COMPARISON ON COMPRESSIVE STRENGTH OF CONCRETE BY USING DIFFERENT TYPES OF CEMENT FOR GRADE M20 AND M25

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Dedicated

To

``Our Beloved Parents``

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ABSTRACT

Concrete consummation is becoming increasingly complex and the importance of producing matures that are both cost effective and durable has never been higher. Many experimental woks have been performed to determine the compressive strength of different types of cement. The overtimes of the study are to determine the compressive strength of concrete by using two different types of cement for two different grades M20 and M25. The Materials used for the experiment are OPC & PCC Cement, Indian Pakure stone, Sylhet sand and water. The mass of the specimens was recorded carefully. For 14 days, the values of compressive strength of concrete OPC and PCC are 34.26 MPa and 25.83 MPa respectively of grade M20. For 21 days, the alues are 34.66 MPa and 28.73 MPa and 28 days values are 39.19 Mpa 30.02 Mpa respectively for the same types of cements for OPC and PCC of grade M20. For 14days, the highest compressive strength of the concrete found 29.63 MPa for OPC of grade M25 and the lowest compressive strength is 24.54 MPa for PCC of grade M25. For 21 days, the highest compressive strength of the concrete found 35.02MPa for OPC of grade M25 and the lowest compressive strength is 27.00 MPa for PCC of grade M25 And 28 days, the highest compressive strength of the concrete found 36.33MPa for OPC and the lowest compressive strength is29.57MPa for PCC of grade M25. The compressive strength of OPC cement was better than the PCC cement for the both grade M20 and M25.

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CHAPTER 1
Introduction

1.1 General

The history of cementing materials is as old as the history of engineering construction. Concrete compressive strength for general construction varies from M20 and M25 and higher in commercial structures. Cement is a binding materials. It was first invented by Egyptians. It obtained by burning together a mixture of naturally occurring argillaceous and calcareous materials at high temperature. Test for concrete strength for different types of cement carried out on concrete cylinders. Various standards codes recommended a concrete cylinder or concrete cube as the standard specimen for the test, There are various types of cement for two different grade M20 and M25 used in concrete construction. Each type of cement has its properties, uses, and advantages based on composition materials used during its manufacture cement strength, quality of concrete materials and quality control during the production of concrete strength.

1.2 Compressive Strength

Compressive strength can be defined as the capacity of concrete to withstand loads before failure of the many tests applied to the concrete, the compressive strength test is the most important, as it gives an idea about the characteristics of the concrete. Compressive strength is one of the most important properties of concrete and mortar. The strength of the binder (cement) therefore has a significant effect on the performance characteristics of the mixture and ensures the overall quality of the finished product. The M describes the mix design of concrete while the strength digits in N/mm^a. Therefore concrete is known for its compressive strength. There are different grades of concrete such as M10, M15. M20, M25, M30. M40 etc. the usage of right concrete grades depends on advice given by the structural engineer. The formula for calculating compressive strength of cement is the maximum load carried by the mortar specimen (cube) which means the load point on compressive testing machine at which the specimen starts breaking is divided with the surface area (contact area).

Because of the high capital risk in the construction industry, instead of testing the strength in 28th day, the strength can be checked in 14 ,21,28 day based on the concrete strength psi to predict the construction works target strength. For a grade of concrete with 20 MPa strength, it will be denoted by M20, where M stands for mix. These grade of concrete is converted into various mix proportions. For example, for M20 concrete, mix proportion will be 1:1.5:3 for cement: sand: coarse aggregates M25 grade stands for concrete with a characteristic

compressive strength of 25 N/mm^2.A grade M25 concrete with a mix proportion of 1:1:2:0.45 (cement: sand: coarse aggregates: water-to-cement ratio) was used for all concrete mixes.

1.3 Background and Motivation

In public market, it is very difficult to get several of Portland composite cement (PCC) cement. The currently outstanding types are PPC (Portland pozzolan cement) and PCC (Portland composite cement). This brands of cement is currently used as an adhesive in a mixture of concrete. In the ready mix business there is also a tight competition, so in order to be able to exist they substitute cement. Problem arise at the time of testing cube and cylinder test objects that is the testing of concrete samples in various ages. The test data are often obtained at the ages 14days, 21 days and 28 days that the compressive strength of the concrete in accordance with the planned compressive strength is even greater. However the 28 days sample test often results in a smaller value than the quality of the plan. To determine the value of compressive strength in the test at age less than 28 days.

1.4 Research Objectives and Overview

The objectives of the study are following-

The expected objective of this research is the achievement of compressive strength and capacity of material or structure to resist or withstand under compression. Compressive strength is one of the most important properties of concrete.

Compressive strength can be defined as the capacity of concrete to withstand loads before failure:

1. To determine the compressive strength of concrete by using different types of cement for two different grade M20 and M25.
2. To comparison of compressive strength of concrete by using different types of cement for two different grade M20 and M25.

1.5 Outline of the study

It is suitable for the most common and well-accepted measurement of concrete strength to assess the performance of a given concrete mixture. It is suitable for measuring the ability of concrete to withstand loads that will decrease the size of the concrete. Concrete strength is the prominent concrete specification, but tensile, flexural, and other properties can play a significant role in modern designs.

CHAPTER-2

Literature Review

2.1 Concrete

Compressive strength Is very Important for any kind of construction work. For compressive strength using different typos cement for two different grade M20 and M25 In construction work, Compressive strength refers to the ability of a certain material or structural element to withstand loads Hint reduce the size of that material or structural element when applied, A force Is applied to the top and bottom of a test sample until the sample fractures or Is defonncil. Although there are many types of cement different grade M20 and M25 In the market today many of us cannot determine which cement strength Is the best. Many of experiment had been done by different types of cement, R,M, Mbnnur et,al. (2015) studied the compresslve strength of different types of cements composite cement. In the experiment the cement types they had worked with are Bashundhara cement, Seven Rings cement, Shah Cement and they of found the highest compressive strength of concrete to using Uaslumdharo cement, Thus, experiment were very very important to make decision to which type of cement use In construction work for long time durable.

Concrete durability and compressive strength of concrete are related to porosity. This research focuses on the strength variation of Ordinary Portland Cement (OPC) and Portland Composite Cement (PCC) at different days as well as the porosity variation with days, The aim of this study is to ascertain the effect of porosity and its corresponding compressive strength of mortars with OPC and PCC, The curing days for samples were 4,7,10, 14, 21 and 28 days for porosity test. The curing days of cement mortar sample were 3,7,14, 28. 42 and 56 days for compressive strength test. In this experiment the CHM-l 52.5N Portland cement as OPC and Ch'M-ll 42.5 N Portland Composite Cement (PCC) were used. It was found that OPC cement gains early age high compressive strength whereas PCC cement gains high compressive strength at later age. Also it has been found that the strength of OPC and PCC cement, in OD condition is higher than the SSD condition. Another finding is this with the increase of the age of sample, the porosity decreases significantly.M. L. R. Siddique et.al. studied the compressive strength of different types of Portland composite cement. In the experiment, they used Mclroccm cement, Bashundhara cement and crown cement. They

found highest compressive strength for Metroccm cement. Basically, the main goal of this research is to determine which cement is the best for compressive strength of is strongest among the local cement types of Bangladesh. Concrete is a manmade composite construction material, composed by mixing batched quantities of fillers. Fine aggregates and coarse aggregates embedded in a binder paste (Cement + Water + Air) under certain conditions that make it easy to move/transport, place, cure, compact/set and harden to become a strong, durable and compression resistant product.

In this study, it was tried to obtain bearing concrete by using the pumice and perlite aggregates in certain proportions. Different cement dosages were used in every mixture poured with Portland cement and Portland composite cement, the 60% pumice and 40% perlite aggregates of which were kept stable. The silica fume was added as much as 10% of cement amount in mixture. Mixtures from 200 to 500 doses were made and poured with every type of cement. The prepared samples left to water cure and their 14,21and28 days compressive strengths were determined. The test results indicated that the mixtures poured with Portland cement has a higher compressive strength than those poured with Portland composite strength. While the concretes poured with Portland composite cement up to 500 doses can be used as only insulation, the concretes poured with Portland cement at 450 doses and above show the characteristics of side bearing concrete.(Mustafa Haluk Celikl and Mahmut Durmaz2,March-2012).

Concrete, basically exists in any of these three states plastic (fresh) state, setting state & hardened state and as an engineering material, it is technically evaluated on the basis of five main determining characteristics, which are strength, workability, durability, cohesiveness and stiffness. When carrying-out the design of any proposed concrete structure, and making considerations for its quality control (QC), the compressive strength of the concrete is generally the specified property (Jones and Kaplan, 1957). This arises from the fact that in comparison with other properties of concrete, the testing of concrete compressive strength is easier.In addition, some other properties of concrete such as weathering resistance, impermeability and modulus of elasticity have a direct relationship with the compressive strength of concrete, and thus, are deducible from the values of concrete compressive strength of the three commonly tested strengths of hardened concrete, which are compressive strength tensile strength and flexure! strength its compressive strength is generally regarded as hs most important engineering property.The compressive strength of a material or structure, is tbe capacity of that material or structure to overcome (resist) loads which tend to reduce hs

size. It is usually determined using a Universal Testing Machine (UTM), and reported with respect to a specified technical standard Noted that there are three broad determining factors that primarily affect the compressive strength of concrete, (Nemati, K.M,2015) which are:

• Effect of constituent materials (ingredients) and the mix proportions (water/cement redo, air entrainment cement brands, maximum aggregate size & mixing water etc.).

• Curing conditions (time/age, temperature & relative humidity

•Testing parameters

The 'workability of fresh (plastic) concrete' which simply refers to the ease with which a concrete mix is placed, handled, compacted and finished Thus, the higher the permeability of concrete, the lower the durability and vice versa. Defined the durability of concrete, as the ability of concrete to withstand weathering/environmental action, abrasion, chemical attack or other processes that could result in deterioration. (Menon. D.and Sengupta A.K,2008)

2.2 Cement

In general, adhesive substances of all kinds, but, in a narrower sense, the binding materials are used in building and civil engineering construction. Cements of this kind are finely ground powders that when mixed with water, set to a hard mass. Setting and hardening result from hydration, which is a chemical combination of the cement compounds with water that yields submicroscopic crystals or a gel-like material with a high surface area. Because of their hydratine properties, constructional cements, which will even set and harden under water, are often called hydraulic cements. The most important of these is Portland cement.This article surveys the historical development of cement, its manufacture from raw materials, its composition and properties, and the testing of those properties. The focus is on Portland cement, but attention also is given to other types, such as slag-containing cement and high-alumina cement

Construction cements share certain chemical constituents and processing techniques with ceramic products such as brick and tile, abrasives, and refractories. For detailed description of one of the principal applications of cement, see the article building construction. Cements may be used alone (i.e. "neat" as grouting materials), but the normal use is in mortar and concrete in which the cement is mixed with inert material known as aggregate. Mortar is cement mixed with sand or crushed stone that must be less than approximately 5 mm (0.2 inch) in size. Concrete is a mixture of cement, sand or other fine aggregate, and coarse

aggregate that for most purposes is up to 19 to 25 mm (0.75 to 1 inch) in size, but the coarse aggregate may also be as large as 150 mm (6 inches) when concrete is placed in large masses such as dams.

Mortars are used for binding bricks, blocks, and stone in walls or as surface renderings. The origin of hydraulic cements goes back to ancient Greece and Rome.
The materials used were lime and a volcanic ash that slowly reacted with it in the presence of water to form a hard mass. This formed the cementing material of the Roman mortars and concretes of more than 2,000 years ago and of subsequent construction work in Western Europe. Volcanic ash mined near what is now the city of Pozzuoli, Italy, was particularly rich in essential aluminosilicate minerals, giving rise to the classic pozzolana cement of the Roman era. To this day the term pozzolana, or pozzolan, refers either to the cement itself or to any finely divided aluminosilicate that reacts with lime in water to form cement.

(The term cement, meanwhile, derives from the Latin word caementum, which meant stone chippings such as were used in Roman mortar not the binding material itself).
There are four stages in the manufcture of Portland cement: (1) crushing and grinding the raw materials, (2) blending the materials in the correct proportions, (3) burning the prepared mix in a kiln, and (4) grinding the burned product, known as "clinker," together with some 5 percent of gypsum (to control the time of set of the cement). The three processes of manufacture are known as the wet, dry, and semidry processes and are so termed when the raw materials are ground wet and fed to the kiln as a slurry, ground dry and fed as a dry powder, or ground dry and then moistened to form nodules that are fed to the kiln. It is estimated that around 48 percent of the world's carbon dioxide (CQ2).emissions come from the manufacture of cement, making it a major contributor to global warming. Some of the solutions to these greenhouse gas emissions are common to other sectors, such as increasing the energy efficiency of cement plants, replacing fossil fuels with renewable energy,and capturing and storing the C02 that is emitted. In addition, given that a significant portion of the emissions are an intrinsic part of the production of clinker, novel cements and alternate formulations that reduce the need for clinker are an important area of focus. A first approximation of the chemical composition required for a particular cement is obtained by selective quarrying and control of the raw material fed to the crushing and grinding plant Finer control is obtained by drawing material from two or more batches containing raw mixes of slightly different composition. In the dry process, these mixes are stored in silos; slurry

tanks are used in the wet process. Thorough mixing of the dry materials in the silos is ensured by agitation and vigorous circulation induced by compressed air. In the wet process, the slurry tanks are stirred by mechanical means or compressed air or both. The slurry, which contains 35 to 45 percent water, is sometimes filtered, reducing the water content to 20 to 30 percent, and the filter cake is then fed to the kiln. This reduces the fuel consumption for burning.

2.3 Portland Composite Cement

Portland composite cement is the common type of cement in general use around the world as a basic ingredient of concrete, mortar, stucco, and non-specialty grout Several types of Portland composite cement are available. The most common, called ordinary Portland cement (OPC), is grey, but white Portland cement is also available. Its name is derived from its resemblance to Portland stone which was quarried on the isle of Portland in Dorset England. Portland composite cement is a caustic materials meaning that it has the ability to chemically bum your skin if you are not handling it with enough care.

Concrete is a composite material consisting of aggregate (gravel has and sand), cement, and water. It's one of the most widely used substance on earth, and as such, Portland cement manufacturing is currently vital to the world is economy. It is one of the construction industry largest cause of climate changing carbon dioxide emission. Portland cement can be used on its own or as a mixture with other components.

2.4 Ordinary Portland Cement

Ordinary Portland Cement (OPC) is mostly used for common structures and also for important civil works. In India, about 80% of cement is of this category. It has mainly three grades. Grade means mortar cube strength in N/mm^2 after 28 days. Let's know more about the Ordinary Portland Cement.

Ordinary Portland Cement (OPC) is the most common cement used in the world mostly because of the abundance and low cost to produce it. OPC is produced simply by grinding limestone and secondary materials to a powder. It got its name as it was first produced in Portland.

The grades of Ordinary Portland Cement (OPC) are:-

(a) Grade 33

(b) Grade 43

(c) Grade 53

Grade 33 means after 21 days, the strength of this type of cement with standard must be 33 N/mrn2. The ratio of cement mortar must be L3_(standard cement and sand).The initial setting time of this cement is not less than 30 minutes and final setting time should not exceed 10 hours. Properties and uses of Ordinary Portland Cement. It is commonly used for various engineering works. The OPC cement has moderate strength and less heat of hydration, of be does not cause any defect. It is mainly used in pavements. This cement does not attain the strength so quickly and its setting time is normal so it may also be called as normal setting cement. The cost of producing Ordinary Portland Cement (OPC) is very low and available at, the best quality because of the readily available raw material in the area where it is produced.

Being low-cost cement it is widely used in the production of concrete, which is the most popular material used for construction in the world for roads, houses, buildings, dams and in other construction work etc. Ordinary Portland cement is also used for mortars and in making grouts. To produce Ordinary Portland Cement (OPC) need mixing raw materials and use of a rotary kiln with maintained 1400-1450°C temperature by rising chemical reactions. Ordinary Portland Cement (OPC)-53 grade is produced using a highly specialized process that allows optimum distribution of each particle, thereby allowing superior crystalline structure and balanced composition. The result is better strength and durability. Ordinary Portland Cement (OPC)-43-grade cement is produced by inter-grinding of clinker and gypsum, to an optimum Fineness to ensure both strength & durability of concrete at all ages, which is suitable for all construction works.

2.5 Water Cement Ratio

The water cement ratio is the ratio of the weight of water to the to a concrete mix. A lower ratio leads to higher strength and durability, but may make the mix more difficult to work with and form. Workability can be solved with the use of water cement ratio produced by conventional mixing technologies are usually with water cement ratio 0.45 for grade M20 and 0.45 grade M25, for testing their 14 days and 21 days and 28 days compressive strength.

2.5.1 Aggregate

Construction aggregate, or simply aggregate, is a broad category of coarse to medium, grained particulate material used in construction, Including sand gravel, inched recycled concrete and geoscientific aggregates. Aggregates are the most mined misdials in the world. The products characteristics are standard in order censure the necessary levels of reliability and process.

Aggregate information In building and construction, materials are used for mixing with cement bitumen, lime, gypsum, or mortar, Aggregate can either be natural or manufactured. Natural aggregate are generally extracted form larger rock formation through an open excavation. Extraverted rock is typically reduced to usable size by mechanical cruising.

2.5.2 Coarse Aggregate

Coarse aggregate is stone which are broken into small size and irregular in shape. In construction work the aggregate are used such as lime stone and granite or river aggregate. Course aggregates are any particles greater than 0.19inch, but generally range between 3/8 and 1.5 inches in diameter. Gravels constitute the majority of coarse aggregate used in concrete with crushed stone making up most of the reminder. Coarse aggregates are generally categorized as rock larger than a standard no. course aggregates are used in every construction projects. Which includes the construction of roads, buildings. railway tracks etc. Aggregate makes concrete strong and durable when mixed with cement, sand, and water. The size of coarse aggregates affects several aspects of the concrete, mainly strength and workability, and the amount of water needed for the concrete mix. It also helps to determine how much fine aggregate is needed to produce a concrete batch.

Concrete is more workable when smooth and rounded aggregate is used instead of rough angular or elongated aggregate. Most natural sands and gravel from riverbeds or seashores are smooth and rounded and are excellent aggregates. Coarse aggregate size is directly proportional to the slump (workability) of a fresh concrete with constant water cement ratio. Compressive strength of a concrete increases with increase in coarse aggregate size. The size of the coarse aggregate determines the maximum water-cement ratio for grade M20 is 0.45 and grade M25 is 0.45.



Figure No 2.1: Coarse Aggregate.

2.6: Fine Aggregate:

Fire aggregates are essentially any natural sand particles won from the land through the mining process. Fine aggregates consist of natural sand or any crushed some particles that are ¼ inch or smaller. This product is often refers to as ¼ inch minus as if refers to the size or grading, of this particular aggregate.

Fine aggregates (sand) fills voids between aggregates. If forms the bulk and makes or concrete economical. If provides resistance against shirking and cracking. It is naturally available.

Fine aggregates is the essential ingredient in concerete that consists of natural sand or crushed stone. The quality and fine aggregates density strongly influence the hardened properties of the concrete.

The concrete or mortar mixture can be made more durable, stronger and cheaper if you made the selection of fine aggregates on basis of grading zone particle shape, surface texture, abrasion skid resistance, absorption and surface moisture.



Figure No 2.2: Fine aggregates

Different sizes of sand is necessary for different works. Sometimes, sand is termed as fine, medium, and coarse. It is difficult to distinguish one type of sand from others when such terms are used. It is advisable to express sand in terms of fineness modulus.

According to F.M. sand can be classified as under:

Types of Sand	Ranges of Fineness Modulus
Find Sand	2.2-2.6
Medium Sand	2.6-2.9
Coarse Sand	2.9-3.2

Sand having a fineness modulus more than 3.2 will not be suitable for making satisfactory concrete.

Properties of Fine Aggregate:

1) Size of Fine Aggregates

2) Strength.

3) Shape of Fine Aggregates

4) Specific Gravity.

5) Surface Texture of Fine Aggregates

6) Water Absorption.

7) Surface Index of Fine Aggregates

8) Soundness.

9) Surface Moisture.

10) Specific Surface of Fine Aggregates

2.6.1: Sieve Analysis of Fine and Course Aggregate

Sieve analysis forms the basic essential test for determining the gradation of aggregates. The main property investigated in this test is the particle size. Sieve analysis is the method of dividing a sample of aggregates into various fractions each consisting of particles of same size. The sieve analysis is carried out to determine the particle size distribution in a sample of aggregate, which we call gradation. The aggregate fraction from 4.75 to 75 micron is referred to as fine aggregates.

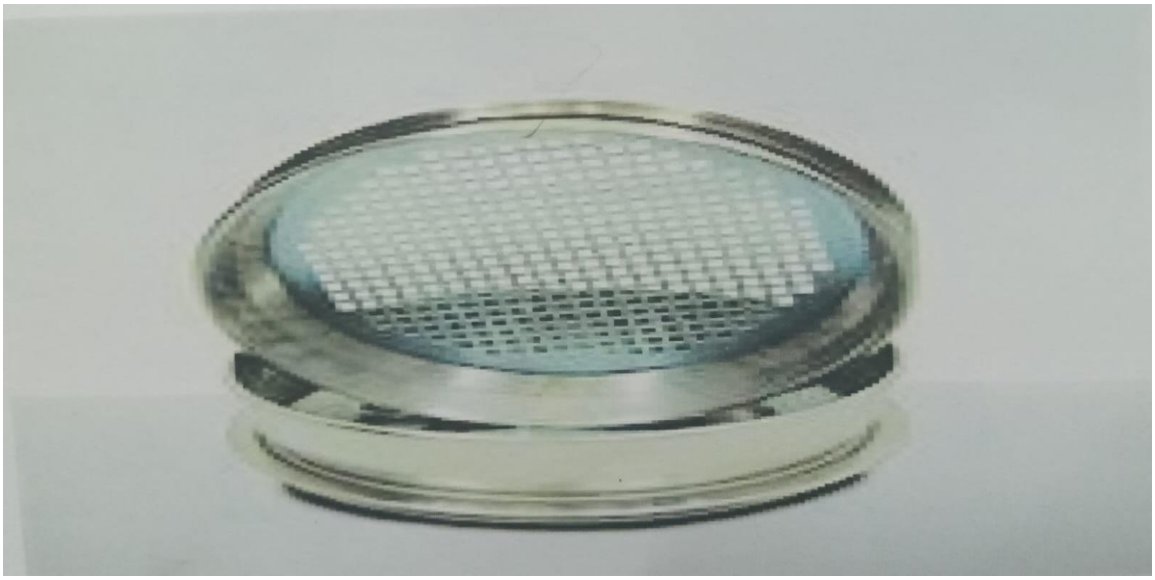


Figure No 2.3: Sieve

In practice, each fraction contains particles between definite limits, these being the openings of standard test sieves. Before sieving, the soil should be air dried in order to avoid lumps of fine particles and also to prevent clogging of the finer sieves. Sieves should also be cleaned before use The term sieve analysis is given to the operation of dividing a sample of

aggregates into fraction each consisting of particles between specific limits. The analysis is conducted to determine the grading of material proposed for using as aggregates. The term fineness modulus (F.M) is a ready index of coarseness or fineness of material. It is an empirical factor obtained by adding the cumulative percentages of aggregates retained on each of the standard sieves and dividing this sum arbitrarily by.No.100, No.50, No.30, No. 16, No.8, No.4, 3/8 in, ½ in, 1.5 in, 3 in, are the ASTM standard sieves. This test method confirms to the ASTM standard requirements of specification C136.

CHAPTER 3
Methodology

3.1 Preparation of Cylinder

The Comprehensive strength of the concrete cylinder is one of the most amare performance measurers performed by the engineers in the structural design. The comprehensive strength of concrete cylinders is determined by applying continuous Inad over the cylinder until failure occurs. The test is conducted using a comp revision testing machine. The cylinder specimens are cast in steel, cast iron or any mold made of non-shwaters material Even under severe conditions, the molds used must retain its original shape and dimensions Cylindrical specimens for testing should be 4x8 inch (100*200) mm. The mixed concrete is placed in to the molds in layers than 5 cm deep. The strokes per layer during the compaction must not be less than 30 in number. Compaction must reach the underlying layers allowing the majority of the air voids to escape.

The samples are taken and submerged in clean and fresh water until the testing age is reached.



Figure No 3.1: Preparation of Cylinder

3.2 Concrete Mixing

A concrete mixer is a device that homogeneously combines cement, aggregate such as sand or stone, and water to from concrete. A typical concrete mixer uses a revolving drum to mix the components. This process is so crucial that if the concrete making ingredients aren't mixed properly, it can lead to concrete failure under compression load. A concrete mixture ratio of 1 part cement, 1.5 parts sands, and 3 parts aggregate will produce a concrete mix of approximately 3000 psi. Mixing water with the cement, sand and stone will from a paste that will bind the materials together until the mix hardens.

The primary goal of concrete mixing is to make the concrete mass homogeneous and uniform in color while maintaining the required consistency. Production of good quality and bad quality of concrete includes the same material, but the proportion and mixing methods can be differentiating. As a result, sufficient precautions should be followed while mixing concrete.



Figure No 3.2: Mixing of sand cement and stone chips

3.3 Casting of Cylinder

Casting is a manufacturing process in which a liquid material is usually poured into a mold, which contains a hollow cavity of the desired shape, and then allowed to solidify. The solidified part is also known as a casting, which is ejected or broken out of the mold to complete the process. Casting is most often used for making complex shapes that would be otherwise difficult or uneconomical to make by other methods. In addition to the exact geometry of the component, the possible casting and molding methods must also be taken into account in advance in order to obtain an optimum cast part under series production conditions too.



Figure No 3.3: Casting of Cylinder

Besides various changes to the construction, initial experiences with regard to future component properties, rejections and rework are also gained during pilot production. It is extremely important to have been rejection and ultimately all factor that restrict the output under control by the start of series production at the latest. This is the only way to achieve high productivity and low costs at the same time in order to be able to maintain the specified price for the component.

3.4 Curing

The curing of concrete is the process of keeping the concrete damp or moist and warm after the initial setting of concrete or removal of formwork. Proper curing of concrete maintains the satisfactory moisture content and favorable temperature inside the concrete so that hydration of cement may continue until the desired properties are developed. The curing of concrete must be continued for a reasonable period of time to achieve its desired strength and durability.



Figure No 3.4: Curing of Cylinder

Initial curing during the first 24 to 48 hours after molding all test specimens are stoerd. After curing, a large amount of water needs to be disposed of on the curing side. But water cooler than 50c is not suitable for curing concrete. As the hydration reaction in concrete expels heat and keeps concrete warm, using cold water less than 50c on concrete may lead to cracking and failing. Alternate drying and wetting on the concrete surface causes volumetric changes in concrete and ultimately leads to cracking.

3.5 Preparation to Crush the Concrete Cylinders

The cylinders were kept submerged as long as for 14 days. After that were withdraw 12 pcs cylinder of M20 grade are made by cylinders (PCC) cement 3 pcs and (OPC) cement 3 pcs and M25 grade are made by cylinders (PCC) cement 3 pcs and (OPC) cement 3 pcs from the dram. In Sonargaon University (SU) Lab, after that the cylinders had been placed in the center of Universal Testing Machine (UTM) one by one (take help from the manual) to find out the crushing of each cylinder. Then were kept submerged as long as for 21 days. Then we kept another test for 21days and Another we kept submerged as long as for 28 days. Then we kept another test for 28days .After that we are withdrew from the dram and crushing the cylinders and noted down the value.



Figure No 3.5: Preparation of Cylinder M20 and M25 Grade

3.6 UTM Machine

UTM machine is also known as UTM tester, materials testing machine or maternal testing frame and that's why manufactures gave a common name "Universal testing machine" and this machine is used to test the compressive shength of matenals UIM machines have different roles stripped of capabilities or marketed for specifle indestres & sectors which play unique roles in the development of infiustiniature, roads, and highways UTM is one of the best multi-purpose equipment for R&D labs of the QC department.



Figure No 3.6: Place the cylinder in UTM machine

3.7 Compressive Strength Test

Compressive strength test, mechanical test measuring the maximum amount of compressive load a material can bear before fracturing. The test piece, usually in the form of a cylinder is compressed between the platens of a compression testing machine by a gradually applied load. Brittle materials such as rock, brick, cast iron, and concrete may exhibit great compressive strengths but ultimately, they fracture. The crushing strength of concrete,

determined by breaking a cylinder, and often called the cylinder strength, Some ductile metals, such as mild steel, have very great compressive strengths, but the actual values are difficult to measure. When a load is applied to a ductile metal, it deforms elastically up to a certain point and then plastic deformation occurs, Increasing loads may even completely flatten a test piece without any definite fracture occurring, so that value can be obtained for the compressive strength for two different grade M20 and grade M25 respectively.



Figure No 3.7: Place the cylinder in UTM machine

3.8 Compressive Fracture of Cylinder

For 14, 21 and 28 days test, the specimen was kept at the center of UTM machine and crushed one by one and noted the value. Total crushed 36 specimen in Sonargaon University lab.

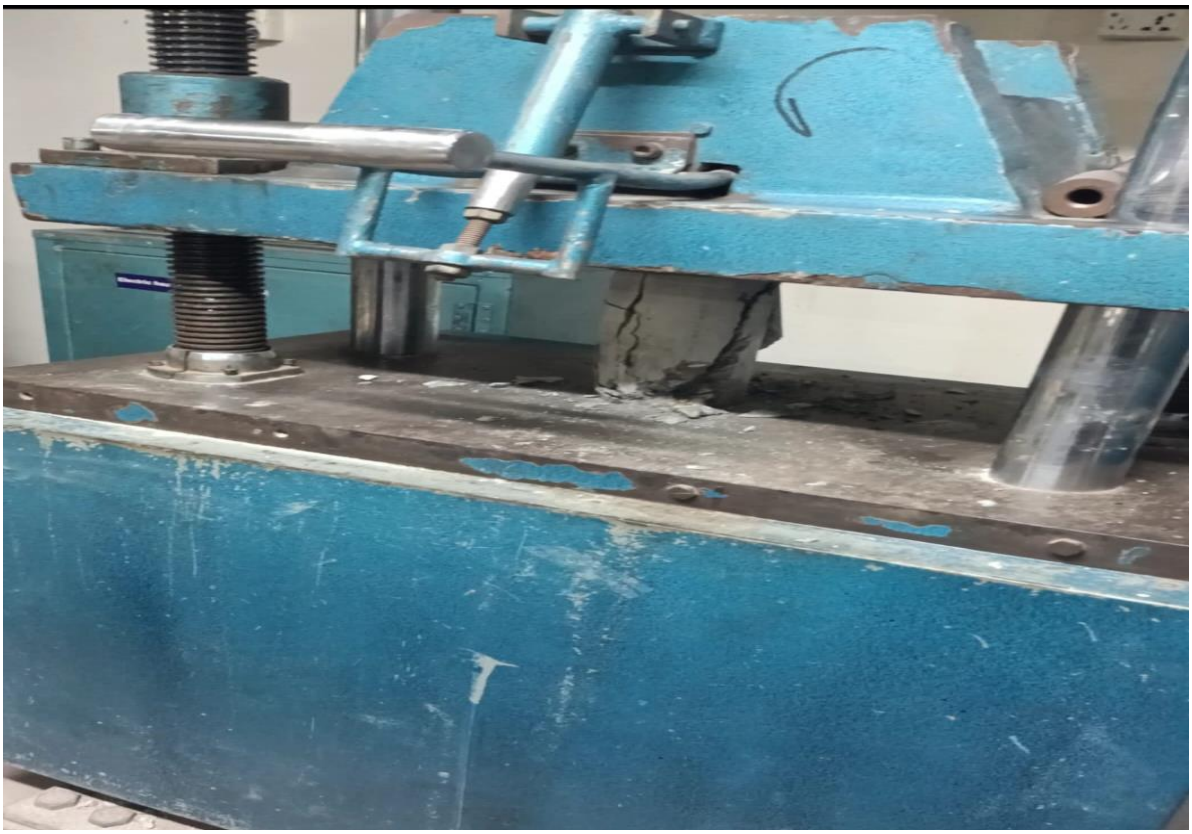


Figure No 3.8: Compressive fracture of Cylinder Grade M20 and M25

3.9 IMPORTANCE OF COMPRESSIVE STRENGTH

a) Effect of cement

The Inhaling high levels of dust may occur when workers empty bags of cement. In the short term, such exposure irritates the nose and throat and causes choking and difficult breathing. Cement industry is one of the main producers of carbon dioxide, a potent greenhouse gas Concrete causes damage to the most fertile layer of the earth topsoil. Compressive strength increases with the increasing of cement content. Cement dust may enter into the systemic circulation and thereby teach the essentially all the organs of body and affects the different tissues including heart, liver, spleen, bone, muscles and hairs and ultimately affecting their micro-structure and physiological performance.

b) Effect of aggregate/cement ratio

Well graded aggregates result in the least amount of voids in a given volume. Less voids result in excessive paste availability in a unit volume and more lubrication decreasing the aggregate/cement ratio increases the compacting factor due to the increase in the art of fines (cement) in the mix and decreasing aggregate content, which acts as lubricant and leads to a decrease in the internal friction between the aggregates, particles, and as a result, compacting factor increases.

c) Effect of aggregate properties

Aggregates influence the properties of concrete/mortar such as water requirement, cohesiveness and workability of the concrete in plastic stage, while they influence strength, density, durability, and permeability, surface finish and color in hardened stage.

Aggregate is commonly considered insert filler, which accounts for f/b 60 to 80 percent of the volume and 70 to 85 percent of the weight of concrete. Although aggregate is considered inert filler, it is a necessary component that defines the concrete's thermal and elastic properties and dimensional stability.

d) Effect of admixture

Admixtures have increased both compressive strength and durability of concrete.

e) Effect of the specimen size

Concrete strength decreased as the specimen sieve increased and the decrement was more obvious in the specimens with low aspect ratio.

f) Effect of the rate of loading

As rate of loading increases, compressive strength, modulus of elasticity, and the slope of the descending portion of the stress-strain curve of concrete increase

g) Effect of the moisture content

The results indicate that, with increasing moisture content, the compressive strength Decreases initially and then increases. The effect of moisture content on compressive strength increases with the increasing porosity.

3.10 Compressive Strength Formula

Compressive strength is the maximum compressive stress that, under a gradually applied given solid material can sustain without fracture. Compressive strength is calculated by dividing the maximum load by the original cross-sectional area of a specimen in a compressive test. The compressive strength is one of the most important and useful properties of concrete. The design strength of the concrete normally represents its 28th day. Compressive strength can be defined as the capacity of concrete to withstand loads before failure of the many tests applied to the concrete, the compressive strength test is the most important, as it gives an idea about the characteristics of the concrete.

The compressive strength was calculated by using the equation:

$$F=P/A$$

Where. F is compressive strength of specimen in pound per square inch (psi). P is the maximum applied load by pound. A is the cross-sectional area (inch square). Compressive strength test, mechanical test measuring the maximum amount of compressive load a material can bear before fracturing. The test piece, usually in the form of a cube, prism, or cylinder, is compressed between the platens of a compressive-testing machine by a gradually applied load.

CHAPTER 4

Result and Discussion

4.1 Result of Fine Aggregate

The test sample of the aggregate (F.M) shall weight, after drying, approximately the following.

Requirement:

Aggregate with least 99% passing No. 4 Sieve 1000gm

And more than1% retained on a No 8 Sieve

Aggregates with at least87% passing No. 8 Sieve 100gm

Table 4.1: Result of aggregates sieve analysis

Sieve No.	**Retain**	**% Retain**	**Cumulative % Retain**	**FM**	**Finer**
#4	39	3.9	3.9%		99.1%
#8	84	8.4	12.3%		87.7%
#16	330	33	45.3%		54.7%
#30	301	30.1	75.4%	332.4/100	24.6%
#50	205	20.5	95.9%	=3.324	4.1%
#100	37	3.7	99.6%		0.4%
Pan	4	0.4	-		0
	Total=1000gm		=100		

4.2 Result of Coarse Aggregate

The weight of the test sample of coarse aggregate (C.A) shall conform to the following requirements:

Aggregate with nominal maximum size of ¼ in. 10 lbs.

Table 4.2: Result of Coarse Aggregate

Sieve No.	**Retain**	**% Retain**	**Cumulative % Retain**	**FM**	**Finer**
#3/4``	358	35.8	35.8	731.3/100 =7.3	64.2
#3/8``	597	59.7	95.5		4.5
#4	45	4.5	100		0
#8	0	0	100		0
#16	0	0	100		0
#30	0	0	100		0
#50	0	0	100		0
#100	0	0	100		0
	Total=1000gm		Total=731.3		

4.3 Specific Gravity of Coarse Aggregate

Table 4.3: Data sheet for specified gravity of coarse aggregate:

Wt. of pycnometer filled with water to calibration, B (gm)	Oven Dry Wt. in air, A (gm)	Wt. of pycnometer with Specimen and water to Calibration mark, C (gm)
2005	1975	1245

Table 4.4: Specific Gravity of Coarse Aggregate

Test	Formula	Calculation	Result
Apparent Specific Gravity	$\frac{A}{A-C}$	1975/1975-1245	2.70
Bulk Specific Gravity (Oven Dry Basic)	$\frac{B}{B-C}$	2005/2005-1245	2.64
Bulk Specific Gravity (S.S.D. Basic)	$\frac{A}{B-C}$	1995/2005-1245	2.59
Absorption Capacity, D%	$\frac{(B-A)x100}{A}$	2005-1975×100/1975	1.52

We found the specific gravity of the apparatus to be 2.70 and bulk specific gravity oven dry ac obtained from 2.64. Apparent capacity reduction received 1.52 and bulk SSD received 2.59.

Table 4.5: Data sheet for Specific gravity of fine aggregate:

Wt. of pycnometer Filled with water to Calibration, B gm	Oven Dry Wt. in Air. A gm	Wt. of pycnometer With Specimen and Water to Calibration Mark, C gm	WL of SSD sample In Air. S gm
657 gm	289 gm	838 gm	300 gm

Table 4.6: Specific gravity of fine aggregate:

Test	**Formula**	**Calculation**	**Result**
Apparent Specific Gravity	$\frac{A}{B+A-C}$	$\frac{289}{257+289-838}$	2.68
Bulk Specific Gravity (Over dry Basis)	$\frac{A}{B+S-C}$	$\frac{289}{657+300-838}$	2.42
Absorption Capacity D%	$\frac{(S-A)x100}{A}$	$\frac{(300-289)x100}{289}$	3.81
Bulk Specific Gravity (S.S.D Basic)	$\frac{S}{B+S-C}$	$\frac{300}{657+300-838}$	2.52

The specific gravity of the Sylhet sand as fine aggregate after open drying was found 2.42 we found the specific gravity of the apparatus to be 2.68 and bulk specific gravity oven dry ac obtained from 2.42. Apparent capacity reduction relived 5 and bulk SSD received 2.52.

Table 4.7: Result of 14 Days Compressive Strength Test of M20 Ratio

SL. No	Types of Cement	Mix Properties	Water Cement Ratio	Crushing Value (KN)	Compressive Strength (MPa)	Average Strength (MPa)
1.	PCC	1:1.5:3	0.45	255	30.41	28.73
				250	27.80	
				230	28.00	
2.	OPC	1:1.5:3	0.45	325	38.96	34.66
				240	34.77	
				245	30.24	

Table 4.8: Result of 14 Days Compressive Strength Test of M25 Ratio

SL. No	Types of Cement	Mix Properties	Water Cement Ratio	Crushing Value (KN)	Compressive Strength (MPa)	Average Strength (MPa)
1.	PCC	1:1:2	0.45	198	24.30	24.54
				110	24.90	
				205	24.42	
2.	OPC	1:1:2	0.45	230	27.95	29.63
				270	33.49	
				225	27.45	

Table 4.9: Result of 21 days compressive strength Test of Grade M20 Ratio

SL. No	Types of Cement	Mix Properties	Water Cement Ratio	Crushing Value (KN)	Compressive Strength (MPa)	Average Strength (MPa)
1.	PCC	1:1.5:3	0.45	255	30.41	28.73
				250	27.80	
				230	28.00	
2.	OPC	1:1.5:3	0.45	325	38.96	34.66
				240	34.77	
				245	30.24	

Table 4.10: Result of 21 Days Compressive Strength Test of M25 Ratio

SL. No	Types of Cement	Mix Properties	Water Cement Ratio	Crushing Value (KN)	Compressive Strength (MPa)	Average Strength (MPa)
1.	PCC	1:1:2	0.45	210	26.12	27.00
				230	28.12	
				210	26.71	
2.	OPC	1:1:2	0.45	295	36.04	35.02
				300	36.51	
				270	32.52	

Table 4.11: Result of 28 days compressive strength Test of Grade M20 Ratio

SL. No	Types of Cement	Mix Properties	Water Cement Ratio	Crushing Value (KN)	Compressive Strength (MPa)	Average Strength (MPa)
1.	PCC	1:1.5:3	0.45	232	28.34	30.02
				245	24.49	
				265	32.22	
2.	OPC	1:1.5:3	0.45	335	41.35	39.19
				330	34.94	
				297	36.28	

Table 4.12: 28 Days Compressive Strength Test of M25 Ratio

SL. No	Types of Cement	Mix Properties	Water Cement Ratio	Crushing Value (KN)	Compressive Strength (MPa)	Average Strength (MPa)
1.	PCC	1:1:2	0.45	255	30.25	29.57
				245	29.65	
				235	28.82	
2.	OPC	1:1:2	0.45	280	34.56	36.33
				325	34.33	
				290	35.10	

4.13: After the experiment it shows the result below:

For grade M20 compressive strength of the concrete is to reach 25.84 MPa in 14 day & 34.26 MPa in 14 days of OPC

For grade M20 compressive strength of the concrete is to reach 28.73 MPa in 21 day & 34.66 MPa in 21 days of PCC

For grade M20 compressive strength of the concrete is to reach 30.02 MPa in 28 day & 39.19 MPa in 28 days of OPC

For grade M25 compressive strength of the concrete is to reach 24.54 MPa in 14 day & 29.63 MPa in 14 days of OPC

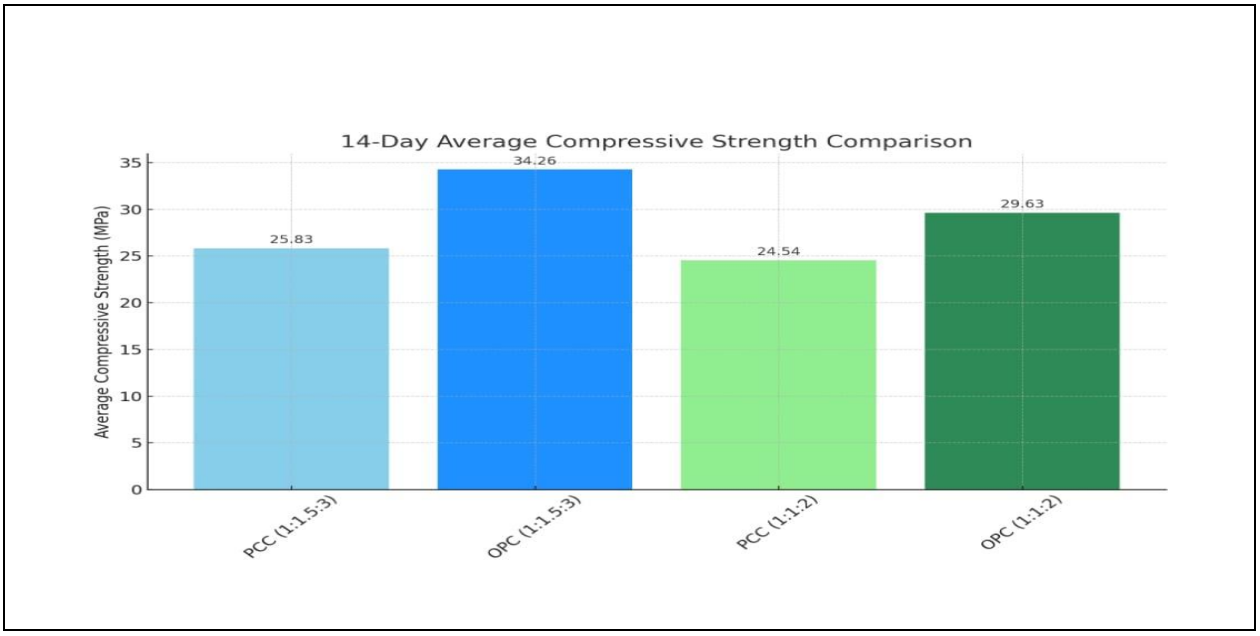
For grade M25 compressive strength of the concrete is to reach 27.00 MPa in 21 day & 35.02 MPa in 21 days of PCC

For grade M25 compressive strength of the concrete is to reach 29.57 MPa in 28 day & 36.33 MPa in 28 days of OPC

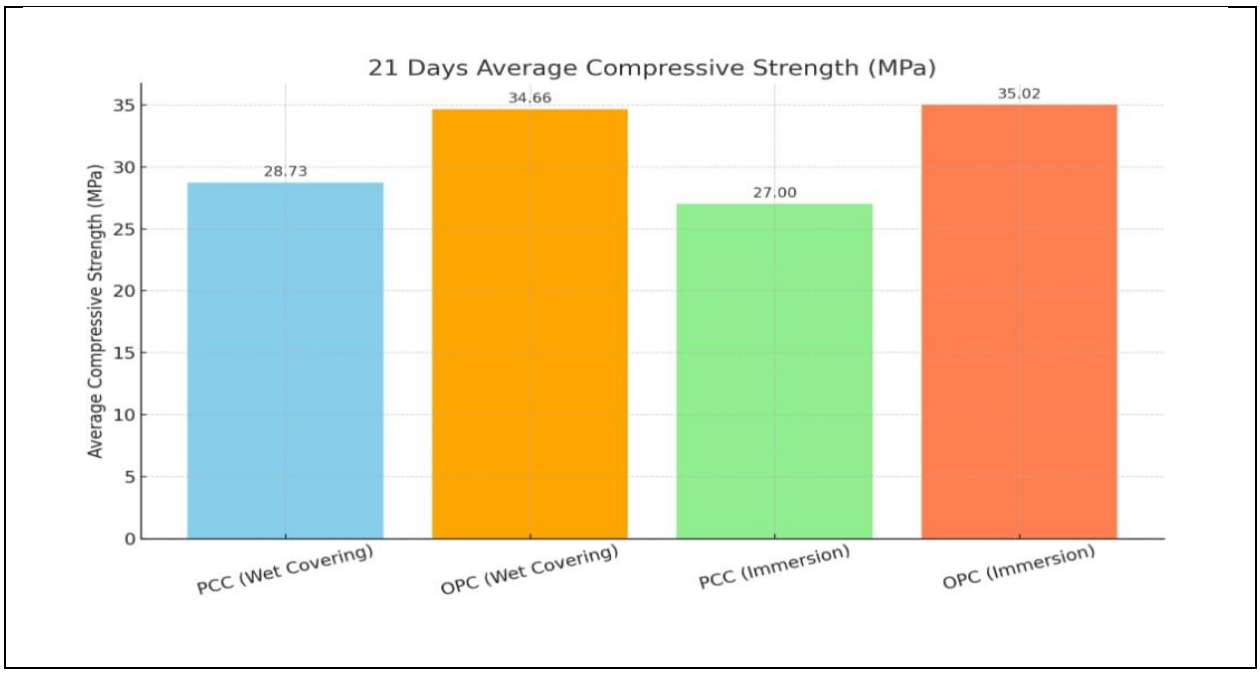
The compressive strength of OPC was better than the different types of cement.

4.14: Comparison Chart between Grade M20 and M25

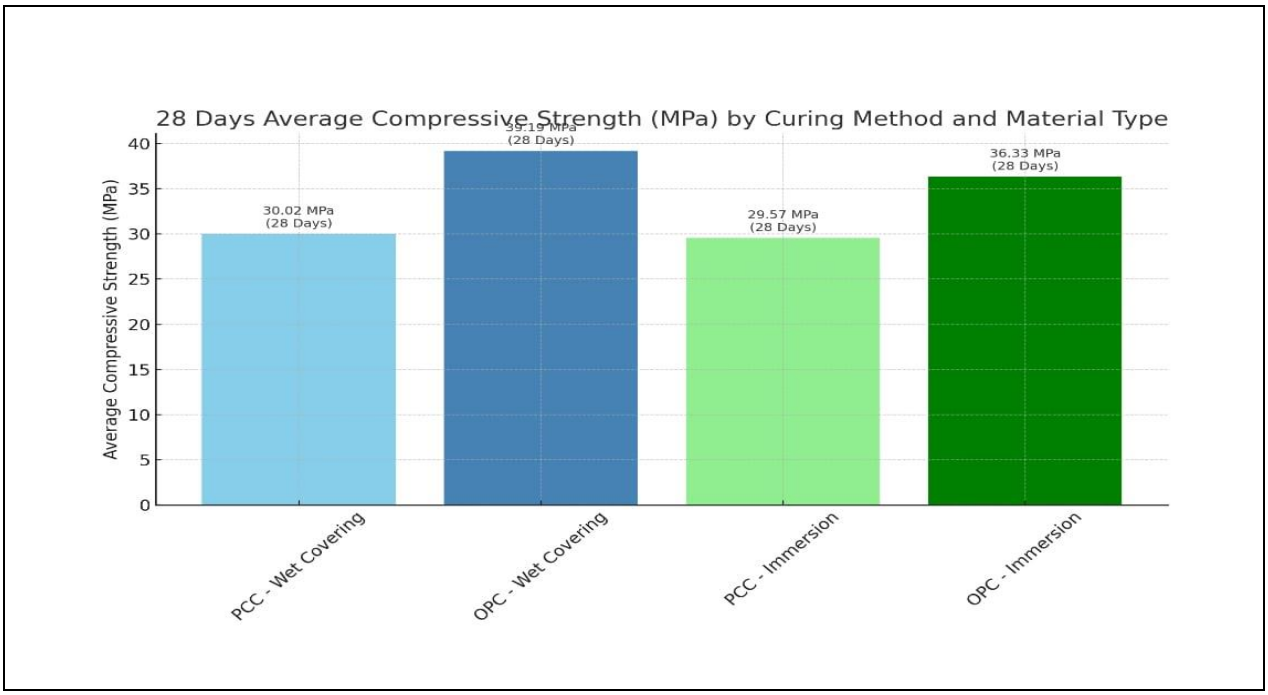
The comparison between different types of cement for two grades M20 and M25 are given bellow:



It is observed from the 14days test results that, both the wet covering method and spraying water method of curing gave better strength of cylinder for Indian pakur stone at 14 days. In these three methods cement hydrates rapidly and gains better strength at early stage.



- It is observed from the test results that the wet covering method of curing gave high compressive strength value for both Indian pakur stone at 21 days.On the contrary immersion curing method showing low strength at 21 days compressive strength test.



- It is observed from the test results that the wet covering method of curing gave high compressive strength value for both Indian pakur stone at 28 days. On the contrary immersion curing method showing low strength at 28 days compressive strength test.

CHAPTER 5

Conclusions

5.1 Decision

After the experiment, we get the decision below:

1. The comparison of compressive strength of concrete by using different types of cement for grade M20 and M25

2. In 21 days, compressive strength test result of OPC and PCC fulfill nearby the conditions of M20 grade.

3. In 28 days, compressive strength test result of OPC and PCC greade M25 fulfill the conditions of M25 grade.

4. We get highest compressive strength of concrete by using different types of cement for grade M25 cement and get lower compressive strength of concrete for PCC cement M20 grade.

5. Over all we get by all testes OPC cement has been better than the others cement.

5.2 Recommendation

The following are some recommendations provided considering the previous discussion:

1. More work or study can be done in further with others local cement types.

2. The other grade like M7, M10, M15, M35, M40, M45 and M50 may be worked in further.

3. Different water cement ratio can also be worked in further.

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