# COMPARATIVE ANALYSIS OF CHEMICAL AND NATURAL ADMIXTURE IN CONCRETE

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# DEDICATION

Dedicated

toOURPARENT

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# LISTOFABBREVIALITIONS

| | |
|---|---|
| **ASTM** | AmericanSocietyforTestingandMaterials |
| **PCC** | PortlandCompositeCement |
| **FM** | FineAggregate |
| **CA** | CoarseAggregate |
| **FA** | FineAggregate |
| **PSI** | Poundpersquareinch. |
| **W/C** | WaterCementratio. |
| **NC** | Normal Concrete |
| **CS** | Compressive Strength |
| **STS** | Splitting Tensile Strength |

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# ABSTRACT

Concrete's compressive strength and splitting tensile strength are two major problems. This study investigates the use of natural and chemical admixtures to increase the compressive and splitting tensile strength of concrete and to make it more cost-effective. In our project, concrete cylinders with and without admixtures are formed, and their compressive strength is assessed 7, 14, and 28 days after curing. The results of both concrete categories are contrasted.

Investigating the increase in compressive and splitting tensile strength caused by chemical and natural admixture is the main goal of this study. In this thesis project, we prepared four sets of 18 cylinder samples each, for a total of 72 cylindrical samples. We followed the guidelines for ASTM standards when working on this project. We used the M20 standard concrete grade, and the mix ratio was 1:1.5:3. We used the same quantity of cement, coarse aggregate, fine aggregate, and w/c ratio in each sample. One set of these was created without the use of admixture, while the remaining three were created using two chemical and one natural admixture in the same quantity of 7.2 ml. We investigated the compressive and splitting tensile strengths following three cycles of curing for 7, 14, and 28 days. After 28 days, the compressive strength measured 2372 psi without admixture, 2969 psi with 7.2 ml of self-compacting admixture, 2707 psi with 7.2 ml of gram flour as admixture, and 3201 psi with 7.2 ml of gram flour (using 7.2 ml high strength admixture).After 28 days of curing, the splitting tensile strength measured 309 psi without admixture, 365 psi with 7.2 ml of self-compacting admixture, 348 psi with 7.2 ml of gram flour as an admixture, and 448 psi with 7.2 ml of gram flour (using 7.2 ml high strength admixture).

Here the amount of used admixture was 1% of the used cement weight. The additional cost for chemical admixture is 1.1 taka per sample and for gram flour the cost is 0.5 taka per sample. Comparing all of resultswe can say that natural admixture (Gram flour) isa suitable alternative to chemical admixture comparing economicaleffectand strength.

Throughout the thesis study, all codes and conducts were upheld in accordance with ASTM standard requirements..

**Keywords**

Concrete,M20 Grade concrete,PCC,Compressivestrength,Splitting tensile strength,

Admixture.

# CHAPTER 1

# INTRODUCTION

## 1.1General

Concrete refers to a versatile structural material consisting of chemically inert particulate substance, coarse & fine aggregates, water and cementing substances. Due to high durability and good resistancy against the compressive stress concrete is vastly used in construction industries. Concrete can also withstand against weathering effects, chemical action, and abrasion. It is considered as a man-made rock having a good workability, well efficiency to slum, air content and finish ability.

Concrete is said to be the heart of construction. At the initial stage concrete acts like plastic, workable mixture that develops strength from hydration process with the duration of time. Concrete is used for both substructure and superstructure including foundations, wastewater treatment plant, parking structures, exterior & interior surface, floor construction, and so many other purposes. Concrete's compressive and tensile strengths for splitting are its most crucial features and terms. This testes provide information about the characteristics of concrete. The compressive and splitting tensile strength can be affected by some factors like component material properties and their proportion, preparation method, curing techniques and testing process. By using a cube or cylinder test, the compressive and splitting test strength can be measured. To conduct a proper concrete cylinder or cube specimen test, certain standard criteria must be followed. The accepted testing method for concrete strength is C39/C39 from the American Society for Testing and Materials (ASTM). With just this one test, we can specify whether concreting is proper.

Aggregates are another fundamental material for construction work. They provide volume, load resistance, other desired physical properties for the end product include wear or erosion protectivity. The mechanical strength that aggregates offer is another important contribution. The majority of a concrete mixture is made up of coarse aggregate and fine aggregate together; for this purpose, we mostly employ natural sand, gravel, and crushed stone. The aggregate's particle size distribution is crucial since it shows how much binder is required.

The more the variation in particle size, the more compaction will occur.Adding aggregate with smaller particles tends to fill these gaps; nevertheless, aggregate with an extremely equal size distribution has the biggest gaps. The binder material efficiently binds a surface's aggregate with a paste by filling in the spaces between the aggregate. Fresh concrete's characteristics are influenced by the texture and shape of the aggregate. In non-bearing structures, aggregate concrete can also be recycled.The knowledge of concrete technology has evolved throughout the years, yet thousands of years ago, concrete was only utilized to build civilization. To increase the cement's durability and workability, additional materials such fly ash, slag, rice husk ash, and additives are employed. These are added when mixing fresh or hardened concrete in order to increase certain features, such as workability, durability, or early and final strength.

## 1.2Objectiveof theStudy

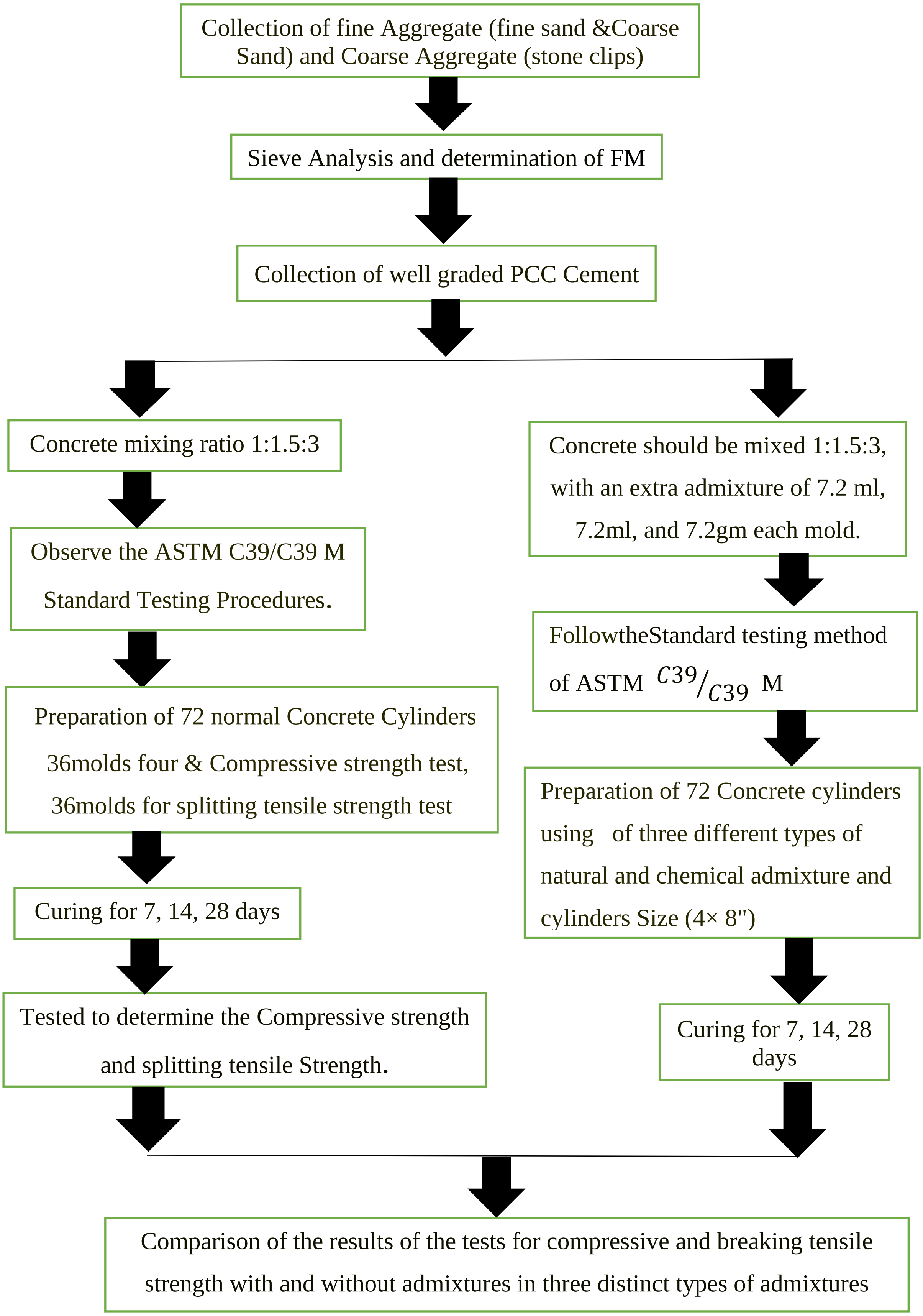
The following are the study's objectives

1. To examine how it influences compressive strength and splitting tensile strengthof concrete after using natural and chemical admixture.
2. Todeterminetheeconomiceffectusing natural and chemicaladmixture inconcrete.
3. Tofind a suitable admixture considering strength and cost.

## 1.3Scopeof theStudy

- Aftercompletingourcompressivestrength and splitting tensile strengthtestweknowtheoverallstrengthof concrete.
- Through this we can quickly ascertain a concrete's compressive strength (psi) and evaluate the consistency of the concrete being made.
- Provides information about properties of concrete.
- Using this test, we can determine which is more appropriate for construction and if the concreting was done properly or not.

## 1.4 Methodology of the Study



## 1.5Thesis Outline

Five chapters, a list of references, and appendices make up our thesis project.

**Chapter1(Introduction)**

This chapter covers concrete, importance of its mix, compressive strength, also, research objective, and scope

**Chapter2(Literature Review)**

Mixture details. Previous research papers, journal papers and thesis books on its effect on concrete properties are included.

**Chapter 3 (Experimental Work)**

This chapter discusses the types of laboratory tests, standards, methods adopted, material properties and curing conditions.

**Chapter 4 (Results and Discussion)**

In this chapter we discuss the test results we get from this experiment.

**Chapter 5 (Conclusion and Recommendations)**

This Recommendations for future work are made in this chapter.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Introduction

The chapter practices the earlier studies available. It is compacted with the concrete admixture. Also evaluated were the effects of various admixtures on the mechanical characteristics of concrete.

## 2.2 Admixture description

When concrete mortar or grout is prepared, additives typically chemical ones are added. Turns wet during mixing. They are a mixture of one or more chemicals. It is available as a powder. Aqueous solutions predominate. Accurate dispensing is made simpler in this way.

The main justifications for admixtures are listed below:

1. Reduce the price of building with concrete.
2. The aim is to more successfully achieve specific properties of concrete
3. Standard quality care strives to mix, transfer, and place in harsh environments.
4. Aim to split the concrete pouring operation's limbs.

### 2.2.1 The effectiveness of Admixtures

The following activities are performed by Admixtures. (Newman and Choo, 2003):

1. The reaction rate of the cement phases might be accelerated or retarded as a result of chemical interactions during the cement hydration process.
2. Generally results in good particle dispersion on the cement surface.
3. It alters the water's surface tension, usually leading to more air entrainment.
4. Increased plastic viscosity or mixed cohesiveness as a result of the water's religion being impacted.

### 2.2.2 Benefits of Admixtures

Use of admixture benefits the benefits are:

- ✓ Fast installation and assembly.
- ✓ High performance.
- ✓ High water reduction capacity gives precast concrete high initial strength.
- ✓ Rich quality, for example, concrete with a denser, less porous texture
- ✓ The risk of bleeding is reduced; thus helps in concrete pumping.

## 2.3 Aggregate

The most influential admixtures in concrete. Most significantly, they have an impact on the economy and minimize contraction. In the past, aggregates were thought to be chemically stable materials. Some are chemically active and aggregates of specific aggregates and have stable chemical bonds. Considering that small amounts of aggregate make up between 70 and 80 percent of the volume of concrete, it is obvious that these particles have a noticeable impact on the strength of the material.

Natural aggregates fall into two categories-

- Coarseaggregate
- Fineaggregate

### 2.3.1 Coarseaggregate

Construction materials used as bulky fillers. In reference to the durability of hard concrete, coarse aggregate is defined as being tough, tidy, and well-graded. A 4.75 mm sieve is often used for coarse materials. Generally, coarse may be anticipated to exist, and quarries should be acquired by blasting or crushing by hand or a crusher. They must be thoroughly cleaned before being used to make concrete.

### 2.3.2 Fineaggregate

Natural sand particles that have been extracted from the earth by mining. In fine aggregate building projects, filler materials of smaller sizes are used. Only a 0.075 mm sieve is present in the mixture, which passes through a 4.75 mm sieve. As much material as the standard allows for thickness. Fine aggregates for concrete include sand, fly ash, cinder, scorched earth, surki, and stone screening.

## Literature Review

**(Gonen & Yazicioglu, 2007)**Although adding SF and FA to concrete improved its transport qualities more than it did its compressive strength, which was only modestly raised by their addition. The ability of concrete to maintain long-term structural performance is known as durability.Concrete is exposed to three different environments: air, water, and soil. One of the many crucial elements in the design of concrete structures that affects how long they will last is carbonation. FA and SF were replaced with 15% and 10% of the weight of cement, respectively, in the concrete mixtures. In comparison to the outcomes of other concrete mixtures, the depth of carbonation was less in concrete mixtures that simultaneously contained SF and FA.

**(Dinakar & Manu, 2014)**Their findings show that the application of metakaolin to enhance the toughness and mechanical qualities of concrete is a relatively recent development in the field of concrete technology. The volume of the fine aggregate is fixed at 40% of the volume of the mortar, while the volume of the coarse aggregate is set at 50% of the solid volume of the concrete. By taking into account the needed strength and the makeup of the employed components, the total amount of powder or fine content is determined. To determine the effectiveness of metakaolin, fix the percentage using TCM = TP kg/m3. Using information from the literature, determine the efficacies for the vibrated metakaolin concrete. In the current inquiry, a mixed design methodology was proposed for the design of self-compacting metakaolin concretes using the efficiency curve and replacement percentages possible at specific strengths.

**(Hassan et al., 2000)**Based on short- and long-term testing methods used to design and regulate the quality of high-performance concrete, the concrete mixes were evaluated. These, in turn, boost concrete's resistance to the penetration of hazardous chemicals such carbon dioxide, water, oxygen, chloride, and sulfate ions, leading to improved durability performance.Up to the age of one year, two distinct mixes' porosity, engineering, and transport properties were compared to make an assessment. The components of the OPC mix were adjusted in concrete mixtures to produce optimum packing of the particles and minimal porosity. 10% and 30%, respectively, by weight, of the OPC were substituted with SF and FA in the concrete mixes for the SF and FA. The engineering and performance qualities of the mixes were evaluated in the study using a variety of testing methods. 3, and shown as percentages of the OPC concrete.

**(Monkman et al., 2016)**Waste CO2 was injected into the concrete mixtures to speed up the hydration and development of strength without damaging the initial qualities. An effective additive to raise the performance of concrete is carbon dioxide. The reacting carbonation heats In concrete trucks, a series of 4 m3 concrete mixtures were made while being mixed with an injection of carbon dioxide. Finely dispersed calcium carbonate reaction products are produced during the reaction between the CO2 and the hydrating cement, and they have an impact on the subsequent hydration. Although the reference concrete had a greater addition of a strength-enhancing/retarding water reducer, the batches with the two higher dosages of CO2 did not demonstrate a benefit in terms of strength.

**(Alsadey, 2012)**Concrete is frequently utilized in the precast concrete industry as concrete blocks, cladding panels, pipelines, piles, and lampposts. The use of super plasticizer has a few benefits, including the ability to create concrete with high workability and constant cement content and strength, easy placement and compaction, concrete with normal workability but lower water requirements, concrete with a combination of high workability and low water content, and concrete with normal strength and workability but less cement content. The characteristics of concrete were observed to decrease with an indication of lower compressive strength when SP or retarder was overdosed. After casting, the concrete samples underwent standard curing. More water is made available for mixing concrete in general by deflocculating the cement particles, and a dose of super plasticizer between 1-3 l/m3 is used. Alternately, it can be used to lower the water content while preserving acceptable workability, hence increasing the ultimate strength of concrete.

**(Iqbal et al., 2017)**5% more kg/m3, followed by a 0.2% decline and a subsequent increase of 25 kg/m3 in fly ash When the fly ash content was raised from 100 to 125 kg/m3, the compressive strength improved by 13. 5%; however, when the fly ash quantity was raised to 150 kg/m3, the modulus of elasticity only experienced a minimal 0.1% change. The purpose of the current study is to ascertain how changes in fly ash content affect the characteristics of self-compacting lightweight concrete (SCLWC).5 % reduction in it while flexural strength was reduced by a significant margin with 17 % reduction when flying ash content was increased by the same amount to 150 kg/m$^3$. There is a significant increase of up to 26 % in splitting tensile strength and a 10 % increase in flexural strength of concrete when 25 kg/m$^3$ of fly ash was added increasing its quantity from 100 kg/m3 to 125 kg/m$^3$.

**(Nehdi et al., 2003)**The RHA concrete's AEA requirements were higher than those for SF concrete but significantly lower than those for conventional fluidized bed RHA concrete. RHA concrete had a higher resistance to surface scaling than concrete with a same amount of SF. In terms of preventing surface scaling brought on by deicing salts, RHA concrete performed marginally better than SF concrete.This article shows how silica fume (SF) and RHA created using fluidized bed technology perform in concrete mixtures. The process was used to create RHA from Egyptian rice husk, and the results were compared to SF and RHA made in the United States utilizing fluidized bed technology in terms of performance.

**(Ayub et al., 2014**)According to the literature that is currently available, adding mineral additive to concrete to replace some of the cement enhances its microstructure. On the plus side, these mineral admixtures give concrete more defense against dangerous solutions. Except for FA and GGBS, which have no discernible impact on the strength of concrete at 28 days, all mineral admixtures improve the mechanical properties of concrete. However, the increase in strength at later ages is significant. compared the outcomes of high-performance cement pastes containing MK to pastes made with regular Portland cement (OPC), SF, and FA.The compressive strength of concrete is increased by the use of mineral additive. Based on the results that have been reported in the literature, the mechanical properties of hardened concrete that contains fly ash, silica fume, ground granulated blast furnace slag, met kaolin, and rice husk ash are discussed in this paper. It is concluded that the content and particle size of the mineral admixtures are the factors that have the greatest impact on the mechanical

**(Zeyad et al., 2020)**The prepared specimens with 10% cement replacement with VPP and 0%

exhibited positive results. An ideal 10% VPP replacement rate with 0 was used to maximize the indirect tensile and flexural strength. Because the cement content was reduced by the use of VPP, the characteristics of fresh concrete were enhanced.At 10% VPP replacement with 0.0, indirect tensile and flexural strengths were optimized. Maximum durability was seen at a 20% VPP replacement rate together with 0. 20%, 0. 35%, and 0. 20% of PF content. However, when PF percentage increased above 0. 20% of PF content, and as PF percentage increased to above 0. 20%, durability started to decrease. Additionally, the partial replacement of Portland cement with other materials enhances the sustainability of construction as well as the characteristics of concrete and reduces CO2 emissions and energy use..

**(Köksal et al., 2008)**The amount of silica fume, the volume fraction of the fiber, and the fiber aspect ratio all affect how tough high-strength steel fiber concrete is. Compared to concretes containing simply silica fume or solely steel fiber, the combination of silica fume and steel fiber performed better. In concrete, silica fume was first used in 1952, according to a Norwegian researcher. However, the inclusion of steel fiber to concrete greatly increases the hardness of high-strength concrete.Concretes made with additions of both steel fiber and silica fume exhibited better compressive strengths than concretes made with simply silica fume. The major goal of this research is to manufacture silica fume and steel fiber-based concrete that is more ductile and high strength..

**(Uysal & Yilmaz, 2011)**The impact of mineral admixtures on the characteristics of SCC have thus been the subject of numerous investigations. Furthermore, the workability of self-compacting concrete can be greatly enhanced by these mineral admixtures. Therefore, it would be beneficial for the concrete industry if MP could be utilized as a mineral addition in SCC. In this study, the impact of mineral admixtures LP, BP, and MP on the initial and final characteristics of SCC will be examined. The outcomes demonstrate that waste LP, BP, and MP can be successfully used as mineral admixtures in the production of SCC. The addition of a mineral additive is one of the key distinctions between SCC and regular concrete. Mineral admixtures can also increase concrete's particle packing and reduce its permeability.

**(Mala et al., 2013)**When concrete is made using a ternary mixture of OPC + FA + SF, the super plasticizer dose is lower and the percentage replacement of OPC is higher. The ternary mix cement system consistently had greater SF and FA efficiency factors than the corresponding binary blend cement systems. Due to its advantages in terms of both the economy and the environment, the ternary blend cement system of OPC + FA + SF compromise is a better option than the binary blend cement system of OPC + SF to obtain strength comparable to the control mix. For a given amount of compressive strength, the split tensile strength of concrete employing the binary and ternary cement systems was greater than OPC.In order to get the same workability as OPC concrete and concrete utilizing a binary blend of silica fume, a ternary blend of SF and FA requires less super plasticizer, which lowers the cost. The findings show that the strength relative to the control mix increases up to a specific replacement level and then falls when the overall replacement level of OPC in concrete using a ternary blend of OPC + FA + SF increases. The rate at which concrete gains strength early on is slower when fly ash is used in place of OPC.

**(He et al., 2020)**Recycled aggregate concrete with SRA has greater later strength and elastic modulus than reference concrete with NCA because to the improvement in recycled aggregate quality. The later interior microstructure is improved by the inclusion of SRA, and concrete produced with SRA and high-quality recycled aggregates displays a later, more compact microstructure than the reference concrete with NCA. The creep strain of concrete made with recycled aggregates is significantly reduced by the inclusion of SRA, and concrete made with SRA and high-quality recycled aggregates has a lower creep strain than the reference concrete made with NCA. The early mechanical qualities of recycled aggregate concrete are further decreased by the addition of SRA, whereas the latter mechanical and creep properties are improved. Concrete made with recycled aggregates has a specified creep and creep coefficient.

**(Hewayde et al., 2007)**Measured and compared to control specimens, the sulphuric acid resistance of concrete specimens containing various admixtures was determined. Concrete constructed with Type 50E cement held up similarly to concrete made with Type 10 cement in the face of harsh sulfuric acidic conditions (7% and 3% H2SO4). 8 Sulfate Reducing Bacteria (SRB), which are microscopic organisms that live in the slime layer of sewer pipes, start the corrosion of concrete sewer pipes by sulphuric acid. The mechanical and physical characteristics of concrete (compressive strength and porosity) and its resistance to sulphuric acid assault could not be clearly correlated. Globally significant economic costs are associated with the sulfuric acid attack on concrete sewer lines

**(Sari & Pasamehmetoglu, 2005)**Structural lightweight concrete, which is used for reinforced concrete, is the third category. By carefully choosing the admixtures and grading the lightweight aggregate, the desired quality for lightweight concrete can be achieved. the range in strength and density of lightweight concrete. The lightweight aggregate gradation is crucial in giving fresh concrete its workability as well as the requisite strength and density of hardened concrete. This study produced lightweight concrete blocks with a density of 1300 kg/m3 and a minimum compressive strength of 6.56 N/mm2. Super plasticizers and air-entraining admixtures increased the workability of new concrete as well as the strength-to-density ratio of the hardened concrete. Investigated factors, which include mixing and ideal granulometry

# CHAPTER 3

# METHODOLOGY

## 3.1 General

This chapter gives information on the raw materials we utilized, how samples were made, and how the investigation's conventional experimental tests were conducted.

## 3.2 Materials

Alltype of materials as like cement, sand, stone chipswehave collected from nearbyouruniversitycampus.

### 3.2.1 Cement

Throughout the entire experimental inquiry, Portland Composite Cement was used (PCC)

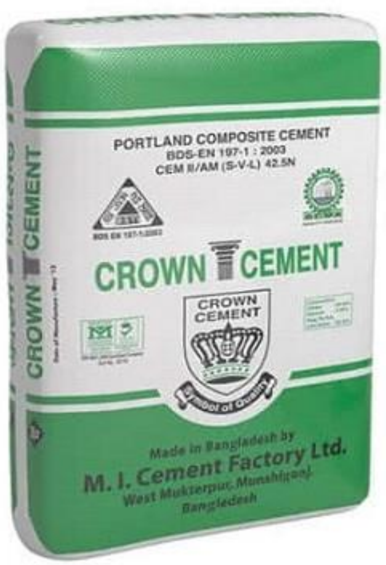


**Figure 3.1: Portland Composite Cement (PCC)**

### 3.2.2 FineAggregate

Here, both Sylhet Sand and regular river sand have been utilized. This fine aggregate sample was gathered from Ashulia, Savar, Dhaka.

**Figure 3.2: Fine Aggregate (Sylhet Sand)**

### 3.2.3 CoarseAggregate

Thissampleof coarse aggregate (stone chips) has been gathered from Ashulia, Savar, Dhaka.

**Figure 3.3: Coarse aggregates**

### 3.2.4 Water

When mixing concrete, water is a crucial component. Normal water was utilized in our experiment.

### 3.2.5 ADMIXTURE

**Figure 3.4: High Strength gaining Natural and Chemical admixture**

## 3.3 Testing for Aggregate Properties

Both the coarse aggregate and the fine aggregate met the requirements for the important testing. Below is a list of the tests.

### 3.3.1 Sieveanalysisoffineaggregate

The specifications of this test technique meet the standards of the ASTM standard.

**Apparatus**

1. Balance: Sensitive to variations in sample weight of less than 0.1%.
2. Sieves: ASTM method.

**Sampling**

A sieve analysis of fine aggregate has been performed in accordance with the ASTM C 136/C (2004) standard specification. Following are the steps:

## Procedure:(FineAggregate)

Step 1: A 500g sample of our fine aggregate is taken (as per ASTM standard specification, the aggregate composition must be completely dry). Importing the material to a digital scale will reveal this. Additionally, we recorded the weight as well as the weight of the pan and each sieve from the mechanical sifter.

Step 2:Put the aggregate mixture into a mechanical wall-gutted sifter's top sieve. Here, sieves number #4, #8, #16, #30, #50, and #100 are used. This combo is rocked by these clothes. Filter them. The mechanical sifter has a bottom pan with a cover that may be used to collect material that passes through a #100 sieve and to seal the sifter during testing. It takes the sifter 10 to 20 minutes to become excited once the cover has been placed.

Step 3: By weighing the sieves with the aggregate retained and deducting the weight of each sieve, you can find the total weight of aggregate retained on all of the sieves. Additionally, each aggregate weight retained in the sieve was recorded separately. Additionally, make sure that the aggregates' combined weights in the sieve and bottom pan equal the aggregates' initial weight.

Step 4: Separately sieve organize the data. Figure out the percentages. From these values the percentage of material can be calculated if the entire volume of material is run through this sieve alone.The fineness modulus is obtained by dividing by 100 the total percentage of material passing through the sieve used to plot the material retained by all sieves.

Step 5: After the fineness modulus has been calculated, the sum of the percentages retained on a given set of sieves must be determined. Additionally, the outcomes are split by 100. Fineness modulus specified sieves are No. #100, #50, #30, #16, #8, #4.

### 3.3.2 SieveAnalysisofCoarseAggregate

According to ASTM C 136/C (2004), a sieve analysis of coarse aggregate was conducted. The steps are as follows:

**Procedure(Coarseaggregate)**

Step 1: Here, we used a digital scale to weigh a 1000gm sample of coarse aggregates. After weighing the bottom pan and each clean sieve individually and recording their weights.

Step 2: Putting the aggregates into the mechanical sifter (which uses filter sizes #3/4", #3/8", #4, #8 & #16) this apparatus is used to sieve the components as well as shake them (similar to how a paint mixer works).

Step3:Identify the aggregates that are kept in each particular sieve and note the information. Use the steel brush to clean each sieve to make sure that all the items are captured.

Step 4: After tallying the data and doing those calculations, the proportion that would have been kept in each sieve if that sieve had been used to screen the entire volume. The fineness modulus can be estimated by adding up the percentage of material retained in each filter and dividing the total by 100 .The cumulative percentages retained on a series of sieves with a well-defined specification must be added together, and the result must be divided by 100 to establish the fineness modulus..

**Figure 3.5: Sieve Analysis Testing Apparatus**

## 3.4 Making Concrete Cylinder Processes

**Table3.1 EstimationofMaterials**

| Type of Concrete | Mixing Ratio | No. of specimen | Name of specimen | W/C Ratio | Admixture (ml) | Water (lit.) | Cement (kg) | Coarse Aggr. (kg) | Fine Aggr. (kg) |
|---|---|---|---|---|---|---|---|---|---|
| Without Admixture | 1:1.5:3 | 18 | Cylinder | 0.5 | 0 | 6.5 | 13 | 20 | 40 |
| With Natural Admixture | 1:1.5:3 | 18 | Cylinder | 0.5 | 140 | 6.5 | 13 | 20 | 40 |
| With Self Compacting Admixture | 1:1.5:3 | 18 | Cylinder | 0.5 | 140 | 6.5 | 13 | 20 | 40 |
| With high strength Admixture | 1:1.5:3 | 18 | Cylinder | 0.5 | 140 | 6.5 | 13 | 20 | 40 |

## 3.5 Concretemixing

We manually mixed the concrete using the steps for mixing concrete.

Step 1: Lay a plastic sheet out on the floor.
Step 2: The blend design has been conducted dry condition.
Step 3: The blend design has been created using a 1:1.5:3 ratio.
Step 4: We used3/4" down grade total.
Step 5: The weighted machine measures the amount of CA, FA, cement, and water in accordance with the ratio.
Step 6: Made a pile out in the distance with the gravestone and the beach.
Step 7: Added cement on top of the gravestone and beach debris pile.
Step 8: The amount of mixture utilized per bag of cement (50 kg) has been 200ml, 300ml, and 400 ml

**Figure 3.6: Mixing Concrete (Hand Made)**

### 3.5.1 The Making of Molds

ASTM standard C470 was followed in the preparation of the typical concrete specimen mold.

For this experiment, cylinder molds measuring 4" x 8" were used. There are nine testing periods and four different sample kinds. Thus, there are 72 cylinders in all.

Thecylindermoldswerecleanedproperlyandacoatoflubricationoilwasappliedontheinner surfaceofmold. On the inside, though, there was no sign of extra oil

**Figure 3.7: Making of Molds**

## 3.6 Slumptest:

Concrete's slump value (PCC) when mixed with various amounts of plasticizer additives and water-reducing

**Table3.2:Slumpvalueofconcrete**

| Slump | At0 min |
|---|---|
| Normalconcrete(Withoutadmixture) | 82 mm |
| Concretewithself-compactingadmixture(130ml) | 113.5 mm |
| Concretewithgram flour admixture(130 gm) | 87 mm |
| Concretewithhigh strength admixture(130ml) | 96 mm |

## 3.7 Casting

Step 1: For casting concrete we use mold which is 4” diameter, 8” height.

Step 2: Carry the concrete into the mold without leakage.

Step 3: The solid cylinder must be readily junked and some work must be done before pouring the concrete mixture into the mold.

Step 4: Three layers of concrete are added to the mold, and tamping rod number 30 is utilized.

**Figure 3.8: Molds for concrete casting**

Figure 3.9: Casted concrete in molds

## 3.8OpeningofMolds

After two days, the specimen was safely taken out of the mold. The concrete cylinder was still fragile at this early stage, so the specimen was carefully removed from the mold. The specimen was immediately placed in a tank of fresh water after being released from the mold. The item was submerged entirely in water

**Figure 3.10: Opening cylinder Specimen from Molds**

## 3.9 Curing

After 24 hours the casting sample was removed. All samples were submerged under water at 27 °C. The sample was kept for 7 days, 14 days and 28 days. Water was changed every 7 days.60 minutes before to the test, samples are removed from the water. The material was dry when the test was performed on it.

**Figure 3.11: Curing Of cylinder Molds**

**Figure3.12:ReplacingthewateratCuring**

## 3.10 Compressive and splitting tensilestrengthtestofconcretecylinder

As a key indicator of concrete quality, compressive strength and splitting tensile strength are frequently utilized. The pace at which concrete gains strength over time is gauged by its compressive strength. This testing procedure complies with specification C39 of the ASTM standard.

Shortly after the removal from the storage tank, the test was conducted. To ensure consistent seating, two bearing blocks were placed at the top and bottom of the cylindrical concrete specimen. Here, a continuous load will be applied to the cylinder to measure the compressive strength of concrete until failure occurs.

### 3.10.1 Apparatus

Theapparatusrequiredismentioned below:

1. Universaltestingmachine.
2. 4 inch in diameter and 8 inch in height cylinder mold.
3. Weightbalance.

**Figure 3.13: universal Testing MachineFigure 3.14: Cylinder mold of 4 in x 8 in**

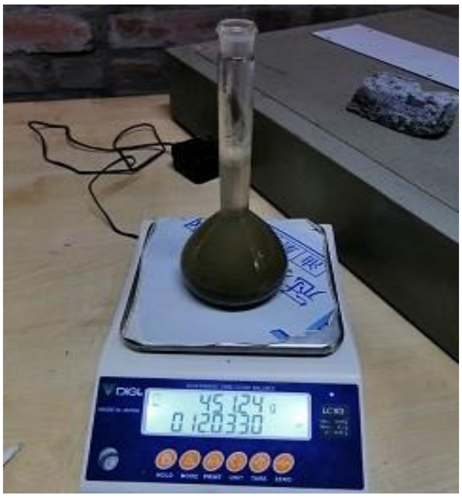


**Figure 3.15: Weighing balanceFigure 3.16: Weighing Balance (kg)**

### 3.10.2 Procedure for Concrete Cylinder Test

1. All of the concrete cylinders were cast using the standard size of 4"/8" and were given 7, 14, and 28 days to cure. For testing, all specimens have the same casting dimensions.
2. Meticulously removed each sample from the curing tank
3. Wipe any remaining water from the top of each sample.
4. Vertically arrange all of the samples on the UTM
5. Before applying the weight, make sure the loading platforms touch the cylinder's highest point.
6. Continue applying the load constantly and uniformly to the surface until the instance fails.
7. It has been loaded to its carrying capacity.
8. Evenly repeated for the remainder of the samples.

**Figure 3.17: Compressive Strength test of cylinder mold**

# CHAPTER4

# RESULT AND DISCUSSION

## 4.1 Introduction

This chapter includes an examination of the various findings as well as the results of the experiment and other tests conducted for this study.

## 4.2 FinenessModulus(FM)

### 4.2.1 Analysis of SieveforStoneChips

**Table 4.1: Sieving of stone Chips**

| Number of sieve | **Size of Sieve(mm)** | **Retained weight(gm)** | **Percentage of weight retained (%)** | **Cumulative Percentage Retained (%)** | **Percentage Finer (%)** |
|---|---|---|---|---|---|
| $1\frac{1}{2}''$ | 37.5 | 0 | 0% | 0 | 100 |
| $\frac{3}{4}''$ | 19 | 583.56 | 58.356 | 58.35 | 41.644 |
| $\frac{3}{8}''$ | 9.5 | 68.96 | 6.896 | 65.252 | 34.748 |
| #4 | 4.75 | 339.71 | 33.971 | 99.223 | 0.777 |
| #8 | 2.36 | 0.42 | 0.042 | 99.265 | 0.735 |
| #16 | 1.18 | 0.86 | 0.086 | 99.351 | 0.649 |
| #30 | 0.60 | 0.58 | 0.058 | 99.409 | 0.591 |
| #50 | 0.30 | 1.15 | 0.115 | 99.524 | 0.476 |
| #100 | 0.15 | 0.84 | 0.084 | 99.608 | 0.392 |
| Pan |  | 3.56 | 0.356 | 719.988 | 0.036 |
| Dust |  | 0.36 | 0.036 |  | 0 |

| | | | | | |
|---|---|---|---|---|---|
| Total | | 1000 | | | |

$$\text{Fineness Modulus, F.M} = \frac{\sum Cumulative\ \%\ retained}{100}$$

$$\text{F.M} = \frac{719.988}{100} = 7.19 \approx 7.2$$

The standard limit of F.M is 6.7 to 8 for CA. Where our finding was7.2 bestowed within the standard limit

### 4.2.2 Analysis of sieving for Sylhet sand

**Table 4.2: Sieving of stone chips**

| **Number of sieve** | **Size of sieve (mm)** | **Retained weight (gm)** | **Percentage of weight retained (%)** | **Cumulative Percentage Retained (%)** | **Percentage Finer (%)** |
|---|---|---|---|---|---|
| #4 | 4.75 | 1.17 | 0.234 | 0.234 | 99.766 |
| #8 | 2.36 | 16.16 | 3.232 | 3.466 | 96.534 |
| #16 | 1.19 | 87.9 | 17.58 | 21.046 | 78.954 |
| #30 | 0.59 | 154.76 | 30.352 | 51.398 | 48.602 |
| #50 | 0.3 | 183.3 | 36.66 | 88.058 | 11.942 |
| #100 | 0.15 | 50.59 | 10.118 | 98.176 | 1.824 |
| Pan | | 5.81 | | | |
| Total | | 500 | | 262.38 | |

$\text{FM} = \frac{262.38}{100} = 2.62$

The acceptable limit of FM of fine particles is 2 to 4

Where we have got 2.62, which is existing withinthe standard limit. The type of our sand sample is medium sand (limit 2.6 to 2.9)

## 4.3 Graphical representation of sieving of CA

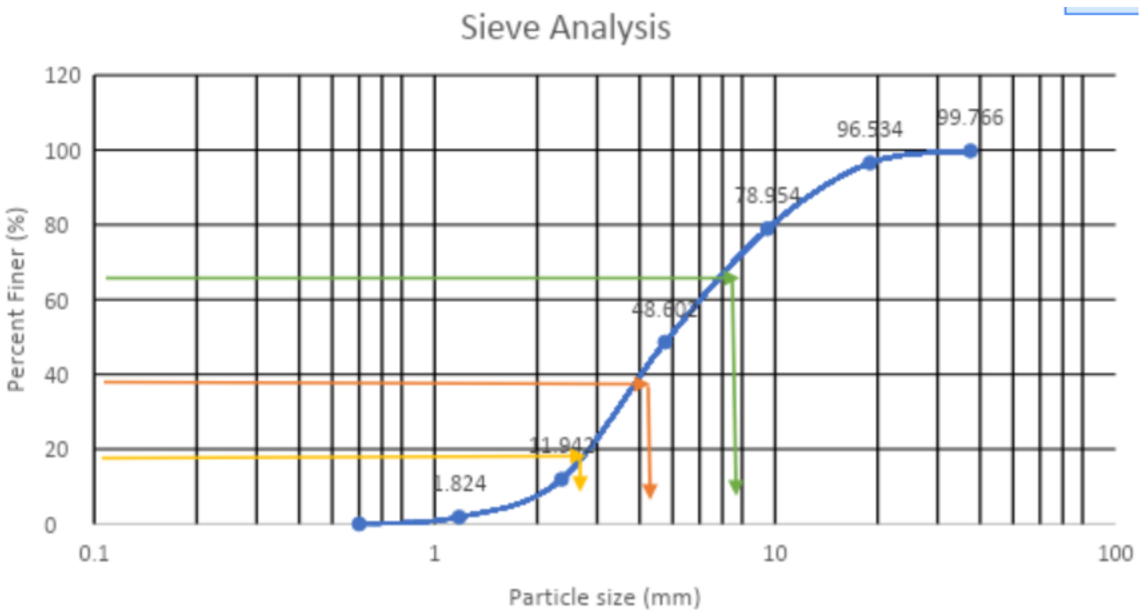


**Figure 4.1: Curve of grain size distribution of CA**

## 4.4 Specific gravity test of CA and FA

**Table 4.3: Specific Gravity Test of Coarse Aggregate and Fine Aggregate**

| Sample | Fine Sand | Coarse Sand | Coarse Aggregate |
|---|---|---|---|
| Determination No. | 1 | 2 | 3 |
| Wt. of Pycnometer (gm) | 111.10 | 111.10 | 529.42 |
| Wt. of Pycnometer (gm) + dry soil (gm) | 268.33 | 265.41 | 1021.60 |
| Wt. of soil, Ws (gm) | 157.23 | 154.31 | 492.18 |
| Wa.of of Pycnometer + water + soil, W: (gm) | 451.24 | 450.23 | 1835.17 |
| Wt. of Pycnometer + water, $W_2$ (gm) | 353.60 | 353.60 | 1527.00 |
| Room temperature T° C | 30° C | 30° C | 30° C |
| Specific gravity of water Gw (at 20°c) (from Table: 2.3). | 0.9982 | 0.9982 | 0.9982 |
| Specific gravity of water Gw (at T°c) (from Table:2.3) | 0.9957 | 0.9957 | 0.9957 |

| | | | |
|---|---|---|---|
| Specific gravity of soil at 20°C :Gş (at 20°C) | 2.63 | 2.67 | 2.66 |

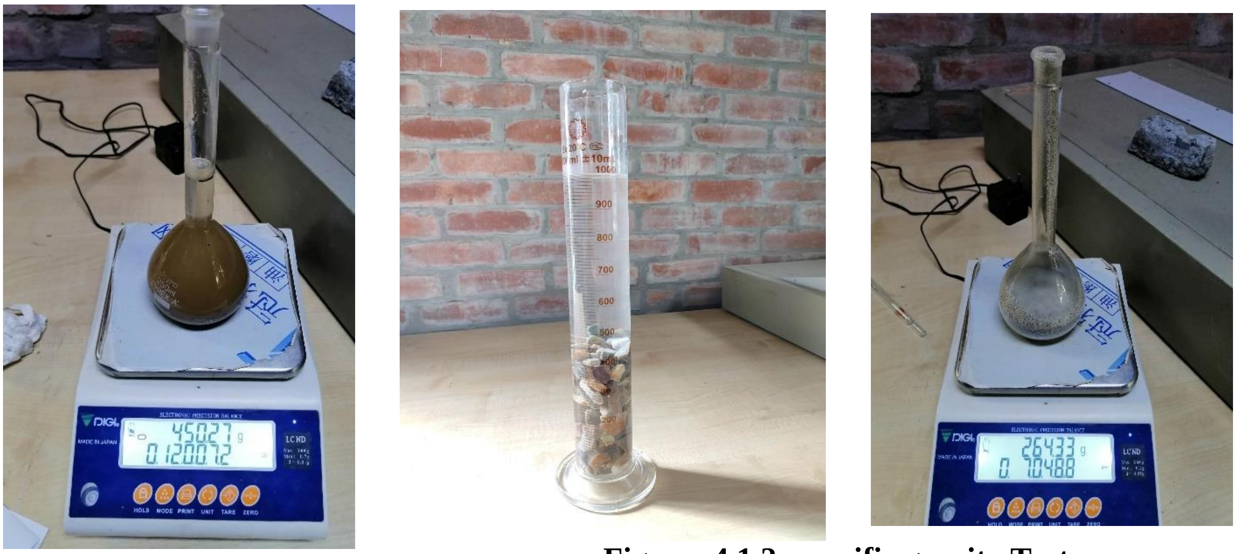


**Figure -4.1.2: specific gravity Test**

## 4.5 Analysis ofCompressive Strength

### 4.5.1 Compressive Strength of Normal Concrete

**Table 4.4: Compressive Strength of NC**

| Time duration of curing (days) | No of Sample | Strength of crushing | | | |
|---|---|---|---|---|---|
| | | (KN) | Ib | Psi | Average |
| 7 | 1 | 70 | 15737 | 1252 | 1305 |
| | 2 | 77 | 17310 | 1377 | |
| | 3 | 72 | 16186 | 1288 | |
| | | | | | |
| 14 | 1 | 111 | 24954 | 1985 | 1902 |
| | 2 | 99 | 22256 | 1770 | |
| | 3 | 109 | 24504 | 1950 | |
| | | | | | |
| 28 | 1 | 128 | 28776 | 2289 | 2372 |
| | 2 | 136 | 30574 | 2432 | |
| | 3 | 134 | 30124 | 2396 | |

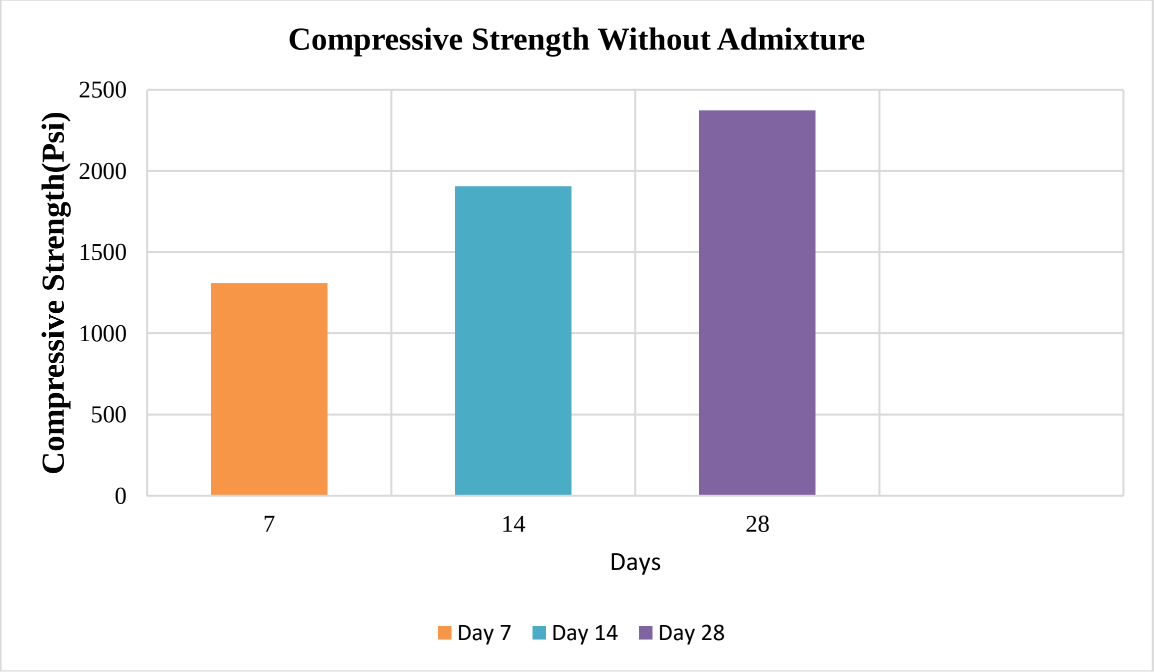


**Figure 4.2: Graph of compressive strength of NC**

### 4.5.2 CS after additionting 7.2ml Self Compacting Admixture:

| Curing Duration Days | No of Sample | **Compressive Strength of Concrete with 7.2ml Self Compacting Admixture**<br>Crushing Strength | | | |
|---|---|---|---|---|---|
| | | (Kn) | Ib | Psi | Average |
| 7 | 1 | 82 | 18434 | 1467 | 1485 |
| | 2 | 80 | 17985 | 1430 | |
| | 3 | 87 | 19559 | 1556 | |
| | | | | | |
| 14 | 1 | 121 | 27202 | 2164 | 2176 |
| | 2 | 127 | 28551 | 2271 | |
| | 3 | 117 | 26303 | 2093 | |
| | | | | | |
| 28 | 1 | 167 | 37544 | 2986 | 2969 |
| | 2 | 168 | 36419 | 3005 | |
| | 3 | 163 | 36644 | 2915 | |

**Table 4.5Compressive Strength of Concrete with 7.2ml Self Compacting Admixture**

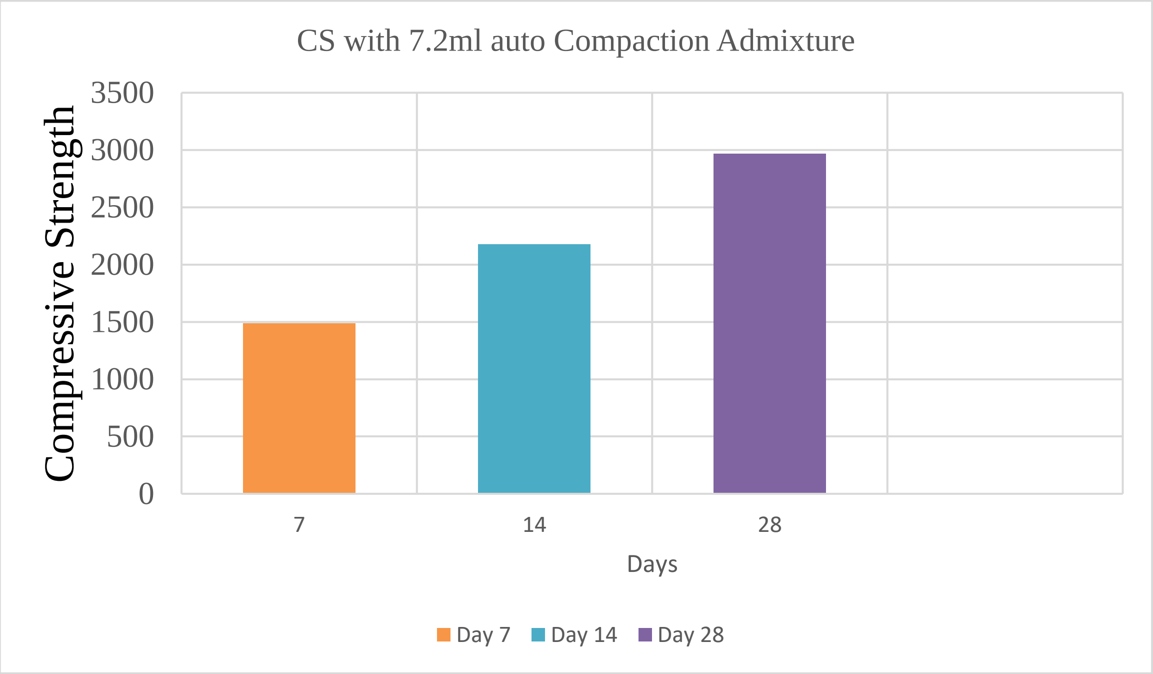


**Figure 4.3: Graphical Representation of Self compacting admixture applied strength**

### 4.5.3 CS of Concrete using 7.2gm gram flour

**Table 4.6Compressive Strength of Concrete using 130gm gram flour**

| Curing Days | No of Sample | Crushing Strength | | | |
|---|---|---|---|---|---|
| | | (Kn) | Ib | Psi | Average |
| 7 | 1 | 79 | 17760 | 1413 | 1473 |
| | 2 | 81 | 18210 | 1449 | |
| | 3 | 87 | 19558 | 1556 | |
| | | | | | |
| 14 | 1 | 120 | 26977 | 2146 | 2206 |
| | 2 | 117 | 26308 | 2271 | |
| | 3 | 123 | 27652 | 2200 | |
| | | | | | |
| 28 | 1 | 148 | 33272 | 2647 | 2707 |
| | 2 | 152 | 34171 | 2719 | |
| | 3 | 154 | 34621 | 2754 | |

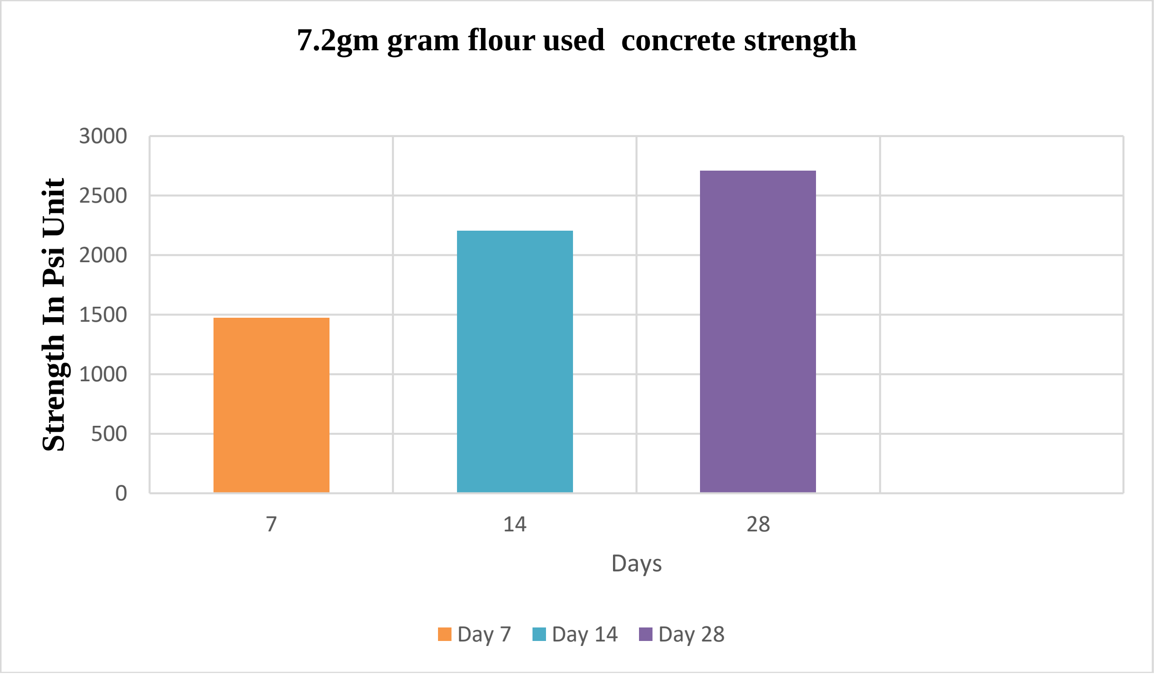


**Figure 4.4: Graphical View of strength with 7.2gm gram flour**

### 4.5.4 CS after applying 7.2ml high strength admixture

**Table 4.7: High strength admixture applied strength**

| Curing days | No of Sample | Crushing Strength | | | |
|---|---|---|---|---|---|
| | | (Kn) | Ib | Psi | Average |
| 7 | 1 | 102 | 22931 | 1825 | 1825 |
| | 2 | 99 | 22256 | 1770 | |
| | 3 | 105 | 23605 | 1878 | |
| | | | | | |
| 14 | 1 | 148 | 33272 | 2647 | 2605 |
| | 2 | 146 | 32822 | 2611 | |
| | 3 | 143 | 32148 | 2558 | |
| | | | | | |
| 28 | 1 | 177 | 39791 | 3166 | 3201 |
| | 2 | 181 | 40691 | 3237 | |
| | 3 | 179 | 40241 | 3201 | |

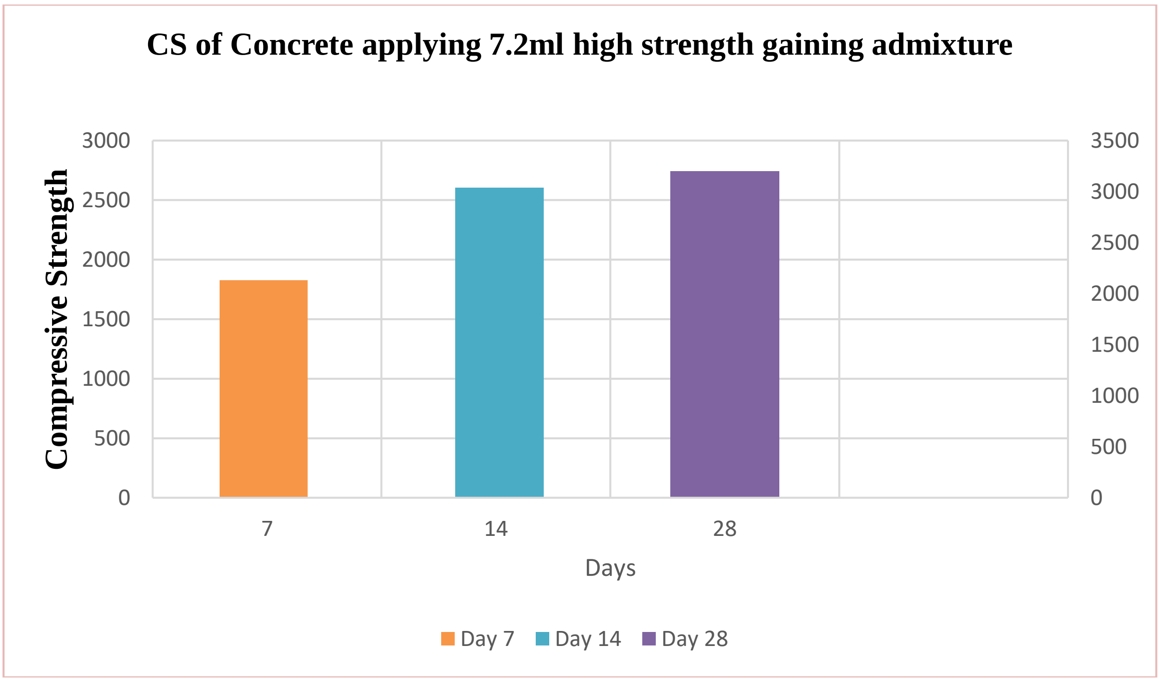


**Figure 4.5: Graph chart of HAS applied strength**

### 4.5.5 Comparison among Compressive Strength of Normal Concrete and Concrete with three type of Admixture

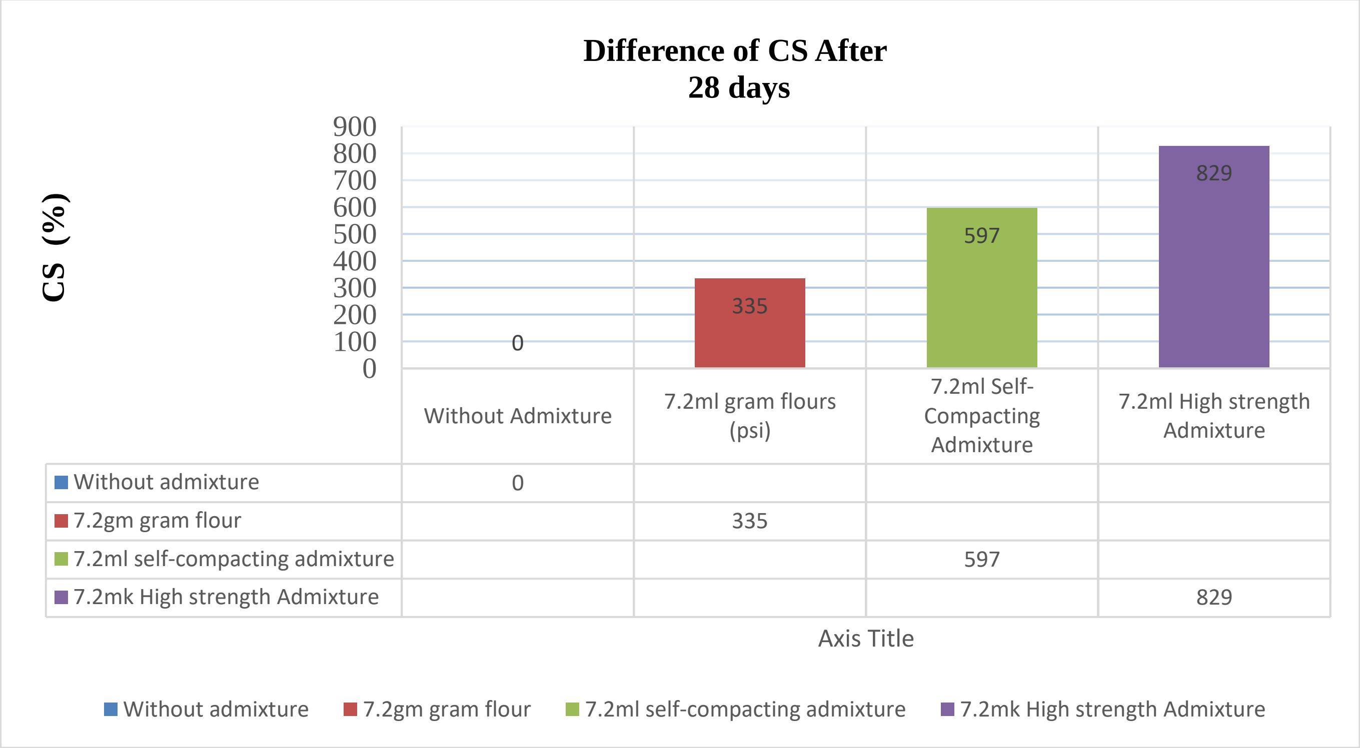
**Table 4.8: Comparison among normal and admixture applied compressive strength**

| Specimen | W/C Ratio | Mix Ratio | Curing Time | Compressive strength | | | |
|---|---|---|---|---|---|---|---|
| | | | | Normal Concrete (psi) | Concrete with 7.2ml High strength Admixture (psi) | Concrete with 7.2ml Self Compacting Admixture (psi) | Concrete with 7.2gm gram flour(psi) |
| Cylinder | 0.5 | 1:1.5:3 | 7days | 1305 | 1825 | 1485 | 1473 |
| | | | 14days | 1902 | 2605 | 2176 | 2206 |
| | | | 28days | 2372 | 3201 | 2969 | 2707 |

### 4.5.6 Variation of CS after 28 days

**Table 4.9:CS variation after 28 days of curing**

| | **Without Admixture** | **7.2ml High strength Admixture** | **7.2ml Self Compacting Admixture (psi)** | **7.2ml gram flours (psi)** |
|---|---|---|---|---|
| CS after curing 28days | 2372 | 3201 psi | 2969 psi | 2707 psi |
| Increment of strength | 0 | 3201-2372<br>= 829 psi | 2969-2372<br>= 597 psi | 2707-2372<br>= 335 psi |
| Percentage increases | 0 | = 34.9% | = 25.16% | =14.12% |



| | Without Admixture | 7.2ml gram flours (psi) | 7.2ml Self-Compacting Admixture | 7.2ml High strength Admixture |
|---|---|---|---|---|
| 🟦 Without admixture | 0 | | | |
| 🟥 7.2gm gram flour | | 335 | | |
| 🟩 7.2ml self-compacting admixture | | | 597 | |
| 🟪 7.2mk High strength Admixture | | | | 829 |

Figure 4.6: Growing of Strength after 28 days

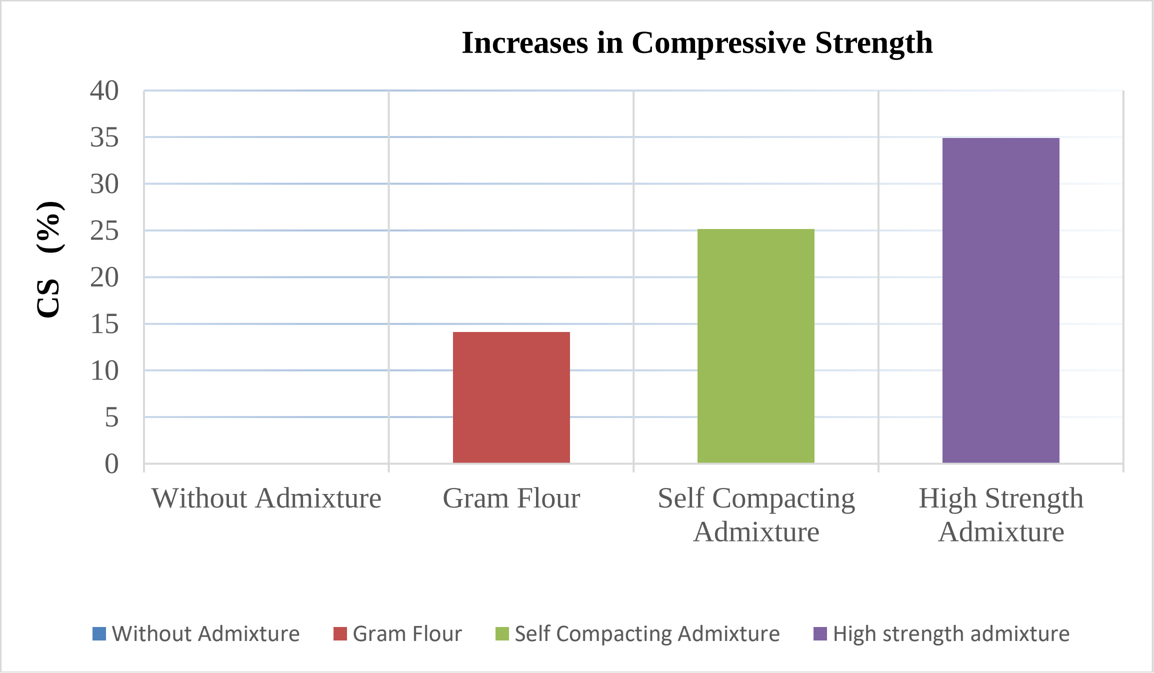
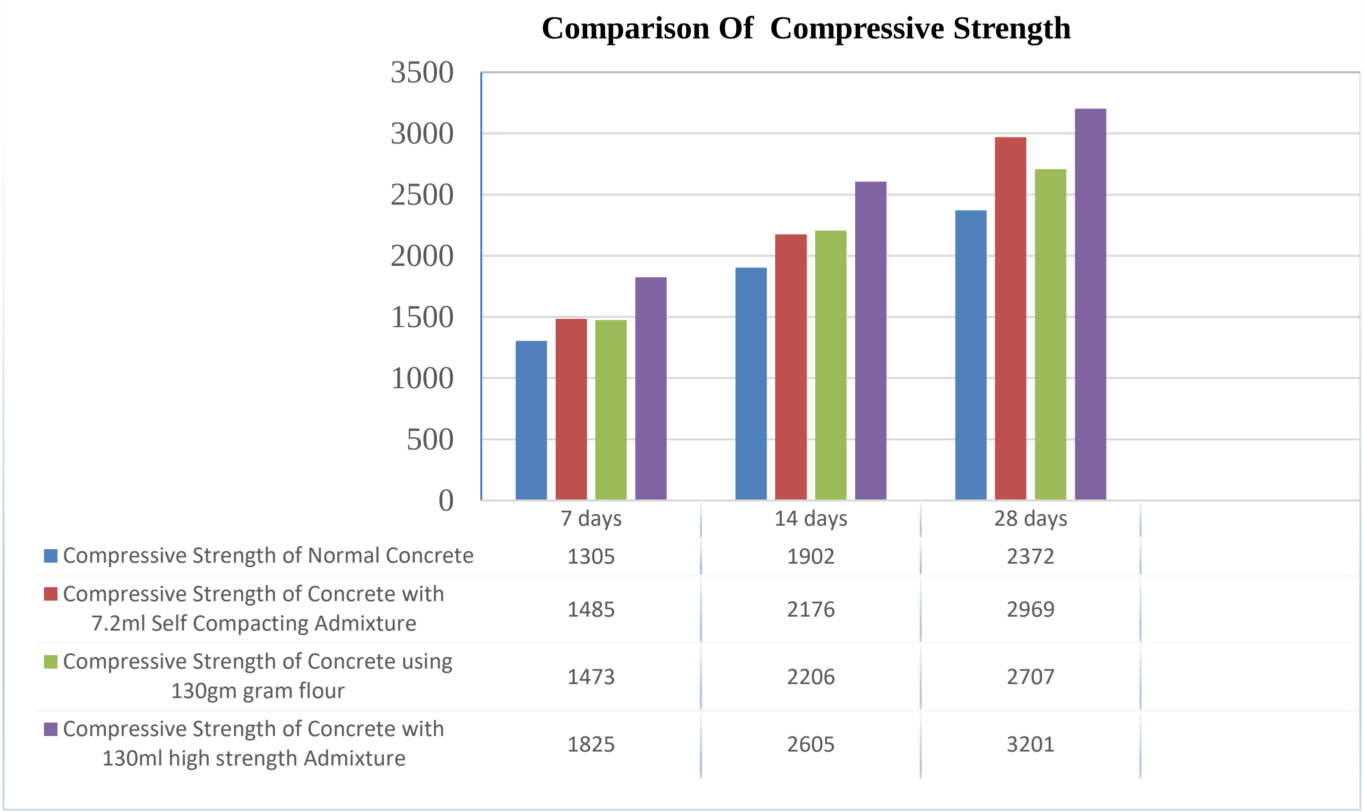


**Figure 4.7:**Increasing phenomena in Compressive Strength

## 4.5.7 Comparison of compressive strength



| | 7 days | 14 days | 28 days |
|---|---|---|---|
| 🟦 Compressive Strength of Normal Concrete | 1305 | 1902 | 2372 |
| 🟥 Compressive Strength of Concrete with 7.2ml Self Compacting Admixture | 1485 | 2176 | 2969 |
| 🟩 Compressive Strength of Concrete using 130gm gram flour | 1473 | 2206 | 2707 |
| 🟪 Compressive Strength of Concrete with 130ml high strength Admixture | 1825 | 2605 | 3201 |

Figure -4.8:Comparison of Compressive Strength

## 4.6 Splitting tensilestrength Analysis

### 4.6.1 Splitting tensile strength of NC

Table 4.10:Normal Concrete’s STS

| Curing Days | Specimen No. | Crushing Strength | | | |
|---|---|---|---|---|---|
| | | (Kn) | Ib | Psi | Average |
| 7 | 1 | 38 | 8543 | 187 | 192 |
| | 2 | 42 | 9442 | 206 | |
| | 3 | 37 | 8318 | 182 | |
| | | | | | |
| 14 | 1 | 46 | 10341 | 226 | 241 |
| | 2 | 52 | 11690 | 255 | |
| | 3 | 49 | 11016 | 241 | |
| | | | | | |
| 28 | 1 | 63 | 14163 | 309 | 309 |
| | 2 | 59 | 13264 | 290 | |
| | 3 | 67 | 15063 | 329 | |

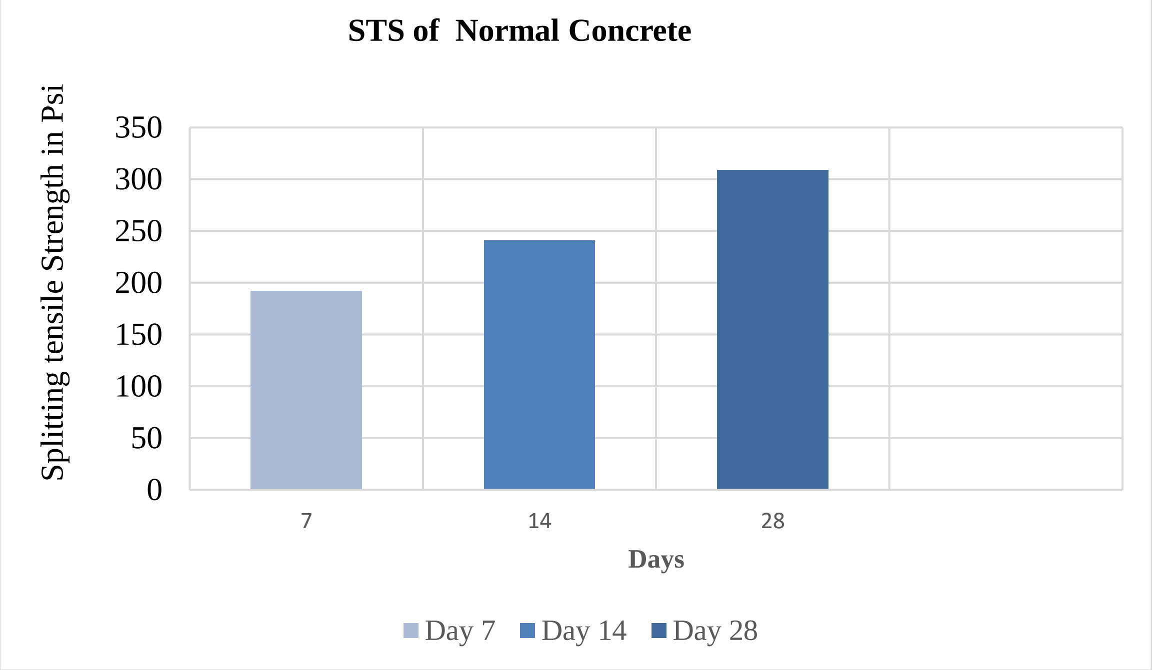


Figure -4.9: Chart diagram of STS of NC

### 4.6.2 STS applying of 7.2ml Self Compaction developing admixture

**Table 4.11: STS increment additioning 7.2ml Self compactor admixture**

| Curing period (days) | Specimen No. | Bearing Strength before getting crushed | | | |
|---|---|---|---|---|---|
| | | (Kn) | Ib | Psi | Average |
| 7 | 1 | 41 | 9217 | 201 | 213 |
| | 2 | 47 | 10566 | 231 | |
| | 3 | 42 | 9442 | 206 | |
| | | | | | |
| 14 | 1 | 53 | 11915 | 260 | 272 |
| | 2 | 55 | 12364 | 270 | |
| | 3 | 58 | 13039 | 285 | |
| | | | | | |
| 28 | 1 | 79 | 17760 | 388 | 365 |
| | 2 | 71 | 15962 | 349 | |
| | 3 | 73 | 16411 | 358 | |

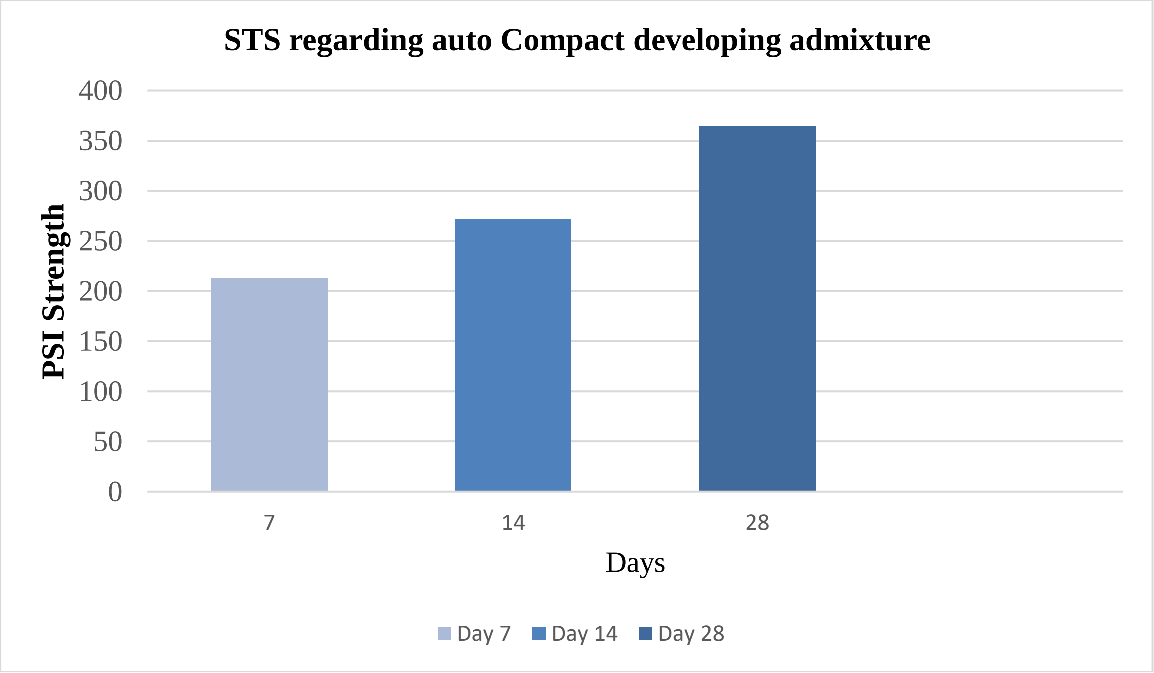


**Figure 4.10: Graphical overview of STS by using self-compactor admixture**

### 4.6.3 STS Phenomena with 7.2gm gram flour as Natural admixture:

**Table 4.12: Gram flour applied STS**

| Curing Days | Specimen No. | Crushing Strength | | | |
|---|---|---|---|---|---|
| | | (Kn) | Ib | Psi | Average |
| 7 | 1 | 43 | 9667 | 211 | 200 |
| | 2 | 38 | 8543 | 187 | |
| | 3 | 41 | 9217 | 201 | |
| | | | | | |
| 14 | 1 | 64 | 14388 | 314 | 310 |
| | 2 | 67 | 15062 | 329 | |
| | 3 | 59 | 13264 | 289 | |
| | | | | | |
| 28 | 1 | 73 | 16411 | 358 | 348 |
| | 2 | 71 | 15961 | 349 | |
| | 3 | 69 | 15512 | 339 | |

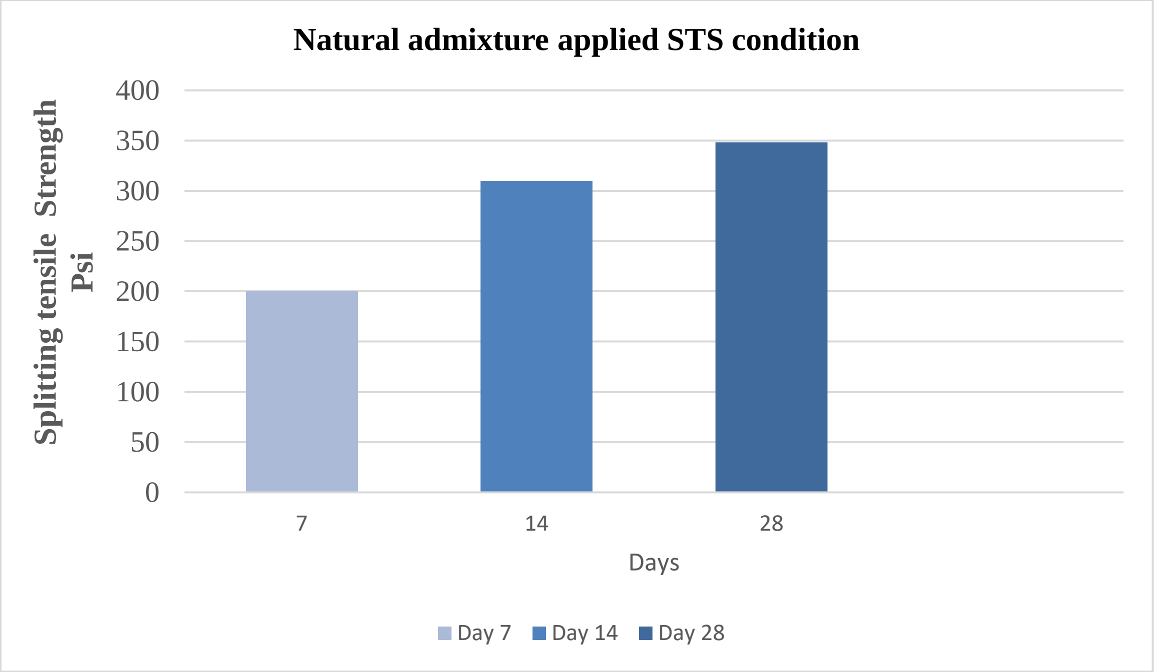


Figure 4.11: Graph of STS with natural gram flour

### 4.6.4 STS after 7.2ml high strength admixture:

**Table 4.13:STS with respect to applying high strength gaining admixture**

| Curing Days | Sample No. | Crushing Strength | | | |
|---|---|---|---|---|---|
| | | (Kn) | Ib | Psi | Average |
| 7 | 1 | 46 | 10341 | 226 | 222 |
| | 2 | 42 | 9442 | 206 | |
| | 3 | 48 | 10791 | 236 | |
| | | | | | |
| 14 | 1 | 71 | 15961 | 348 | 350 |
| | 2 | 69 | 15512 | 339 | |
| | 3 | 74 | 16636 | 363 | |
| | | | | | |
| 28 | 1 | 93 | 20907 | 457 | 448 |
| | 2 | 92 | 20682 | 452 | |
| | 3 | 89 | 20008 | 437 | |

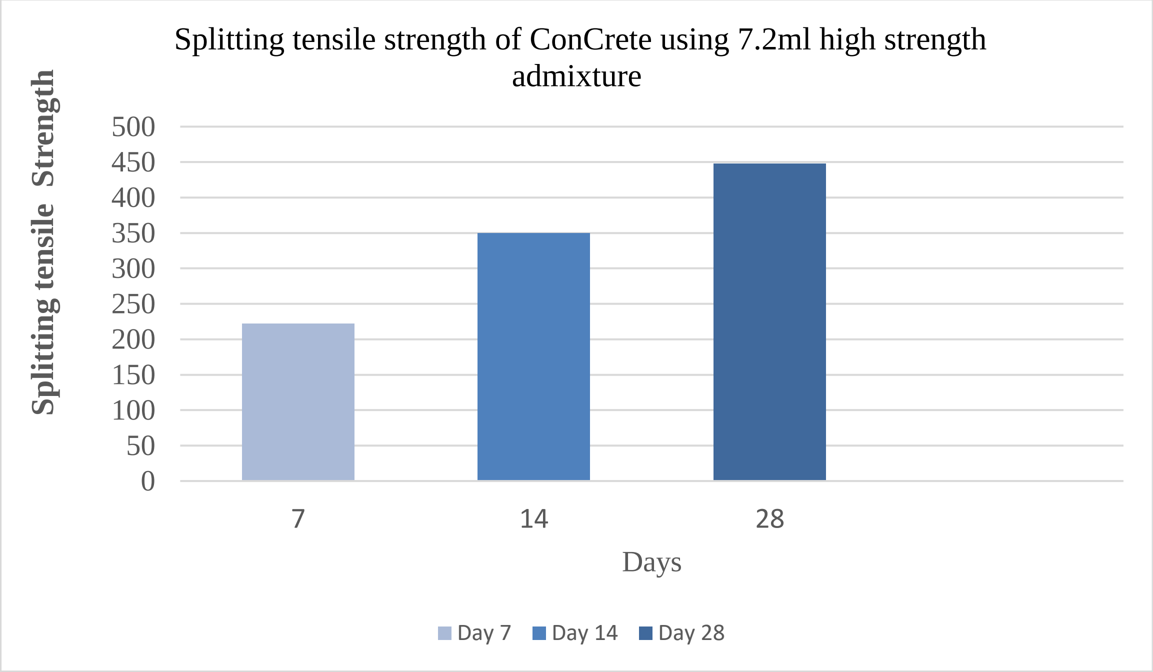


**Figure 4.12: Bar chart overview Of STS using strength promoter admixture**

### 4.6.5 Summary of Tensile strength

**Table 4.14: Tensile Strength summary in psi**

| Specimen | W/C Ratio | Mix Ratio | Curing Time | Tensile strength | | | |
|---|---|---|---|---|---|---|---|
| | | | | Normal Concrete (psi) | Concrete with 7.2ml High strength Admixture (psi) | Concrete with 7.2ml Self Compacting Admixture (psi) | Concrete with 7.2ml gram flours(psi) |
| Cylinder | 0.5 | 1:1.5:3 | 7days | 192 | 222 | 213 | 200 |
| | | | 14days | 241 | 350 | 272 | 310 |
| | | | 28days | 309 | 448 | 365 | 348 |

### 4.6.6 Comparison of STS after 28days properly curing

**Table 4.15: Increment in STS after 28 days of curing**

| | **Without Admixture** | **7.2ml High strength Admixture** | **7.2ml Self Compacting Admixture (psi)** | **7.2ml gram flours (psi)** |
|---|---|---|---|---|
| Splitting tensile Strength After 28 days | 309 | 448 psi | 365 psi | 348 psi |
| Increasing in strength | 0 | 448-309<br>= 139 psi | 365-309<br>= 56 psi | 348-309<br>= 39 psi |
| Increment percentage | 0 | = 44.98% | = 18.12% | = 12.6% |

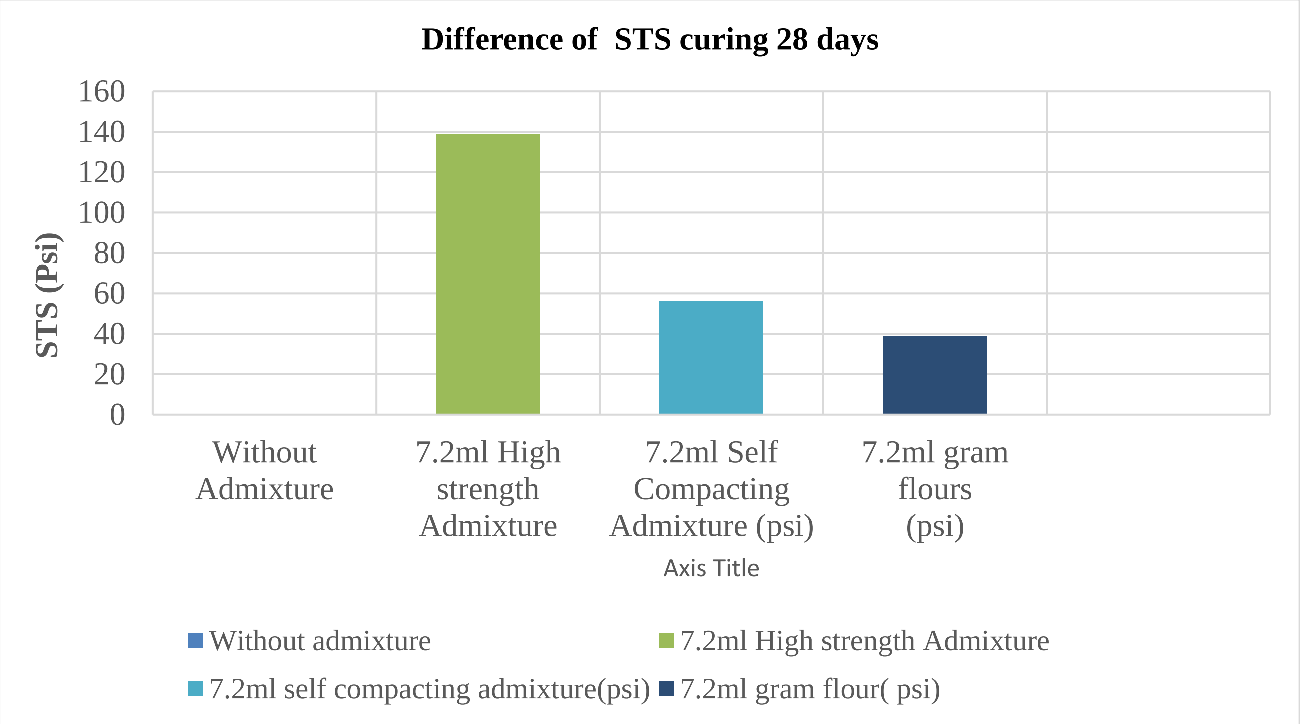


**Figure 4.13: Increasing of strength after curing of 28 days**

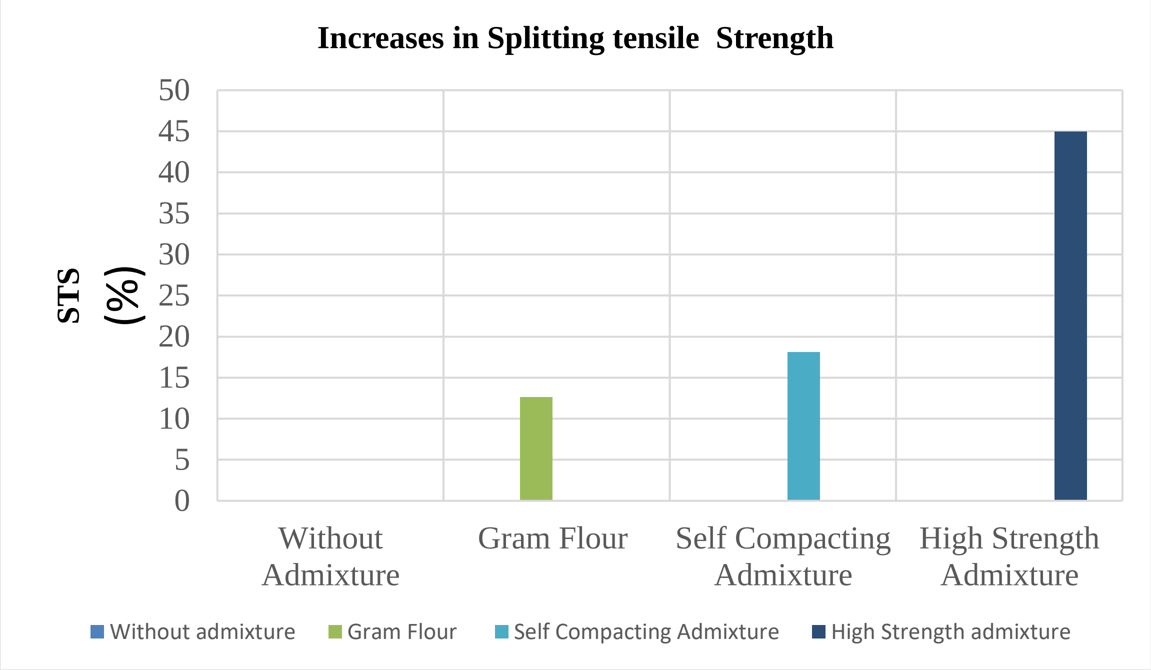
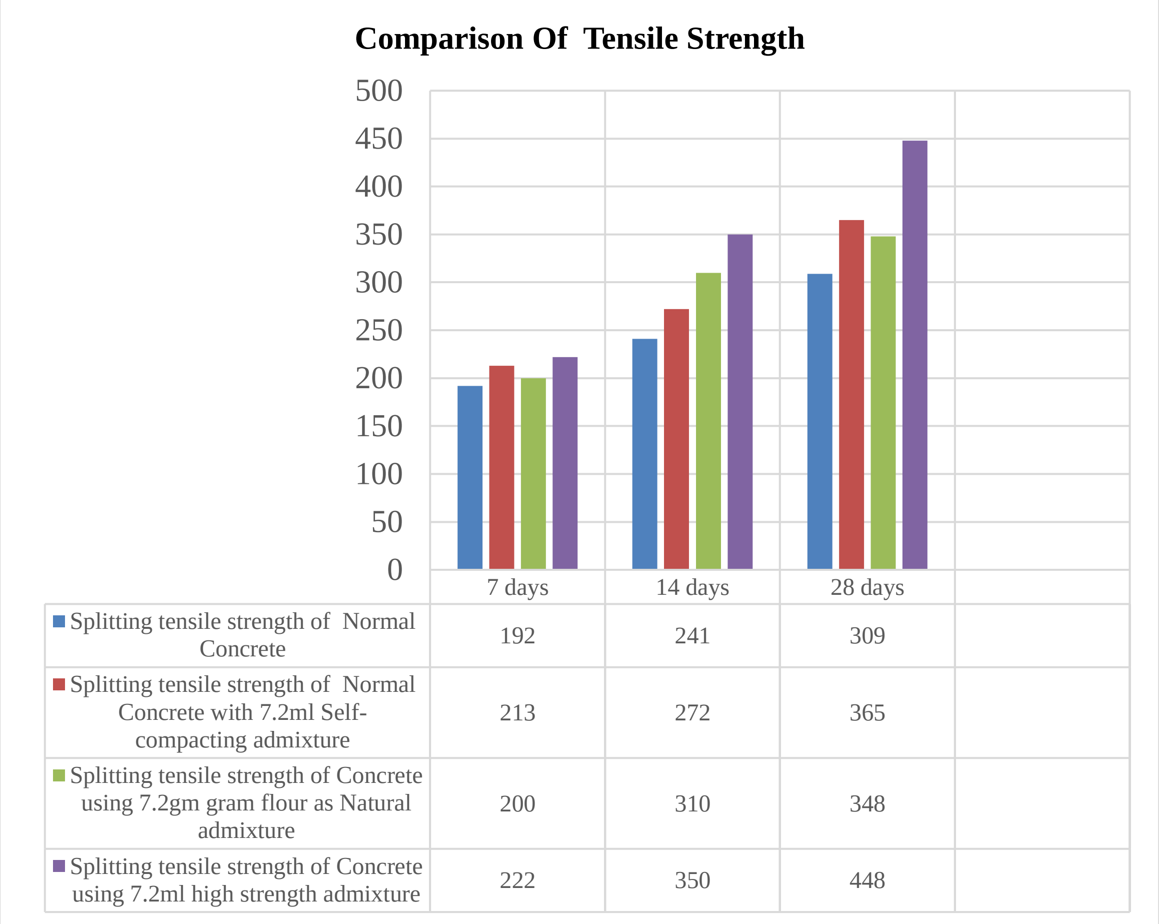


**Figure 4.14: Increased amount of STS**

## 4.6.7 Comparison of STS



| | 7 days | 14 days | 28 days |
|---|---|---|---|
| 🟦 Splitting tensile strength of Normal Concrete | 192 | 241 | 309 |
| 🟥 Splitting tensile strength of Normal Concrete with 7.2ml Self-compacting admixture | 213 | 272 | 365 |
| 🟩 Splitting tensile strength of Concrete using 7.2gm gram flour as Natural admixture | 200 | 310 | 348 |
| 🟪 Splitting tensile strength of Concrete using 7.2ml high strength admixture | 222 | 350 | 448 |

**Figure 4.15: Comparison of Splitting tests**

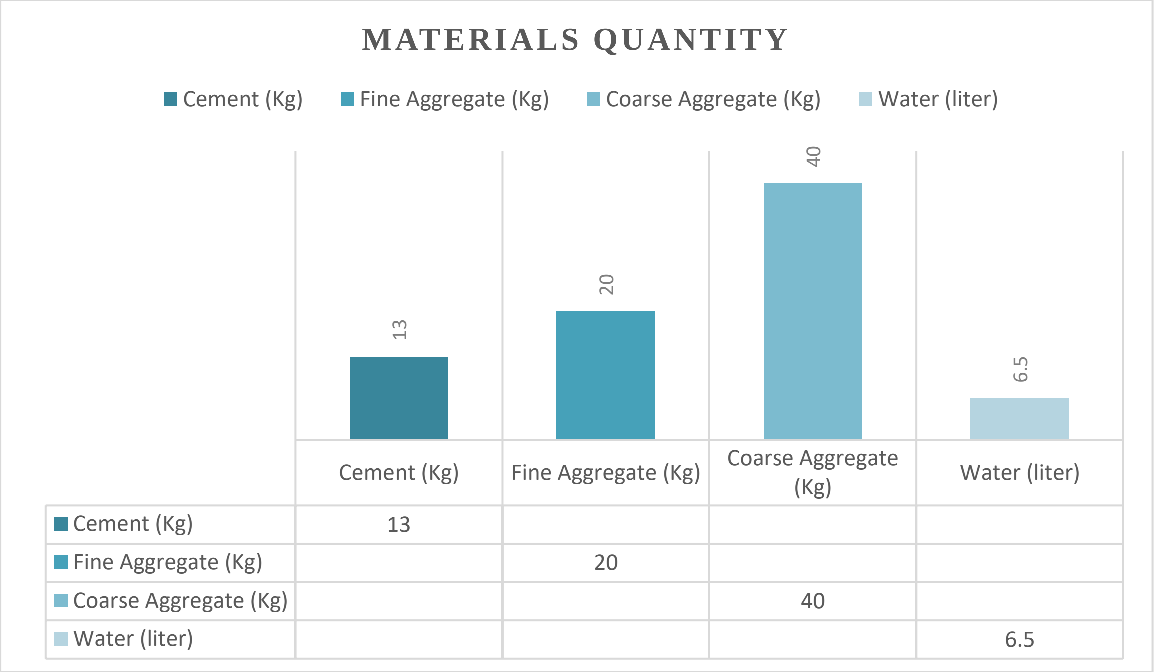
## 4.7 Materials and Cost Calculation

### 4.7.1 Sample Calculation of STS and Compressive Strength test

Data calculation is provided in the appendix

### 4.7.2 Calculate Quantities of Materials forConcrete

Here we have just provided the results and graphical view. All sample calculation is shown in the appendix



| | Cement (Kg) | Fine Aggregate (Kg) | Coarse Aggregate (Kg) | Water (liter) |
|---|---|---|---|---|
| Cement (Kg) | 13 | | | |
| Fine Aggregate (Kg) | | 20 | | |
| Coarse Aggregate (Kg) | | | 40 | |
| Water (liter) | | | | 6.5 |

**Figure -4.16:Amount of materials used**

### 4.7.3 Economical Effect calculation

The appendix provides detailed calculation. Here we have shown only the results.

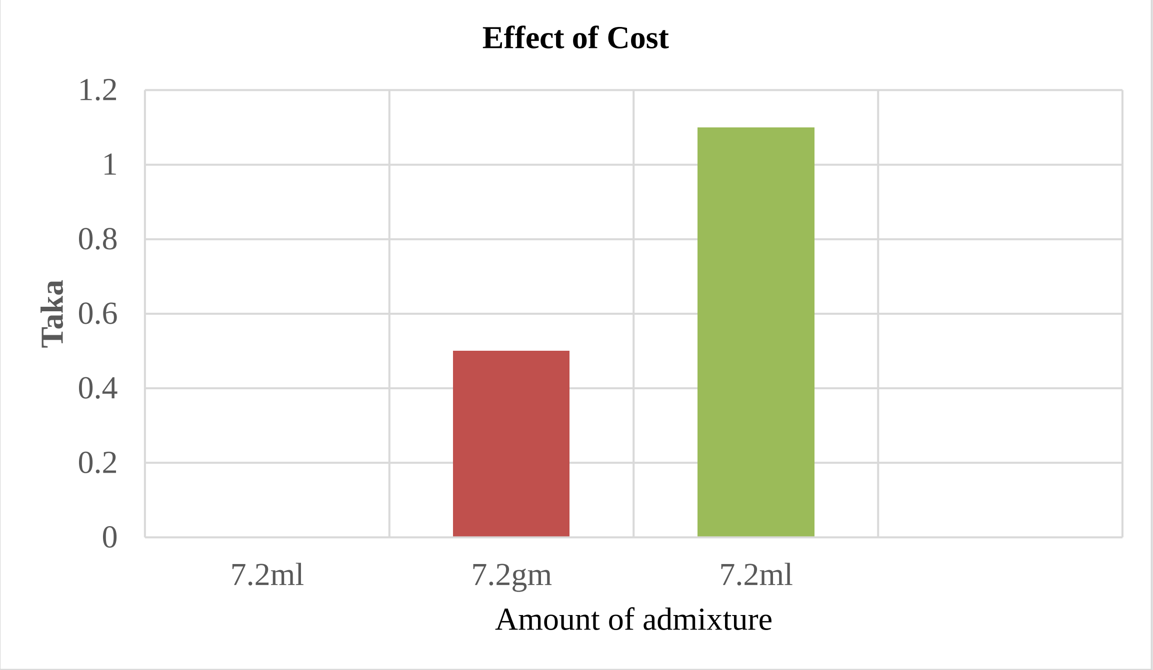


**Figure 4.17:Economical Effect**

| | 7.2mlself-compacting admixture | 7.2gm gram flour | 7.2ml high strength admixture |
|---|---|---|---|
| **Cost of Using Admixtures** | **1.2 taka** | **0.5 taka** | **1.2 taka** |

# CHAPTER5

# CONCLUSION AND RECOMMENDATION

## 5.1 General

Thischapter provides information about how we can increase the compressive and splitting tensile strength by additioning some natural or chemical admixture. These will certainly create a good impact undoubtedly usefulfortheconstructionofbetter concretestructure and the conclusion.

## 5.2 Conclusion

We have prepared 72 cylindrical molds in normal condition & using chemical and natural admixture. The main point of view of this chapter is to present a summary of the conclusions with respect to results and also a comparative analysis. And after that cost effect of concrete for admixture.

:

### 5.2.1 FindingsoftheStudy:

1. Observed Compressivestrengthwas1305psi,1902psi,and 2372psi and Splitting tensile strengthwasnoted192psi,241psi,and 309psi withoutadmixtureafter7, 14, and 28 days of curing.
2. Applying 1% self-compacting admixture (7.2 ml), the compressive strength increases to 1485 psi, 2176 psi, and 2969 psi and the STS increases to 213 psi, 272 psi, and 365 psi after curing respectively.
3. For gram flour, that was 1473 psi, 2206 psi, and 2707 psi in compression and 200 psi, 310 psi, and 348 psi in tensile strength.
4. Additioning high strength gaining admixture,we have got the compressive strength 1825 psi, 2605 psi, and 3201 psi where the tensile strength is 222 psi, 350 psi, and 448 psi
5. For the applied admixtures compressive strength increases by 335 psi, 597 psi, and 829 psi and STS increases by 39 psi, 56 psi, 139 psi for gram flour, self-compacting admixture.

6. The cost for self-compaction and high strength admixture is 1.1 taka per mold and for gram flour it is 0.5 taka only Using 1% self-compacting admixture quantity of 7.2 ml, we found the strength thatwas 213 psi, 272 psi, and 365 psi, after 7 days, 14 days, and finally, 28 daysofcuring.

7. Comparing all of resultswe can say that natural admixture (Gram flour) is a suitable alternative to chemical admixture comparing economicaleffectand strength

## 5.3 Recommendations

The followingnumberofguidelineswererevealedbelow for futurestudyonthis topic.

1. For more accuracy in result more specimen should be tested.
2. Better source for materials can give better result.
3. For assurance of better strength qualityof concrete acceptable admixturecanbeused.
4. Self-compacting admixture is very much applicable where there is an insecurity of vibration.
5. High strength admixture can be used for heavy weight concrete structure.

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# APPENDIX

**Specific gravity determination of CA:**

Specific gravity at T°C as –

$G_s(_{at}T°\ C) = \frac{Ws}{Ws - W1 + W2}$

$= \frac{492.18}{492.18 - 1835.17 + 1527}$

$= 2.67$

Specific gravity at 20°C as –

$G_{s(}(_{at\ 20}{}^{o}c) = G_s(_{at}\ T°\ C) \times \frac{Gw\ ((\text{at T° C})}{\text{Gw( at 20° C)}}$

$= 2.67 \times \frac{0.9987}{0.9982}$

$= 2.66$ ;

So, Specific gravity of coarse aggregate at 20°C is $G_s = 2.66$

**Determination of Specific gravity for Fine Sand:**

Specific gravity at $T^o$ C,

$G_s(_{at}T°\ C) = \frac{Ws}{Ws - W1 + W2}$

$= \frac{157.23}{157.23 - 451.24 + 353.60}$

$= 2.639$

Specific gravity at 20°C as –

$G_{s(}(_{at\ 20}{}^{o}c) = G_s(_{at}\ T°\ C) \times \frac{Gw\ ((\text{at T° C})}{\text{Gw( at 20° C)}}$

$= 2.639 \times \frac{0.9957}{0.9982}$

$= 2.63$

Specific gravity of fine sand at 20°C is $G_s = 2.63$

## Determination of Specific gravity for Coarse Sand:

Specific gravity at $T^o$ C,

$$G_s(_{at}T° C) = \frac{Ws}{Ws - W1 + W2}$$

$$= \frac{154.31}{154.31 - 450.23 + 353.60}$$

$$= 2.675$$

Specific gravity at 20°C as –

$$G_{s(}(_{at\ 20}{}^{o}c) = G_s(_{at}\ T° C) \times \frac{Gw\ ((\text{at T° C})}{\text{Gw( at 20° C)}}$$

$$= 2.675 \times \frac{0.9957}{0.9982}$$

$$= 2.675$$

Specific gravity of coarse sand at 20°C is $G_s$= 2.675

## Calculation of Compressive Strength Test

## Sample Calculation

We Know,

Compressive Strength of concrete,

= Maximum compressive load / Cross Sectional Area

Such as,

Maximum Compressive load,

= 70 KN

= 70 x 224.81

= 15737lb We know, [1KN=224.81lb]

And Cross Sectional Area of cylinder,

$= (\pi d^2)/4$

$=(3.1416*4^2)/4 = 12.57 \text{ inch}^2$

So, Compressive Strength of Concrete

=Maximum compressive load / Cross Sectional Area

= 15737/12.57

= 1252psi

= 8.63 Mpa [1 MPa= 145psi]

Calculate Quantities of Materials for Concrete

Here we are preparing 4 sets of cylinder mold and each set has a 9-cylinder mold.1st set was concrete without admixture and the last 3 sets were using admixture with three different percentages.

Volume of cylinder specimen:

$$= {}^{\pi d2}\!/_{4} \times h$$

$$= \pi 4^2/4 \text{ x } 8$$

$$= 100.531\ inch^3$$

$$= 0.058\ ft^3$$

Dry Volume = 1.5 c 0.058 cft

=0.087 cft

Weight of cylinder specimen:

= Volume × Unit weight of concrete

= 0.058 × 150 × 1.54

= 13.398 lb × 0.4535

= 6.07 kg

M20 concrete proper mixing ratio is 1:1.5:3

And we assumed water/cement ratio = 0.48

According to the ratio of 1:1.5:3

Amount of Cement:

$$= \frac{1}{1+1.5+3} \text{ x } 1.69 = 0.30\text{cft (per sample)}$$

= 0.30 x 43 kg

= 13kg

Amount of Sand:

$$= \frac{1.5}{1+1.5+3} \times 1.69$$

= 0.46 (per sample)

= 0.46 ×43

= 20 kg

Amount of Aggregate:

$$= \frac{3}{1+1.5+3} \times 1.69$$

= 0.92 (per sample)

= 0.92 × 43

= 39.5 kg

Amount of Water:

$= 0.5 \text{ x } 13 \frac{1 x 1000}{100}$

= 6.5lite

**Calculate Amount of Admixture for Concrete** Dosage of admixture: 200-400 ml per bag (50kg) cement

Here, We have used 1% admixture of the weight of cement.

As the weight of cement needed for 18 Sample is 13 kg

So, Amount of Admixture for 200 ml: $= 13 \text{ x } \frac{1 x 1000}{100}$

= 130 ml

$= \frac{130}{18}$ ml

= 7.2ml per sample

Amount of High- Strength admixture for one Sample = 7.2ml
Similarly, Self-Compacting Admixture = 7.2ml
Amount of natural admixture (gram Flour)

$=13 \text{ x } \frac{1 x 1000}{100}$ gm

= 130gm

$= \frac{130}{18}$ ml

= 7.2ml (per sample)

**Calculation of Economical Effect**

For Experiment purpose we gave used High -Strength and Self Compacting admixture . The market price of these admixtures is 150taka per liter and the price of gram flour is 70 taka per kg.

1 liter bottle = 1000 Here we have used 130ml admixture for 18 sample (where 9 sample for Compressive Strength test and 9 sample for splitting tensile Strength test)

Cost for 130ml chemical Admixture $=\frac{130}{1000}$ x 150

= 19.5 Taka

$= \frac{19.5}{18}$ Taka Sample

= 1.1 Taka/Sample

Cost for 130ml natural gram flour as Admixture $=\frac{130}{1000}$ x 70

= 9.1 Taka

$= \frac{9.1}{18}$ Taka Sample

= 0.5 Taka/Sample