EFFECTS OF AGGREGATE TYPES ON MECHANICLE PROPERTIES OF CONCRETE

BY

MOZZAMMEL HAQUE

ID: BCE1801013043

AKHI RANI

ID: BCE-1801013001

MD. ABDUS SALAM

ID: BCE-1801013137

MD.ABUSAYEED

ID: BCE-1801013099

MD.NAZRUL ISLAM

ID: BCE-1801013015

A thesis submitted to the Department of Civil Engineering of Sonargaon University (SU) in partial fulfillment for the degree of Bachelor of Science in Civil Engineering



Department of Civil Engineering
Sonargaon University (SU)
147/I Green Road, Dhaka-1215, Bangladesh
Section: 13A
Semester: Summer 2021

EFFECTS OF AGGREGATE TYPES ON MECHANICLE PROPERTIES OF CONCRETE

By

MOZZAMMEL HAQUE	ID: BCE-1801013043
AKHI RANI	ID: BCE-1801013001
MD.ABDUS SALAM	ID: BCE-1801013137
MD.ABUSAYEED	ID: BCE-1801013099
MD.NAZRUL ISLAM	ID: BCE-1801013015

Supervisor

Md. GolamKibria
Lecturer, Department of Civil Engineering
Sonargaon University (SU)

A thesis submitted to the Department of Civil Engineering of Sonargaon University (SU) in partial fulfillment for the degree of Bachelor of Science in Civil Engineering

Department of Civil Engineering
Sonargaon University (SU)
147/I Green Road, Dhaka-1215, Bangladesh

Section: 13A
Semester: Summer 2021

BOARD OF EXAMINERS

The thesis titled “Effects of aggregate types on mechanical properties of concrete” Mozzammel Haque (ID: BCE1801013043), Akhi Rani (ID: BCE1801013001), Md. Abdus Salam (ID: BCE1801013137), Md. Abusayeed (ID: BCE1801013099), Md. Nazrul Islam (ID: BCE1801013015) has been accepted as satisfactory in partial fulfillment on date of defense.

1. Md. GolamKibria — Chairman
Lecturer, Department of Civil Engineering
Sonargaon University (SU)

2. Angila Tabassum
Assistant Professor, Department of Civil Engineering
Sonargaon University (SU)

Member

DECLARATION

It is hereby declared that this thesis/project or any part of it has not been submitted elsewhere for the award of any degree or diploma.

STUDENT NAME	STUDENT ID	SIGNATURE
1. MOZZAMMEL HAQUE	ID: BCE-1801013043	
2. AKHI RANI	ID: BCE-1801013001	
3. MD. ABDUS SALAM	ID: BCE-1801013137	
4. MD. ABUSAYEED	ID: BCE-1801013099	
5. MD. NAZRUL ISLAM	ID: BCE-1801013015	

Dedicated

to

"Md. Golam Kibria

Lecturer, Department of Civil Engineering

Sonargoan University"

ACKNOWLEDGMENT

All praises and profound gratitude to the almighty Allah who is the most beneficent and the most merciful for allowing great opportunity and ability to bring this effort to fruition safety and peacefully.

We sincerely acknowledge and express my deep sense of gratitude to Md. Golam Kibria (Lecturer) the guide this project. As a guide he gave a maximum help and coordinator in finishing the project work. With his past years of experience and teaching steered we to come out wish success through the most difficult problems faced by us. His active interest in topic and valuable advice was the source of the author's inspiration.

We would like to place on record our deep sense of gratitude to our guides for their cooperation and unfailing courtesy to us at every stage.

We sincerely would like to thank all instructions and staffs of the Civil Engineering Department of Sonargaon University (SU), Dhaka which contributed in various ways to the completion of this thesis.

Finally, we would like to express our deepest gratitude to our entire group member whose support and manual labor contributed in various ways for the completion of this thesis work.

Authors

Mozzammel Haque
Akhi Rani
Md. Abdus salam
Md. Abusayeed
Md. Nazrul Islam

ABSTRACT

It's known to all that many countries are developing day by day with the running times of the whole world and Bangladesh is one of them. For this development the construction of mega projects and other different projects like school, college, industrial, commercial building etc. are carried out in different sectors of Bangladesh. Capital city of Bangladesh, Dhaka has experienced a rapid growth of urban population. Due to the scarcity of land in the city, it is indispensable to construct high rise buildings to accommodate the population in the city. For construction of high rise buildings, high strength concrete mix proportions are to be developed using the locally available construction materials. With this objective, this study has been planned. Cylinder concrete specimens of diameter 100 mm and height 200 mm were made with same mix proportions (1:1.5:3) of concrete. The variables that have been studied were W/C(0.40 to 0.450), cement content, sand-to-aggregate volume ratio, type of cement (ordinary Portland cement, blended cement with different proportions of fly ash, ground granulated blast furnace slag, and silica fume), different types of aggregates (stone chips of different place) , aggregates properties (aggregate crushing value, Aggregate impact value , Fineness Modulus). Before making concrete specimens, a grading that gives maximum unit weight of the aggregate, i.e., minimum void in aggregate was developed both for fine and coarse aggregates. All aggregates were also investigated for unit weight, absorption capacity, and abrasion value. Fresh concrete was tested for workability using a slump cone. In this study we collect five project concrete cylinder test data and analysis that to find out which material is preferable for high strength concrete. Concrete cylinder specimens were tested for compressive strength, at 28 days. The results revealed that it is possible to get high strength of concrete using the locally available materials used in this study. To achieve further strength, it is necessary to use good quality coarse aggregate with lower value of abrasion. *Keywords: Compressive strength, Water cement ratio, Mixing ratio, stone chips, Aggregate crushing value, Aggregate impact value, Fineness Modulus.*

NOTATION

fc'= the 28 days' compressive strength of cylinder specimen of concrete

fy = Yielding strength of reinforcement

F.M: Fineness modulus.

MPa: Mega Pascal.

Psi: Pound per square inch.

W/C: Water Cement ratio.

C.C: Crushed Concrete.

MM: Model Mosque project

FTC: Farmers Training Center Project

RPF: River Police Fari Project

ADD: Abloom Design Dyeing LTD.

OTI:OrientTrade International

TABLE OF CONTENTS

TITLEPAGE NO

Abstract 7

Notations 8

List of the tables contents 11

List of the figure contents 12

CHAPTER- I: INTRODUCTION

1.1 General 13-17

1.2 Methodology 18

1.3 Objective of the study 19

1.4 Background of the study 19

1.5 Limitations 20

1.6 Outline of the thesis 20

CHAPTER- II: LITERATURE REVIEW

2.1 Literature review 21-24

CHAPTER -III: EXPERIMENTAL INVESTIGATION

3.1 Introduction 25

3.2 The Properties of Ingredients of concrete 25

3.2.1 Aggregate 25

3.2.1.1 Test for fine aggregate 26

3.2.1.2 Sieve analysis of fine aggregate 26-27

3.2.1.3 Test for Coarse aggregate stone chips 27

3.2.1.4 Aggregate Impact Value Test of stone chips 27-28

3.2.1.5 Aggregate crushing value of stone Chips 29

3.2.1.6 Unit weight of course aggregate 30

3.2.2 Cement 31

3.2.3 Water 31

3.3 Concrete Mix Design 32

3.4 Process of Casting 32

3.4.1 Batching 32

3.4.2 Mixing 32

3.4.3 Compaction of Concrete 32

3.4.4 Curing of Concrete 32

3.4.5 Methods of Curing 33

3.5 Tests of the Specimens of Concrete 34-36

CHAPTER –IV: TEST RESULTS AND ANALYSIS

4.1 Introduction 37

4.2 Test result of the concrete specimen 37

4.3 Test Result Analysis 38

CHAPTER-V: CONCLUSION AND RECOMMENDATION

5.1 General 39

5.2 Conclusion 39

5.3 RECOMMENDATION 39

5.4 REFEREN40

List of the Tables

NO. TITLE **PAGE NO**

1.2 Flow chart of total Methodology 18

3.1Sieve analysis of fine aggregate27

3.2 Aggregate Impact Value Test of stone chips28

3.3Aggregate crushing value of stone Chips 29

3.4Unit weight of course aggregate 30

3.5 Model Mosque cylinder test report 34

3.6 River Police Faricylinder test report 35

3.7 Farmers Training Center cylinder test report 35

3.8 Abloom Design Dyeing Ltdcylinder test report 36

3.9 OrientTrade International cylinder test report 36

4.1Test result of the concrete specimen 37

List of the Figures

FIGURE NO.	TITLE	PAGE NO.
Figure-1	Fine aggregate	26
Figure-2	Coarse aggregate	**26**
Figure -3	Sieve analysis	27
Figure-4	Aggregate impact value	28
Figure-5	Aggregate crushing value	**29**
Figure -6	Unit weight of course aggregate	30
Figure-7	Curing of concrete cylinder	31

CHAPTER - I

Introduction

1.1GENERAL

Bangladesh is a development Country. Our economic is increasing day by day. Our Construction is progressing with our economic. Our country made in mega project. So concrete is use largely.

Concrete is a composite material which consists of cement, fine aggregate (sand), coarse aggregate (gravel or granite) and water in a certain prescribed proportion. The most dominant construction material is concrete and the most collapse structures concrete structures.

Compressive strength of concrete is the most widely used test for determining the performance of concrete structures. Both stone chips brick are used in Bangladesh for producing concrete structures. Concrete made with stone chips usually have higher strength then concrete made with brick chips. But structures make with 1st class brick chips are also satisfactory. The history of building is marked by a number of trends. One is the increasing durability of the materials used. The present state of building construction is complex. There is a wide range of building products and systems which are aimed primary at groups of building types of markets. The design process for building is highly organized and draws upon research establishments that study material properties and performance, code officials who adopt and enforce safety standards.

A study of test data from many laboratories using a variety of materials complying with ASTM specifications indicates that large majority of the strength tests are in the area within the band. In many instances it is necessary to consider the strength of the concrete. As with durability and water tightness, it is found that strength is principally dependent on the amount of mixing water used and the extent to which the chemical reaction between the cement and water have progressed. The type of coarse aggregate is one of the most important factors affecting the behavior of high-strength concretes. In this study we collect five project concrete cylinder test data collection and analysis. These projects short description are given below;

01.Establishing 560 **Model Mosque** and Islamic Cultural Centers in Zila and Upazila of Bangladesh. SH Construction of 03-Storied UpazilaMasjid Complex with 03-Storied Foundation at Plain Land for Islamic Foundation Type-B one at **Nabinagar**UpazilaBrahmanbaria District with Civil Sanitary and Electrification works construction by Public Works Division, Brahmanbaria which client is Islamic Foundation Brahmanbaria. The object of the project to develop Islamic cultural knowledge and create the opportunities for Muslim prayer, religious education, training &dewah activities in the peoples in our country.



Model Mosque Nabinagar

02. Construction of River Police Outpost cum Barrack Building at SolimgonjBrahmanbaria head: Civil,sanitary, internalelectrification works construction by Public Works Division, Brahmanbaria which client is Ministry of Home Affairs. The object of this project to ensure basic infrastructure support to the Police Department and develop safety of river route.



River Police Faari, Solimgonj

03.Farmers training at the upazilla level for transfer of technology. SH Construction of **Farmers Training Center** three storied building with three storied foundation including civil sanitary internal electrification deep tube-well internal road boundary wall one at **Kasba**in Brahmanbaria District. Construction by Public Works Division,Brahmanbaria which client is Ministry of Agricultural. Object of the project to develop farmer agriculture knowledge and training at the upazilla level for transfer of technology.



Farmers Training Center, Kashba

04.Abloom Design Dyeing Ltd, Sonargoan, Narayangonj.Construction by M/SDaly construction LTD. Which client is Managing director Abloom Design Dyeing LTD. Object of this project to develop garments industry in our country.



Abloom Design Dyeing LTD

05.Orient Trade International bridge project, Narayangonj. Construction by NDE Ready Mix Concrete Ltd. Object of this project to develop communication system.



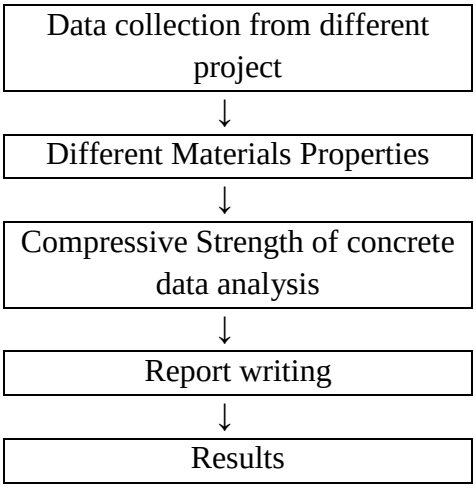
Orient Trade International bridge project

1.2 Methodology

In this thesis work, compressive strength test was performed on 4 inch by &8-inch cylindrical concrete specimens. We collectionconcrete cylinders' test result from different projects in our country. Then Compressive Strength of concrete data analysis and report writing. Cement used as binder materials and Sylhet sand was uses as fine aggregate. Comparison of compressive strength was made among cylinders made with stone chips.

The Curing period was 28 days. After required days curing, compressive strength test was performed. Finally, analysis the data was done to fine out the result. Molds 100 mm cylinder were used to mold the concrete cylinder. The mold was properly greased by using oil in order to prevent the adhesion of concrete. The concrete was cast using the molds and in accordance with BS1881: Part 108:1983. After 24 hours in the molds the specimens were removed and placed in water tank for 7, 14 and 28 days. Compressive strength test was performed on five setcylinderof each strength level after two hours of removal from the curing tank. This was done in accordance with BS EN 12390-3: 2009.

Flow chart:



1.3Objectives of the study

This research work is aimed at the overall study of the compressive strength of concrete mix for varieties of structures made with stone chips. These things lead to the following specific objectives:
(i) To identify concrete strength make with stone chips.
(ii) To identifyconcrete strength make with Sylhet sand.
(iii) To compare between the strength characteristics of concrete made with different source of aggregate.
(iv)To identify which properties of material concrete is high strength.

1.4 Background of the study

Most of construction projects in Bangladesh the people involved are not educated they all do the work based on a vast of practical experience but don't have any theoretical knowledge as a result they remain in a dark when they do a work that is faulty or deviate from design. On the other hand, concrete made with stone chips is very popularly used in the modern construction work such as pile, column, slab beam etc., due to greater strength of stone chips as compare to brick chips but it is less available and much costly than brick chips. But the stone chips collected from the demolished structural components are commonly being used in construction work. So this study is aimed primarily in generating the information of the strength different source stone chips.
In this thesis paper comparison is done between the strength test results of concrete made with stone chips.

1.5 Limitations

I. In this project could be performed using same mix proportions.
II. More cylinders should need to be experimented to get a more accuracy from this project.
III.Due to limitations of time we have measured the strength of cylinder only under 28 – days curing condition. 56 days & 91 days' strengths should also be measured for precision

1.6 Outline of the Thesis

In introduction chapter, background of the study is introduced along with brief preface of objective of the study is included. Background of the study is also included in this chapter.The Chapter II is described as a review on the researches, done the past**.** In the chapter III some description about strengthened its histories, cement, aggregates, different strengths tests, its past and present practices are given.

Third chapter, titled as experiment program included short descriptions of the materials brought for the research. Them the laboratory works such as determination of various properties of materials e.g.aggregate crushing value, aggregate impact value, unit weight and sieve analysis of fine aggregates are described.

In the results discussions chapter 4 relevant data analysis are presented.

In the final Chapter named conclusions and recommendations, results, obtained from the research are concisely presented with limitations methodology and recommendation for the further proceedings of results.

Chapter II

Literature Review

2.1 Literature review

A literature review of the effect of coarse aggregate grading compressive strength on the performance of Ordinary Portland cement concrete, use of Sylhet sand stone chips some proportioning methods is presented in this chapter.Concrete strength is determined by the characteristics of the mortar, coarse aggregate, and the mortar-aggregate interface. Aggregate generally occupies 70 to 80% of the concrete total volume, so it is normal to expect that aggregate properties (that is, shape, texture, mineralogy, maximum size, and strength) could determine concrete performance.

Since concrete is a large hardened mass of heterogeneous its properties are flanked by a large number of variables related of difference types and amount is of ingredients, the difference in mixing, transporting, placing and curing and the difference in specimen fabrication and test details. Because of the many variables methods of checking the quality of concrete must be employed. The usual procedure is to cast strength of the concrete in the structure. The reliability of this assumption should always be questioned because of different curing condition for the specimen and the structure, because poor workmanship in placing in the structure may not be reflected in tests of specimen and because poor testing procedures may provide false results. A pattern of tests should be used rather than placing reliance only a few tests to check uniformity and other characteristics of concrete. Statistical methods as given in ACI standard 214 should be used where large quantities concrete are involved.

Most concrete is proportioned for a given compressive strength at a given age and consequently a compressive test in most frequently used A 4 x 8 in the cylinder is most commonly required but the large cylinder is frequently used with mass concrete to be placed dams. Compressive strength may also be determined from modified cylinder tests made on beam specimens remaining after flexural tests and on cores of various size out from hardened concrete. The details of all strength tests are given in ASTM standards.

A number of research (Ayininuola and Olalusi, 2004; Ede, 2010 and 2011**[1])**have identified the use of substandard materials, particularly concrete as the leading cause of building collapse in Nigeria. Concrete failure still occurs despite adequate design and mix ratio. This advocates the existence of a breach in requirement for production of quality concrete. Previous works confirm the use of inferior concrete aggregates materials as among the causative elements of structural concrete failure in buildings. Gollu et al. (2016) mentioned unsuitable materials, unsound aggregate, reactive aggregate, and contaminated aggregate as part of the sources of concrete failure in buildings. Akinleye and Tijani (2017) stated that the use of low quality aggregates also affects the performance of asphalt concrete in Southwest Nigeria. Concrete will only become a quality material for construction when its constituents are properly sourced. The quality of aggregate can vary significantly due to the geographic location and environmental condition (Ajagbe et al.,2018).

Fowler and Quiroga (2003) reported that aggregates are expected to have important effects on the properties of concrete since they occupy 70-80% of it. Concrete aggregates and paste are the major factors that affect the strength of concrete (Shetty, 2005), the properties of aggregate greatly affect the durability and structural performance of concrete as aggregate with undesirable propertiescannot produce strong concrete (Neville, 2011). It is not necessarily true that aggregate whose properties all appear satisfactory will always make good concrete, and this is why the criterion of performance in concrete has to be used. According to Mehta and Monteiro (2001), the aggregates exercise a significant influence on strength, dimensional stability, and durability of concrete. Ajagbe and Tijani (2016) stated that assessment of concrete aggregate is vital to overcome the problem of structure collapse due to concrete failure in a certain environment. De Larrard (1999) and Dewar (1999) agreed that the aggregate source has an impact on concrete strength. Concrete strength is governingby aggregate size,

Compressive strength is the most significant mechanical property of concrete. It is obtained by measuring concrete specimen after curing for 28days. Some of the factors that influence the concrete strength include aggregate quality, cement strength, water content and water/cement ratio (Noorzaei et al., 2007)

The incessant collapse of building in Nigeria and its associated loss of life, loss of properties and injuries to the survivors of collapsed building incidents have become worrisome to the extent that the Council for the Regulation of Engineering Practice in Nigeria (COREN) has recently advocated for a death penalty for the owners of collapsed buildings. Poor quality of materials has accounted for more than 50% of causes of building collapse in Nigeria (Oke, 2011). Ajagbe et al. (2015) stated that provision of necessary information to local concrete industry and practitioners regarding the application of aggregates from different sources will prevent selection of substandard aggregates for concrete. According to Ayininuola and Olalusi (2004) and Ede (2011), the use of substandard materials for concrete is the leading cause of building collapse in Nigeria. Therefore, an examination of the strength of concrete made from aggregates obtained from different sources in Nigeria is required to overcome the problem of building collapse due to concrete failure.

The effects of aggregate type on mechanical properties were investigated under standard, atmospheric and high-pressure steam curing. The type of coarse aggregate is one of the most important factors affecting the behavior of high-strength concretesAjamu, S.O. and Ige, J.A., 2015. **[2]**Effect of coarse aggregate size on the compressive strength and the flexural strength of concrete beam. Concrete structures deflect, crack, and loose stiffness when subjected to external load. Loss of flexural strength of concrete is largely responsible for cracks in structure. In reinforced concrete structures, the mix proportions of the materials of the concrete and aggregate type determine the compressive strength while the composite action of concrete and steel reinforcement supplies the flexural strength.Qin, M., ZHANG, G., Zhan, W. and LI, S., 2018. Study on Mechanical Character of. Journal of Materials in Civil Engineering. **[3]**The mechanical character of natural Pebbles concrete and crushed stone concrete is studied in this study. The results show that compared with the aggregate concrete, the W/B can reduce the crushed stone concrete to a certain extent. The tension and compression ratio of pebble concrete is lower than that of crushed stone concrete, and the compressive strength of pebble concrete is less than that of crushed stone concrete

Akila, K., Abishanth, A., Bharani, S., Deepak, S. and Vishalakshi, K.P., 2018. Microstructural investigation of Different Types of Coarse Aggregate used in Concrete.**[4]**

As an important component of concrete, aggregate has significantly influence on normal and high performance concrete. In this paper, the effect of aggregate types on the strength properties of normal

and high performance concrete with target compressive strength of 20,40,60 MPa were investigated. Concrete specimens were prepared with four different types of aggregates, namely limestone, pink granite, grey granite and anchorite.

Gunasunthari, K. and Vishalakshi, K.P., Effect of different types of coarse aggregates on mechanical properties and fracture energy of concrete**. [5]**

As an important component of concrete, aggregate has significantly influence on normal and high performance concrete. In this paper, the effect of aggregate types on the strength properties and fracture energy of normal and high performance concrete

CHAPTER –III

EXPERIMENTAL INVESTIGATION

3.1 INTRODUCTION

This chapter includes the experiments required to determine the properties stone chips of concrete, processes of manufacture of concrete, and tests to determine the properties of fresh & hardened concrete.

3.2 THE PROPETIES OF INGREDIENTS OF CONCRETE

Following are the commonly used ingredients in concrete:

(a) Aggregate

(i) Fine aggregate (ii) Course aggregate

• Brick chips • Stone chips

(b) Binding Materials

(c) Water

3.2.1 AGGREGATES

Aggregate is important that the aggregate have good strength, durability and weather resistance, that its surface be free from impurities such as loam, silt and organic matter which may weakened the bond with the cement paste, and that no unfavorable chemical reaction take place between it and the cement.

Aggregate can be classified on the basis of size as

- Fine aggregate
- Course aggregate





Figure-2 Coarse aggregate Figure-1 Fine aggregate

3.2.1.1 TEST OF FINE AGGREGATE

It is the aggregate most of which passes through a 4.75mm IS sieve and contain only that much finer material as is permitted by the specifications. The fine aggregate that had been used in this study was locally available Sylhet sand. Fine aggregate test report given below;

3.2.1.2 SIEVE ANALYSIS OF FINE AGGREGATE

Sieve analysis of fine aggregate is used to determine the particle size distribution & fineness modulus of fine aggregate.The particle size of an aggregate as determine by sieve analysis is termed grading of aggregate.The test method for sieve analysis of fine aggregate conforms to the ASTM standard requirements of specification C136.The value of F.M. of Sylhet sand is given in the Table 3.1.



Figure -3 Sieve analysis

Table 3.1

Project	Properties	Value	Remarks
Model Mosque	Fineness Modulus	2.84	Sylhet sand
River Police Fari	Fineness Modulus	3.12	Sylhet sand
Farmers Training Center	Fineness Modulus	3.30	Sylhet sand
Abloom Design Dyeing	Fineness Modulus	2.56	Sylhet sand
Orient Trade International	Fineness Modulus	2.50	Sylhet sand

3.2.1.3 TEST FOR COARSE AGGREGATE OF STONE CHIPS

The aggregate most of which are retained on the 4.75mm IS sieve and contain only that much finer material as is permitted by the specifications. Generally, stone Chips used as coarse aggregate.

3.2.1.4Aggregate Impact Value Test of stone chips

The test method of coarse aggregate of stone chips conforms to the British standard (BS)requirements of specification BS 812(part 3) 1975. The aggregate impact valueof stone chips given below;

Table-3.2

Project	Types of aggregate	Sample size	Aggregate impact value %	Remarks
Model Mosque	Crushed stone (stone chips)	14 mm to 10mm	24	Bolagong stone
River Police Fari	Crushed stone (stone chips)	14 mm to 10mm	32	Bolagong stone
Farmers Training Center	Crushed stone (stone chips)	14 mm to 10mm	19	Bolagong stone
Abloom Dyeing Design	Crushed stone (stone chips)	14mm to 10mm	18	Dubai stone
Orient Trade International	(Crushed stone (stone chips)	14mm to 10 mm	20	Dubi stone

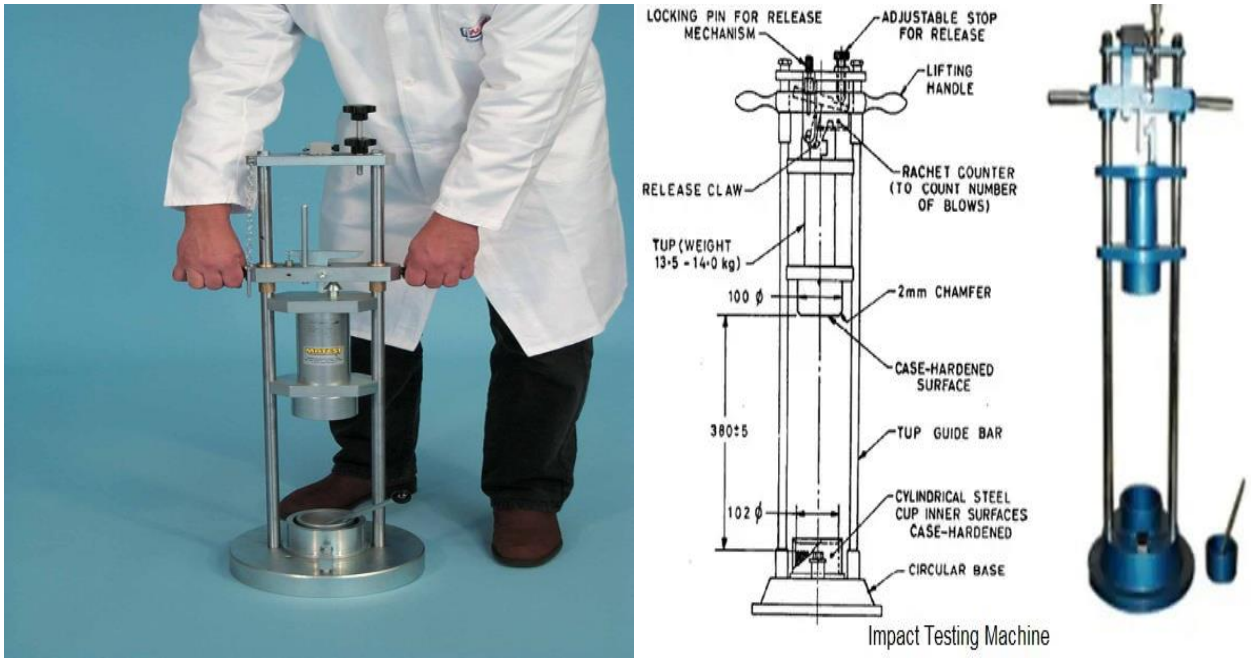


Figure-4 Aggregate impact value

3.2.1.5Aggregate crushing value of stone Chips

The test method for Aggregate crushing value of coarse aggregate of stone chips conforms to the British standard (BS)requirements of specification BS 812(part 3) 1975.

Aggregate crushing value is defined as the percentage by weight of the crushed (or finer) material obtained when the test aggregates are subjected to a specified load under standardized conditions, and the strength of the aggregate used in road construction is expressed by numerical index.

Table 3.3

Project	Types of aggregate	Sample size	Aggregate crushing value %	Remarks
Model Mosque	Crushed stone (stone chips)	20 mm to 14 mm	25	Bolagonj stone
River Police Fari	Crushed stone (stone chips)	20 mm to 14 mm	22	Bolagonj stone
Farmers Training Center	Crushed stone (stone chips)	20 mm to 14 mm	19	Bolagonj stone
Abloom Design Dyeing	Crushed stone (stone chips)	20 mm to 14 mm	21	Dubai stone
Orient Trade International	Crushed stone (stone chips)	20 mm to 14 mm	20	Dubai stone



Figure-5 **Aggregate crushing value**

3.2.1.6 UNIT WEIGHT OF COURSE AGGREGATE

Unit weight is the traditional terminology used to describe the property of concrete which is weight per unit volume. The test method for unit weight conforms to the ASTM standard requirements of specification C 29. Calculation: M= (G-T)/V M = Dry rounded bulk density T = Mass of the measure G = Mass of the aggregate plus measure V = Volume of the measure

The values of dry rounded unit weight of stone chips are given in the

Table 3.4

Project	Types of aggregate	Unit weight Kg/m3	Remarks
1 MM	Crushed stone (stone chips)	1580	Bolagong stone
2 RPF	Crushed stone (stone chips)	1580	Bolagong stone
3 FTC	Crushed stone (stone chips)	1570	Bolagong stone
4 ADD	Crushed stone (stone chips)	1590	Dubai stone
5 OTI	Crushed stone (stone chips)	1590	Dubai stone



Figure -6 UNIT WEIGHT OF COURSE AGGREGATE

3.2.2**CEMENT**

A cementing material is one which has the adhesive and cohesive properties necessary to bond inert aggregates into a solid mass of adequate strength, durability. For making structural concrete, so called hydraulic cements are used exclusively. Water is needed for the chemical process (hydration) in which the cement powder sets and hardens into solid mass. Various hydraulic cements have been developed, Portland cements, this was first patented in England in 1824, is by far the most common. In hydraulic cement that hardens by interacting with water and forms water resisting compound when it receives its final sets. It is highly durable and compressive strength in mortar and concrete. Its specific gravity ranges from 3.12 to 3.16 and weight 1208 kg/m3 (94 lb./ft3). Its measured fineness by particles size ranges from 10 microns to 50 microns. The specific gravity of cement used in this study was 3.15. The ORDINARY PORTLAND CEMENT (OPC) CEM-1 was used in this study.

3.2.3 **WATER**

Water is essential in the production of concrete in order to precipitate chemical with the cement, to wet the aggregate, and to lubricate the mixture for easy workability. Since the quality of water affect the strength it is necessary to go into the purely of water. In this study drinking water has been used in mixing of concrete.

3.3 CONCRETE MIX DESIGN

Most of the available mix design methods are based on empirical relationships, charts and graphs developed from extensive experimental investigations.

In this study ACI mix design method has been used. This method if based on the fact that for a given maximum size of fine aggregate, the water content determines the workability of mix. Using the steps of ACI method of mix proportioning, the mix proportion was found 1:1.5:3

3.4 PROCESS OF CASTING

Production of quality of concrete requires meticulous care exercised at every stage of manufacture of concrete. The various stages of casting of test specimens are:

(a) Batching

(b) Mixing

(c) Compacting

(d) Curing

(e) Finishing

3.4.1 BATCHING

Weigh batching is the correct method of measuring the materials. For important concrete, invariably, weigh batching system is should be adopted.

In this study weigh batching has been used for measuring the materials.

3.4.2 MIXING

In this study concrete mixing had been done by the tilting type mixer. Speed of the mixer was of about 15-20 revolution per minute. Mixing time was 5-6 minute.

3.4.3 COMPACTION OF CONCRETE

Compaction of concrete is the process adopted for expelling the entrapped air from the concrete. In the process of placing and mixing of concrete, air is likely to get entrapped in the concrete. If this air in not remove fully, the concrete losses strength considerably.

3.4.4 CURING OF CONCRETE

Fresh concrete gains strength the most rapidly during the first few days and weeks. Structural design is generally based on the 28-days strength, about 70 percent of which is reached at the end of the 1st week after placing. The final concrete strength depends greatly on the condition of moisture and temperature during this initial period. In this study cylinder curing 28 days properly.



Figure-7 Curing of concrete cylinder

3.4.5 METHODS OF CURING

The best method of water curing is immersion of specimens in water because it satisfies all the requirements of curing namely promotion of hydration, elimination of shrinkage and absorption of the heat of hydration. In the study, the specimen was submerged in water for 28 days.

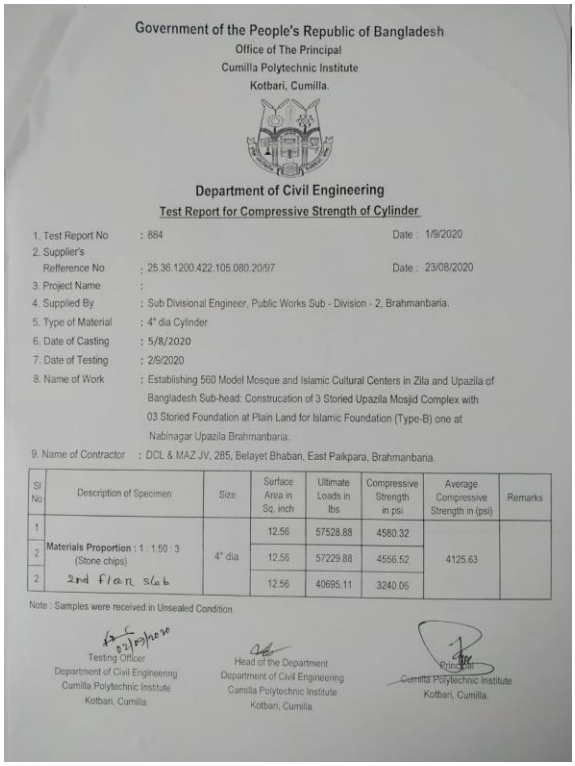
3.5 TESTS OF THE SPECIMENS OF CONCRETE

Testing of harden concrete plays an important role in controlling and confirming the qualityof concrete. In this study we collectfive (5) project cylinder test report which mix ratio 1:1.5:3 use 100% Sylhet sand, stone chips, OPC cement (CEM 1).These test data are given below;

- **Model Mosque Project, Nabinagar, Brahmanbaria.**

  Date of casting: 05 August 2020
  Table 3.5

Sl NO	Description of specimen	Size	Surface area in sq. inch	Ultimate loads in lbs.	Compressive strength in psi	Average compressive strength in psi
01	Materials proportion 1:1.5:3 (stone chips) 2nd floor slab	4" dia	12.56	57528.88	4580.32	4125.63
02			12.56	57229.88	4556.52	
03			12.56	40695.11	3240.06	



Government of the People's Republic of Bangladesh
Office of The Principal
Cumilla Polytechnic Institute
Kotbari, Cumilla.

Department of Civil Engineering
Test Report for Compressive Strength of Cylinder

1. Test Report No : 884 Date : 1/9/2020
2. Supplier's Refference No : 25.36.1200.422.105.080.20/97 Date : 23/08/2020
3. Project Name :
4. Supplied By : Sub Divisional Engineer, Public Works Sub - Division - 2, Brahmanbaria.
5. Type of Material : 4" dia Cylinder
6. Date of Casting : 5/8/2020
7. Date of Testing : 2/9/2020
8. Name of Work : Establishing 560 Model Mosque and Islamic Cultural Centers in Zila and Upazila of Bangladesh Sub-head: Construcation of 3 Storied Upazila Mosjid Complex with 03 Storied Foundation at Plain Land for Islamic Foundation (Type-B) one at Nabinagar Upazila Brahmanbaria.
9. Name of Contractor : DCL & MAZ JV, 285, Belayet Bhaban, East Paikpara, Brahmanbaria.

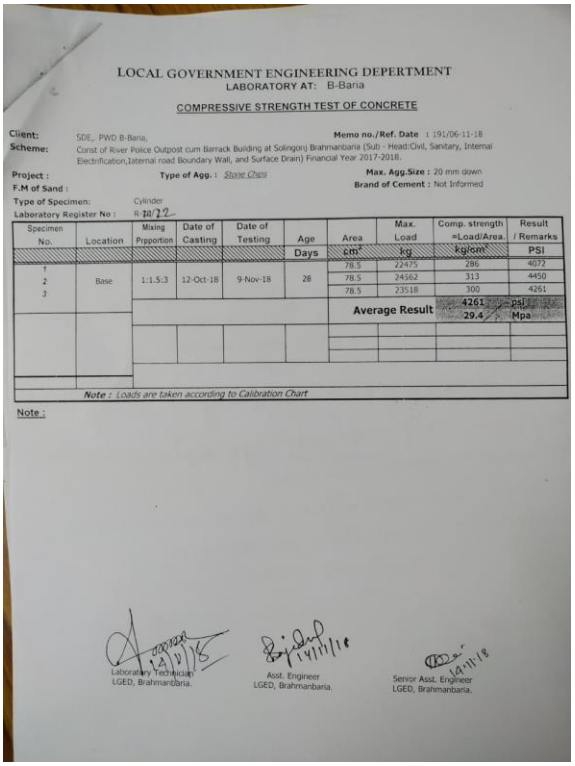
Sl No	Description of Specimen	Size	Surface Area in Sq. inch	Ultimate Loads in lbs	Compressive Strength in psi	Average Compressive Strength in (psi)	Remarks
1	Materials Proportion : 1 : 1.50 : 3 (Stone chips)	4" dia	12.56	57528.88	4580.32	4125.63	
2			12.56	57229.88	4556.52		
3	2nd Flor Slab		12.56	40695.11	3240.06		

Note : Samples were received in Unsealed Condition

Testing Officer
Department of Civil Engineering
Cumilla Polytechnic Institute
Kotbari, Cumilla.

Head of the Department
Department of Civil Engineering
Cumilla Polytechnic Institute
Kotbari, Cumilla.

Principal
Cumilla Polytechnic Institute
Kotbari, Cumilla.



LOCAL GOVERNMENT ENGINEERING DEPERTMENT
LABORATORY AT: B-Baria

COMPRESSIVE STRENGTH TEST OF CONCRETE

Client: SDE, PWD B-Baria, Memo no./Ref. Date : 191/06-11-18
Scheme: Const of River Police Outpost cum Barrack Building at Solingonj Brahmanbaria (Sub - Head:Civil, Sanitary, Internal Electrification,Internal road Boundary Wall, and Surface Drain) Financial Year 2017-2018.
Project : Type of Agg. : Stone Chips Max. Agg.Size : 20 mm down
F.M of Sand : Brand of Cement : Not Informed
Type of Specimen: Cylinder
Laboratory Register No : R-20/22

Specimen No.	Location	Mixing Proportion	Date of Casting	Date of Testing	Age Days	Area cm²	Max. Load kg	Comp. strength =Load/Area. kg/cm²	Result / Remarks PSI
1	Base	1:1.5:3	12-Oct-18	9-Nov-18	28	78.5	22475	286	4072
2						78.5	24562	313	4450
3						78.5	23518	300	4261
						Average Result		4261 psi / 29.4 Mpa	

Note : Loads are taken according to Calibration Chart

Note :

Laboratory Technician
LGED, Brahmanbaria.

Asst. Engineer
LGED, Brahmanbaria.

Senior Asst. Engineer
LGED, Brahmanbaria.

Model Mosque test report River Police Fari test report

- **River Police Fari, Solimgang, Brahmanbarai.**

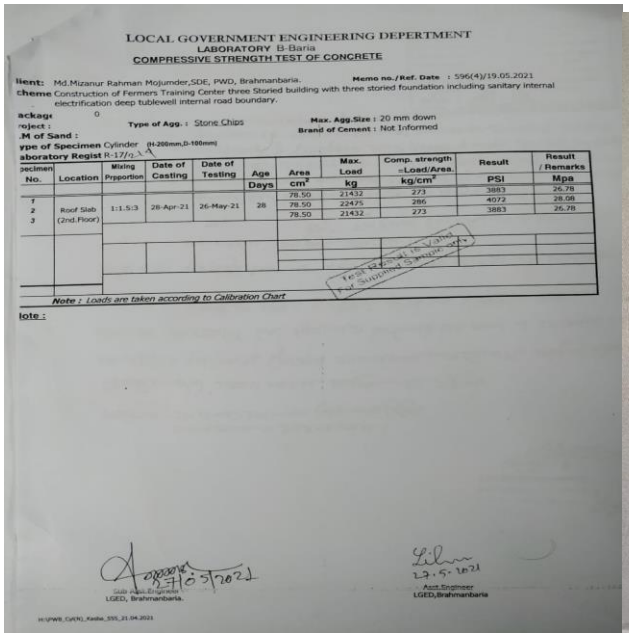
Date of casting: 12 October 2018
Table 3.6

Sl NO	Description of specimen	Size	Surface area in sq. cm	Ultimate loads in kg	Compressive strength in psi	Average compressive strength in psi
01	Materials proportion 1:1.5:3 (stone chips) Base	4" dia	78.5	22475	4072	4261
02			78.5	24562	4450	
03			78.5	23518	4261	

❖ Farmers Training Center,Kasba, Brahmanbaria.

Date of casting: 28 April 2021
Table 3.7

Sl NO	Description of specimen	Size	Surface area in sq. cm	Ultimate loads in kg	Compressive strength in psi	Average compressive strength in psi
01	Materials proportion 1:1.5:3	4" dia	78.5	21432	3883	3946
02			78.5	22475	4072	
03			78.5	21432	3883	



LOCAL GOVERNMENT ENGINEERING DEPERTMENT
LABORATORY B-Baria
COMPRESSIVE STRENGTH TEST OF CONCRETE

Client: Md.Mizanur Rahman Mojumder,SDE, PWD, Brahmanbaria. Memo no./Ref. Date : 596(4)/19.05.2021
Scheme Construction of Fermers Training Center three Storied building with three storied foundation including sanitary internal electrification deep tublewell internal road boundary.
Package : 0
Project : Type of Agg. : Stone Chips Max. Agg.Size : 20 mm down
M of Sand : Brand of Cement : Not Informed
Type of Specimen Cylinder (H-200mm,D-100mm)
Laboratory Regist R-17/0.2

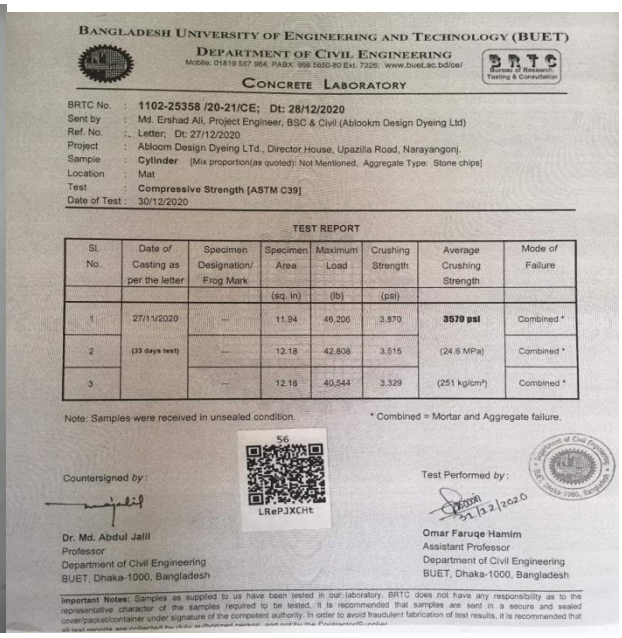
Specimen No.	Location	Mixing Proportion	Date of Casting	Date of Testing	Age Days	Area cm²	Max. Load kg	Comp. strength =Load/Area kg/cm²	Result PSI	Result / Remarks Mpa
1	Roof Slab (2nd.Floor)	1:1.5:3	28-Apr-21	26-May-21	28	78.50	21432	273	3883	26.78
2						78.50	22475	286	4072	28.08
3						78.50	21432	273	3883	26.78

Note : Loads are taken according to Calibration Chart

Note :

Sub Asst. Engineer
LGED, Brahmanbaria.

Asst.Engineer
LGED,Brahmanbaria



BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)
DEPARTMENT OF CIVIL ENGINEERING
Mobile: 01819 557 964; PABX: 966 5650-80 Ext. 7226; www.buet.ac.bd/ce/
CONCRETE LABORATORY

BRTC No. : 1102-25358 /20-21/CE; Dt: 28/12/2020
Sent by : Md. Ershad Ali, Project Engineer, BSC & Civil (Ablookm Design Dyeing Ltd)
Ref. No. :, Letter; Dt: 27/12/2020
Project : Abloom Design Dyeing LTd., Director House, Upazilla Road, Narayangonj.
Sample : Cylinder [Mix proportion(as quoted): Not Mentioned, Aggregate Type: Stone chips]
Location : Mat
Test : Compressive Strength [ASTM C39]
Date of Test : 30/12/2020

TEST REPORT

Sl. No.	Date of Casting as per the letter	Specimen Designation/ Frog Mark	Specimen Area (sq. in)	Maximum Load (lb)	Crushing Strength (psi)	Average Crushing Strength	Mode of Failure
1	27/11/2020	---	11.94	46,206	3,870	3570 psi	Combined *
2	(33 days test)	---	12.18	42,808	3,515	(24.6 MPa)	Combined *
3		---	12.18	40,544	3,329	(251 kg/cm²)	Combined *

Note: Samples were received in unsealed condition. * Combined = Mortar and Aggregate failure.

Countersigned by:

Dr. Md. Abdul Jalil
Professor
Department of Civil Engineering
BUET, Dhaka-1000, Bangladesh

Test Performed by:
27/12/2020

Omar Faruqe Hamim
Assistant Professor
Department of Civil Engineering
BUET, Dhaka-1000, Bangladesh

Important Notes: Samples as supplied to us have been tested in our laboratory. BRTC does not have any responsibility as to the representative character of the samples required to be tested. It is recommended that samples are sent in a secure and sealed cover/packet/container under signature of the competent authority. In order to avoid fraudulent fabrication of test results, it is recommended that

Farmers Training Center test report

Abloom Design Dyeing Ltd test report

❖ Abloom Design Dyeing LTD. Narayangang.

Date of casting: 27 November 2020

Table 3.8

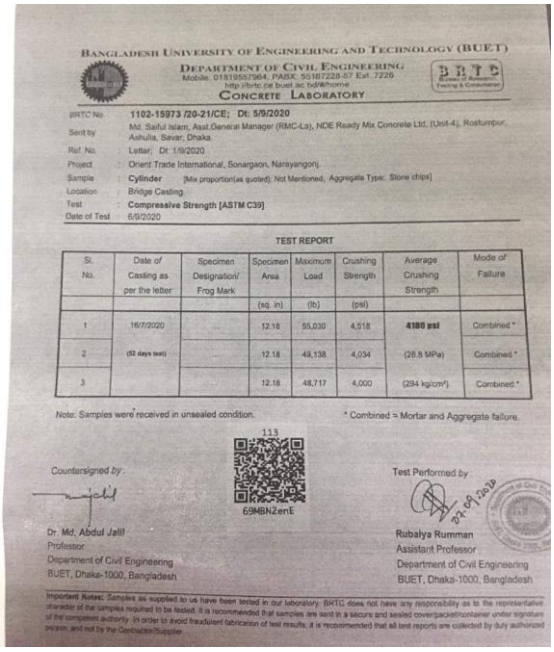
Sl No	Description of specimen	Size (inch)	Area (in^2)	Ultimate loads (Ib)	Compressive strength (Psi)	Average compressive strength(Psi)
01	Materials proportion 1:1.5:3 (stone chips)	4	11.94	46206	3870	3570
02			11.94	42808	3515	
03			11.94	40544	3329	

❖ Orient Trade International, Sonargoan,Narayangonj.

Date of casting: 16 July 2020

Table 3.9

Sl No	Description of specimen	Size (inch)	Area (in2)	Ultimate loads (Ib)	Compressive strength (Psi)	Average compressive strength(Psi)
01	Materials proportion 1:1.5:3 (stone chips)	4" dia	12.18	55030	4518	4180
02			12.18	49138	4034	
03			12.18	48717	4000	



BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

CONCRETE LABORATORY

BRTC No. : 1102-15973 /20-21/CE; Dt: 5/9/2020

Sent by : Md. Saiful Islam, Asst.General Manager (RMC-La), NDE Ready Mix Concrete Ltd. (Unit-4), Rosulpur, Ashulia, Savar, Dhaka.

Ref. No. : Letter; Dt: 1/9/2020

Project : Orient Trade International, Sonargaon, Narayangonj.

Sample : Cylinder [Mix proportion(as quoted): Not Mentioned, Aggregate Type: Stone chips]

Location : Bridge Casting.

Test : Compressive Strength [ASTM C39]

Date of Test : 6/9/2020

TEST REPORT

Sl. No.	Date of Casting as per the letter	Specimen Designation/ Frog Mark	Specimen Area (sq. in)	Maximum Load (lb)	Crushing Strength (psi)	Average Crushing Strength	Mode of Failure
1	16/7/2020 (52 days test)		12.18	55,030	4,518	4180 psi	Combined *
2			12.18	49,138	4,034	(28.8 MPa)	Combined *
3			12.18	48,717	4,000	(294 kg/cm²)	Combined *

Note: Samples were received in unsealed condition.

* Combined = Mortar and Aggregate failure.

113

69MBNZenE

Countersigned by :

Dr. Md. Abdul Jalil
Professor
Department of Civil Engineering
BUET, Dhaka-1000, Bangladesh

Test Performed by :

Rubaiya Rumman
Assistant Professor
Department of Civil Engineering
BUET, Dhaka-1000, Bangladesh

Important Notes: Samples as supplied to us have been tested in our laboratory. BRTC does not have any responsibility as to the representative character of the samples required to be tested. It is recommended that samples are sent in a secure and sealed cover/packet/container under signature of the competent authority. In order to avoid fraudulent fabrication of test results, it is recommended that all test reports are collected by duly authorized person, and not by the Contractor/Supplier.

Orient Trade International test report

CHAPTER -IV

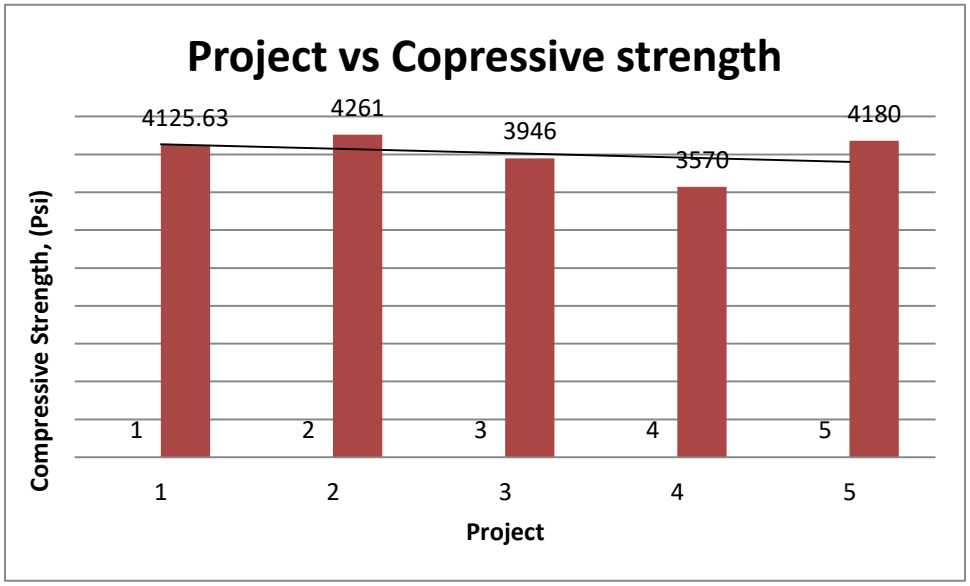
TEST RESULTS AND ANALYSIS

4.1 INTRODUCTION

It is very important to control and ensure the strength of concrete in RCC work. To perform this study, we collected BUET, LGED, Polytechnic Institute test reports of five project cylinder samples of different place in our country.

Test result of the concrete specimen. Table 4.1

Project	Cylinder Size	Average Compressive strength (Psi)	Remarks
Model Mosque	4x8	4125.63	OPC CEM-1
River Police Fari	4x8	4261	OPC CEM-1
Farmers Training Center	4x8	3946	OPC CEM-1
Abloom Design Dyeing LTD	4x8	3570	OPC CEM-1
Orient Trade International	4x8	4180	OPC CEM-1



4.2 TEST RESULT ANALYSIS

The average Compressive strength of the sample are 4125.63 psi, 4261 psi, 3946 psi, 3570 psi and 4180 psi. The highest value is 4262 psi.

The materials in this sample are below:

Materials	Description
Cement	OPC, CEM-1
Sand	100 % Sylhet sand. FM=3.12
Stone Chips	Crushed stone,aggregate impact value 32, aggregate crushing value 22 unit weight 1580, Size: 20 mm down , Bolagonj

CHAPTER-V

CONCLUSION AND RECOMMENDATION

5.1 GENERAL

This chapter was set out to represent the conclusion of this project. Lastly, some testing, investigations and studies were also recommended after the conclusion, to further the strength characteristics of stone chips aggregates concrete for the application in high strength concrete.

5.2 CONCLUSION

In this study we determined which type mechanical properties of material we used to achieve high strength concrete.

In this study we have collected data from different source of government project, though the mix proportion were same for all project but some cases the compressive strength were different.

Project I, II and V are similar results about 4000 Psi, but rest of two were not same.

Cement – CIM-1, OPC

Sand- FM 3.12 Sylhet sand

Stone Chips -20mm down, Bolagonj

5.3 RECOMMENDATION

This research can be done many following ways:

1. Fine Aggregate Variation Such as Local Sand and Sylhet Sand may vary with F.M can be considering for the strength
2. Effects of Coarse and Fine Aggregates such specific gravity, SSD, Etc. may be consider for determining the strength of the specimen.
3. Different mixing ration can be considering for different strength analysis.

REFERENCE

[1]Ayininuola and Olalusi, 2004; Ede, 2010 and 2011 Nigeria

[2]Ajamu, S.O. and Ige, J.A., 2015.Effect of coarse aggregate size on the compressive strength and the flexural strength of concrete beam. Journal of Engineering Research and Applications, 5(4), pp.2248-2267.

[3]Qin, M., ZHANG, G., Zhan, W. and LI, S., 2018. Study on Mechanical Character of. Journal of Materials in Civil Engineering 8 (2), 70-76, 1996

[4]Akila, K., Abishanth, A., Bharani, S., Deepak, S. and Vishalakshi, K.P., 2018. Microstructural investigation of Different Types of Coarse Aggregate used in Concrete. Concrete Research Letters 3 (2), 452-458, 2012

[5]Gunasunthari, K. and Vishalakshi, K.P., EFFECT OF DIFFERENT TYPES OF COARSE AGGREGATES ON MECHANICAL PROPERTIES AND FRACTURE ENERGY OF CONCRETE**.**