CE 400 Project & Thesis

A Study on Strength Behaviour of Concrete Incorporating With Jute Fiber

A Project Report Submitted to the Department of Civil Engineering ,

Sonargaon University (SU), DHAKA in partial fulfilment of the requirements

for the degree of B.Sc. in CIVIL Engineering.

Supervised by

Nishat Anjum

Lecturer

Department of Civil Engineering

Sonargaon University (SU)

Submitted By

Md. Abedur Rahman	**ID:BCE1602008022**
Md. Lutfor Rahman	**ID:BCE1602008212**
Md. Mahedi Hasan	**ID:BCE1602008023**
Morium Begumm	**ID:BCE1602008143**
Ananya	**ID:BCE1602008052**

Department of Civil Engineering SONARGAON UNIVERSITY, DHAKA, BANGLADESH.

APPROVAL

This is certify that the thesis submitted by Md. Abedur Rahman, Md. Lutfor Rahman, Md. Mahedi Hasan, Morium Begumm, Ananya.

Entitled “A study on Strength Behaviour of Concrete Incorporative With Jute Fiber” has been approved in partial fulfilment of the requirements for the Bachelor Of Science in Civil Engineering.

SUPERVISOR

Nishat Anjum
Lecturer,
Department Of Civil Engineering
Sonargaon University (SU).

DECLARATION

This is to declare that the work and material presented in the report has been carried out by us and has not previously been submitted to any University College/Organization for any Academic qualification. We hereby ensure that the work that has been presented does not breach existing copyright. We undertake to indemnify the university against any loss or damage arising from breach of the foregoing obligation.

Thanking You

Sincerely yours

Authors

Signature of the supervisor

.....

Nishat Anjum

Lecturer

Department of Civil Engineering (SU)

Signature of the group member

.....	.....
Md. Abedur Rahman	Md. Lutfor Rahman
BCE- 1602008022	BCE- 1602008212
.....	.....
Md.Mahedi Hasan	Morium Begumm
BCE- 1602008023	BCE- 1602008143

.....

Ananya

BCE- 1602008052

ACKNOWLEGEMENT

All praises and profound gratitude to the almighty Allah who is the most beneficent and the most merciful for allowing great opportunity and ability to bring this effort to fruition safety and peacefully. We sincerely acknowledgment and express my deep sense of gratitude to Nishat Anjum, Lecturer, department of Civil Engineering, the guide of this project. As a guide she gave a maximum help and coordination in finishing the project work. With him past years of experience and teaching steered us to come out with success through most difficult problem faced by us. Her active interest in this topic and Valuable advice was the source of the author's inspiration. We would like to place on record our deep sense of gratitude to our guides for their cooperation and unfailing courtesy to us every stage. We sincerely would like to thank all instructors and staffs of the Civil Engineering Department of Sonargaon University (SU), Dhaka, which contributed in various ways to the completion of this thesis work Finally, we would like to express our deepest gratitude to our entire group member whose support and manual labour contributed in various ways for the completion of this thesis work. The authors acknowledge the experimental facilities provided by strength of materials laboratory, department of civil Engineering of Sonargaon University (SU) the authors also acknowledge the efforts of all staff of strength of materials laboratory who conducted this study.

ABSTRACT

Experimental work was performed to determine the compressive strengths of cylinder test and to compare them with various cement .Firstly we collect the ordinary Portland Cement, jute fiber, Sylhet sand, (3/4)" down stone chips, water, The primary objective of this study is to investigate the effect of reinforcing raw jute fibers on the mechanical properties of cement concrete composites. The investigation helps to explore more on the variation of properties of concrete with jute fibers, its effective usage and to reduce the usage of polymer fibers which interns an environmental harm. In the present study, raw jute fibers cut to 20 mm and 15 mm were used with the proportionate mix of cement, coarse aggregate and sand with the water-cement ratio of 0.45. The mixed specimens are casted for different volume content of jute fibers (0%,0.1%, 0.5% and 0 .75%.) and 28 days.

When 0.1% Jute using in concrete then the result of concrete compressive strength increase 5%.

When 0.1% Jute using in concrete then the result of concrete tensile strength increase 7%.

TABLE OF CONTENT

Name of the content

Chapter-4

Result and Discussion

Chapter-5
Conclusion and Recommendation

Chapter-1

Introduction

1.1 General: Composite are fabricated by combining reinforcing material with concrete, which enhances the structural properties of concrete and it is commonly known as fiber reinforced concrete. In this study an effort is made to evaluate the compressive strength characteristics by adding jute fibers in plain cement concrete. As a process of waste management, the jute fibers that are produced in large scale are used as a reinforcing agent with concrete so that there is a significant increase in the structural properties of concrete. Normally a composite material such as fiber reinforced concrete comprises of a variety of fiber which may be natural or artificial. The addition of these natural fibers is more economical compared with artificial fibers. As Bangladesh is one of large producers of jute, these fibers can be used in order to overcome the brittle behave us of concrete. Jute also is one of the most affordable natural fibers and is second only to cotton in amount produced. An attempt to identify the optimum percentage of jute fibers which are to be used with concrete in order to achieve the maximum compressive strength is reported in this article. Different fiber contents were used as reinforcement which is assumed and achieved randomly oriented and uniformly distributed in the matrix. Specimens with varying fiber contents were tested in axial compression. The sustainable development with higher strength is the growing demand of construction industry. Concrete reinforcement by natural fibers are more promising to insure the concrete strength improvement with non-hazardous impact on environment as well as the effective use of available natural assets. To achieve this goal, numerous researchers have used the fiber as well as yarn very effectively as a concrete reinforcing material (Thakureta12014 Balladur and Shah 1992; Barreta1.1996 Meddaha and Bencheikh 2009 Rizkalla and Hassan 2002Z akaria, et al. 2015). The fibers can insure the post-cracking resistance, high-energy absorption feature, and increased fatigue resistance of cement-based composites (Savastanoeta1.2009). Among two different types of fibers, i.e., natural fibers and artificial polymer-based fibers, natural fibers are promising to use as reinforcement to overcome the inherent deficiencies in FRCC reinforced with polymer-based fiber (Ramakrishna and Sundararajan 2005).The main deficiencies associated with the use of artificial fibers are relatively high cost and health and environmental hazards on the contrary, natural fibers which are biodegradable, in expensive, environmentally friendly, and easily available as reported by distal. (2010) are produced from naturally available resources, for

instance, coconut tree, banana tree, cotton, and jute. Researchers have conducted numerous studies on the effect of natural fibers on the mechanical and physical behavior of concrete to investigate the extent of improvement. In recent years, unrelenting efforts have been observed for using natural fibers in FRCC for improving the energy efficiency, economy, and eco-friendliness flavor (Ramakrishna and Sundararajan2005). Hence, the demands to utilize natural fibers for making good-quality and low- cost sustainable FRCC for housing and other necessities are increasing. Additionally, the other potential application of natural fiber-reinforced cement composites is limited to those area where energy is to be absorbed or the areas prone to impact damage. Accordingly, natural fiber-reinforced cement composites are most suitable for shatter- and Earthquake-resistant construction, Foundation floor for machinery in factories, fabrication of lightweight cement-based roofing and ceiling boards, wall plaster, and construction materials for low-cost housing (Aziz et al. 1981). Variety of factors influences mechanical properties of FRCC reinforced with natural fiber. The factors are characteristics of fibers, nature of the cement-based matrix, and the way of mixing, casting, and curing the composite (Aziz et al. 1981). Among these parameters, the type of fiber and their characteristics have a Significant influence on the mechanical properties of these composites (Jaraboeta12012). Jute fibers, which come from annual plants, are available in plenty in Bangladesh. It is a prospective material for cement-based matrix. According to the previous study (Mansur and Aziz 1982Chakrabortyet all. 2013Meddaha and Bencheikh 2009; Bezerraeta 12004), a number of difficulties are encountered while mixing natural fibers to produce composite. For instance, Media and Bencheikh 2009 mentioned that inhomogeneous distribution of fibers yields bulk and surface flaws. The stress concentration at these flaws would accelerate crack propagation which results to lower fracture strength of the mortar specimens (Bezerraeta12004). Chakrabortyeta1.2013) also reported to use natural fibers in FRCC that the agglomeration could not be avoided. The amount of fibers that can be added to a mix is limited by the tendency of "bailing" (Mansur and Aziz 1982) where the fibers frequently intermesh and form fiber balls which is critical to be separated. The bailing of fibers results in an ineffectual and segregated mix which produces a highly porous and honeycombed concrete. As a result, a remarkable strength fall of the concrete composite occurs. From the above elucidation, it can be concluded that the fiber mixing plays a vital role in the perfection of mechanical properties of fiber-reinforced concrete composites. Additionally, the use of natural fibers in concrete made with crushed stone has been universally used. The use of crushed bricks very common (Rashid et al. 2009) in Bangladesh, parts of India, and some other countries having scarcity of stone. Additionally, the

mechanical properties of concrete made with crushed bricks are quite different than those made with crushed stone (Mansur et al. 1999; Mohammed at al 2014 Investigator.

1.2 Objectives Following the objectives:

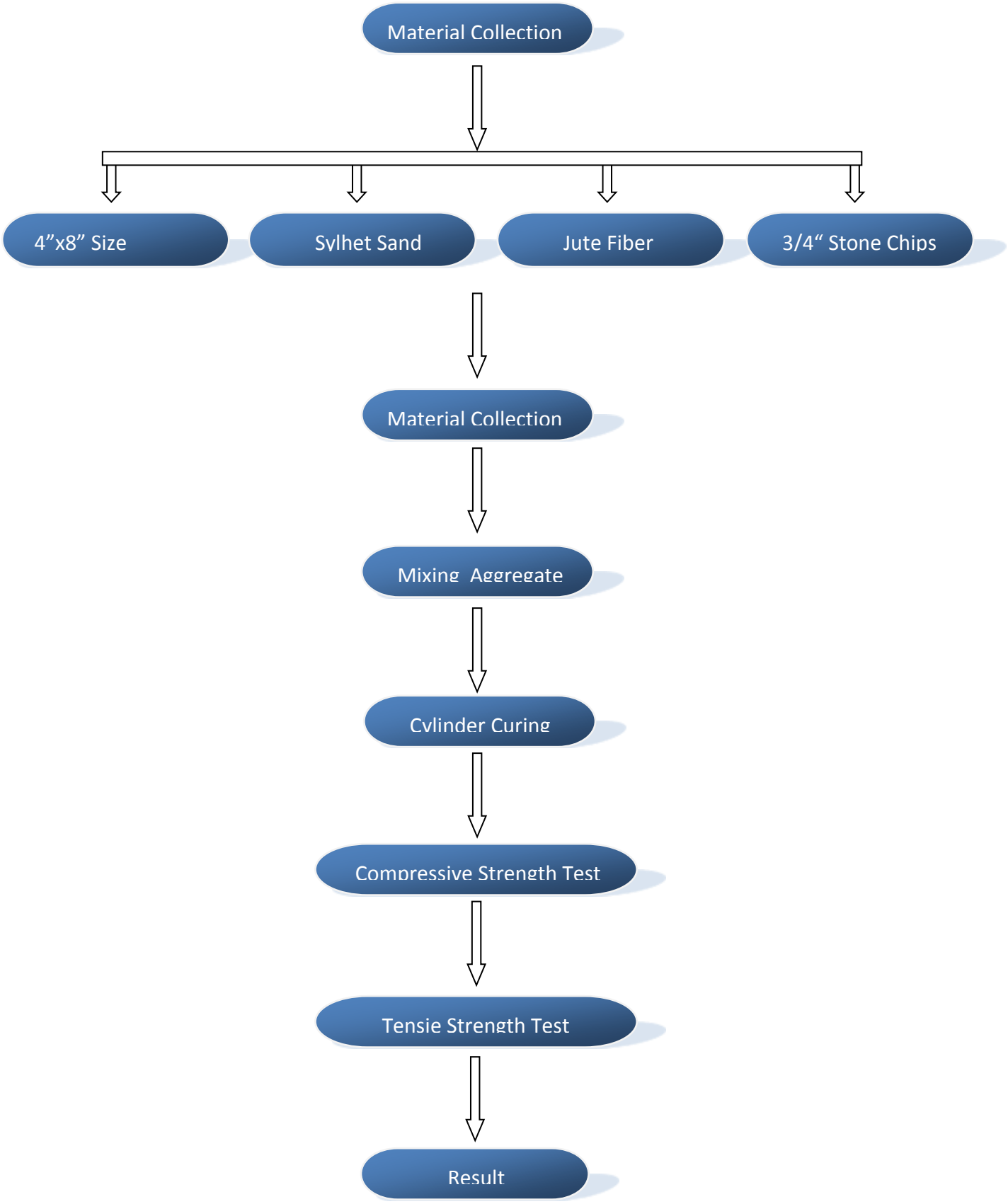
- ❑ To Determine compressive strength concrete incorporated with jute fiber.
- ❑ To Determine tensile strength concrete incorporated with jute fiber.
- ❑ To Comparison with Plain concrete and incorporate Jute fiber concrete.

Figure 1: Compressive Strength Test

Figure 2: Tensile Strength Test

Figure 3: Reading Colletion

1.3 Material Chart:



Chapter-2

Literature Review

2.1 General

A literature review of the effect of coarse aggregate grading compressive strength on the performance of Portland cement use concrete use of Sylhet sand some proportioning methods is presented in this chapter. since concrete is a large hardened mass of heterogeneous its properties are flanked by large number of variables related to difference types and amounts of ingredients, difference in mixing, transporting placing and curing and difference in specimen fabrication and test details. Because of the many variables, methods of checking the quality of concrete must be employed. The usual procedure is to cast strength of the concrete in the structure. The reliability of this assumption should always be questioned because of different curing condition for the specimen and the structure, because poor workmanship in placing in the structure may not be reflected in tests of specimens and because poor testing procedures may provide false results. A pattern of test should be used rather than placing reliance only a few tests to check uniformity and other characteristics of concrete. Statistical methods as given in ACI standard 214 should be used where large quantities concrete are involved. Most concrete is proportioned for a given compressive strength at a given age and consequently a compressive test is most frequently used. A 4*8 in cylinder is most commonly required but large cylinder is frequently used with mass concrete to be placed drams. The details of all strength tests are given in ASTM standards materials:

2.2 Jute fibers: Jute fiber are of silky texture. These are biodegradable and eco-friendly. The common structural properties of the jute fibers are very high tensile strength and low extensibility. In the present study raw jute fiber cut to a length of 20 mm and 15 mm are used. The content of jute fiber is determined with respect to the weight of cement. The various percentages of jute fibers that used to cast the specimen are 0.1%,0.5%, ad 0.75%.

Properties Of Jute Fiber:

Fiber	Jute Fiber
Length (mm)	10-20
Diameter (µm)	10-30
Density ($g/cm^{3)}$	1.3-1.5
Elongation (%)	1.5-1.8
Young' smodulus (GPa)	10-30

Figure 4: Cuting of Jute fibers

Figure 5: Two Size Jute fibers

2.3 Cement: A cement is a binder a substance used in construction that sets and hardens and bind other materials together .cements used in construction can be characterized as being either hydraulic or non - hydraulic depending upon the ability of the cement to set in the presence of water (see hydraulic and non-hydraulic lime plaster).non -hydraulic cement will not set conditions or underwater ,rather ,it sets as it dries and reacts with carbon dioxide in the air, it can be attacked by some aggressive chemicals after setting hydraulic cements(e, g, Portland cement) set and become adhesive due to a chemicals reaction between the dry ingredients and water. The chemical reaction results in mineral hydrates that are not very water- soluble and so quite durable in water or underwater and further protects the hardened material from chemical attack. The chemical Process for hydraulic cement found by ancient romans used volcanic ash (activated aluminium silicates) with lime (calcium oxide) the most important uses of cement are as a component in the production of mortar in masonry, and of concrete, a combination of cement and an aggregate to from a strong building material. The world cement can be traced back to roman term opus crematorium, used to describe masonry resembling modern concrete that was made from crushed rock with burnt lime as binder. The volcanic ash and pulverized brick supplements that, were added to the burnt lime to obtain a hydraulic binder, were later referred to as cemented, and cement. Fluid cement hardness over time. Most concretes used lime -based concretes such as Portland cement concrete or concretes made with other hydraulic cements, such as cement found. however, road surfaces are also a type of concrete asphalt concrete, where the cement material is bitumen, and polymer concrete (and other hydraulic cement concrete), when the aggregate is mixed together with the dry cement and water, they form a fluid mass that is easily molded into shape. The cement reacts chemically with the water and other ingredients to from a hard matrix which binds all the materials together into a durable stone -like materials that has many uses, often, additives (such as pozzolan or super plasticizers) are included in the mixture to improve the physical properties of the wet mix or the finished material. Most concrete is poured with reinforcing materials (such as rebar) embedded to provide tensile strength, yielding reinforced concrete. famous concrete structures include the hoover dam, the panama canal and the roman pantheon the earliest large-scale user of concrete technology were the ancient roman's ,and concrete was widely used in the roman empire the coliseum was in Rome was built largely of concrete ,and the concrete dome of the pantheon is the world largest unreinforced concrete dome .today ,large concrete structures (example ,dams and multi —story care= parks) are usually made with reinforced concreted concrete. Portland cement is the most common type of cement in general use around the world, use us basic

ingredient of concrete, mortar, stucco, and most non specialty grout. It was developed from other types of hydraulic lime in England in the mid19th century and usually originates from limestone it is a fine power produced by heating materials in a kiln to form what is called clinker, grinding the clinker and adding small amounts of other materials. Several types of Portland cement are available with most common being called ordinary Portland cement (OPC) which is grey in colour, but a white Portland cement is also available. Portland cement is caustic, so it can cause burns, the powder can cause irritation or with severe exposure lung cancer, and can contain some hazardous components such as crystalline silica and hexavalent chromium. Environmental concrete is the energy consumption required to mine, manufacture, and transport the cement and the related air pollution including the related of greenhouse gases (e,, g carbon dioxide 0 dioxin, NOX. SO2, and particulates. the low cost and widespread availability of the limestone, shale, and other naturally occurring material used in Portland cement make it one of the lowest —cost materials widely used over the last century throughout the world. Concrete produced in the world. Concrete produced from Portland cement is one of the most versatile construction materials available in the world. After the Roman Empire collapsed, use of concrete became rare until the technology was developed in the midl8th century. Today concrete is the most widely used man made material (measured by tonnage) the strength concrete at 7days and correlate to 28-day strength. Numerous research works have provided certain relationships. for instance, construction documents often specify a cement type based on the required performance of the concrete or the placement conditions .certain cement manufacturing plants only produce certain of Portland cement the most general sense, Portland cement is produced by heating sources of lime ,irons ,silica, and alumina ,to clinkering temperature (2500 to 2800 degree Fahrenheit) in a rotating kiln then grinding the clinker to fine power The heating that occurs in the kiln Transforms the raw materials into new chemical compounds. Therefore, the chemical composition of the cement is defined by the mass percentages and composition of the raw sources of line iron ,silica ,and alumina as well as the temperature and duration of heating .it is the variation in raw materials source and the plant —specific characteristic ,as well as the variation in raw materials source and the plant —specific characteristics ,as well as the finishing processes (I.e. grinding and possible blending with gypsum ,limestone ,or supplementary cementing materials), that define the cement produced .chemical test verify the content and composition of cement of cement .with physical testing demonstrates physical criteria.in Cl 501M 85 and C595/M240, both chemical and physical properties Aare limited oxide analyses (Si02,caO,Alo3, Fe2o3 etc.) to allow the cement phase composition to be calculated . to

allow the cement phase composition to be calculated type II cement are limited in C150/M85 to a maximum of 8 percent by mass of calcium aluminates (a cement ,phase ,often abbreviated c3A) which impacts a cement's sulphate resistance .Certain oxides are also themselves limited by specifications :For example ,the magnesia (Mg0) content Which is limited to 6 maximum by weight for Portland cements are: air content ,fineness ,expansion ,strength ,heat of hydration ,and setting time . Most of these physical tests are carried out using mortar of paste created from the Cement. This testing confirms that cement has the ability to Perform well in concrete ingredients ,their quantity ,as well as the environment ,and the handing and placing procedures used .Although the process for cement manufacture is relatively similar across North America and much of the globe, the reference to cement specifications can be different depending on the jurisdiction .In addition test methods can vary as well as ,so that compressive strength requirements (for example) in Europe don't "translate" directly to those in North America .When ordering concrete for construction projects, work with a local concrete producer to verify that cement meeting the requirements for the project environment and application is used, and one that meets the appropriate cement specification.

Figure 6: OPC

2.4 Water: The water has two roles in Concrete mixture, first is the chemical composition with cement and perform cement hydration and second is to make the concrete composition fluent and workable. The water which used to make the Concrete is drink water. The impurity of water can have undesirable effect on concrete strength. Water is the inexpensive important ingredient of concrete. Its basin functions in concrete is to reach with cement to form a binding parse which by penetrating into the minute and multi surface irregularities of sand and whoa, brings them into close adhesion, as in other chemical reactions the cement and water combine in define probation one part but weight of Portland cement requiring, about .25 parts by weight for hydration. Concrete containing water in this proportion, would be very dry and should be difficult to place it into the forms. Extra water must therefore be added to lubricate the mix, which is to make it mobile or workable enough to be easily placed into forms. This extra Water however must keep minimum as the use of too much make the concrete weaker in strength. A balanced quantity of water must be determined between too little water and too much water. Water also required in addition to washing aggregates and curing of concrete. The mixing water, washing water must be free from impurities that may lead to weak concrete.

Figure 7: Weight Of Water

2.5 Cement ratio on strength of concrete: The richness of the mix affects the strength of all medium and high strength concrete, i, e those with strength of about MPA (5000 psi) or more. there is no doubt that aggregate /cement ratio is only a secondary factor in the strength concrete but it has been found that for a constant water/cement ratio being thus reduced in other cases a high aggregate cement ratio would lead to lower shrinkage and lower bleeding and therefore to less damage to the bond between the aggregate the cement paste the cement, the paste, the thermal change caused by the heat of hydration of cement would be smaller6.80.the most likely explanation however, lies in the fact that the total water content per cube meter concrete is lower in a leaner mix than in a rich one. As a result ,in a leaner mix ,the void form a smaller fraction of total volume of concrete and it is these voids that have an adverse effect on strength studies on the influence of aggregate content on the strength of concrete with a given quality of cement plaster indicate that when the value of aggregate (as a percentage of the total value) is increased from zero 20, there is a gradual decrease in compressive strength but between 40 and 80 percent there is an increase 6.40 the reasons for this effect are not clear ,but it is the same at various Water cement tatio6.41 the influence of the volume of aggregate on tensile strength is broadly similar 60.40.

Figure 8: Concrete Mixing With Jute Fibre

Chapter -3

Materials & Methodology

3.1 Introduction:

This chapter includes the experiments required to determine the properties of ingredient of concrete. Experimental investigation was carried out on standard size cylinder (4" *8") Experimental program may be divided in to five phases.

1. The preparation of concrete mixing.

2. Casting of cylinders in the laboratory using coarse aggregate and curing for 28 days as marine environment.

3. Testing these cylinders to know the crushing strength.

4.Casting of cylinders in the laboratory using demolish /recycled coarse aggregate and caring for 28 days as before comprised of testing result of these cylinders in know the crushing strength.

3.2 Properties of constituent materials:

Coarse aggregate. Sand was used as fine aggregate and stone chips were used as coarse aggregate.

Figure 9: Concrete Mixing

3.3 Cement Mixing : OPC (Ordinary portland cement)

Figure 10: Cement Collect

Figure 11: Weight Of Cement

3.4 Coarse Aggregate:

Generally Bholaganj stone chips, are aggregate in this study stone chips had been used as a coarse aggregate as show in the figure for the preparation ofconcrete,20mm down graded crushed stone chips was used as coarse aggregate in case. coarse aggregates used in this study were obtained from the crushed cylinders which were cast using course aggregate (crushed stone) .the aggregate most of which are relined on the 4.75mm size .the recycled coarse aggregate was properly washed to remove dust and up before using in the preparation of concrete as shown in the figure.

Figure 12: (4/3”) Coarse Aggregate

3.5 Preparation of concrete cylinders: Thirty sets of (4"*8") cylindered were Cast in two steps. Then the contain 39 cylinders were cast those ordinary Portland cement stone chips, sylhet sand 1:1.47:2.25 coarse aggregates. mobile was used as lubricating oil to wipe the inside of the mouids for its easy removal after herding of the concrete. Fresh concrete was prepared as per designed mix in a drum type mixture machine as shown in the figure immediately after unloading from mixture machine .the fresh concrete was placed in the mould in lour layers and compacted by using 16mm diameter and 600mm in length tampering was 2.5 per layer compaction was censured over the cross- section of the mould through uniform distribution of the temping strokes. then the specimen was stored undisturbed for 24 hours in such a way that it prevent moisture loss method of maintained the specimen within room temperature. weight batching is the correct method of measuring the materials. For important concrete ,invariably , weight batching system is should be adopted .in this study batching has been used for measuring the materials.

Figure 13: Preparation of concrete cylinder

3.6 Casting: We are collected Portland cement, mould and kept to 39 pitch (4" *8").and casting done by work Sonargaon university (SU) lab Sylhet sand, stone chips to casting (1:1.47:2.25) at 39 cylinders. After 24 hours open water dram.

3.7 Curing: During this phase what calls initial curing, the cylinders can stay in this location for up to 24 hours, but be kept at a temperate between 23/c and marine environment gives us several ideas on ways to achieve this main environment keeping cylinders out of the sun in all case curing was done for a period of 28 days .but it was approaches to observe whether it has any significant impact on the compressive strength of once.

Figure 14: After 28 days with draw from the water dram of cylinder

3.8 Dry of cylinders: They were kept submerged as long as for 28 days. After that were with draw from the dram and were kept dry in the sun on the roof at 8.00 am to 3 pm.

Figure 15: Dry in the sun of cylinder

3.9 To Capping of concrete cylinder:

The top surface of cylinder, finished by a trowel are not placed and smooth enough for testing and requires further reparation. ASTM c 617-87 requires the end surface to be place within 0.05 mm (0.002)in there are two methods of obtaining a place and smooth then the surface of the cylinder as shown in figure.

Figure 16: Tamping Of Cylinder Specimen

3.10 Testing of the concrete cylinder:

After the specimens have for the proper length of time. They were placed under the universal testing machine in order to determine the compressive strength of cylinders as shown is the figure. The compressive strength of cylinder is determined according to ASTM C39 at A constant loading rate of 20 psi/s to 50 psi/s (0.14 MPa/s to no 0.4MPa/s).in the study hydraulically operated universal testing machine was at a constant loading rate of .25MPa/s the maximum recorded load is divided by the area of a cross section of the area specimen which gives the compressive strength of cylinder.

Figure 17: Testing of concrete cylinder

13.11 Caring:

They were kept submerged as long for 28days.After that were with draw from the dram and were kept dry in the sun on the roof. Then we are going Sonargaon university (SU) lab for crushing 36 cylinders.

3.12 Crushing:

Concrete is a composite material consists of filter and binding material where the filler materials are fine or cease aggregate and binding materials are cement paste. At the earlier stage of concrete development, it was believed that aggregate were chemically inter and held together by cement .but modern technology proves that aggregate exhibiting chemical bond at the interface of aggregate and paste. Aggregate is such important matter in concrete that maximum properties and workability of concrete are directly change with the properties of mechanical properties of concrete depends on the certain of aggregates like source of aggregate ,normal or light or heavy weight aggregate, size of aggregate ,shape of aggregate, crushing type of aggregates ,angularity index ,surface texture, modulus of elasticity ,bulk density specific gravity, absorption and moisture content , bulking of aggregate ,cleanliness, soundness of aggregate thermal properties and grading of aggregate .more over interfacial transition zone (contact surface between aggregate and cement paste)plays an important role in strength and durability of concrete .But aggregates should be clean and free from

impurities whkh are likely with the process of hydration ,prevention of effective bond between the aggregate and matrix and it reduces the durability of concrete. Sometimes excessive silt and contained in the fine or coarse aggregate may result increase shrinkage or increased permeability in addition to poor bond characteristics. Adherence reducing material like silt and clay must not be covered by aggregate surface and both aggregate and geometry must not allow any spaces which are being arisen from strike of cement particles. this situation is defined as wall effects .to avoid such spaces aggregates shape is a key and if aggregate voids are minimized ,the amount of cement paste required to fill those voids also minimized maintain workability and strength. It is difficult to really measure the shape of irregular body like concrete aggregate which are derived from rocks .not only have the characteristics of the parent rock but also the type of crusher used in crushing ,influence the shape of aggregates. Research shows that, there is a relationship between the voids of aggregate and shape, texture and of aggregate .in rounded, cubical and well Graded particles exhibit lower void content than flaky, elongated and angular aggregates.

Figure 18: Testing of concrete cylinder

Figure 19: Crushing of concrete cylinder

3.13 Compressive strength:

In significant amount slower FM of both fine aggregate and coarse Compressive strength is the main qualitative measure of concrete. the 28 days strength is the most common practices employed to determine the Concrete compressive strength .to ensure the strength of hardened concrete ,tasting of 4"*8" cylinder is the normal practices since long. It has been generally accepted that if the aggregate volumes are so chosen that the packing density of the combined aggregates is maximum then the amount of cementations paste volume required for a given amount of workability(I.e. slump)is the required to a minimum .maximum aggregate packing density can be achieved using the well graded aggregate . Grading of aggregate means particle size distribution of the aggregate. Principle of grading is that the smaller size particles full up the voids left in lager size particles. By adopting proper percentage, of various size aggregate, composite aggregate mix can be developed which will be thoroughly graded. properly graded aggregate produces dense concrete and smaller quantities of fine aggregate and cement .the grading of aggregate is expressed in of percentages by weight by retained on series of standard sieves .sieves as the mesh size of 1.5inch 0.75inc 0.375inch 0.187inch 0.0937inch sieve are used for grading of coarse aggregate and .375inch and .187inch .0937inch 0.0469inch 0.0232inch 0.0117inch and 0.0059inch are used fine aggregate. The main objective of this research is to evaluate the change of concrete compressive strength due to changing of aggregate fineness modulus (FM) along with grading maximum size of coarse aggregate and aggregate combine fineness modulus.

Aggregate usually occupies about 70 to 75 percent of the total volume of the mass of concrete, in which the coarse aggregate takes the major part as such its selection and proportioning should be given carefully attention in order to control the quality of the concrete structures. Coarse aggregate having different size distribution were used in this study. 1.5 inch downgrade.75inch downgrade and.5inch downgrade aggregate were used with fineness modulus of 6.0, 6.5, 7.0, and 7.5 properties of these aggregate were determined in the laboratory. The maximum size of coarse aggregate depends upon the nature of work for which the concrete is used. Literature reveals that concrete compressive strength up to a maximum aggregate size of 1.5inch from a stand point of minimum void space round aggregate are more desirable that irregular. From the stand point of ability to bond with the mortar, the rounded aggregate may be inferior however so that in general the shape the of the particles will be found to be much less important that their size and hardness. Thin flat pieces should be discarded. Sample coarse aggregate were prepared in laboratory to obtain the predefine FM and grading like as fine aggregate .higher fineness modules of aggregate represent aggregate size .compressive strength of aggregate of aggregate are closely related grading as well as size also .Generally concrete compressive strength increase of aggregate fineness modulus ,size of aggregate .if size of aggregate in concrete increases ,surface area will reduce .than quantity of cementing materials per unit surface area increase which increase bond stress with fineness modulus of coarse aggregate (CAFM) , it can be stated that compressive strength increases with increase of coarse fineness modulus . Increase of fine aggregate fineness modulus (FAFM) along with the increase CAFM, concrete compressive strength increase in a significant (FAFM) along with the increase CAFM, concrete compressive strength increases.

Figure 20: Crushing Of Concrete Cylinder

Figure 21: Crushing Of Concrete Cylinder

Aggregate show comparatively low compressive strength .maximum compressive strength was found as 4.83 ksi when fineness modulus of both fine and coarse aggregate were maximum (3.0 and 7.5 respective) and were well graded .fine aggregate having fineness modulus 2.0 is not well graded as compared to ASTM grading requirement which is that's why it gives low compressive strength .the change of concrete compressive strength with variation of fine modulus of fine aggregate this figure also represents that compressive strength increases of fine aggregate .this figure also represent that compressive strength increase with the increase of fineness modulus of fine aggregate and coarse aggregate .coarse aggregate having fineness modulus6.0 is not well graded according to ASTM C 33-93 grading requirement that's why it give low compressive strength aggregate up to 1.5inch maximum size ,concrete compressive size ,concrete compressive strength increases ,aggregate above 1.5 in maximum size the gain in strength due to the reduced water requirement is offset by the detrimental effect of lower bond area and of discontinuities introduced by the large particles . Relation of concrete compressive strength increases rapidly due change of maximum aggregate size up to .75 inch. Further increase of maximum aggregate size has small contribution to concrete compressive strength. Response of concrete compressive strength with combined fineness modulus of aggregate is also analyzed. There is no linear relationship of concrete compressive strength with combine fineness modulus of aggregate.

Chapter-4

Results and Discussion

4.1 Introduction:

Testing of harden concrete plays an important role in controlling and confirming the quality of cement concrete work as per ASTM standard requirement of specification,100mm*200mm cylinder are cat and tested after curing two different sets containing total number of 12 and three cylinder respectively were test. They were differential in terms of the type of coarse aggregate used which in the tables onward. Water cement ratio of .45 and mix proportion of 1:1.5:3 and by selected during the investigation.

4.2 Results:

Compressive Strength:

Figure 10 and 12 illustrate the deviation percentage of compressive strength of jute fiber reinforced concrete composite (JFRCC) to plan on with respect to four different volumetric dosing of jute fiber in two different mix ratios 1:1.5:3 respectively. where the plain concrete are manufactured without any jute fibe from two figure, it can be stated that the remarkable enrichment of compressive strength is observed only for 15 and 20 fiber cut with .75% volumetric content however, the 20 mm fiber length causes the maximum strength loss of concrete composites, for 15 mm fiber length increment of compressive strength is observed with .1% dosing in 1:1.47:2.25 mix ratio where as for another mix ratio,.1% enhancement is visualized with same fiber length and content.

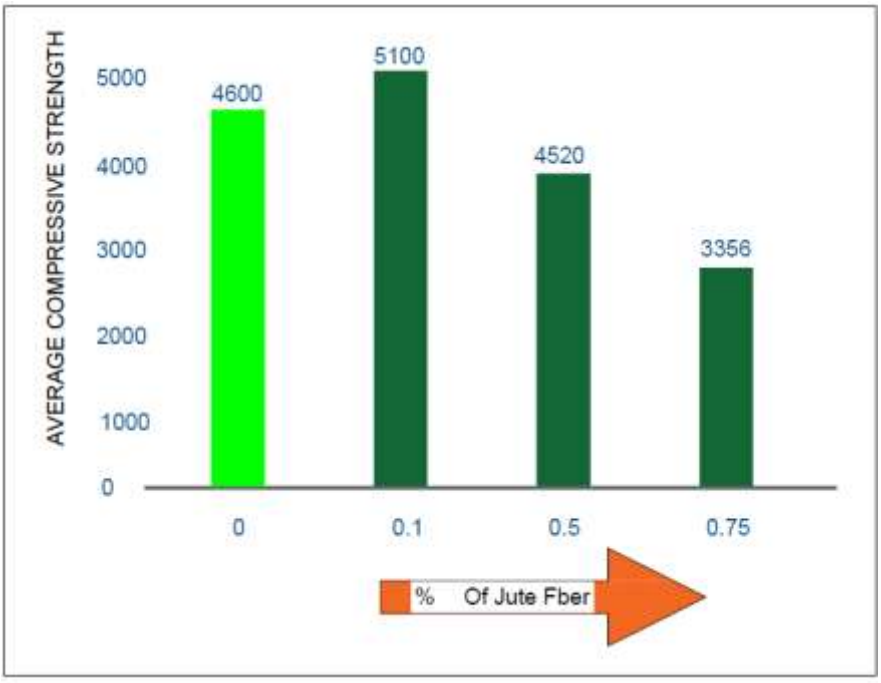


Figure :22 After 28 days compressive strength =5000 psi (Jute Fiver Length=15mm)

Fig. 13 - AFTER 28 DAYS TENSION STRENGTH = 5000 psi
(jute fiber length=15mm)

Figure :23 After 28 days tensile strength =5000 psi (Jute Fiver Length=15mm)

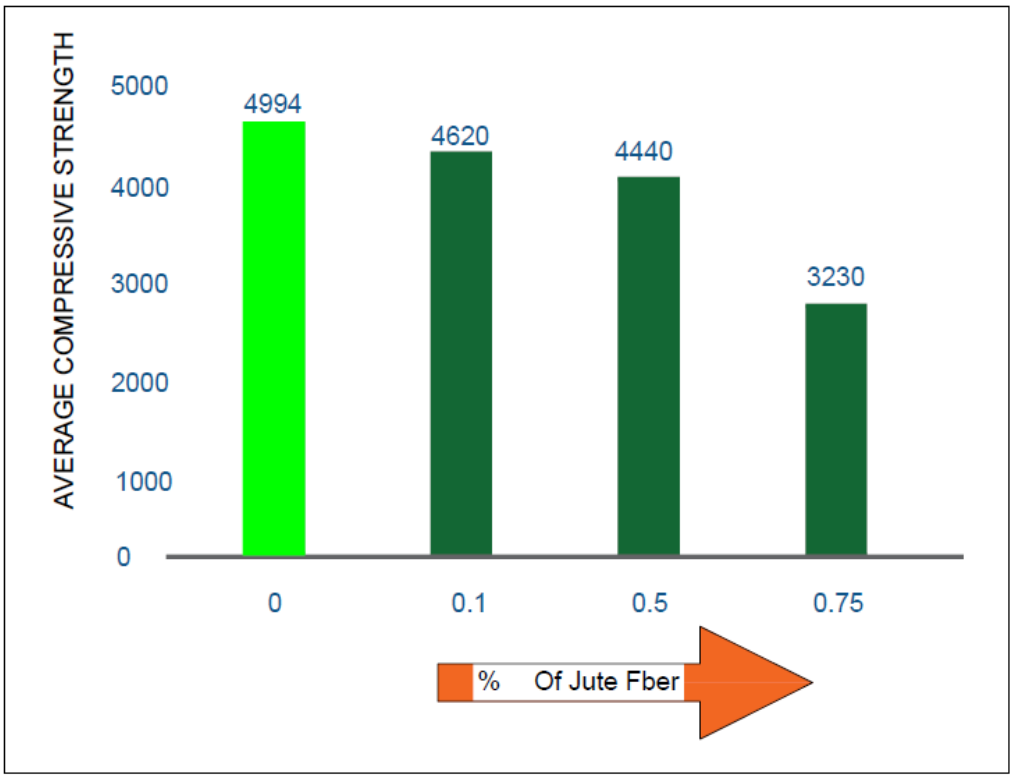


Figure :24 After 28 days compressive strength =5000 psi (Jute Fiver Length=20mm)

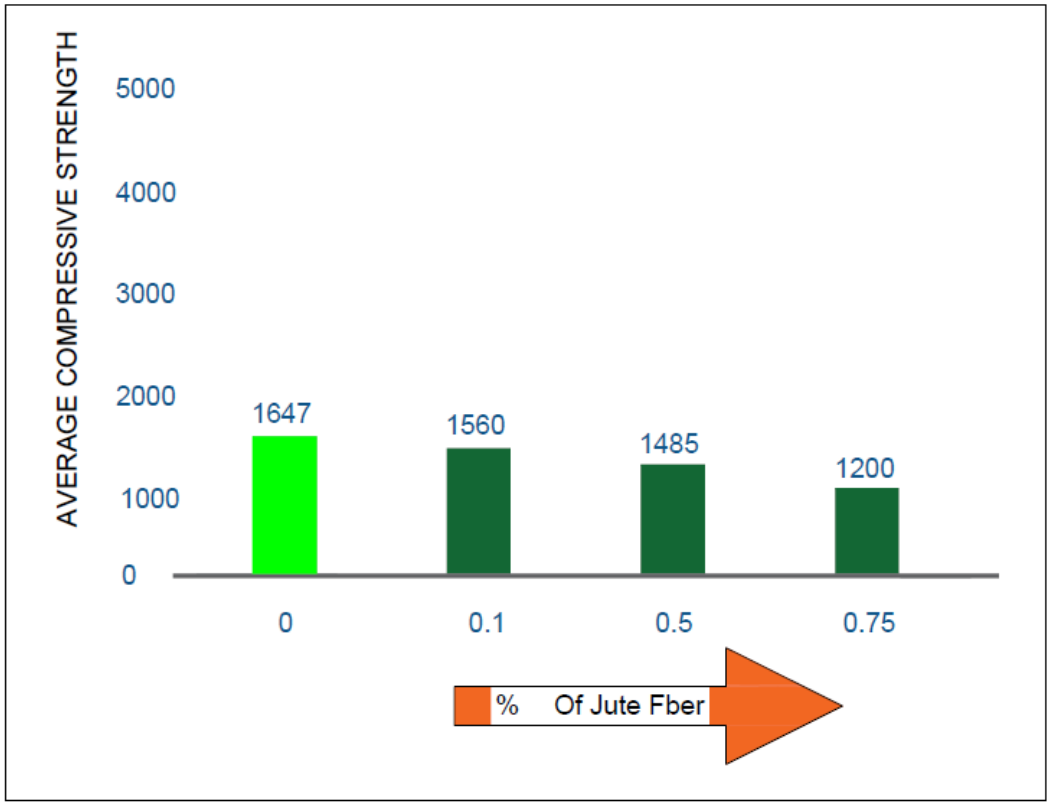


Figure :25 After 28 days tensile strength =5000 psi (Jute Fiver Length=20mm)

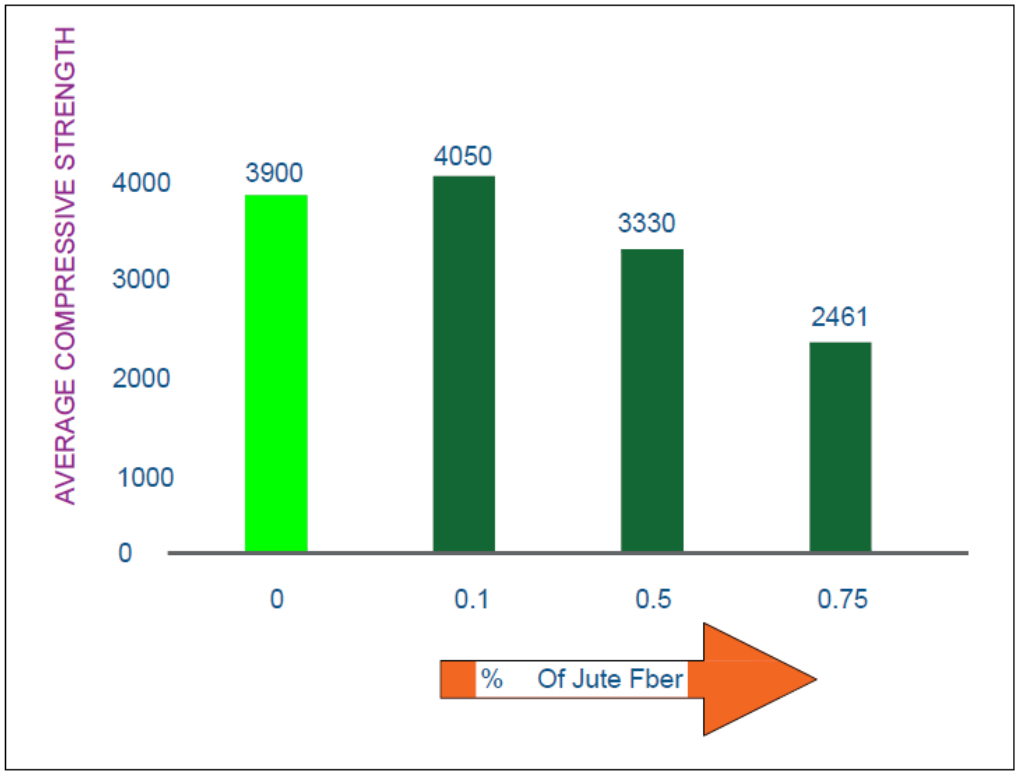


Figure :26 After 28 days compressive strength =4000 psi (Jute Fiver Length=15mm)

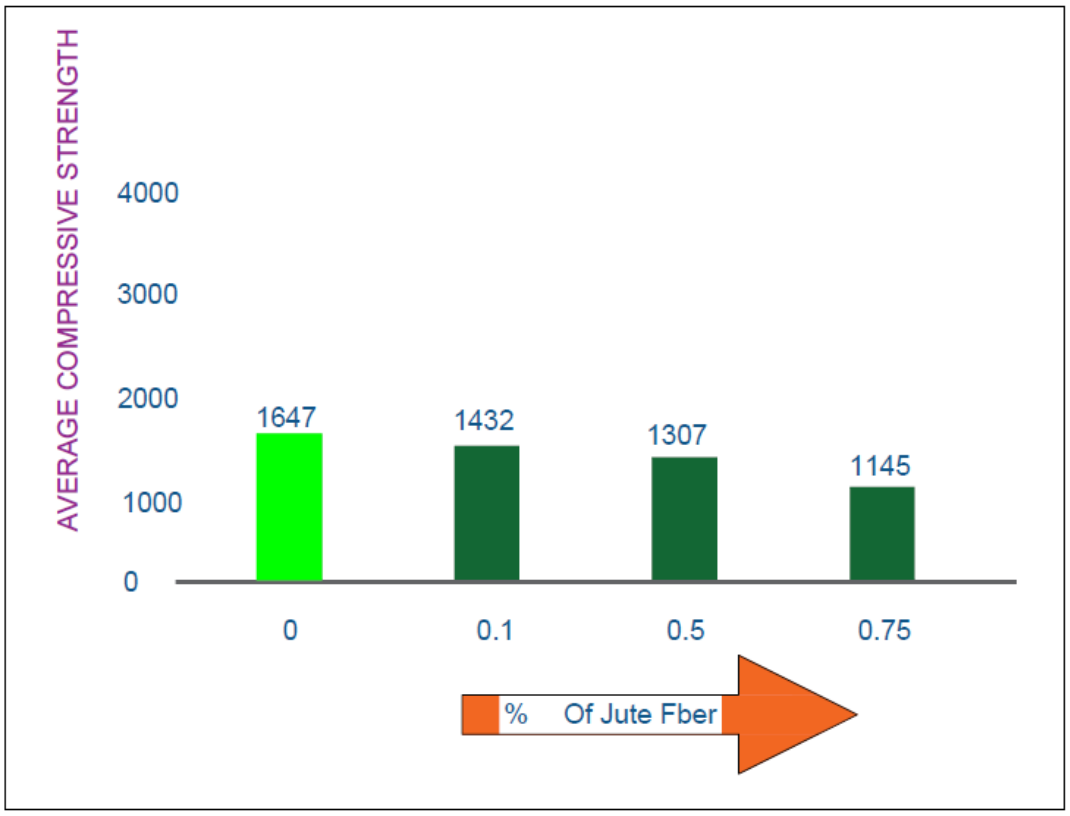


Figure :27 After 28 days tensile strength =4000 psi (Jute Fiver Length=15mm)

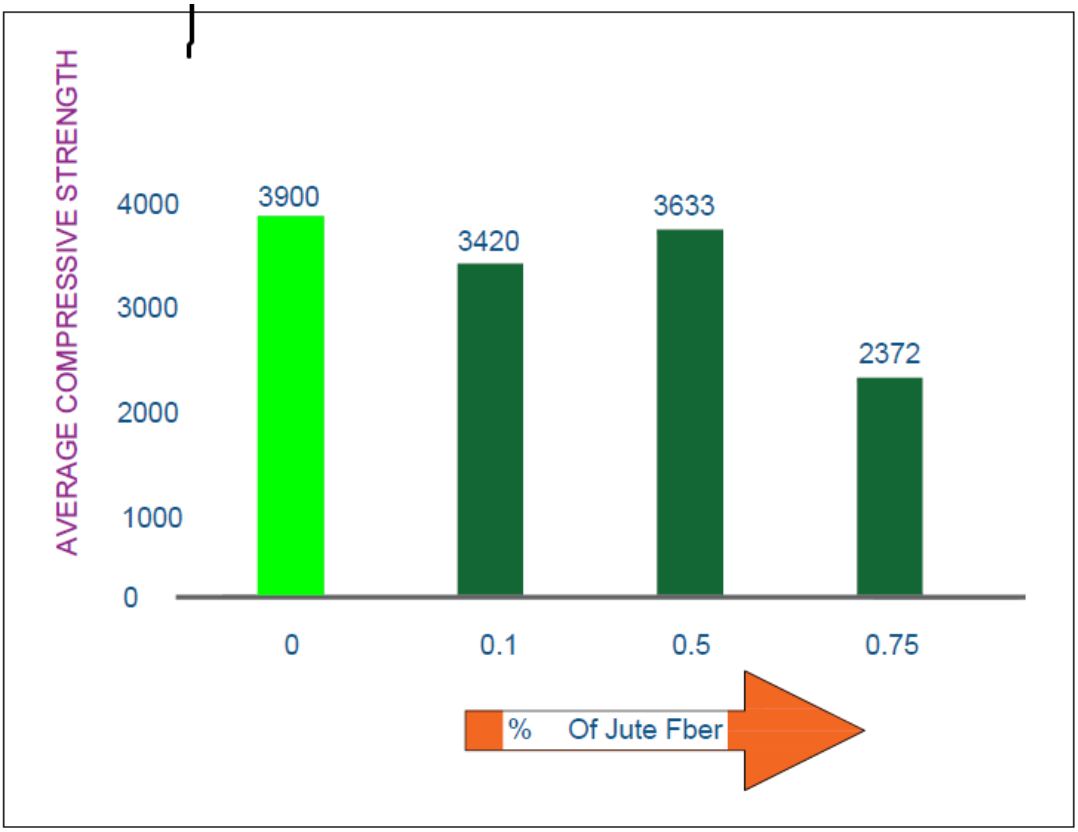


Figure :28 After 28 days compressive strength =4000 psi (Jute Fiver Length=20mm)

Figure :29 After 28 days tensile strength =4000 psi (Jute Fiver Length=20mm)

Proportioning should be given carefully attention in order to control the quality of the concrete structures. Coarse aggregate having different size distribution were used in this study. 1.5 inch downgrade. 75inch downgrade and.5 inch downgrade where use with fitness modulus of 6.0, 6.5, 7.0, and 7.5 properties of these aggregate were determined in the laboratory. The maximum size of course aggregate depends upon the nature of work for which the concrete is use. Literature reveals that concrete compressive strength up to a maximum size of 1.5 inch from a stand point of minimum void space round aggregate are more desirable that irregular. From the stand point of ability to bond with the mortar, the rounded aggregate may be inferior however so that in general in shape the shape of the particles will be found to be much less important that their size and hardness. The gac ucpenas upon the nature of work for which the concrete is used. Aure reveals that concrete compressive strength up to a maximum aggregate size of 1.inc a stand point of minimum void space round aggregate are more desirable that irregular. From and point of ability to bond with the mortar, the rounded aggregate may be in the ratio ever so that in general the shape the of the particles will be found to be much less important their size and hardness. Thin tlal pieces should be discarded. Sample coarse aggregate were reared in laboratory to obtain the predefine FM and grading like as fine aggregate higher fineness modules of aggregate

represent aggregate size .compressive strength of aggregate of aggregate are closely related grading as well as size also Generally concrete compressive strength increase of aggregate fineness modulus ,size of aggregate .if size of aggregate in concrete increases surface area will reduce than quantity of cementing materials per unit surface area increase which increase bond stress with fineness modulus of coarse aggregate (CAFM), it can be stated that compressive strength increases with increase of coarse fineness modulus. Increase of fine aggregate fineness modulus (FAFM) along with the increase CAFM, concrete compressive strength increase in a significant (FAFM) along with the increase CAFM, concrete compressive strength increases Microscopic images of failed JFRCC specimen were taken and shown in and. From the microscopic view, visual analyses were done. Images taken on crack parts of sample shows the presence of randomly distributed jute fiber which caused the increment of strength of JFRCC. Fractured ends of jute fiber appeared in the specimen that showed the largest strength enhancement. From the observation, it would be stated that the adequate bonding between jute fiber and concrete causes the fiber breakage at the cracked line that is why JFRCC expressed the strength augmentation with reference to plain concrete. It can also be visualized that the jute fiber resists crack in different angles and brace it that is absent in plain concrete. For this reason, at the time of failure of various tests, the JFROC specimen is not discrete properly, but for plain concrete, it would be separated very quickly and it may convey better results for developed earthquake-resistive structure.

4.3 Discussion:

1. Effect of the jute reinforcement on the maximum dry density and optimum moisture content.

2. Effect of the jute reinforcement on California bearing ratio.

A. Effect of the jute reinforcement on the MDD and OMC The Proctor's tests results obtained from the tests conducted on the concrete without jute fiber and with different percentage of jute fiber of varying lengths and diameter are discussed as below: It is observed that inclusion of jute fiber reduces the MDD and increases the OMC. With addition of 0% of jute fiber (15mm length) the maximum dry density reduces from 0% to Ogm, whereas the optimum moisture content increases from 0.1%,0.5% ,& 0.75%.MDD reduces from 65gm/cc (with .75% of jute fiber) to .0097gm/cc (with 0.1 % of Jute fiber) to. .013gm, (with 0.5% jute fiber) to .0162 similar affects are observed with 20 mm long jute fibers. It is also observed that diameter of the fiber does not have much effect on the maximum dry density and optimum moisture content.

B. Effects on the California Bearing Ratio The following results are obtained from CBR tests performed on the soil samples mixed with different percentage of jute fiber Test results indicate that with 2.5 jute fiber (without bitumen coating) CBR value increases as high as three times that of the jute fiber i.c.0162gm. The other values corresponding to the 0%, 0.1%, 0.5%, and 0.75% of jute fiber respectively.

Chapter-5

Conclusion and Recommendation

5.1 Introduction:

In this study two sets of cylinders were 39 cylinders prepared with Portland cement, stone chips, Sylhet sand, (1:1.5:3) coarse aggregate.

5.3 Conclusion:

Concrete with jute fiber is an aspiring step towards the sustainable development in Bangladesh where the jute are abundantly cultivated. In the experimental investigations. conducted in the study, it was found that the addition of jute fiber contributes enriched results for mechanical properties of concrete composites for a particular length and content of fiber. More specifically, compressive, flexural, and tensile strength are found to enhance significantly for volume content of 0.1 and 0.5 % and the fiber cut length of 10 and 20 mm. However, with larger fiber length and content, the mechanical properties were found to affect adversely. Finally, it can be stated that the maximum increment is observed for tensile strength which is 7 % with reference to the plain concrete. So JFRCC can be developed with locally fabricated jute in Bangladesh. The least cost of jute, its being renewable resources, the reduced weight of the JFRCC, and the environmental compatibility would clearly show the socioeconomic viability of JFRCC. Based on the insights gained from the test results and analyses of the JFRCC, the incorporation of jute fiber in making FRC composite would be one of the promising strategies to improve the performance of concrete.

5.5 Limitation:

The compressive strength of the concrete depends upon various factors like water cement ratio and Jute fiber quality of cement, curing period mix proportion compaction.

5.6 Recommendation:

From the above research, we have come to the conclusion that we can use to make 0.1% jute fiber. We cannot use up to 0.75%.1From this study we can learn more about how concrete can achieve greater accuracy, Such as

- To determine shear strength test.
- To determine permeability test.
- To determine prevent jute degeneration
- To determine flexural strength test.

References:

1.Mohammad Zakaria, Mashud Ahmed, Md. Mozammel Hogue, Abdul Hannan. (2015). Effect of jute yarn on the mechanical behavior of concrete composites.

2.Springer Plus 4 (1). Sumit Chakra borty, Sarada Prasad Kundu, Aparna Roy, Basudam Adhikari, S.B.Majumder; "Polymer modified jute fiber as reinforcing agent controlling the physical and mechanical characteristics of cement morta•"; Elsevier,

3.Volume: 49, Issue: December 2013 Sumit Chakraborty, Sarada Prasad Kundu, Aparna Roy, Ratan Kumar Basak, Basudam Adhikari's. Majumder ; "Improvement ofthe mechanical properties of jute fiber reinforced cement mortar: A statistical approach";Elsevier,

4.Volume:38,Issue:January 2013 Tara Sen, Ashim Paul; "Confining concrete with sisal and jute FRP as alternatives for CFRP and GFRP"; International Journal of Sustainable Built Environment,

5.Volume: 04, Issue: 248-264 Tara Sen, H.N. Jagannatha Reddy; "Strengthening of RC beams in flexure using natural jute fiber textile reinforced composite system and its comparative study with CFRP and GFRP strengthening systems"; International Journal of Sustainable Built Development,

6.Volume: 02, Issue: 41-55 ProfiVeerapuramSridharan andAsst professor 'Optimization of Machinability of Polyester/Modified Jute Fabric Composite Using Grey Relational Analysis (GRA)'Procedia Engineering,

7.Vol. 64 , p. 1003-1012, 2013 RI ProfBasudamAdhikari and Prof SubhasishBasuMajumder Materials Science Centre Indian Institute of Technology 'Development of jute fiber reinforced cement concrete composites'June 2011 [5]

8.Prof.S. Pravin Kumar on `Effect of alkali treatment on jute fibre composite.',2007 9.Xiangming Zhou,Seyed Hamidreza Ghaffar,Wei Dong,Olayinka Oladiran,Mizi Fan; "Fracture and impact properties of short discrete jute fibre-reinforced cementitious composites";Elsevier "Fibre-reinforced composites: Materials, Manufacturing, and Design" by Mallick P.K. published on 1988. ISBN 0-8247-7796-4 [2]

10.vvww.worldjute.cornicliversificationidiversification_composit etechno.8.html [3] 11.www.woodweb.com. [4]

12."Investigation on jute fibres and their composites based on polypropylene and epoxy Matrices" Phd thesis by Der Fakuitat Maschinenwesen, Technischen Universitat Dresden, 2006. [5]

13.Das S, "Jute composite and its applications", International workshop USG, 2009. [6] 14.wwvv.jute.org Placketta David, Logstrup Tom Andersenb, Walther Batsberg Pedersenc, Late Nielsenc: "Biodegradable composites based on I-polylactide and jute fibres", Composites Science and Technology 63 (2003) 1287-12

ACI Concrete Mix Design

For, 35 Mpa/5000 psi

Steo-1: Slump =3''-4''

Step-2: Water=305 lb/yd^3

Air = 6%

Water Cement Ratio 0.4

Step-3: Weight of cement = 305/0.40

= 762.5 lb/yd^3

Step-4: Course Aggregate

0.63 X 27 = 17.01 ft^3/yd^3

17.01 X 100 = 1701 lb/yd^3 [Duy rotted unit weight = 100 lb/ft^3]

Water = 305/62.4 = 4.89 ft^3

Cement = 762.5/3.15 X 62.4 = 3.88 ft^3 [Specific Gravity = 3.15]

Course Aggregate = 1701/2.7 X 62.4 = 10.1 ft^3 [Specific Gravity = 2.7]

% of Air = 6% X 27 = 1.62

Total = 3.88+10.1+1.62 = 4.89

Fine Aggregate: = 27 – 20.49 = 6.57 ft^3

So, Weight = 6.51 X 2.65 X 62.4 = 1076.51 lb/yd^3

Weight:	Adjustment:
Water = 305 lb	F.A = 1076.5 X 1.043
Cement = 762.5 lb	= 1122.78 =1123
C.A = 1701 lb	C.A = 1701 X 1.01
F.A = 1076.5 lb	= 1718

Water:

305 – 1076.5 (0.043 – 0.013) – 1701 X (0.01 – 0.01) = 272 lb

Water – 272 lb

Cement – 762.5 lb

Course Aggregate: - 1718 lb

Fine Aggregate: - 1123 lb

Cement = 762.5/762.5 = 1

Fine Aggregate = 1123/762.5 = 1.47

Course Aggregate = 1718/762.5 = 2.25

So, 1:1.47 :2.25

For, 35 Mpa/4000 psi

Steo-1: Slump =3''-4''

Step-2: Water=305 lb/yd^3

Air = 6%

Strength = 4000

Water Cement Ratio 0.48

Step-3: Weight of cement = 305/0.48

= 635.42 lb/yd^3

Step-4: Course Aggregate

0.63 X 27 = 17.01 ft^3/yd^3

17.01 X 100 = 1701 lb/yd^3 [Duy rotted unit weight = 100 lb/ft^3]

Water = 305/62.4 = 4.89 ft^3

Cement = 635.42/3.15 X 62.4 = 3.23 ft^3 [Specific Gravity = 3.15]

% of Air = 6% X 27 = 1.62

Course Aggregate = 1701/2.7 X 62.4 = 10.1 ft^3 [Specific Gravity = 2.7]

Total = 4.89 + 3.23 + 1.62 + 10.1 = 19.84

Fine Aggregate: = 27 – 19.84 = 7.14 ft^3

So, Weight = 7.16 X 2.65 X 62.4 = 1183.98 lb/yd^3

Weight:	Adjustment:
Water = 305 lb	F.A = 118.98 X 1.043
Cement = 635.42 lb	= 1234.89 =1235
C.A = 1701 lb	C.A = 1701 X 1.01
F.A = 118.98 lb	= 1718

Water:

305 – 1076.5 (0.043 – 0.013) – 1701 X (0.01 – 0.01) = 272 lb

Water – 272 lb

Cement – 635.42 lb

Course Aggregate: - 1718 lb

Fine Aggregate: - 1234 lb

Cement = 635.42/635.42 = 1

Fine Aggregate = 1235/635.4 = 1.94

Course Aggregate = 1718/735.4 = 2.7

So, 1: 1.94 : 2.7