but also reshape the paradigm of global sustainable development [45].

Things that people do not need anymore and want to get rid of can be defined as waste [46]. Different types of waste can be classified as solids, liquids, or gases, according to their physical state. Different types of solid waste can be classified according to their original use (packaging waste, textile waste, food waste, etc.), materials (glass, paper, etc.), physical properties (combus-tible, compostable, recyclable, etc.), origin (domestic, commercial, agricultural, industrial, etc.), and safety level (hazardous or nonhazardous). Household waste and commercial waste together can be classified as municipal solid waste [47]. The world's annual waste generation amounts to 7–10 billion tones in total, approximately 2billion tonnes of which is municipal solid waste [48]. Hence, it is a fact that unnecessary consumption is a part of everyday life, resulting in huge volumes of solid waste [49].

Although textiles are fundamentally used to protect the body from cold, heat, and light, and to preserve modesty, they have become a reflection of personality, wealth, or interest in fashion. Nowadays, because of technological improvements, textiles are used in a wide range of applications rather than only for fabrication of garments[50]. From the sourcing of raw materials to textile production, garment manufacturing, and distribution to retail stores, the textile industries generate huge amounts of waste, which occupy a large place in the municipal solid waste category [51].

Global population growth and increasing demand for new products have led to irrepressible textile production and consumption [52]. One of the most important reasons for textile waste generation is the idea, created by the fashion industry, that people need new products each season [52]. Large amounts of production and postconsumer fiber waste have been amassed with the growth of the world's population and rising living standards (Lu andHamouda 2014). It is predicted that global fiber consumption will reach 110bmillion tonnes in the year 2020 [53].

2.9 Using Waste material in concrete

During the past years, concrete and cement technology have attained a lot of achievements. One of the achievements is the incorporation of industrial wastes as filler or additive in cement and concrete production with technical, economic and environmental advantages [54]. Increasing population, expanding urbanization, climbing way of life due to technological innovations has demanded a huge amount of natural resources in the construction industry, which has resulted in scarcity of resources. This scarcity motivates the researchers to use, solid wastes generated by industrial, mining, domestic and agricultural activities [55].

The disposal of solid wastes is a major problem throughout the world. Recycling and use of these waste materials, is increasing worldwide, especially in the construction industry. Using these recycled materials and wastes in construction is being more popular due to shortage of natural mineral resources and increasing waste disposal costs. Textile cutting waste from the industries and tailoring shops disposed as waste product in heaps thus causing disposal problem and environmental pollution. Studies have indicated that many forms of fibers recovered from various waste streams and suitable for concrete to act as reinforcement [10].

Concrete has proved to be an excellent disposal means for fly ash, silica fume, ground granulated blast furnace slag (GGBS), marble powder, and so forth which not only traps the hazardous material but also enhances the properties of concrete. Concrete, as a material, has significantly been benefited from the usage of fly ash, silica fumes, and GGBS. For a constant workability, the reduction in water demand of concrete due to fly ash is usually between 5 and 15% when compared with Portland cement only mix. The reduction is large at higher w/c ratio [56].

In recent years there has been an increased use of mixing the Portland cement and GGBS components directly in the concrete mixer. An advantage of this procedure is that the proportion of Portland cement and GGBS can be varied at will. The granulated slug can be ground to a fineness of any desired value, but usually, greater than 350 m^3/kg. The presence of GGBS in the mix improves workability and makes the mix more mobile but cohesive [57]. However, the workability of concrete containing GGBS is more sensitive to variations in the water content of the mix than is the case with Portland cement only concrete. Mixes containing GGBS are found to exhibit an early loss of slump. The presence of GGBS in the mix leads to retardation of 30 to 60 min at normal temperatures [58].

Silica fume has a very high reactivity with calcium hydroxide, and this reactivity permits silica fume as a replacement for a small proportion of Portland cement [59]. Marble powder has higher density and it is assumed that this would improve the segregation resistance of the self-compacting concrete. Corinaldesi et al. [60] mentioned that high fineness of marble powder is proved to be very effective in assuming very good cohesiveness of mortar and concrete. They further showed that marble powder had a very high Blaine's fineness value of about 1.5 m^2/g with 90% of particles passing through 50 μm sieves and 50% under 7 μm. According to Gupta et al. [61] the value of segregation index increases with the increase in the amount of marble powder as a replacement of fly ash. Binici et al. [62] found that marble dust concrete had higher compressive strength than that of the corresponding lime stone dust and control concrete with equivalent w/c and mix proportion. Batayneh et al. [63] found that glass containing concrete composites was the most consistent composite than fiberglass within the selected range of 5 and 20% aggregate substitutes.

Rebeiz [64] investigated the strength properties of unreinforced and reinforced polymer concrete using an unsaturated polyester resin based on recycle polyethylene terephthalate (PET) plastic waste. The results showed that the resins based on recycled PET can be used to produce a good quality of precast concrete.Sikalidis et al. [65] investigated the utilization of MSW for the production of mortar. Choi et al. [66] investigated the effects of waste PET bottles aggregate on p, properties of concrete. The waste plastic could reduce the weight by 2–6% of normal weight concrete. However, the compressive strength was reduced up to 33% compared to that of normal concrete. Similarly, the results of Batayeneh et al. [63] showed the deterioration of compressive strength with an increase in the proportion plastic content. For the plastic proportion of 20% of sand, the compressive strength was reduced up to 70% compared to that of normal concrete.

Recently, Marzouk et al. [67] studied the use of consumed plastic bottle waste as sand-substitution aggregate within composite materials for building applications and showed the effects of PET waste on the density and compressive strength of concrete. It was found that the density and compressive strength decreased when the PET aggregates exceeded 50% by volume of sand. Jo et al. [68] investigated the mechanical properties such as compressive strength and flexural strength of polymer concrete using an unsaturated polyester resin based on recycled PET, which contributes in reducing the cost of the material and saving energy. Pezzi et al. [69] used plastic material particles incorporated as aggregate in concrete and evaluated the chemical, physical, and mechanical properties. The results showed that the addition of polymeric material in fractions <10% in volume inside of cement matrix does not imply a significant variation of the concrete mechanical features.

2.9Using material in concrete as strip

using Aluminum strips which increases the compressive strength of concrete up to 22% with 2.5% of Alumi- num strip comparing with the reference mix. The value of tensile strength for concrete has been increased from 1.87MPa for a reference mix to 5.38 MPa for 2.5% Aluminum strips. Whereas, the flexural strength (modulus of rupture) of con- crete increases significantly from 3.31 MPa for a reference mix to 11.20 MPa for 2.5% Aluminum fiber[70].

The addition of scrap polyethylene strips increases the compressive strength by 11% and flexural strength of concrete by 40% at 28 days curing period as compared with the control specimen [71].

2.9Aplication of waste textile strip in concrete

Using 20mm x 20mm cut textile strip on concrete reduces both cube compressive strength due to loss of cohesion.as well as increases the tensile strength and energy absorption of concrete[10].Textile strip waste use 0% to 2% by weight of cement and also use waste plaster of paris 10%-20% by weight of cement improves Compressive strength of concrete[72].

CHAPTER THREE

METHODOLOGY

3.1 Study period

The study period to conduct this thesis was Four months starting fromOctober,2019 up toFebruary, 2020.

3.2 Study Variables

Dependent variables

Physical and Mechanical properties of concrete such as

-Workability
-Compressive strength
- Flexural strength
- Tensile strength

Independent variables

- Waste Textile Fiber percent addition in concrete production.

3.3 Study Design

A study design/frame is the process that guides researchers on how to collect, analyze, and interpret observations. Therefore, the objective of the research wasachieved under the methodology outlined below.

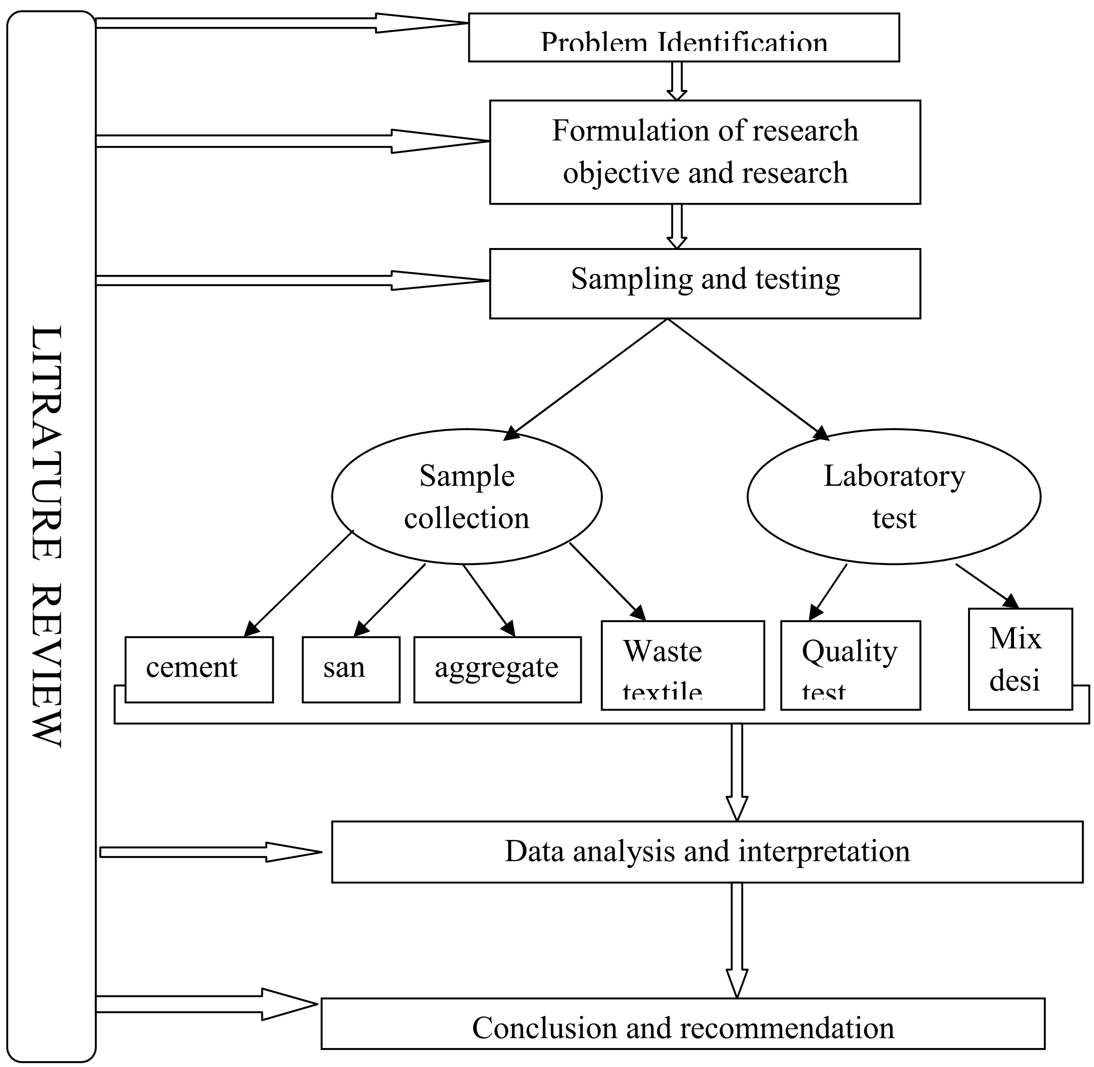

Figure 3.1: Research Design Frame

3.4 Sample Size & Sampling Techniques

3.4.1 Sample size

Table 3.1was used to determine the Sample size for checking the compressive strength, tensile strength and flexural strength of Concrete produced by Waste PolysterTextile Fiber.

Table3.1. Sample size determination for the respective given tests.

Type of Fiber	% of waste cloth by the mass of cement	No of sample for the specified days						Total
		For Compressive strength		For Tensile strength		For Flexural strength		
		7th	28th	7th	28th	7th	28th	
For control	0%	3	3	3	3	3	3	18
Textile Fiber	1%	3	3	3	3	3	3	18
	2%	3	3	3	3	3	3	18
	3%	3	3	3	3	3	3	18

Based on table3.1 the sample sizes wasused for determining the compressive strength, tensile strength and flexural strength which is obtained by multiplying the sum of samples for each days with number of percent textile addition. A total number of 72 samples (24 samples * 3) was casted for testing. From this, (12*2=24) are for compressive strength, (12*2=24) for tensile strength and (12*2=24) for flexural strength, where the number 2 refers the number of days (7 daysand 28 days).

3.5 Source of Data

The study was based on primary data Laboratory test and secondary data from previously conducted studies, book publications, maps/images, reports, and classified other documents.

3.6Data Collection Procedure

The waste textile was collected from the local tailoring shops, then distinguished according to their type. The Ethylene Polyester textile type were identified and used as the waste textile materials. The waste textile were cut into small sizes approximately 20mm x 20mm. The amount of 20mm x 20mm waste textile was determined by weight of cement percentage and ranging from 1%, 2% and 3%.

3.7 Instrument or Tools

Scissors for manually cutting off the waste cloth, Sieve for coarse aggregate (37 mm – 4.75 mm) and fine aggregate (9.5 mm – 0.075 mm), Oven, Mixer, Vibrators, Mix tools, curing tank, Balance, Mold for concrete cubic (15*15 mm), flexural (10 *50 mm) and tensile tests (15*30), Automatic Compression Machine to test compressive and tensile strength. Flexural strength and Slump test apparatus those apparatuses used in the laboratory test application.

3.8 Experimental Procedure

3.8.1Materials

In the preparation of concrete, different ingredients of materials was used (cement, fine aggregate, coarse aggregate, water, and Textile Fiber). These materials alsoused for concrete mix design preparation.

Cement

Ordinary Portland cement (OPC) produced as per CEM-I-42.5 grade with a weight of 50Kg/bag was used throughout the experiment. This cement commonly used for making concrete for all general-purpose like structural and road works.

Water

Drinking water from the laboratory was used for both curing and mix design works.

Textile Fiber

The waste PolysterTextile used in this study wascollected from Tailoring Shop. It wasused directly by cutting it using scissors with a constant size of 20mm x 20mm [10]. The amount of 20mm x 20mm waste textile was determined by weight of cement percentage and ranging from 1%, 2% and 3% .

a. Cuting Textile fiber b.Mixing the textile piece c.drain washed Textile cut sample

Figure 3.2- Waste Textile Fiber Cutting Sample

Aggregate

I. Fine Aggregate (Sand)

Fine Aggregate is usually called sand including natural sand and manufactured sand which size is from (less than 4.75mm). Commonly the fine aggregates in Jimma town for the demands used from different quarry sites such as Gambela, Chewaka, Worabe, and Asendabo sand. Worabe sand is the most commonly used sand in the town since it's clean than the others and cheaper than sand from Gambela. In this study, Worabe quarry site sand was used which is brought from Gurage zone.

II. Coarse Aggregate

Coarse Aggregate is an integral part of many construction applications, sometimes used on their own, such as a granular base placed under a slab or pavement, or as a component in a mixture, such as an asphalt or concrete mixtures. Coarse Aggregate generally called gravel including natural gravel and crushed stone which size is (higher than 4.75mm). The coarse aggregate was purchased from the market where it is collected around Jimma City.

3.8.2Laboratory Test Procedure

Aggregate Tests

The following tests have been conducted to evaluate the characteristics of aggregate.

- **Silt Content of Sand**

This test was conducted to determine the amount of silt contained within given amount of sand. Both field and laboratory method was used in the determination of silt content.

According to the Ethiopian Standard it is recommended to wash the sand or reject it if the silt content exceeds a value of 6%.

I. Field Test Method

Worabe natural river sand which is available in Jimma was used for laboratory tests. The silt content for field test method is calculated by using laboratory standard formula. (Refer Appendix A)

Figure 3.3- Silt Content of Sand

II. Laboratory Test Method

The laboratory test method was conducted using ASTM C 117 standard. In this method 500 g of sample was washed, weighed and left to dry in an oven for 24 hr with a temperature 1050C.

- **Moisture Content of Fine and Coarse Aggregate**

The moisture content of the given fine and course aggregate was determined by oven drying 500gm and 2kg for the respective aggregate samples for about 24hrs with a temperature of 105 °C to 110 °C and cool for an hour and calculate it by using formula in Appendix A.

- **Unit Weight of Aggregate**

The unit weight test has been conduct to determine the weight for a given volume of the respective fine, then dividing the respective aggregates weight by the volume of the container of aggregate. The amount of material which can be placed in a cylinder of unit volume the normal range of unit weight for aggregate for normal-weight concrete is from 1200 to 1760 kg/m3.

Figure3.4 :- Unit weight for coarse aggregate

- **Sieve Size**

According to ASTM C 136 the sieve size for both fine and course aggregate was tested. So, it is determining the particle size of distribution of aggregate to make within the range. The grading requirements for fine aggregates the particle size distribution of aggregate is determined using the standard formula.

The summation of the cumulative percentage of the material retained on the sieve including is divided by 100 is called fineness modules as.

Fineness modules is used as an index to the fineness and uniformity of aggregate supplied, but it is not an indication of grading since there could be an infinite number of grading which will produce a given fineness modulus.

Figure 3.5- Sieve Size of Fine Aggregate and Coarse Aggregate

- **Specific Gravity and Absorption Capacity of Fine Aggregate**

The test was conducted to determine the bulk specific gravity by using oven dried sample (saturated surface basis), apparent specific gravity, absorption of fine aggregates and Pycnometer apparatus. The procedure used for this test was taken from ASTM C 128 which defined the Bulk specific gravity by the total volume of the solid including pores of the aggregate and Apparent specific gravity by the volume of the solid that include the impermeable pores but not the capillary ones.

- **Specific Gravity and Absorption Capacity of Coarse Aggregate**

The bulk specific gravity of coarse aggregate is defined as another characteristic of material which needs to be determined. Bulk specific gravity at oven dry, saturated surface dry and apparent specific gravity of coarse aggregate was determined by using ASTM C 127.

3.8.3 Water Absorption Test for Waste Textile Fiber

Water absorption test is used to determine the amount of water absorption Waste Textile Fiber for concrete product and the test was conducted following ASTM D 2216 standard. Using a 100 g of Waste Textile Fiber, weight measurement was taken before and after immersing the sample in a water bath Finally, the moisture content was determined using the formula shown in Appendix F.

3.8.4 Concrete Mix Design

In the experiments, a waste textile was introduced at 0%, 1%, 2% and 3% to the concrete. In introducing the fibers into the mix, it was ensured that there was single fiber addition and the fibers reached the mixer individually and were immediately removed from the point of entry by the mixing action, so as to produce uniform fiber distribution.

- Specifications:
  1. Concrete is required for mass concrete structures. Thatwill not be exposed to moisture in a severe freeze-thaw environment.
  2. To design C-25 concrete grade having 33.5 MPa target mean strength.
  3. Slump should be between (25-75mm) for proportioning purpose.
  4. A nominal maximum size aggregate of 25 mm is required.
  5. Non- air entrained concrete was selected.
  6. Absolute volume (metric) method was used.
  7. The mix design procedure used in this research was according to ACI 211.1-91.

The data from test results for mix design includes:

Table3.2: Properties of coarse aggregate from the test results:

Properties	Result
Nominal maximum size of aggregate	20mm
Unit weight	1586.47 kg/m3
Specific gravity	2.8
Water absorption	1.42%
Moisture content	1.11%

Table3.3 :Properties of fine aggregate from the test results:

Properties	Result
Unit weight	1521.58kg/m3
Fineness modulus	2.98
Specific gravity	2.55
Water absorption	1.43%
Moisture content	1.79%
Silt content	1.99%

- Ordinary Portland Cement Type1 with specific gravity of 3.15 and 42.5R grade was used.

Step 1: Target mean strength: Since no statistical data is available, f_{cr} (required compressive strength for proportions) equals to, f_c + 8.5 = 25+8.5 = 33.5Mpa

Step 2: Slump: The expected slump for workability was selected between (25mm -75mm) ± 20mm for proportioning purposes.

Step 3: Maximum size of aggregate: nominal maximum size was fixed to be 25 mm.

Step 4: Water and air content: For non-air entrained concrete, water content was 179kg and 1.5% of air content.

Step 5: Water to cement ratio: From table 3, the recommended W/C ratio for f_{cr}= 33.5Mpa becomes interpolating the values for 30Mpa = 0.54 and for 35Mpa = 0.47 and finally W/C ratio for 33.5Mpa becomes 0.491.

Step 6: Cement content: using the information's in step 4 and 5 water to cement ratio becomes;

$$^{w}/_{c}\,ratio = \frac{wateramount}{cementcontent}$$

Therefore, cement content equals to365kg.

Step 7:Coarse aggregate content: For nominal maximum size aggregate of 20 mm and sand fineness modulus of 2.98, the dry bulk volume can be 0.65m^3.

Mass of coarse aggregate = $1586.47kg/m^3 \times 0.65m^3 = 1031.206kg$

Step 8: fine aggregate amount: First all ingredient amounts changed to volume as follows;

- Air = $\frac{1.5}{100} \times 1m3 = 0.015m^3$
- Cement = $\frac{365}{3.15*1000} = 0.116m^3$
- Water = $\frac{179}{1000} = 0.179m^3$
- Coarse aggregate = $\frac{1031.206}{2.8*1000} = 0.368m^3$

Total volume of ingredients = 0.678 m^3

The calculated absolute volume of fine aggregate is then 1 – 0.678 = $0.322m^3$

The mass of dry fine aggregate is 0.322 x 2.55 x 1000 = 821.1kg

Step 9: total concrete Ingredient Proportion mass before moisture adjustment becomes:

Table 3.4 Total concrete Ingredient Proportion mass before moisture adjusted.

Materials	Proportion mass in Kg.
Coarse aggregate	1031.206
Fine aggregate	821.1
Cement	365
Water	179
Total mass	2396.306

Adjustment of moisture content;

Moisture Corrections are needed to compensate for moisture in and on the aggregates. In practice, aggregates will contain some measurable amount of moisture. The dry-batch weights of aggregates, therefore, have to be increased to compensate for the moisture that is absorbed in and contained on the surface of each particle and between particles. The mixing water added to the batch must be reduced by the amount of free moisture contributed by the aggregates.

From the laboratory Tests indicate that for the coarse-aggregate moisture content is 1.11% and fine-aggregate moisture content is 1.79%. With the aggregate moisture contents (MC) indicated, the trial batch aggregate proportions become:

- Coarse aggregate (1.11% MC) = 1031.206x 1.0111=1042.65kg.
- Fine aggregate (1.795% MC) = 821.1 x 1.0179 = 835.79kg

Therefore, Water absorbed by the aggregates does not become part of the mixing water and must be excluded from the water adjustment. Surface moisture contributed by the coarse aggregate amounts to 1.11% – 1.42% = -0.31%; that contributed by the fine aggregate is, 1.79%-1.43 % (MC-Absorption) = 0.36%.

The estimated requirement for added water becomes 179 – (-0.31)-0.4=179.71kg

The estimated batch weights for one cubic meter of concrete are revised to include aggregate Moisture as follows:

Table 3.5revised proportion of ingredients of concrete

Materials	Proportion mass in Kg.	Appropriate ratio	Remark
Coarse aggregate	1042.65	2.9	1042.65/365
Fine aggregate	835.79	2.2	835.79/365
Cement	365	1	365/365
Water	179.71	0.5	179.71/365
Total	2423.15	6.25	

Table 3.6 Quantities of Materials for Laboratory Batching in different percentage of waste polyester textile for Concrete Mix design.

Mix Quantities per m^3						
Replacement percentage	Cement, kg	Fine aggregate, kg	Water, kg	Coarse aggregate, kg	Waste textile cut, kg	Total
0%	365	835.79	179.71	1042.65	0	2423.15
1%	365	835.79	179.71	1039	3.65	2423.15
2%	365	835.79	179.71	1035	7.3	2423.15
3%	365	835.79	179.71	1031.7	10.95	2423.15

Concrete Production Process

The concrete molds and mixer were cleaned prior to using to remove the dusts and coated with releasing agent (oil) to smooth the surface and to prevent sticking of mixed concrete with the mold and mixer. The ingredients, such as; cement, fine aggregate (sand), coarse aggregate, water and Textile Fiber were measured by weight balance. After that the material blended by dry mixed for a minute. Then, water was added to the dry mixed concrete ingredients mixture and thoroughly mixed for two more minute, then added in to mold samples.A size of 15x15x15cm cube and 15x30cm molds were used to prepare samples for compressive tests and tensile tests respectively, whereas 50x10x10cm iron and wooden molds used to prepare samples for flexural test.

Figure 3.7- Concrete mix ingredients

- Workability Test for Concrete

The workability test is the most widely used method of checking the consistency of concrete. The slump test was used to investigate the workability of the waste Textile fiber added concrete mix. The standard slump cone was filled in three layers by rodding each layer 25 times according to ASTM C 143. After rodding the final layer, the slump cone was immediately be removed from the concrete and measures of vertical difference between the top of the mold and the displaced original center of the top surface of the specimen was taken. The slump test was checked against ACI 211.1.8.1 and corrections was taken if the mix collapses and the result is close to zero.

Figure 3.8- Workablity Test Samples

- Curing Concrete

To achieve maximum strength, concrete sample need a period of damp curing, where they are kept moist. This is a common requirement for all cementitious materials. According to ASTM C 192 standard the concrete molds was kept for 24 hours and then the casted concrete cubes was removed from the mold and placed inside a water bath for curing to take place until the testing age wasreached. The final tests was conducted after the sample is cured for 7 and 28 days in a water tank.

Figure3.9 : Curing sample

- Testing of Compressive Strength

The compressive strength of concrete is one of the most important and useful properties of concrete. For most of the works cubical molds of size, 15 cm x 15cm x15 cm are commonly used. In this study, the concrete mix was made with 0.51% of water and Waste textile fiber content of 1%, 2%and 3% by weight of cement. The concrete cube specimens was tested in the 300 KN Denison Compression Machine at a loading rate of 200 KN/min. The average of the three specimens was taken as the compressive strength of the concrete.

Figure 3.10- Compressive Strength Test Sample

- Testing for flexural Strength of Concert Beam

The strength of concrete is defined as the capability of the material to resist stress without failure. The modules of rupture was determined by using ASTM C 78 standard (ASTM and Materials 2000). The flexural strength specimen size has a height of specimen 500mm, a width of specimen 100mm and depth of specimen100 mm. The flexural strength can be determined by using the formula.

Figure 3.11. Flexural strength test sample

- Testing of Splitting Tensile Strength of Concrete

A tensile split test was conducted to determine the indirect tension test for concrete. The splitting tensile test was carried out on a standard cylinder test using side diametric compression (ASTM 1999). The cylindrical specimen size have a diameter of 150mm and a height of 300mm.

Figure 3.12. Split tensile tests Samples

CHAPTER FOUR

RESULT AND DISSCUSION

4.1 Results of Waste Polyester Textile

4.1.1Water Absorption of WastePolyster Textile

Table 4.1. Water absorption test result of Waste PolyesterTextile

Fiber %	Sample no	Weight before immersed (W1)g	Weight after immersed (W2)g	Fiber dry (g)	Water absorption (%)
100	1	100	359	95	(359-100)/100=2.59
100	2	100	352	98	(352-100)/100=2.52
100	3	100	364	96.5	(364-100)/100=2.64
Mean				96.5	2.58%

As shown on table 4.1, water absorption for normal fiber was found to be 2.58%.the result shows the textile absorbs water highly and this lead to decrease in concrete workability.There fore during mix design calculation the water adjustment should be with the concederetion of textile water absorption.

4.2 Concrete ingredients test result

4.2.1 Fine and Coarse Aggregate

- Sieve Analysis Test Results for Fine Aggregate

The grading requirements for fine aggregates are set according to According to ASTM 136-97 and, the particle size distribution of fine aggregate used for the experiment is shown in the Figure 4.1 below.

Table 4.2. Sieve Analysis test result for fine aggregate

Sieve size,mm.	Weight Retained in gm	%of Retained	% cum.Retained	% cum passing	Gradation Limit (ASTM)
9.5	0	0	0	100	100
4.75	79.7	4	4	96	95-100
2.36	169.2	8.5	12.8	87.6	80-100
1.18	351.7	17.6	30	70	50-85
0.6	655	32.8	62.8	37.2	25-60
0.3	544	27.2	90	10	10-30
0.15	153.6	7.7	97.7	2.31	2-10
0.075	46	2.3	100	0	0
*pan	0.01	0.001	100	0	0
Dry weight	1999.9	100	298		

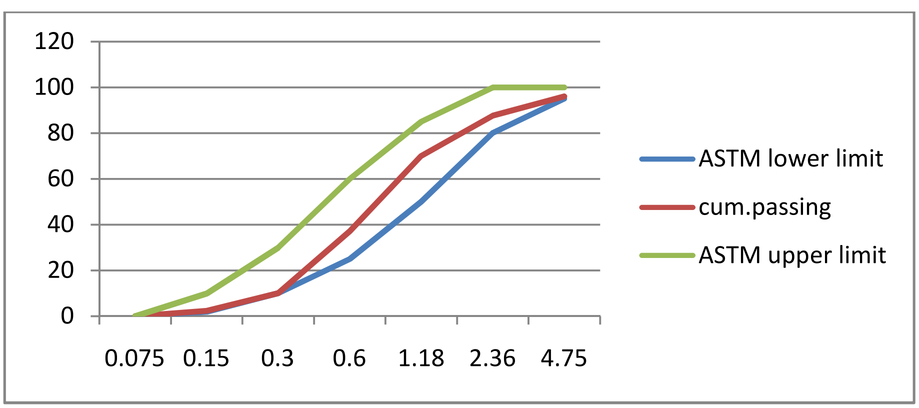

Figure 4.1 Sieve analysis results of fine aggregate

This result of finance modules of sand was 2.98 %. The fines modules of fine aggregate must be between 2.3 and 3.1 [46]. However, depending upon this size, sand can be classified as coarse sand when a fineness modulus is between 2.90 to 3.20; medium sand with a fineness modulus of 2.60 to 2.90 and; fine sand with a fineness Modulus of 2.20 to 2.60. Apparently, the sample was classified as coarse sand.

- Sieve Analysis for Coarse Aggregate

For coarse aggregate particle size distribution is determined by sieve analysis gradation.

Table 4.3 Gradation curve for Coarse Aggrgate

Sieve Size	Mass retained	%age retained	Cumulative % retained	Cumulative % passing	Specification % passing
75	0	0		0	
63*	0	0		0	
37.5	0	0	0	100	100
28	110	2.2	2.2	97.8	90-100
20	1780	35.6	37.8	62.2	40-85
14	1700	34	71.79	26.21	10-50
10	1312	26.24	98.03	1.97	0-15
4.75	40.5	0.81	98.84	1.16	0-5
Pan	58	1.16	100	0	
sum	5000.5	100	408.66	289.34	

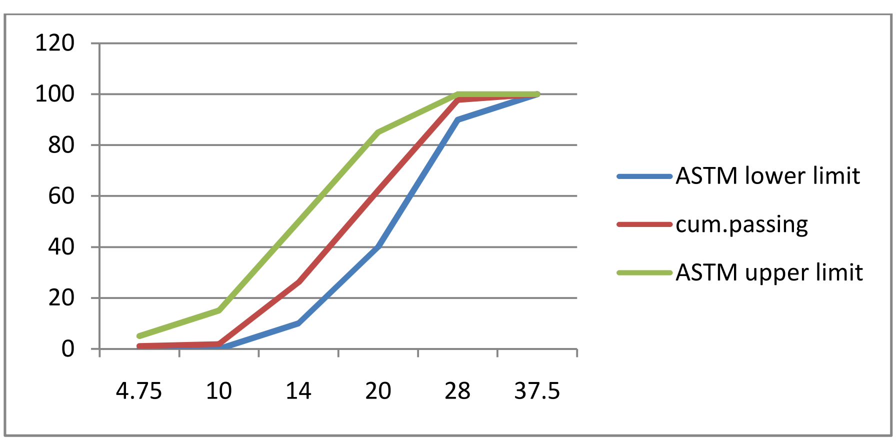

Figure 4.2. Gradation curve for Coarse Aggrgate

The grading requirements for coarse aggregates are set according to ASTM C33 and, the particle size distribution of course aggregate used for the experiment is shown in Figure 4.2. [46]standards, the maximum nominal size of aggregate is 20mm and minimum size is 4.75mm. This result of finance modules of course was 2.89%, depending upon their size,Aggregate can be classified as medium Aggregate with a fineness modulus of 2.60 to 2.90. Therefore, the sample can be classified as medium Aggregate.

- Summarized Test Result for Aggregate Test

The below table contains the summarized results of aggregate tests conducted.

Table 4.4. Summarized Results of Aggregete Test

No	List of Tests		Fine Aggregate	Coarse Aggrega te	Permissible Range and Standard
1	Silt content	Before washing	8.5%	-	< 6 % (ES C D3.201) ASTM C 117
		After washing	1.47%	-	
		Lab silt content	1.99%	-	
2	Moisture content		1.79%	1.11%	0.2 – 2 % (ASTM C 566-89)
3	Unit weight	Compacted unit weight (kg/m3)	1521.58	1586.47	1200–1760kg/m3 fine aggregate 1250–1400kg/m3 (coarse aggregate) ASTM C 29/C 29 M91A
		Loose unit weight (kg/m3)	1423.59	1518.77	
4	Fineness modulus		2.98%	2.89%	2.0-3.5 (fine aggregate) 2.6– 2.9 (coarse aggregate) ATSM C 136
5	Absorption capacity		1.43%	1.42%	0.2 – 2 % (ASTM C-33-01)
6	Specific gravity	Apparent specific gravity	2.65	2.91	2.4 – 3 (ASTM C 127, C 128)
		Bulk specific gravity	2.55	2.80	2.4 – 3 (ASTM C 127, C 128)
		Bulk specific gravity(SSD)	2.59	2.84	2.4 – 3 (ASTM C 127, C 128)

Table 4.3 reveals that the silt content before washing is more than expected according to ES C D3.201 standard. Therefore, it is necessary to wash the whole silt before washing. This helps to avoid the bond decrement of sand. The results after washing for both the field and laboratory method are1.47 % and 1.99% respectively, which are in the acceptable range. Hence, the later experiments are conducted using the washed sand.

Moisture content is important to determine water-cement ratio based on the assumption of inertness of aggregates. Hence, the moisture content of the fine and course aggregate sample was found to be 1.79% and 1.11% respectively. Moreover, both moisture results are in acceptable range of ASTM C 566-89 standard(ASTM 2004).

Unit weight of sample test has been conducted to determine the weight for a given volume of the respective fine aggregate. The weight of the fine aggregate in the cylinder is determined using the bulk density and the volume measurement. The compacted unit weight of coarse and fine aggregate sample was found to be 1521.58 kg/m3 and 1586.47 kg/m3 respectively. Whereas, loose unit weight of coarse and fine aggregate sample was 1423.59 kg/m3and 1518.77 kg/m3. When the results are compared with ASTM C29 standard, both the compact and loosen unit weights are within the acceptable range(ASTM and Absorption of Coarse Aggregate 2006).

The specific gravity and absorption of the given coarse aggregate test was taken from ASTM C 217 whereas ASTM C 218 was used for fine aggregates. Result of fine aggregates listed in table 4.2 reveals that both the absorption and specific gravity values of both fine and course aggregates are in the acceptable range of ES and ASTM standard. This result assures that the water ratio selected for concrete mix will be appropriate.

4.3 Test result on workability of fresh concrete

The addition of Polyester Textile reducethe workability of fresh concrete. This is attributed to the fact that the textiles absorb some of the water in the concrete mix making the mix be of less flow.

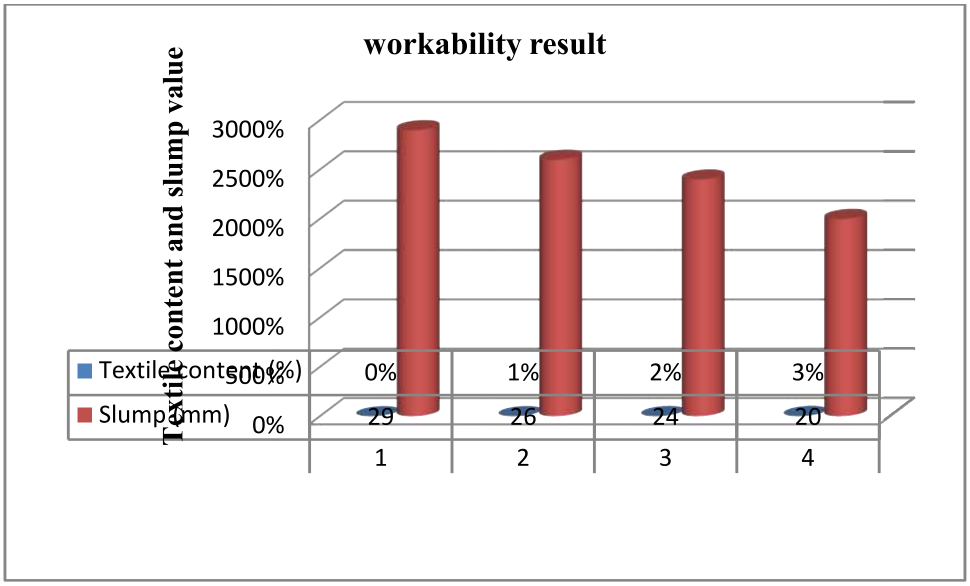

Figure4.3 Fresh concrete slump test results with the use of Polyester Textile

The effect of adding Waste polyester Textile in concrete mix workability of concrete was shown in figure 4.3. The table depicts that as the textile addition percent increase the slump range decrease. From the observation conducted during laboratory work, the concrete mix seento be stiff, meaning the mix is not workable in according to ACI 211.1.8.1. Therefore, this result suggests that water to cement ratio should be adjusted. However, it shouldn't be forgotten that the adjustment should be in optimum range otherwise it will have an effect on the strength of the concrete. The slump value good result in 25-50mm additionally, the slump values for other percent's (controland 1%) gives a satisfactory slump value along with good workability.

4.4 Compressive Strength Result

The compressive strength test was carried out conforming of C-25 obtain at the 7 and 28 days strength with the addition of Waste polyester Textile for concrete production.

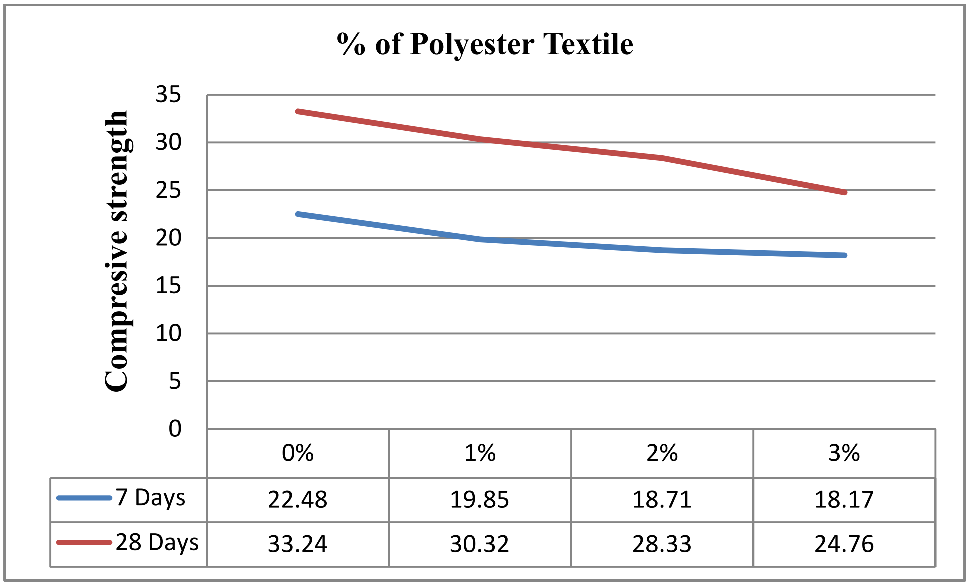

Figure 4.3. Effect of Polyester Textile on Compressive Strength of Concrete

The compressive strength of C-25 grade concrete mix with the addition of Polyester Textile is presented in figure 4.3 above. At the age of seven day the observed rates of compressive strength of 0, 1%, 2% and 3% Polyester Textile added concrete were 22.48MPa,19.85MPa, 18.71MPa and 18.17MPa respectively and also at the age of twentyeigth day, the observed rates of compressive strength of 0, 1%, 2% and 3% Polyester Textile added concrete were 33.24MPa, 30.32MPa, 28.33MPa and 24.76MPa respectively.Moreover, the maximum amount of compressive strength is found for control mix to be 22.48 MPa and 33.24MPa for 7th day and 28th day respectively. Whereas, the minimum value is obtained for addition ratioof 3% having the value of 18.17MPa for 7th day and 24.76MPafor 28th day curing time respectively.

In addition to this, it can be seen from the graph that the compressive strength decreases for curing time, 7th day and 28th day, as the percentage of textile addition increases. There is a

25.5 % decrease in compressive strength between the minimum (3%) and maximum (0 %) amount of textile addition.

4.5 Split Tensile Strength Result

The effects of Textile fiber in split tensile strength C-25 concrete mix is shown in figure 4.4 below.

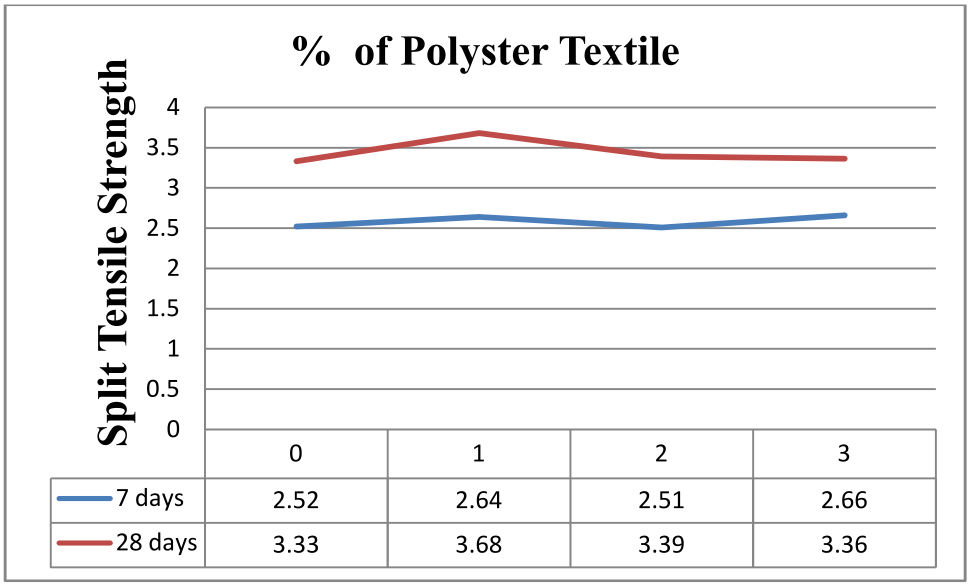

Figure 4.4. Effect of waste Polyester Textile on Split Tensile Strengthof Concrete

From the figure it can be seen that the maximum amount of tensile strength is found to be 3.68MPa and 3.39MPa for 28 day curing time of 1% and 2 % oftextile addition respectively. Whereas the maximum value of tensile strength for 7 days curing time is found to be 2.66 MPa and 2.64MPa for 3 % and 1% textile additions respectively. Unlike compressive strength, the tensile strength increases as the percentage of textile addition increases till 1% but from there on the tensile strength decreases as the textile addition percentage decreases.

The minimum values for both 7 days and 28 days curing time have been recorded to be 2.51MPa and 3.33MPa respectively for textile percentage addition of 2% and 0 %. There is a total of 9.51 % increase in split tensile strength for 28 days curing time, whereas there is a 5.64 % increase in strength for 7 days curing time in reference to the control mix.

4.6 Flexural Strength Result

The Flexural strength was determined for percentage Polyester textile addition in grade C-25 concrete. The 7 and 28 days compressive strength results are shown in figure 4.5.

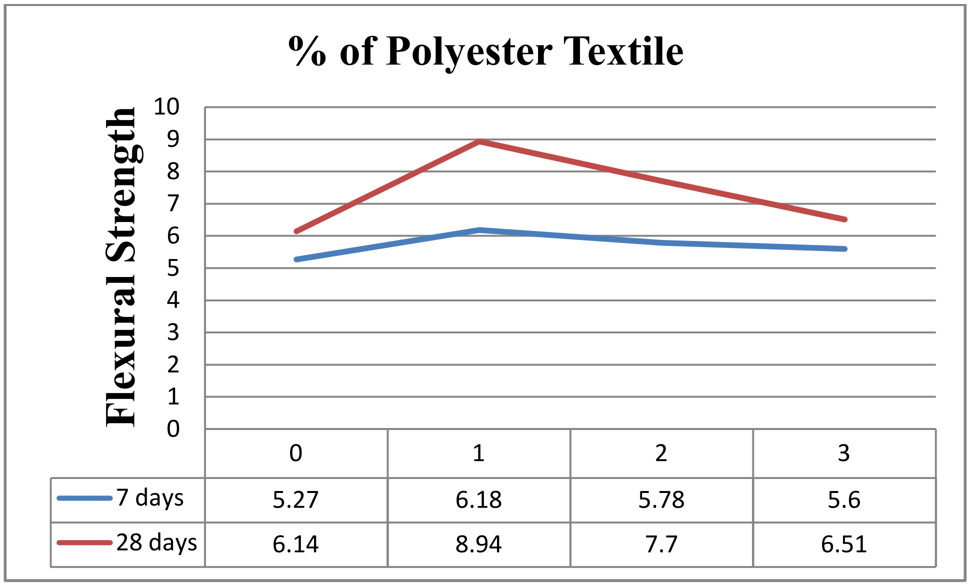

Figure 4.5. Effect of waste Polyester Textile on Flexural Strength of Concrete

Figure 4.5 reveals that the maximum amount, for 1 % textile addition, is found to be 8.94MPa and 6.18MPa for 28 days and 7 days curing times respectively. Whereas the minimum values are recorded to be 5.27MPa for 7 days curing time for 0 % textile addition, likewise 6.14MPa is recorded for 28 days curing time for 0% textile addition.

Moreover, an increase of flexural strength with 31.32 % is realized for 28 days curing time in reference to control mix, whereas there was only 14.72 % increase for 7 days curing time.

4.7 Optimum Proportion Ratio of Fiber in Concrete

In order to select optimum ration of fiber addition on C-25 grade concrete, it is imperative to draw the mechanical properties all in one. Figures 4.3, 4.4 and 4.5 have been used to determine the optimum ratio of Waste Polyester Textile addition.

It is obvious that the Tensile and Flexural strengthincreses as the textile percent addition increases.There fore the compressive strength and workability result was used to determine the optimum proportion of waste polyester textile since both properties of concrete decrese with the increase of percent addition of textile.

The optimum value for compressive strength 28 days result relies between 1% and 2% with 30.32 and 28.33 and optimum value for workability is between 1% and 2%.There fore the researcher take 1% Since compressive strength is 30.32 on this percent addition of polyester textile it on good position for C-25 and the workability can be changed by water cement ratio adjecetment

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

The effect of adding Waste Textile Fiber on physical and mechanical properties of C-25 grade concrete was studied through experimental investigation. The following conclusions are drawn based on the results obtained from laboratory tests and discussion of the findings.

- Workability of C-25 concrete decreases as the waste polyester textile percentage added in the concrete mix increases.
- Tensile strength of C-25 concrete increases up to 9.51% with the increases of waste polyester textile present addition in concrete mix.
- The Flexural strength increaseswith 31.32% as waste polyester textileaddition in the concrete mix increases.
- Compressive strength have decreased with a total amount 8.78 % as the percentage of fiber addition increases.
- The Optimum proportion of WastePolyester Textile addition in concrete is found to be 1%.

There fore, we can use Waste Textile Fiber Concrete, since both flexural strength and Tensile strength of concrete increase with the addition of Waste Textile Fiber.And the result of slump test implies that the water to cement ratio should be adjusted.Moreover,the percent of Waste Textile Fiber to be added on concrete should be 2% by weigth of cement.

5.2 RECOMMENDATION

The following recommendations are drawn from the activities and results of this study.

- Further work is required to get data for long-term deformation characteristics and other structural properties of the experimental concrete.

- The workability through slump test is very much dependent on the Textile percent used, selection water to cement ration should account this effect or admixture could be used as an option.

- These material can be used in the upcoming green building technologies

- Future studies are recommended to focus on

- Comparing performance of otherWastes on mechanical property of concrete.
- Investigating effect of Textile waste in different size on workability and mechanical property ofconcrete.
- Investigating effect of environmental changes on concretes reinforced by waste fibers.
- Investigating effect of curing time on changes of mechanical properties of waste fiber reinforced concrete. These include: shear strength, durability, resistance to impact and crack protection testes etc.
- Economic valuation, job opportunity potential constructing buildings with fiber reinforced concretes for low income communities.

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APENDIX-A

MATERIAL TEST RESULT

A.1 Property of cement

Table A.1- Test Result for Normal Consistency of Cement

Sample No	Weight of cement, [g]	Weight of water added, [g]	Penetration recorded [mm]	ASTM C 187-86
1	300	85	4.4	28.3%
2	300	100	9.5	33%
3	300	90	12	30%

%of water =weight of water (g)/weight of cement (g)…………………………(1)

=100/300=33%

A.2. Property of Aggregate

A.2.1 Property of fine aggregate

I. Silt Content

This formula used to determine silt content of fine aggregate.

- Field method ES

Silt content (%)=A/B * 100………………………………(2)

Where *"A"* is the amount of silt deposited above the sand and
"B" is the amount of clean sand

- Laboratory method (ASTM 117)

Silt content (%)= (M1-M2/M1)*100 ....(3)

Where M1 is unwashed sand and
M2 is washed and dried sand

Table A.2- Laboratory Result for Silt Content Fine Aggregate

1. Field method ES			
Sample	Volume of silt deposit in ml (V1)	Volume of clear sand in ml (V2)	Silt content %silt= (V2/V2)*100
1	26ml	270ml	9.6
2	20ml	265ml	7.5
Before washing Mean			8.55%
Sample	Volume of silt deposit in ml (V1)	Volume of clear sand in ml (V2)	Silt content %silt=((M1-M2)/M1)*100
1	1kg	984.6Kg	1.68
2	1kg	987.4Kg	1.26
After washing Mean			1.47%
2. Laboratory method (ASTM 117)			
Sample	Weight of sand [Kg]	Weight of oven dry [Kg]	Silt content [%]
1	1kg	981.47kg	1.85
2	1kg	979.22kg	2.1
Mean			1.99

II| Moisture Content

W(%)=(A-B)/B *100……………………………………(4)

Where *W* Moisture content (%)
A weight of original sample (g) and
B weight of oven dry sample (g)

Sample taken for fine aggregate according to ASTM 70

A=weight of fine aggregate 500g

B= weight of oven dry sample= 491.2

W(%)=(A-B)/B *100

W(%)=(500-491.2)/491.2*100
=1.79%

Sample taken for coarse aggregate according to ASTM 5566

A=weight of course aggregate2kg

B= weight of oven dry sample= 1.978 kg

W(%) =(A-B/B)*100

= ((2-1.978)/1.978)*100

=1.11

III Unit Weight of Fine and Coarse aggregate according toASTM C 29

The unit weight of the aggregate calculates it by the given formula.

Unit weight=(WVS-WV)/Wcylinder *100

Where WVS weight of cylinder plus sample
WV weight of cylinder and
V cylinder volume of the cylinder

Table A.3- Laboratory Test Result for Unit Weight Aggregate

1.Unit weight of fine aggregate	Sample 1	Sample 2
1.1 Rodding method		
Weight of Cylinder	2938.4	2938.4
Weight cylinder + sample	6690	6730
Volume of cylinder	2475.5	2475.5
Unit weight=(WVS-WV)/Wcylinder *100	1515.55	1527.61

Mean	1521.58	
2.1 Lose Weight method		
Weight of Cylinder	2938.4	2938.4
Weight cylinder + sample	6500	6425
Volume of cylinder	2475.5	2475.5
Unit weight=(WVS-WV)/Wcylinder *100	1438.74	1408.44
Mean	1423.59	

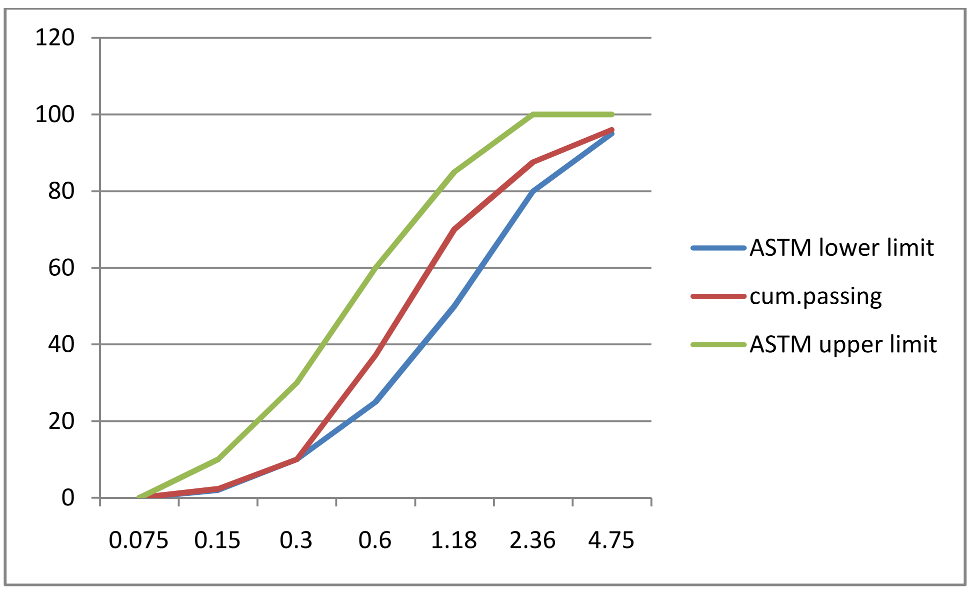
2. Unit weight of course aggregate	Sample 1	Sample 2
2.1. Rodding method		
Weight of Cylinder	9000	9000
Weight cylinder + sample	32750	32730
Volume of cylinder	14844.3	14844.3
Unit weight=(WVS-WV)/Wcylinder *100	1599.94	1573
Mean	1586.47	
2.2 Lose Weight method		
Weight of Cylinder	9000	9000
Weight cylinder + sample	31540	31550
Volume of cylinder	14844.3	14844.3
Unit weight=(WVS-WV)/Wcylinder *100	1518.43	1519.10
Mean	1518.77	

IV. Sieve Analysis

Sieve Analysis for Fine Aggregate ASTM 136

Table A.4- Laboratory Test Result for Sieve Analiysis of Fine Aggregate

Sieve size,mm.	Weight Retained in gm	%of Retained	% cum.Retained	% cum passing	Gradation Limit (ASTM)
9.5	0	0	0	100	100
4.75	79.7	4	4	96	95-100
2.36	169.2	8.5	12.8	87.6	80-100
1.18	351.7	17.6	30	70	50-85
0.6	655	32.8	62.8	37.2	25-60
0.3	544	27.2	90	10	30-Oct
0.15	153.6	7.7	97.7	2.31	10-Feb
0.075	46	2.3	100	0	0
*pan	0.01	0.001	100	0	0
Dry weight	1999.9	100	298		



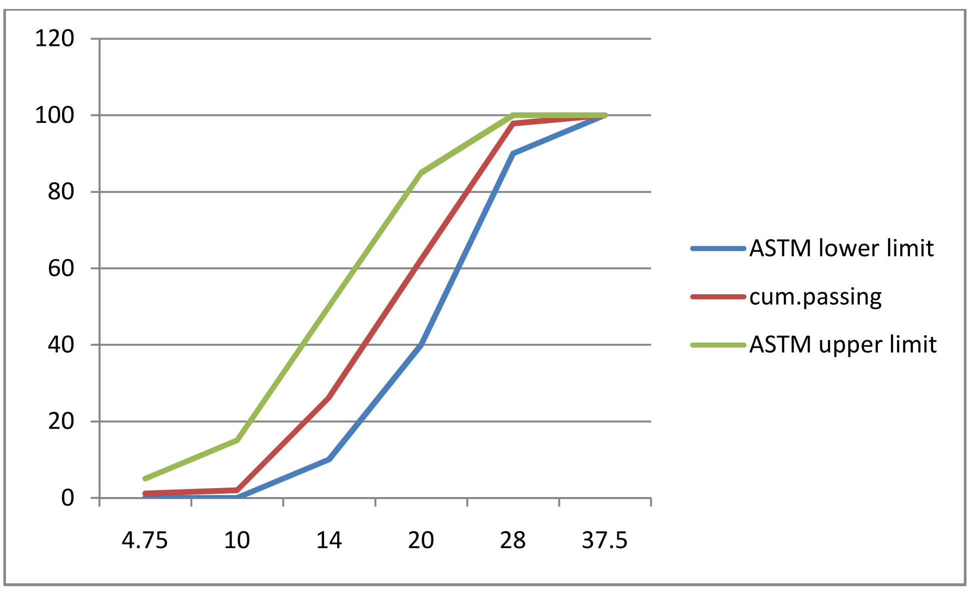
Fineness modules=ΣCumulative passing/100

= 298/100

=2.98%

Table A.5- Laboratory Test Result for Sieve Analiysis of Coarse Aggregate

Sieve Size	Mass retained	%age retained	Cumulative % retained	Cumulative % passing	Specification % passing
75	0	0		0	
63*	0	0		0	
37.5	0	0	0	100	100
28	110	2.2	2.2	97.8	90-100
20	1780	35.6	37.8	62.2	40-85
14	1700	34	71.79	26.21	10-50
10	1312	26.24	98.03	1.97	0-15
4.75	40.5	0.81	98.84	1.16	0-5
Pan	58	1.16	100	0	
sum	5000.5	100	408.66	289.34	



Fineness modules=ΣCumulative passing/100

= 289/100

=2.89%

V. Specific Gravity and Absorption of Fine Aggregate

Specific gravity and absorption of fine aggregates was determining by using the following formula

Bulk Specific Gravvity (Oven dray) = A/B + S – C ………………………….(7)

Bulk Specific Gravvity (Saturated Surface Dray) = S/B + S – C……………(8)

Apparent Specific Gravity = A/B +A – C …………………………………….(9)

Absorption capacity (%) = (S-A)/A *100 …………………………………….(10)

Where *A* weight of oven-dry sample in air,
B weight of Pycnometer filled with water,
C weight of pycnometer with sample and water to calibration mark, and
S weight of saturated surface dry specimen, all measurement has in g.

Table A.6- Laboratory Test Result for Specific Gravity of Fine Agggregate

Description		Test 1	Test 2	Average
A. Mass of Oven Dry Sample in Air	G	498	492.79	495.395
B. Mass of Saturated Surface Dry Sample in Air	G	505.1	500	502.55
C. Mass of Flask + Water	G	727.9	724.8	726.35
D. Mass of Flask + Water + Sample	G	1040	1031.7	1035.85
Absorption capacity (%) = (S-A)/A *100		1.41	1.46	1.43
Test temperature , oC		22	22	
Apparent Specific Gravity = A/B +A – C		2.642	2.651	2.65
Bulk Specific Gravvity (Oven dray)		2.546	2.552	2.546
Bulk Specific Gravvity (S.S.D)		2.582	2.589	2.59

VI. Specific Gravity and Absorption of Coarse Aggregate

$\boldsymbol{BulkSpecificGravity}$ ($\boldsymbol{OvenDry}$) = A/B-C

$\boldsymbol{BulkSpecificGravity}$ ($\boldsymbol{SaturatedSurfaceDry}$) = B/B-C

$\boldsymbol{ApparentSpecificGravity}$ = A/A-C

$\boldsymbol{AbsorptionCapacity}$ (%) = (B-A/A)*100

Where A weight of oven-dry sample in air,

B weight of saturated surface dry test sample in air, and

C weight of saturated surface dry test sample in a water and water to calibration mark, all measurement has in g

Table A.7- Laboratory Test Result for Specific Gravity and Absorption of CoarseAgggregate

Description		Test 1	Test 2	Average
A. Mass of Oven Dry Sample in Air	G	3589	3509	
B. Mass of Saturated Surface Dry Sample in Air	G	3640.7	3559.4	
C. Mass sample in Water	G	2360	2300.9	
Absorption capacity (%) = (S-A)/A *100		1.42	1.416	1.42
Test temperature , oC		21	22	21.5
Apparent Specific Gravity = A/B +A – C		2.92	2.905	2.91
Bulk Specific Gravvity (Oven dray)		2.802	2.788	2.80
Bulk Specific Gravvity (S.S.D)		2.843	2.828	2.84

Summary of fine and coarse aggregate

Table A.8- Summary of Fine and Coarse Agggregate

No	List of Tests		Fine Aggregate	Coarse Aggregate	Permissible Range and Standard
1	Silt content	Before washing	8.5%	-	< 6 % (ES C D3.201) ASTM C 117
		After washing	1.47%	-	
		Lab silt content	1.99%	-	
2	Moisture content		1.79%	1.11%	0.2 – 2 % (ASTM C 566-89)
3	Unit weight	Compacted unit weight (kg/m3)	1521.58	1586.47	1200–1760kg/m3 fine aggregate 1250–1400kg/m3 (coarse aggregate) ASTM C 29/C 29 M91A
		Loose unit weight (kg/m3)	1423.59	1518.77	
4	Fineness modulus		2.98%	2.89%	2.0-3.5 (fine aggregate) 2.6– 2.9 (coarse aggregate) ATSM C 136
5	Absorption capacity		1.43%	1.42%	0.2 – 2 % (ASTM C-33-01)
6	Specific gravity	Apparent specific gravity	2.65	2.91	2.4 – 3 (ASTM C 127, C 128)
		Bulk specific gravity	2.55	2.80	2.4 – 3 (ASTM C 127, C 128)
		Bulk specific gravity(SSD)	2.59	2.84	2.4 – 3 (ASTM C 127, C 128)

APPENDIX B

WORKABILITY TEST RESULT TO C-25 CONCRETE

Table B.1- Result of slump values for C-25 concrete

Mix design	Water content (kg/m3)	Slump value (mm)
Control	180	29
1%	180	26
2%	180	24
3%	180	2

APPENDIX C

COMPRESSIVE STRENGTH FOR C-25 CONCRETE

Table C.1- Compressive Strength Test Result for 7th day

No	% age	Test day	Dimension (cm)			Weight (gm)	Volume (cm3)	Failure load (KN)	Unit weight (gm/cm3)	Comp. Strength (MPa)	Comp. Strength (MPa) Avrage.
			L	W	H						
1	0%	7th	15	15	15	8351.4	3.37	527.2	2.37	23.4	**22.48**
2			15	15	15	8461.1	3.37	513.91	2.37	22.81	
3			15	15	15	8635	3.37	477.68	2.37	21.23	
Average								**506.26**		**22.48**	
1	1%	7th	15	15	15	8395	3.37	434.08	2.37	19.29	**19.85**
2			15	15	15	8635	3.37	477.68	2.37	21.23	
3			15	15	15	8586.5	3.37	428.11	2.37	19.03	
Average								**448.62**		**1985**	
1	2%	7th	15	15	15	8517	3.37	413.53	2.37	18.38	**18.71**
2			15	15	15	8454	3.37	427.7	2.37	19.01	
3			15	15	15	8524.5	3.37	421.53	2.37	18.74	
Average								**420.92**		**18.71**	
1	3%	7th	15	15	15	8545.5	3.37	363.2	2.37	16.14	**18.17**
2			15	15	15	8367	3.37	421.9	2.37	18.72	
3			15	15	15	8335	3.37	442.58	2.37	19.67	
Average								**409.23**		**18.17**	

Table C.2- Compressive Strength Test Result for 28th day

No	% age	Test day	Dimension (cm)			Weight (gm)	Volume (cm3)	Failure load (KN)	Unit weight (gm/cm3)	Comp. Strength (MPa)	Comp. Strength (MPa) Avrage.
			L	W	H						
1	0%	28th	15	15	15	8358.6	3.37	788.7	2.37	35	**33.24**
2			15	15	15	8371.2	3.37	743.85	2.37	33.01	
3			15	15	15	8375.5	3.37	713.46	2.37	31.71	
Average								**748.67**		**33.24**	
1	1%	28th	15	15	15	8866.5	3.37	644.58	2.37	28.65	**30.32**
2			15	15	15	8351	3.37	688.62	2.37	30.61	
3			15	15	15	8375.5	3.37	713.46	2.37	31.71	
Average								**682.22**		**30.32**	
1	2%	28th	15	15	15	8528	3.37	592.74	2.37	26.35	**28.33**
2			15	15	15	8354	3.37	626.22	2.37	28.82	
3			15	15	15	8461.5	3.37	670.92	2.37	29.82	
Average								**629.96**		**28.33**	
1	3%	28th	15	15	15	8037.5	3.37	551.28	2.37	24.51	**24.76**
2			15	15	15	8280	3.37	531.25	2.37	24.1	
3			15	15	15	8351	3.37	577.28	2.37	25.66	
Average								**575.47**		**25.76**	

APPENDIX D

FLEXURAL STRENGTH FOR C-25 CONCRETE

Table D.1- Flexural Strength Test Result for 7th day

No	% age	Test day	Dimension (cm)			Weight (gm)	Volume (cm3)	Failure load (KN)	Unit weight (gm/cm3)	Bending Strength (MPa)	Bending Strength (MPa) Avrage.
			L	W	H						
1	0%	7th	15	15	15	12021	3.37	303	2.37	4.5	**5.27**
2			15	15	15	12794	3.37	374	2.37	5.6	
3			15	15	15	12810	3.37	383	2.37	5.7	
Average								**353**		**5.27**	
1	1%	7th	15	15	15	12145	3.37	388	2.37	5.8	**6.18**
2			15	15	15	12196	3.37	431	2.37	6.74	
3			15	15	15	12183	3.37	397	2.37	6	
Average								**405**		**6.18**	
1	2%	7th	15	15	15	12423	3.37	353	2.37	5.3	**5.78**
2			15	15	15	12600	3.37	376	2.37	5.63	
3			15	15	15	11602	3.37	389	2.37	5.8	
Average								**372**		**5.78**	
1	3%	7th	15	15	15	12318	3.37	344	2.37	5.2	**5.6**
2			15	15	15	12287	3.37	380	2.37	5.7	
3			15	15	15	12248	3.37	383	2.37	5.8	
Average								**369**		**5.6**	

Table D.2- Flexural Strength Test Result for 28th day

No	% age	Test day	Dimension (cm)			Weight (gm)	Volume (cm3)	Failure load (KN)	Unit weight (gm/cm3)	Bending Strength (MPa)	Bending Strength (MPa) Avrage.
			L	W	H						
1	0%	28th	15	15	15	12752	3.37	428	2.37	6.4	**6.14**
2			15	15	15	12659	3.37	421	2.37	6.32	
3			15	15	15	11783	3.37	380	2.37	5.7	
Average								**410**		**6.14**	
1	1%	28th	15	15	15	13498	3.37	567	2.37	8.5	**8.94**
2			15	15	15	13437	3.37	608	2.37	9.11	
3			15	15	15	13364	3.37	614	2.37	9.2	
Average								**596**		**8.94**	
1	2%	28th	15	15	15	12385	3.37	496	2.37	7.4	**7.7**
2			15	15	15	13168	3.37	519	2.37	7.79	
3			15	15	15	13218	3.37	524	2.37	7.9	
Average								**513**		**7.7**	
1	3%	28th	15	15	15	11424	3.37	420	2.37	6.3	**6.51**
2			15	15	15	12572	3.37	437	2.37	6.54	
3			15	15	15	12214	3.37	448	2.37	6.7	
Average								**435**		**6.51**	

APPENDIX E

SPLIT TENSILE STRENGTH FOR C-25 CONCRETE

Table E.1- Split Tensile Strength Test Result for 7th day

No	% age	Test day	Dimension (cm)			Weight (gm)	Volume (cm3)	Failure load (KN)	Unit weight (gm/cm3)	Tensile strength (MPa)	Tensile strength (MPa) Avrage.
			L	W	H						
1	0%	7^{th}	15	15	15	3730	3.37	76.47	2.37	2.44	**2.52**
2			15	15	15	3734	3.37	78.94	2.37	2.52	
3			15	15	15	3740	3.37	81.4	2.37	2.6	
Average								**78.94**		**2.52**	
1	1%	7^{th}	15	15	15	3736	3.37	86	2.37	2.74	**2.64**
2			15	15	15	3742	3.37	83.44	2.37	2.66	
3			15	15	15	3705	3.37	78.56	2.37	2.51	
Average								**82.67**		**2.64**	
1	2%	7^{th}	15	15	15	3775.5	3.37	73.82	2.37	2.36	**2.51**
2			15	15	15	3781	3.37	81.79	2.37	2.6	
3			15	15	15	3800	3.37	80.41	2.37	2.57	
Average											

1	3%	7th	15	15	15	3732	3.37	80.43	2.37	2.56	2.66
2			15	15	15	3758	3.37	84.43	2.37	2.69	
3			15	15	15	3796	3.37	85.47	2.37	2.72	
Average											

Table E.2- Split Tensile Strength Test Result for 28th day

No	% age	Test day	Dimension (cm)			Weight (gm)	Volume (cm3)	Failure load (KN)	Unit weight (gm/cm3)	Tensile strength (MPa)	Tensile strength (MPa) Avrage.
			L	W	H						
1	0%	28th	15	15	15	3622	3.37	96.17	2.37	3.1	**3.33**
2			15	15	15	3628.5	3.37	100.84	2.37	3.24	
3			15	15	15	3617.5	3.37	112.96	2.37	3.66	
Average								**103.32**		**3.33**	
1	1%	28th	15	15	15	3818	3.37	118.5	2.37	3.78	**3.68**
2			15	15	15	3824	3.37	117.13	2.37	3.74	
3			15	15	15	3861	3.37	109.23	2.37	3.51	
Average								**114.95**		**3.68**	
1	2%	28th	15	15	15	3510.5	3.37	109.92	2.37	3.53	**3.39**
2			15	15	15	3742	3.37	113.35	2.37	3.63	
3			15	15	15	3816	3.37	104.03	2.37	3.02	
Average								**109.1**		**3.39**	
1	3%	28th	15	15	15	3798	3.37	104.11	2.37	3.33	**3.36**
2			15	15	15	3799.5	3.37	109.16	2.37	3.5	
3			15	15	15	3888	3.37	102.11	2.37	3.26	

Average	**105.13**		**3.36**	

APENDIX F

WATER ABSORPTION TEST FOR WASTE TEXTILE FIBER

The moisture content was determined using the following formula

Wf=(W2-W1/W1)

Table F.1- Water Absorption Test for Waste Textile Fiber

Fiber %	Sample no	Weight before immersed (W1)g	Weight after immersed (W2)g	Fiber dry (g)	Water absorption (%)
100	1	100	359	95	(359-100)/100=2.59
100	2	100	352	98	(176-100)/100=2.52
100	3	100	364	96.5	(184-100)/100=2.64
			Mean	96.5	2.58%

APPENDIX G

SAMPLE PHOTO GALLERY TAKEN DURING THE STUDY

Photo:- cutting and drying textile sample

Photo:-Siveanalysisi for fine aggregate and unit weight for coarse aggregate

Photo:-sive analysis for coarse aggregate

Photo:-Specific Gravity for coarse aggregate

Photo:-specific gravity for coarse aggregate and silt content test for fine aggregate

Photo:- mixing concrete

Photo:- workability test

Photo:compacting and finishing mold concrete

Photo:compacting and finishing mold concrete

Photo:compacting and finishing mold concrete

Photo:- curing

Photo:- compressive strength and split tensile strength test

Photo:- Flexural strength test

Photo:- disposing waste