COMPARISON ON COMPRESSIVE STRENGTH OF CONCRETE BY USING NEW AGGREGATES AND RECYCLED AGGREGATES.

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A thesis submitted to the Department of Civil Engineering in partial fulfillment for the degree of Bachelor of Science in Civil Engineering

Department of Civil Engineering

Sonargaon University

147/I, Green Road, Dhaka-1215, Bangladesh

Section: (19A)

Semester- (Summer-2023)

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DECLARATION

We hereby declare that this thesis represents our own work done after registration for a bachelor's degree in civil engineering at the university of sonargaon, and was not previously included in a thesis or dissertation submitted to this or any other degree, diploma or other degree institution. We guarantee that the current work does not infringe any copyright. we also re-initiate the reassurance of the university against any loss or damage resulting from the breach of previous obligations. Reusing Recycled Aggregates in Structural Concrete. we expect more hypotheses to continue on this topic with advanced data in the upcoming future by others. It is hereby dedicated that except for the content where specific reference have been made to work of others, the studies contained on this research is the result of the investigation carried out by the author’s. No part of this research has been submitted to any other university or educational institutions for any award or degree.

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Dedicate

To

"Our Beloved Parents"

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ABSTRACT

Concrete construction is becoming increasingly complex and the importance of producing structures that are both cost effective and durable has never been higher. Many experimental works have been performed to determine the compressive strength of different types of brick. The objectives of the study are to determine the compressive strength of concrete by using two different types of brick for two different grades M15 & M20. The Materials used for the experiment are new aggregates & recycled aggregates, fine aggregate & water. The mass of the specimens was recorded carefully. For 7 days, the values of compressive strength of concrete for new aggregates & recycled aggregates are 10.12 MPa for (new aggregates100%), 5.8 MPa for (recycled aggregates100%), 8.46 MPa for (new aggregates 50% & recycled aggregates 50%), 7.23 MPa for (new aggregates 25% & recycled aggregates 75%), respectively of grade M15. 12.2 MPa for (new aggregates 100%), 7.8 MPa for (recycled aggregates 100%), 9.3 MPa for (new aggregates 50% & recycled aggregates 50%), 8.39 MPa for (new aggregates 25% & recycled aggregates 75%), respectively of grade M20. For 14 days, the values are 11.03 MPa for (new aggregates100%), 7.64 MPa for (recycled aggregates100%), 9.27 MPa for (new aggregates 50% & recycled aggregates 50%), 8.77 MPa for (new aggregates 25% & recycled aggregates 75%), respectively of grade M15. 12.75 MPa for (new aggregates 100%), 10.06 MPa for (recycled aggregates 100%), 11.07 MPa for (new aggregates 50% & recycled aggregates 50%), 10.86 MPa for (new aggregates 25% & recycled aggregates 75%), respectively of grade M20. For 28 days, 14.7 MPa for (new aggregates 100%), 10.26 MPa for (recycled aggregates 100%), 11.4 MPa for (new aggregates50% & recycled aggregates 50%), 10.52 MPa for (new aggregates 25% & recycled aggregates 75%), respectively of grade M15. 18.84 MPa for (new aggregates100%), 13.4 MPa for recycled aggregates 100%), 15.73 MPa for (new aggregates 50% & recycled aggregates 50%), 14.37 MPa for (new aggregates 25% & recycled aggregates 75%), respectively of grade M20. respectively for the same types of new aggregates and recycled aggregates of grade M15. For 7 days, the highest compressive strength of the concrete found 10.12 MPa for new aggregates of grade M15 and the lowest compressive strength is 5.8 MPa for recycled aggregates of grade M15.

For 7 days, the highest compressive strength of the concrete found 12.2 MPa for new aggregates of grade M20 and the lowest compressive strength is 7.8 MPa for recycled aggregates of grade M20. For 14 days, the highest compressive strength of the concrete found 11.03 MPa for new aggregates of grade M15 and the lowest compressive strength is 7.64 MPa for recycled aggregates of grade M15. For 14 days, the highest compressive strength of the concrete found 12.75 MPa for new aggregates of grade M20 and the lowest compressive strength is 10.06 MPa for recycled aggregates of grade M20. For 28 days, the highest compressive strength of the concrete found 14.7 MPa for new aggregates of grade M15 and the lowest compressive strength is 10.26 MPa for recycled aggregates of grade M15. For 28 days, the highest compressive strength of the concrete found 18.84 MPa for new aggregates of grade M20 and the lowest compressive strength is 13.4 MPa for recycled aggregates of grade M20. The compressive strength of new coarse aggregates was better than the recycled coarse aggregates for the both grade M15 & M20.

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CHAPTER 1

INTRODUCTION

1.1 General

The history of brick materials is as old as the history of engineering construction. Concrete compressive strength for general construction varies from M15 & M20 and higher in commercial structures. It was first invented by Turkey. Test for concrete strength for different types of brick 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 brick for two different grade M15 & M20 used in concrete construction. Each type of brick has its properties, uses, and advantages based on composition materials used during its manufacture brick. 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/mm2. Therefore concrete is known for its compressive strength. There are different grades of concrete such as M7, M10, M25, M30, M35, M40, M45, M50 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 7days, 14days & 28 days based on the concrete strength psi to predict the construction works target strength.

For a grade of concrete with 15 MPa strength, it will be denoted by M15, where M stands for mix. These grade of concrete is converted into various mix proportions. For example, for M15 concrete, mix proportion will be 1:2:4 for cement: sand: coarse aggregates M20 grade stands for concrete with a characteristic compressive strength of 20 N/mm2.A grade M20 concrete with a mix proportion of 1:1.5:3 (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 good brick. The currently outstanding types are best brick. 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 7days, 14days and 28 days that the compressive strength of the concrete in accordance with the planned compressive strength is even greater. However the 28days 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 28days.

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 brick chip's for two different grade M15 & M20.
2. To know different types of brick chip's compressive strength test.
3. To comparison of compressive strength of concrete by using different types of brick chip's for two different grade M15 & M20.

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 types coarse aggregate for two different grade M15 & M20 in construction work. A force is applied to the top and bottom of a test sample until the sample fractures or is deformed. Although there are many types of coarse aggregate for different grade M15 & M20 in the market today many of us cannot determine which coarse aggregate strength is the best. Many of experiment had been done by different types of coarse aggregate. R. M. Mizanur et.al. (2015) studied the compressive strength of different types of Portland 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 Bashundhara cement. Thus, experiment were very important to make a 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 CEM-I 52.5N Portland cement as OPC and CEM-II 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 that with the increase of the age of sample, the porosity decreases significantly. M. L. R. Siddique et.al. (2009) studied the compressive strength of different types of Portland composite cement**.** In They found highest compressive strength for Metrocem 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 7 and 21 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. Celik, M. H. and Durmaz, M, (2012). The compressive strength of the concrete. 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 flexural strength its compressive strength is generally regarded as its most important engineering property. The compressive strength of a material or structure, is the capacity of that material or structure to overcome (resist) loads which tend to reduce its 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 ratio, 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 hydrating 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 refractoriness.

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 aggregate 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 aggregate 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 manufacture 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 4–8 percent of the world’s carbon dioxide (CO2) 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 CO2 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.

Fig. 2.1: Cement

2.3 Water Cement Ratio

The water cement ratio is the ratio of the weight of water to the weight of cement used in 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 resolved with the use of plasticizers. Water cement ratio produced by conventional mixing technologies are usually prepared with water cement ratio 0.45 for grade M15 & 0.45 for grade M20, for testing their 7 days, 14 days and 28 days compressive strength.

2.4 Aggregates

Construction aggregate, or simply aggregate, is a broad category of coarse to medium grained particulate material used in construction, including sand, gravel, crushed stone, slag, recycled concrete and geoscientific aggregates. Aggregates are the most mined materials in the world. The products characteristics are standard in order to ensure the necessary levels of reliability and process. Aggregate information in building and construction, materials are used for mixing with cement, bitumen, lime, gypsum, or other adhesive to concrete or mortar. Aggregate can either be natural or manufactured. Natural aggregate are generally extracted from larger rock formation through an open excavation. Extracted rock is typically reduced to usable sizes by mechanical cruising.

2.5 Coarse Aggregate

Coarse aggregate is full brick which are broken into small sizes and irregular in shape. In construction work the aggregate are used such as limestone and granite or river aggregate. Coarse aggregates are any particles greater than 0.19 inch, 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 remainder. 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 M15 is 0.45 & grade M20 is 0.45.

Fig. 2.2: Coarse Aggregates

2.6: Fine Aggregate

Fine aggregates are essentially any natural sand particles won from the land through the mining process. Fine aggregates consist of natural sand or any crushed stone particles that are ¼ inch or smaller. This product is often referred to as ¼ inch minus as it refers to the size, or grading, of this particular aggregate. Fine aggregate (sand) fills voids between aggregates. It forms the bulk and makes mortar or concrete economical. It provides resistance against shrinking and cracking. It is naturally available.Fine aggregate is the essential ingredient in concrete that consists of natural sand or crushed coarse aggregate. The quality and fine aggregate 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 aggregate on basis of grading zone, particle shape, surface texture, abrasion skid resistance, absorption and surface moisture. 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.

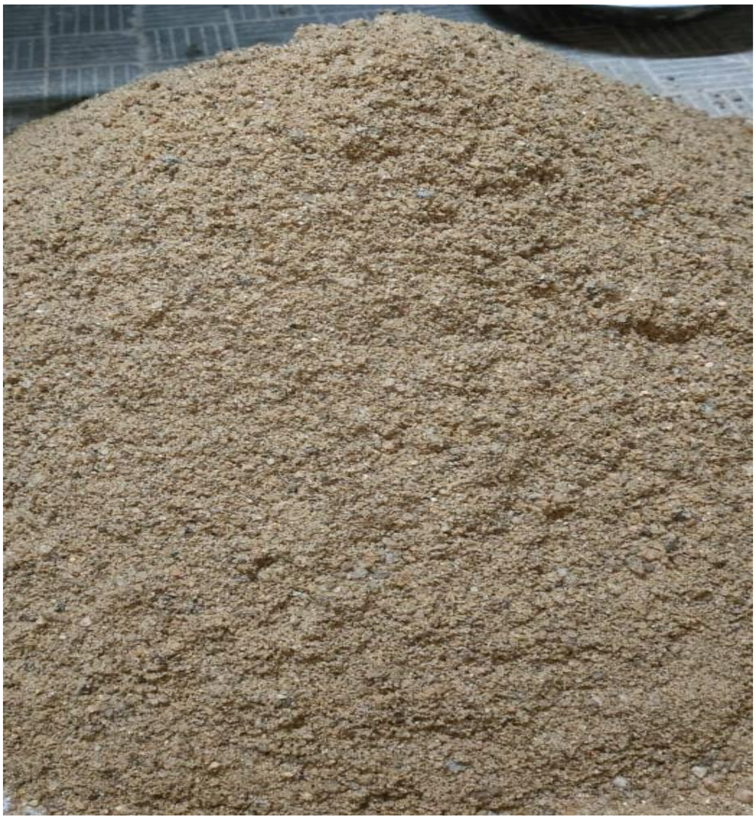


Fig. 2.3: Fine aggregate

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

Types of Sand	Range of Fineness Modulus
Fine 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.

2.7 Sieve Analysis of Fine and Coarse 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. 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.

Fig. 2.4: Sieve

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, ¾ 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 common performance measurers performed by the engineers in the structural design. The comprehensive strength of concrete cylinders is determined by applying continuous load over the cylinder until failure occurs. The test is conducted using a compression testing machine. The cylinder specimens are cast in steel, cast iron or any mold made of non-absorbent material. Even under severe conditions, the molds used must retain its original shape and dimensions. Cylindrical specimens for testing should be 4inch x 8 inch. 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 25 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.

Fig. 3.1: Mold Preparation For Casting

3.2 Concrete Mixing

A concrete mixer is a device that homogeneously combines cement, aggregate such as sand or coarse aggregate, 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 coarse aggregate 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.

Fig. 3.2: Mixing of Sand Cement and coarse aggregate

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. 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.

Fig. 3.3: Casting of Cylinder

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. Initial curing during the first 24 to 48 hours after molding, all test specimens are stored. 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.

Fig. 3.4: Curing of Cylinder

3.5 Preparation to Crush the Concrete Cylinders

The cylinders were kept submerged as long as for 7 days. After that were withdraw 4 piece cylinder of M15 grade are made by cylinders with new aggregates & recycled aggregates. withdraw 4 piece cylinder of M20 grade are made by cylinders with new aggregates & recycled aggregates . 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 14 days The cylinders were kept submerged as long as for 14 days. After that were withdraw 4 piece cylinder of M15 grade are made by cylinders with new aggregates & recycled aggregates. withdraw 4 piece cylinder of M20 grade are made by cylinders with new aggregates & recycled aggregates . after that the cylinders had been placed in the center of Universal Testing Machine (UTM) one by one Then we kept another test for 28 days. After that we are withdrew from the dram and crushing the cylinders and noted down the value.

Fig. 3.5: Preparation of Cylinder M15 & M20 Grade

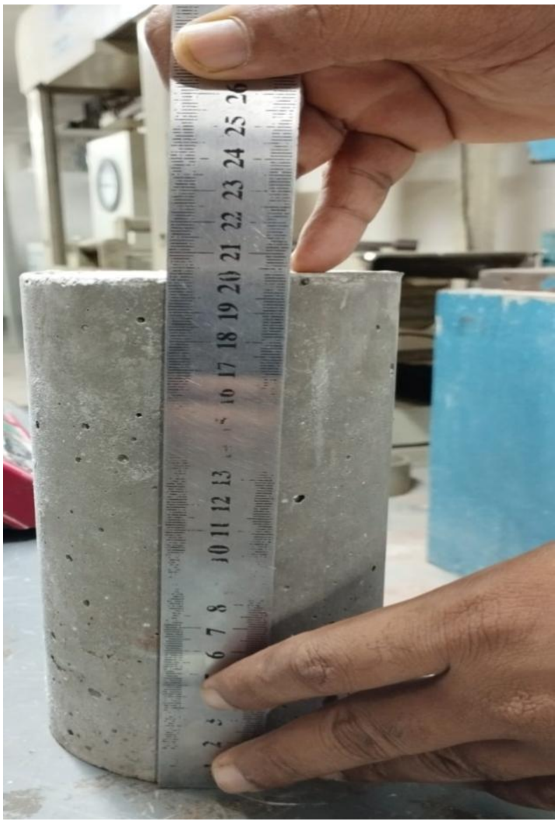


Fig. 3.6: Preparation of Cylinder M15 & M20 measurement Grade

3.6 UTM Machine

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

3.7 Compression Test

Compressive strength of materials is completely opposite of tensile strength testing as mentioned above, basically a maximum pressure has to apply on any object up to its break points. This is called compressive strength of any object. This test also useful to find how much load can bear on bridges pillars, building beams or etc.

3.8 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 M15 & grade M20 respectively.

Fig. 3.7: Place the cylinder in UTM machine

3.9 Compressive Fracture of Cylinder

For 7 days, 14 days 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 24 specimen in Sonargaon University lab.

Fig.3.8:Compressive fracture of Cylinder Grade M15 & M20

3.10 Compressive Strength Importance

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 reach 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 amount 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 inert filler, which accounts for 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 size increased and the decrement was more obvious in the specimens with low aspect ratio.

f) Effect of the rate of loading

As a 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.

h) Effect of the temperature of the testing

The compressive strength can be classified into four distinct patterns of strength loss: 23-200°C, 200-400°C, 400-600°C, and 600-800°C. From 23 to 200°C, the compressive strength of specimens increases with temperature.

3.11 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.

CHAPTER 4

RESULT AND DISCUSSION

4.1 Result of Fine Aggregate

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

Requirement:

Aggregate with at least 100% passing No. 4 Sieve 1000gm.

And more than 3.4% retained on a No. 8 Sieve.

Aggregates with at least 96.6% passing No. 8 Sieve 34gm.

Sieve No.	Retain	% Retain	Cumulative % Retain	FM	Finer
#4 (4.75mm)	0	0	0	275.9/100 =2.8	100
#8 (2.36mm)	34	3.4	3.4		96.6
#16 (1.19mm)	218	21.8	25.2		74.8
#30 (0.59mm)	332	33.2	58.4		41.6
#50 (0.30mm)	322	32.2	90.6		9.4
#100 (0.15mm)	77	7.7	98.3		1.7
Pan	17	1.7	---		0

Table 4.1: Result of aggregate sieve analysis

4.2 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.	Wt. of S.S.D sample In air , S gm.
653 gm.	290 gm.	834 gm.	300gm.

Table 4.2: Data sheet for specific gravity of fine aggregate

4.3 Specific Gravity Of Fine Aggregate

Test	Formula	Calculation	Result
Apparent Specific Gravity	A / (B+A-C)	290 / (653+290-834)	2.67
Bulk SG (Oven Dry Basic)	A / (B+S-C)	290 / (653+300-834)	2.44
Absorption Capacity, D%	((S-A) / A) X 100	((300-290) / 290) X 100	3.45
Bulk SG (S.S.D. Basic), G	S / (B+S-C)	300 / (653+300-834)	2.52

Table 4.3: Data sheet for specific gravity of fine aggregate

The specific gravity of fine aggregate after open drying was found 2.44. We found the specific gravity of the apparatus to be 2.67 and bulk specific gravity oven dry ac obtained from 2.44. Apparent capacity reduction received 3.45 and bulk SSD received 2.52.

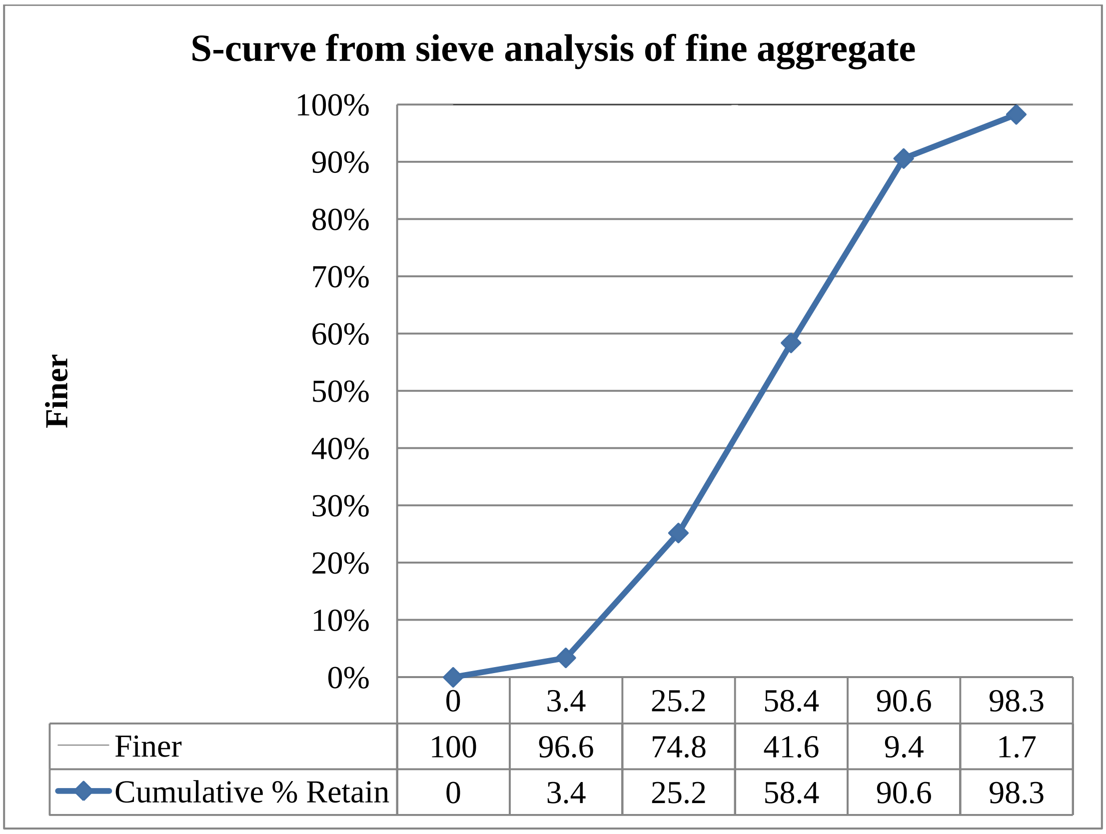


Fig. 4.1: S-curve from sieve analysis of fine aggregate

4.4 Result of New Coarse Aggregate

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

Requirements: Aggregates with nominal maximum size of ¾ in. 10 lbs.

Sieve No.	Retain	% Retain	Cumulative % Retain	FM	Finer
#3/4	199	16.58	16.58	703.08/100 =7.03	83.42
#3/8	839	69.92	86.5		13.5
#4	162	13.5	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

Table 4.4: Result of new coarse aggregate sieve analysis

4.5 Specific Gravity Of New 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.
1315 gm.	1205 gm.	665 gm.

Table 4.5: Data sheet for specific gravity of new coarse aggregate

4.6 Specific Gravity Of New Coarse Aggregate

Test	Formula	Calculation	Result
Apparent Specific Gravity	A / (B+A-C)	1205 / (1315+1205-665)	0.65
Bulk SG (Oven Dry Basic)	A / (B-C)	1205 / (1315-665)	1.86
Absorption Capacity, D%	B / (B-C)	1315 / (1315-665)	2.023
Bulk SG (S.S.D. Basic), G	((B-A) / A) X 100	(1315-1205) / 1205 X 100	9.12

Table 4.6: Data sheet for specific gravity of new coarse aggregate

The specific gravity of the normal course aggregate after oven drying was found 1.86 for coarse aggregate. We found the specific gravity of the apparatus to be 0.65 and bulk specific gravity oven dry ac obtained from 1.86. Apparent capacity reduction received 2.023 and bulk SSD received 9.12.

4.7 Result of Recycled Coarse Aggregate

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

Requirements: Aggregates with nominal maximum size of ¾ in. 10 lbs.

Sieve No.	Retain	% Retain	Cumulative % Retain	FM	Finer
#3/4	182	18.2	18.2	715.6/100 =7.15	81.8
#3/8	792	79.2	97.4		2.6
#4	26	2.6	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

Table 4.7: Result of recycled coarse aggregate sieve analysis

4.8 Specific Gravity Of Recycled 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.
1505 gm.	1372 gm.	788 gm.

Table 4.8: Data sheet for specific gravity of recycled coarse aggregate

4.9 Specific Gravity Of Recycled Coarse Aggregate

Test	Formula	Calculation	Result
Apparent Specific Gravity	A / (B+A-C)	1372 / (1505+1372-788)	0.66
Bulk SG (Oven Dry Basic)	A / (B-C)	1372 / (1505-788)	1.91
Absorption Capacity, D%	B / (B-C)	1505 / (1505-788)	2.01
Bulk SG (S.S.D. Basic), G	((B-A) / A) X 100	((1505-1372) / 1372 X 100	9.7

Table 4.9: Data sheet for specific gravity of recycled coarse aggregate

The specific gravity of the normal course aggregate after oven drying was found 1.91 for coarse aggregate. We found the specific gravity of the apparatus to be 0.66 and bulk specific gravity oven dry ac obtained from 1.91. Apparent capacity reduction received 2.01 and bulk SSD received 9.7.

Results of 7 Days Compressive Strength Test of Grade M15 Ratio							
SL. NO.	Types of Aggregates	Mix Properties	Water Cement (Ratio)	Wight gm	Hight mm	Dia mm	Compressive Strength (MPa)
01	New Aggregates 100%	1:2:4	0.45	3305	204	103.37	10.12
02	Recycled Aggregates 100%	1:2:4	0.45	3195	205	101.52	5.8
03	New Aggregates 50% & Recycled Aggregates 50%	1:2:4	0.45	3420	204	101.17	8.46
04	New Aggregates 25% & Recycled Aggregates 75%	1:2:4	0.45	3364	206	102.78	7.23

Table 4.10: Seven Days Compressive Strength Test of Grade M15 Ratio

Results of 7 Days Compressive Strength Test of Grade M20 Ratio							
SL. NO.	Types of Aggregates	Mix Properties	Water Cement (Ratio)	Wight gm	Hight mm	Dia mm	Compressive Strength (MPa)
01	New Aggregates 100%	1:1.5:3	0.45	3470	203	102.20	12.2
02	Recycled Aggregates 100%	1:1.5:3	0.45	3363	204	102.97	7.8
03	New Aggregates 50% & Recycled Aggregates 50%	1:1.5:3	0.45	3196	201	101.37	9.3
04	New Aggregates 25% & Recycled Aggregates 75%	1:1.5:3	0.45	3447	205	103.11	8.39

Table 4.11: Seven Days Compressive Strength Test of Grade M20 Ratio

Results of 14 Days Compressive Strength Test of Grade M15 Ratio							
SL. NO.	Types of Aggregates	Mix Properties	Water Cement (Ratio)	Wight gm	Hight mm	Dia mm	Compressive Strength (MPa)
01	New Aggregates 100%	1:2:4	0.45	3414	204	102.47	11.03
02	Recycled Aggregates 100%	1:2:4	0.45	3245	204	102.11	7.64
03	New Aggregates 50% & Recycled Aggregates 50%	1:2:4	0.45	3355	101.49	101.49	9.27
04	New Aggregates 25% & Recycled Aggregates 75%	1:2:4	0.45	3317	102.23	102.23	8.77

Table 4.12: Fourteen Days Compressive Strength Test of Grade M15 Ratio

Results of 14 Days Compressive Strength Test of Grade M20 Ratio							
SL. NO.	Types of Aggregates	Mix Properties	Water Cement (Ratio)	Wight gm	Hight mm	Dia mm	Compressive Strength (MPa)
01	New Aggregates 100%	1:1.5:3	0.45	3372	204	102.40	12.75
02	Recycled Aggregates 100%	1:1.5:3	0.45	3410	205	102.50	10.06
03	New Aggregates 50% & Recycled Aggregates 50%	1:1.5:3	0.45	4303	205	102.86	11.07
04	New Aggregates 25% & Recycled Aggregates 75%	1:1.5:3	0.45	3395	204	102.72	10.86

Table 4.13: Fourteen Days Compressive Strength Test of Grade M20 Ratio

Results of 28 Days Compressive Strength Test of Grade M15 Ratio							
SL. NO.	Types of Aggregates	Mix Properties	Water Cement (Ratio)	Wight gm	Hight mm	Dia mm	Compressive Strength (MPa)
01	New Aggregates 100%	1:2:4	0.45	3560	202	103.27	14.7
02	Recycled Aggregates 100%	1:2:4	0.45	3337	203	102.69	10.26
03	New Aggregates 50% & Recycled Aggregates 50%	1:2:4	0.45	3266	202	102.97	11.40
04	New Aggregates 25% & Recycled Aggregates 75%	1:2:4	0.45	3406	204	104.33	10.52

Table 4.14: Twenty-eight Days Compressive Strength Test of Grade M15 Ratio

Results of 28 Days Compressive Strength Test of Grade M20 Ratio							
SL. NO.	Types of Aggregates	Mix Properties	Water Cement (Ratio)	Wight gm	Hight mm	Dia mm	Compressive Strength (MPa)
01	New Aggregates 100%	1:1.5:3	0.45	3559	203	102.34	18.84
02	Recycled Aggregates 100%	1:1.5:3	0.45	3402	204	102.68	13.40
03	New Aggregates 50% & Recycled Aggregates 50%	1:1.5:3	0.45	3356	204	102.57	15.73
04	New Aggregates 25% & Recycled Aggregates 75%	1:1.5:3	0.45	3513	204	103.13	14.37

Table 4.15: Twenty-eight Days Compressive Strength Test of Grade M20 Ratio

After the experiment it shows the result below:-

7 Days for M15

The values are 10.12 MPa for (new aggregates 100%), 5.8 MPa for (recycled aggregates 100%), 8.46 MPa for (new aggregates 50% & recycled aggregates 50%), 7.23 MPa for (new aggregates 25% & recycled aggregates 75%).

7 Days for M20

The values of compressive strength of concrete for new aggregates & recycled aggregates are 12.2 MPa for (new aggregates100%), 7.80 MPa for (recycled aggregates100%), 9.3 MPa for (new aggregates 50% & recycled aggregates 50%), 8.39 MPa for (new aggregates 25% & recycled aggregates 75%).

14 Days for M15

The values are 11.03 MPa for (new aggregates 100%), 7.64 MPa for (recycled aggregates 100%), 9.27 MPa for (new aggregates 50% & recycled aggregates 50%), 8.77 MPa for (new aggregates 25% & recycled aggregates 75%).

14 Days for M20

The values are 12.75 MPa for (new aggregates100%), 10.06 MPa for (recycled aggregates100%), 11.07 MPa for (new aggregates 50% & recycled aggregates 50%), 10.86 MPa for (new aggregates 25% & recycled aggregates 75%).

28 Days for M15

The values are 14.27 MPa for (new aggregates100%), 10.26 MPa for (recycled aggregates 100%), 11.4 MPa for (new aggregates 50% & recycled aggregates 50%), 10.52 MPa for (new aggregates 25% & recycled aggregates 75%).

28 Days for M20

The values are 18.84 MPa for (new aggregates 100%), 13.40 MPa for (recycled aggregates 100%), 15.73 MPa for (new aggregates50% & recycled aggregates 50%), 14.37 MPa for (new aggregates 25% & recycled aggregates 75%). Respectively for the same types of new aggregates and recycled aggregates of grade. For 7 days, the highest compressive strength of the concrete found 10.12 MPa (new aggregates100%), for new aggregates of grade M15 and the lowest compressive strength is 5.8 MPa (recycled aggregates 100%), for recycled aggregates of grade

M15. For 7 days, the highest compressive strength of the concrete found 12.2 MPa (new aggregates100%), for new aggregates of grade M20 and the lowest compressive strength is 7.80 MPa (recycled aggregates 100%), for recycled aggregates of grade M20. For 14 days, the highest compressive strength of the concrete found 11.03 MPa (new aggregates100%), for new aggregates of grade M15 and the lowest compressive strength is 7.64 MPa (recycled aggregates 100%), for recycled aggregates of grade M15. For 14 days, the highest compressive strength of the concrete found 12.75 MPa (new aggregates100%), for new aggregates of grade M20 and the lowest compressive strength is 10.06 MPa (recycled aggregates 100%), for recycled aggregates of grade M20. For 28 days, the highest compressive strength of the concrete found 14.7 MPa (new aggregates100%), for new aggregates of grade M15 and the lowest compressive strength is 10.26 MPa (recycled aggregates 100%), for recycled aggregates of grade M15. For 28 days, the highest compressive strength of the concrete found 18.84 MPa (new aggregates100%), for new aggregates of grade. M20 and the lowest compressive strength is 13.40 MPa (recycled aggregates 100%), for recycled aggregates of grade M20. The compressive strength better both new aggregates grade M15 & M20.

4.16 Comparison Chart between Grade M15 & M20

The comparison between different types of Aggregates for two grade M15 & M20 are given below:

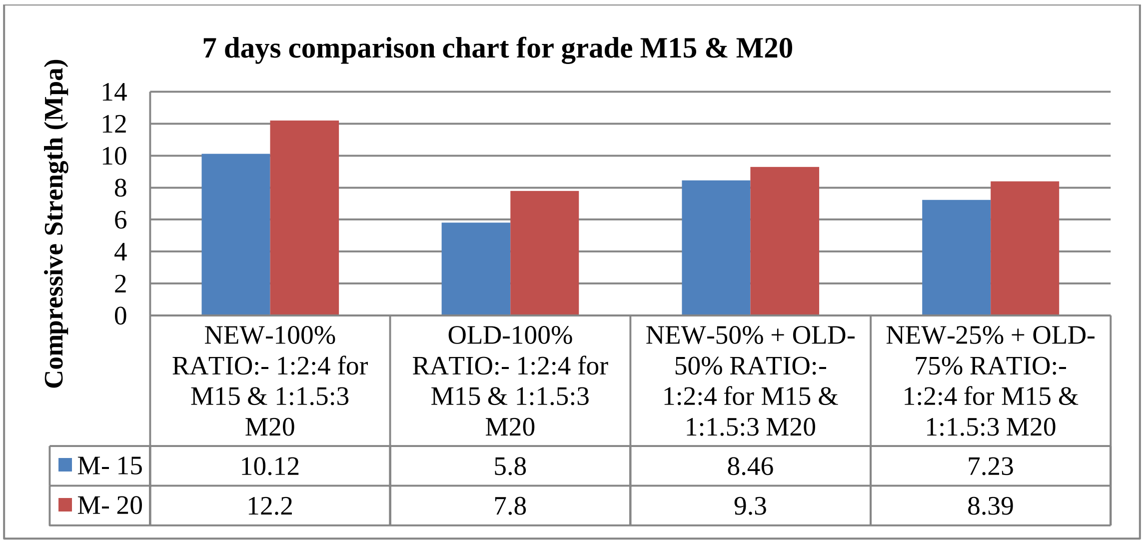


Fig. 4.2: 7-days comparison chart of grade M15 & M20 for different types of aggregates

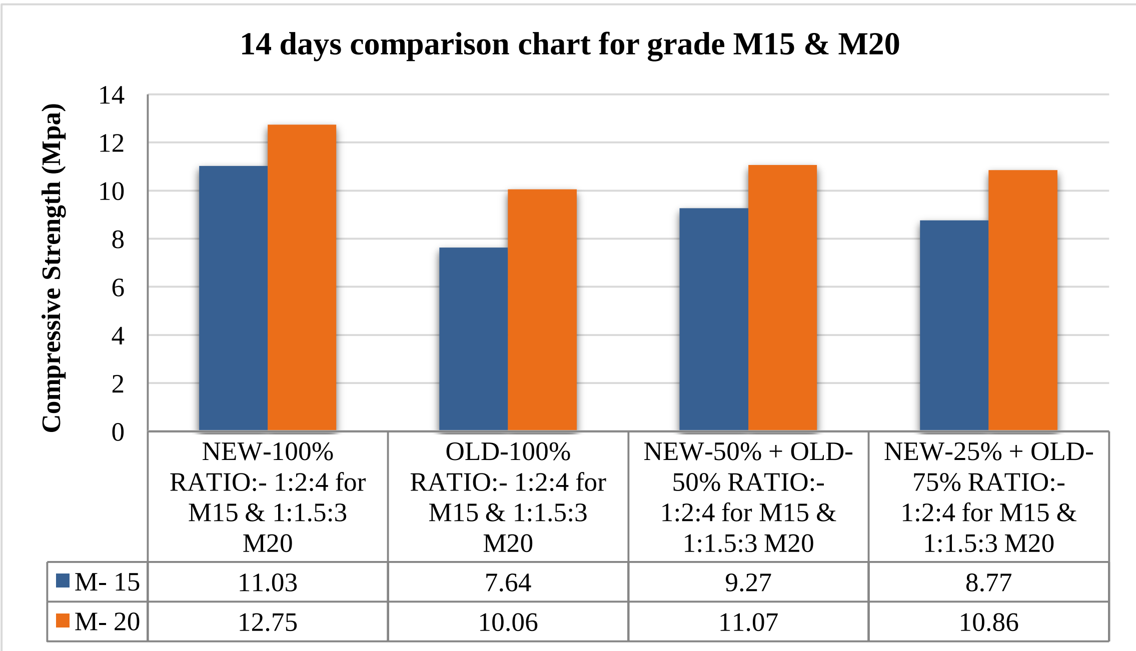
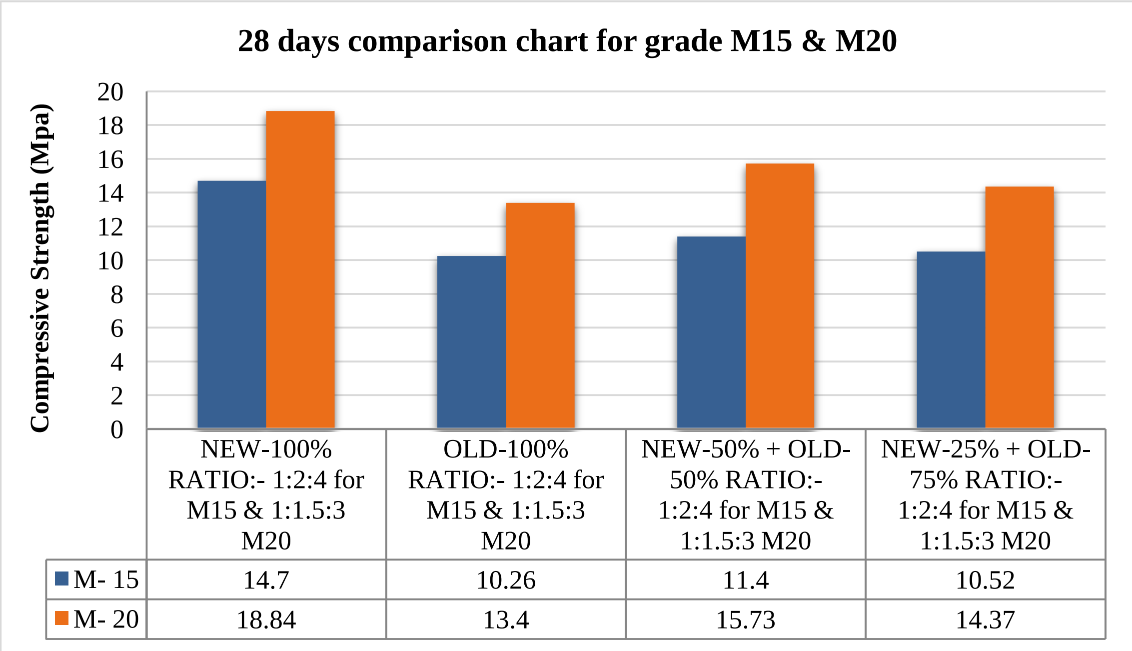


Fig. 4.3: 14-days comparison chart of grade M15 & M20 for different types of aggregates



	NEW-100% RATIO:- 1:2:4 for M15 & 1:1.5:3 M20	OLD-100% RATIO:- 1:2:4 for M15 & 1:1.5:3 M20	NEW-50% + OLD-50% RATIO:- 1:2:4 for M15 & 1:1.5:3 M20	NEW-25% + OLD-75% RATIO:- 1:2:4 for M15 & 1:1.5:3 M20
M- 15	14.7	10.26	11.4	10.52
M- 20	18.84	13.4	15.73	14.37

Fig. 4.4: 28-days comparison chart of grade M15 & M20 for different types of aggregates

CHAPTER 5

CONCLUSIONS

5.1 Decision

The following decision have been made after the experiment:

1. Comparison of compressive strength of concrete by using different types of coarse aggregate for grade M15 & M20.
2. In 28 days, compressive strength test result of new aggregates and recycled aggregates fulfill nearby the conditions of M15 grade.
3. In 28 days, compressive strength test result of new aggregates and recycled aggregates fulfill the conditions but, new aggregates fulfill the condition of grade M20.
4. Get highest compressive strength of concrete by using new aggregates for M15 grade.
5. Get highest compressive strength of concrete by using new aggregates for M20 grade.
6. Over all get by all testes new aggregates has been better than the recycled aggregates.

5.2 Limitations & Recommendations for Future Works

World is growing and urbanizing at a very fast rate and so is Bangladesh. This effect of rapid urbanization is also seen in construction industry. However, with urbanization comes the moral responsibility of sustaining the environment. Concrete is the favorite choice as a construction material among civil engineers around the globe for decades. It is preferred for its better performance, longer life and low maintenance cost. To achieve rapid urbanization every year smaller structures are demolished and newer and bigger ones are constructed. These demolished materials (majority of which is usually concrete) are often dumped on land and is not reused for any purpose. This practice effects the fertility of land. To evaluate the environmental impact of using recycled aggregates in terms of reduced resource costs and waste reduction. With the wave of sustainability also impacting the construction industry, scientist and engineers throughout the world are looking for sustainable and reusable construction materials. One such material is recycled aggregate concrete.

Disadvantages of recycled aggregate downgrading of quality of concrete. Increase in water absorption capacity ranging from 3% to 9%. Decrease in compressive strength of concrete (10-30%). Reduces workability of concrete. Lack of specifications and guidelines. Less durability of RAC, however few papers have shown an improvement in the durability by mixing it with special materials like fly ash. Conclusion not only the problem of hundreds of thousands of tons of construction debris can be solved by recycling and reusing the building wastes, but also the issue of shortage of natural aggregates can be addressed. Recycled aggregate concrete have several reliable applications. However, countries like India need to take some serious urgent measures to unleash the scope of RAC and if done so, concrete recycling will become one of the most important element for construction sustainability. Recycled aggregate can be used in the following constructions can be used for constructing gutters, pavements etc. Large pieces of crushed aggregate can be used for building revetments which in turn is very useful in controlling soil erosion. Recycled concrete rubbles can be used as coarse aggregate in concrete. Production of RAC also results in generation of many by-products having many uses such as a ground improvement material, a concrete addition, an asphalt filler, use for local drain constructions, use for local drain RCC slab, constructions small guard room, garden decoration, make route for garden, home area drain, make RCC boundary wall etc. The following are some recommendations provided considering the previous discussion:

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

2.The other grade like M7, M10, M25, M30, M35, M40, M45 & M50 may be worked in further.

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

REFERENCES

Mizanur, R. M. et.al, "studied the compressive strength of different types of Portland composite cement", pp. 15, 2015.

Google Laptop,

Website:https://www.ask-chemicals.com/technology/applications/cylinder-head casting#:~:text=the%20cylinder%20head%20of%20an, component%20assembly%20of %20the%20engine [Last accessed on 06 Jun. 2023].

Celik, M. H. and Durmaz, M., "The compressive strength of the concrete", March-2012.

Google Laptop,

https://www.researchgate.net/scientific-contributions/Mustafa-Haluk-Celik-2057402740 [Last accessed on 02 April. 2023].

Jones, R., Kaplan, M. F., "The effect of coarse aggregate on the mode of failure of concrete in compression and flexure", *Magazine of Concrete Research*, Vol. 9, No. 26, pp. 89-94. August-1957.

Google Laptop,

https://www.icevirtuallibrary.com/doi/abs/10.1680/macr.1957.9.26.89 [Last accessed on 017 July. 2023].

Siddique , M. L. R. et.al, "studied the compressive strength of different types of Portland composite cement", Vol. 7, pp. 477-486. May 2009.

Google Laptop,

https://scholar.google.com/scholar?q=M.+L.+R.+et.al,&hl=en&as_sdt=0&as_vis=1&oi=scholart [Last accessed on 02 April. 2023].

Nemati, K. M., "Concrete Technology Strength of Concrete", 2015.

Google Laptop,

http://www.courses.washington.edu/cm425/concrete strength.2015 [Last accessed on 23 July. 2023]

Menon, D. and Sengupta, A. K., "Prestressed Concrete Structures" 2008.

Google Laptop,

http://www.nptel.ac.in/courses/105106117/pdf/1_Introduction/1.1_Introduction.pdf. 2008 [Last accessed on 01 Sep. 2023].