AN INVESTIGATION ON PROPERTIES OF COURSE AGGREGATE AS TRANSPORTATION MATERIALS

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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

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Section: (11C)

Semester-Year (Fall-2021)

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BOARD OF EXAMINERS

The thesis titled "**AN INVESTIGATION ON PROPERTIES OF COURSE AGGREGATE AS TRANSPORTATION MATERIALS**" submitted by MasumShahriar, Md. Shiful Islam, Md. Sobuj Uddin, Amit Paul, Bidesh Chandra Roy and Hasan Ali, Student No: 6(six) has been accepted as satisfactory in partial fulfillment of the requirement for the degree of Bachelor of Science in Civil Engineering on Date-of-Defense.

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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.

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Dedicated

to

“FATHER OF NATION”

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ABSTRACT

The aggregates to be used in road construction, particularly the road aggregates used in the wearing course of the pavement should be sufficiently strong resistant to crushing to withstand the high stresses induced due to heavy traffic wheel loads. Specific gravity of an aggregate is basic prime value for any type of road construction. The composition, shape, and size of the aggregate all have significant impact on the workability, durability, strength, weight, and shrinkage of the concrete. Coarse Aggregate can also influence the appearance of the road surface, which is an especially important consideration in road construction. Coarse Aggregate plays an important role in pavement construction. In order to decide the suitability of the Coarse aggregate for use in pavement construction, following tests are carried out: Aggregate Impact Value Test, Aggregate Crushing Value Test, Elongation & Flakiness test.

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CHAPTER 1
INTRODUCTION

1.1 Background and Motivations

Although we are gaining awareness towards environmental conservation, we can hardly imagine a concrete free construction. While considering environmental conservation, cement is the only man-made ingredient in concrete. All other materials are naturally available. Aggregates form an integral part of concrete wherein coarse aggregates are mainly responsible for imparting strength and durability to concrete1-3. Concrete of any grade and type requires coarse aggregates, hence its importance in concrete can never be underestimated. Study of Physical properties of aggregates is being emphasized upon while using coarse aggregates in any concrete. An effort has been made in this manuscript to study in detail the same procured from materials were collected from whole sell market Gabtoli having a source of these aggregates.

1.2 Research Objectives and Overview

The main objectives of the study are given blow

1. To obtain specific gravity and absorption capacity of the fine aggregate.
2. To obtain specific gravity and absorption capacity of the coarse aggregate

1.3 Organization of the thesis

This thesis consists of following five chapters**.**

Chapter 1: Introduction and Objective: This chapter introduces the topic of the Study along with significance and objectives for the study.

Chapter 2: Literature Review: Provides information of the relevant details on surface Aggregate quality, reuse, concrete manufacturing and guideline.

Chapter 3: Methodology: Provides information on source selection, raw surface Aggregate sampling, experimental setup, sample collection, materials collection and Monitoring along with the methods**.**

Chapter 4: Results and Discussion: Analyzing the data collected and discusses the results.

Chapter 5: Concludes the study by providing the findings along with some limitations. This Chapter also provide future recommendations of the study.

CHAPTER 2

Literature Review

2.1 Introduction

Aggregate is a granular material, such as sand gravel, crushed stone, crushed hydraulic-cement concreting medium to procedure either concrete or mortar. Coarse aggregate is the portion of the concrete which is made up of the larger embedded in the mix. Concrete contains three ingredients; Water, cement, and aggregate. That aggregate is made of fine sand and coarse gravel. The particles that ate predominantly retained on the 4.75 mm (No.4) sieve and will pass through 3 inch screen, are called coarse aggregate. The coarse aggregate, the more economical the mix. Larger pieces offer less surface area of the particles than an equivalent volume of small pieces. Use of the largest permissible maximum size of coarse aggregate permits a reduction in cement and water requirements. Using aggregate larger than maximum size of coarse aggregates can result in interlock and form arches or obstructions within a concrete form. That allows the area below to become a void, or at best, to become filled with finer particles of sand and cement only and results in a weakened area.

2.2 Coarse Aggregate

Coarse aggregates are integral part of many construction applications, sometimes used on their own such as a granular base placed under a slab or pavement, or as a component in a mixture, such as asphalt or concrete mixtures. Coarse aggregates are generally categorized as rock larger than a standard No.4 sieve (3/16 inches) and less than 2 inches. Coarse aggregate is mined from rock quarries or dredged from river beds, therefore the size, shape, hardness, texture and many other properties can vary greatly based on location. Even materials coming from the same quarry or pit and type of stone can vary greatly. Coarse aggregate can be characterized as either smooth or rounded (such as river gravel) or angular (such as crushed stone). Because of this variability, test methods exist to characterize the most relevant characteristics, since exact identification would be impossible. Several key characteristics that are

frequently used to describe the behavior of coarse aggregates include relative density (or specific gravity), bulk density, and absorption.

2.3 Types of Aggregate

Gravel aggregates are used for foundations and concretes, as well as products Made of reinforced concrete and materials used in road construction. There are two types of gravel, aggregates, and scrabbled stone – regular, natural or crushed.

The sub-grade material should be clean and free from organic matter and should be able to be compacted by roller, to form stable sub-base. The material should have the following characteristics.

2.4 Content

The key literature review can be divided into sub-sections. This chapter should clarify the motivation and importance of the thesis work. Section 2.1 describes what should be included in the literature review.

2.5 Summary

Every chapter, except the Introduction and Conclusions chapters, may contain a summary. The summary section should summarize key points of the chapter and act as a bridge between the current chapter and the following chapter. The summary section can be 4-5 sentences long.

CHAPTER 3

Methodology

3.1 Introduction

The details of coarse aggregate samples and others materials collection and preparation associated with this study are presented in this chapter. Aggregate as sample and other materials were collected from whole sell market Gabtoli.

3.2 Methodology Overview.

Aggregate Issue:

3.2.1 Selection of coarse aggregate:
Our workout is to identify the aggregate quality and its effect on road construction. These considerations are considered to be selecting coarse aggregate acting on road. In order to decide the suitability of the aggregate for use in pavement construction, following.

- ✓ Crushing test
- ✓ Abrasion test
- ✓ Impact test
- ✓ Soundness test
- ✓ Shape test
- ✓ Specific gravity and water absorption test
- ✓ Bitumen adhesion test.

3.2.2 Course Aggregate sources selection and sample collection: Aggregate as sample and other materials were collected from whole sell market Gabtoli.

3.2.3 Laboratory Test-

Aggregate Crushing Value:

- ❖ The aggregates sample is prepared by first sieved the aggregate and obtain the portion passing 14.0mm test sieve and retained on the 10.0mm test sieve.The aggregates are filled into the Smaller steel cylinder in three layers. Each layer of aggregate is temped for25 times using a temping rod. The temping Rod is

adjusted to fall freely from about 50mm above the aggregate surface and it Must be well uniformly spread over.

- The surface is leveled with the temping rod As a straight edge to prepare the sufficient

  Amount of aggregate on the top layer.
- The aggregate is put into the bigger mould And applied 25 times tamping for each layer.

- The cylinder and aggregates are weighted and the data is recorded.
- The sample in the apparatus is assembled and the hammer is released to fall freely on the Aggregates from a fixed vertical height of 380 ± 5mm the sample is subjected to at total of manual controlled 15 blows.
- The aggregates sample tested is removed from the mould and sieved through 2.36mm sieve opening.
- The aggregate fraction passing the 2.36mmtest sieve is weighted.
- The test for the same batch of aggregate sample is repeated twice.

Aggregate Impact Value:

- The aggregate passing through14mm IS sieve and retained on 10 mm& 2.36 IS sieve is selected for standard test.
- The should be in surface dry condition before testing.
- The cylindrical measure is filled by the taste sample of aggregate in three layers of approximately equal depth, each layer being temped 25 times by the rounded end of the temping rod.
- After the tired is temped, using the temping rod straight edge levels at the aggregate of the top of the cylindrical measure. About 6.5 kg aggregate is required for preparing two testes samples. The taste sample thus taken is than weighted. The sample weight of the sample is taken in the repeat taste.
- The cylinder of the taste apparatus is placed in position on the base plate; One third of the taste sample is plashed in these cylinders and temped 25 times by the temping Rod.
- Similarly others two part of the taste specimen are add each layer being subjected to 25 bowls.

Elongation & Flakiness Index:

The sample is sieved with the sieved is mentioned in above. A Minimum of 200 Pecs of each friction to be tested and taken and weighted. In order to separate flaky materials, each frictions than gauged for thickness on thickness gauge. The amount of flaky materials passing the gauge is weighted to an accuracy of at least 0.1 percent of the taste sample.

3.3 Summary

The aggregates used for the surface course of pavement should be strong enough to withstand the stresses due to wheel loads including the steel tyre of loaded bullock carts.

CHAPTER 4

Results and Discussion

4.1 Introduction

In this section, we explore the mysteries of aggregation, adding things up. We start by considering how numbers aggregate, focusing on the Central Limit Theorem. We then turn to adding up rules. Here we see how individual preferences can be rational, but the aggregates need not be. In this paper, there is no inefficiency due to diversification, and any observed diversification discount must therefore be independent of inefficiencies of that nature. Lastly, the lab setting allows me to understand the conditions under which individual behavior described above leads to aggregate market data that show the diversification discount. In my experiments, participants trade with each other in a market setting over a number of periods. Each period consists of 5 intervals. Thereby operational zing the option to move resources between divisions.

4.2 Specific Aim 1:

4.2.1 Result of Aggregate Crushing Value:

Aggregate Name	Load (Approximate)	Aggregate Value	Return Value	Result
Torsha (Indian)	400	589 gm	536gm	8.99%
Black L.C	400	584 gm	559gm	4.28%
Volagonj	400	577 gm	508gm	11.96%
Bhutan	400	618 gm	567gm	8.25%

Standrad Data Sheet:

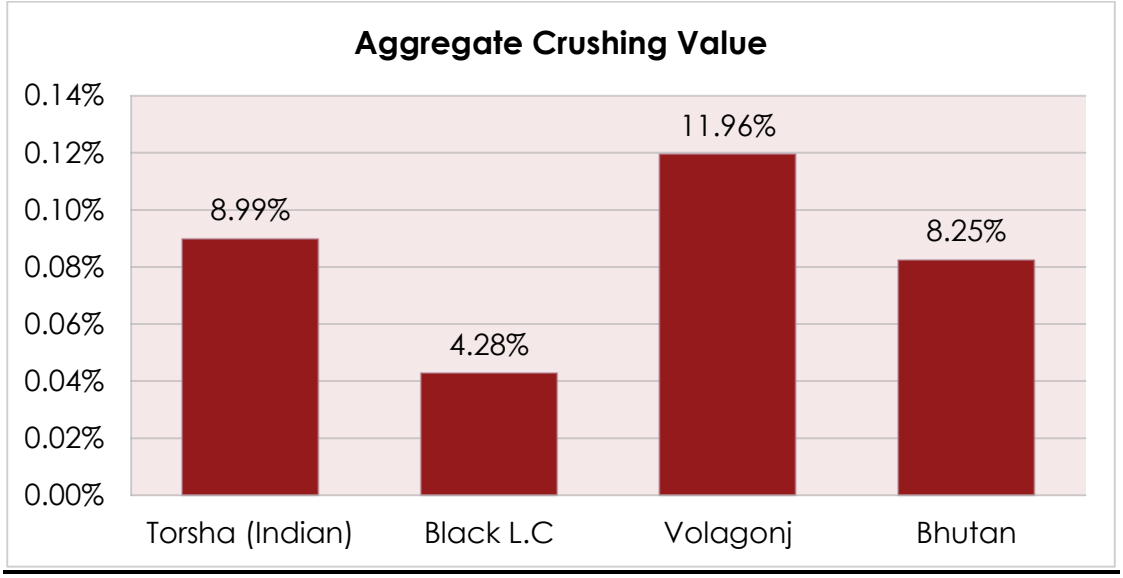


Figure: 4.2.1

4.2.2 Result of Aggregate Impact Value:

Aggregate Name	Load (Approximate)	Result
Black Stone	400	91%
Bhutan	400	95%
Torsha (Indin)	400	88%
Volagonj	400	91.74%

Standard Data Chart:

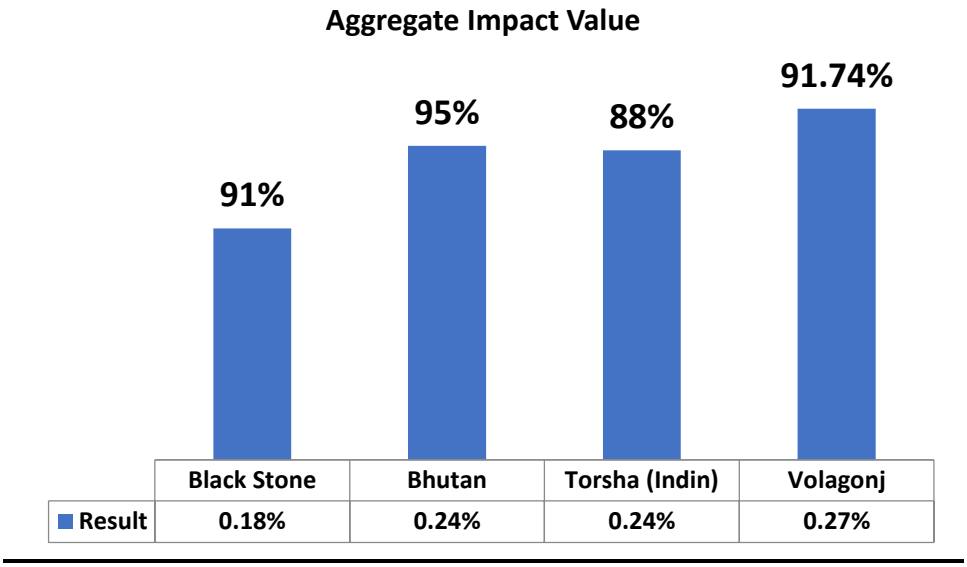


Figure: 4.2.2

4.2.3 Elongation & Flaky Test:

Elongation: Measure of the ductility of a material as determined by a tension test, it is the increase in the gauge-length of a test specimen after fracture divided by its original gauge-length. Higher elongation means higher ductility.

Flaky: The aggregate is said to be flaky when its least dimension is less than 3/5th (or 60%) of its mean dimension. Mean dimension is the average size through which the particles pass and the sieve size on which these are retained. For example, mean size of the particles passing through 25 mm sieve and retained on 20 mm sieve is (20+25)/2=22.5 mm. if the least dimension is less than 3/5 x (22.5) = 13.5 mm, then the material is classified as flaky. Flaky aggregate tends to be oriented in one plane which affects the durability.

4.2.3(a) Elongation &Flaky: Volagonj

Sieve Size: 63 mm, 50mm, 37.5mm28mm, 20mm, 14mm, 10mm, 6.3mm

Standard Table:

Sieve Size	Weight of Aggregate	Flaky	Elongation
63	0	0	0
50	0	0	0
37.5	0	0	0
28	0	0	0
20	539	70	92
14	252	7	76
10	10	5	5
6.3	0	0	0
	W=801gm	W1=82gm	WL=173

4.2.3(b) Elongation & Flaky: Torsha (Indian)

Sieve Size: 63 mm, 50mm, 37.5mm28mm, 20mm, 14mm, 10mm, 6.3mm

Standard Table:

Sieve Size	Weight of Aggregate	Flaky	Elongation
63	0	0	0
50	0	0	0
37.5	0	0	0
28	0	0	0
20	160	40	20
14	510	130	150
10	130	20	110
6.3	5	5	5
	W=805gm	W1=195gm	WL=285gm

4.2.3(c) Elongation & Flaky: Bhutan:

Sieve Size: 63 mm, 50mm, 37.5mm28mm, 20mm, 14mm, 10mm, 6.3mm

Standard Table:

Sieve Size	Weight Of Aggregate	Flaky	Elongation
63	0	0	0
50	0	0	0
37.5	0	0	0
28	117	88	0
20	347	0	84
14	144	7	61
10	2	2	2
6.3	0	0	0
	W=610gm	W1= 97gm	WL=147gm

4.2.3(d) Elongation & Flaky: Black L.C :

Sieve Size: 63 mm, 50mm, 37.5mm, 28mm, 20mm, 14mm, 10mm, 6.3mm.

Standard Table :

Sieve Size	Weight of Aggregate	Flaky	Elongation
63	0	0	0
50	0	0	0
37.5	33	0	0
28	178	43	33
20	365	38	95
14	732	58	208
10	166	10	102
6.3	0	3	0
	W=1500gm	W1=152gm	WL=438gm

Standard Data Chart of Elongation:

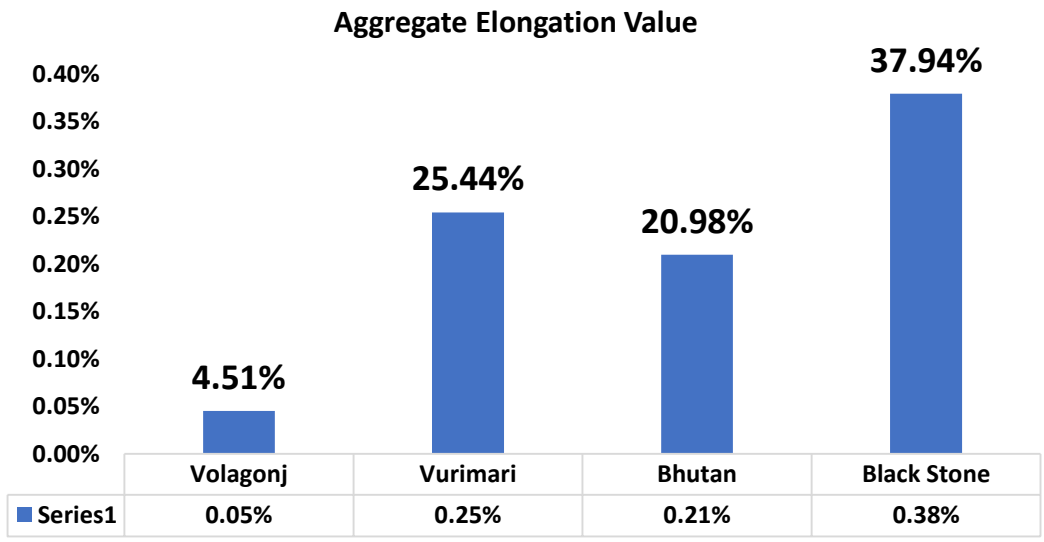


Figure: 4.2.3 (a)

Standard Data Chart of Flakiness:

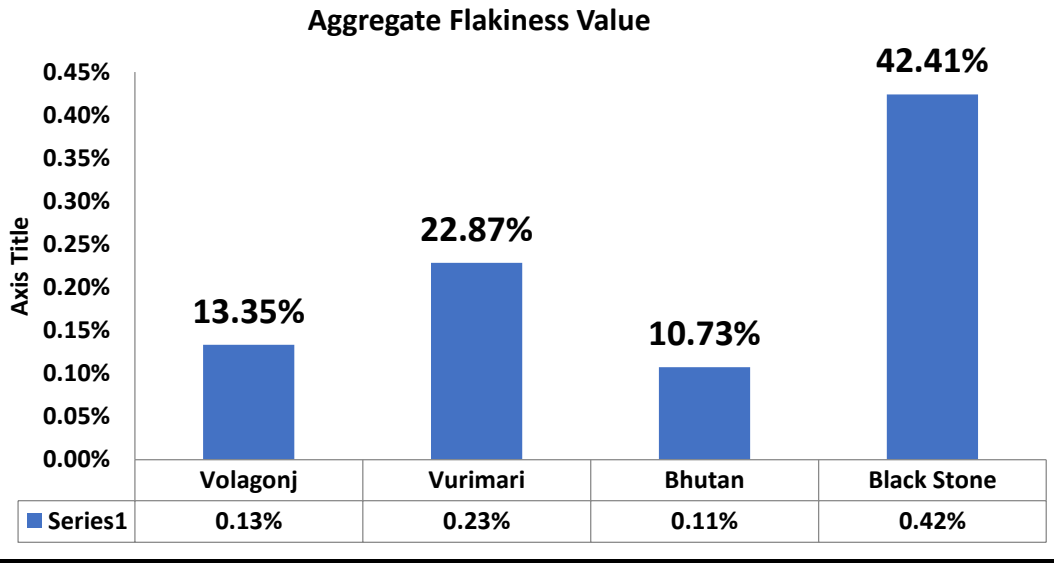
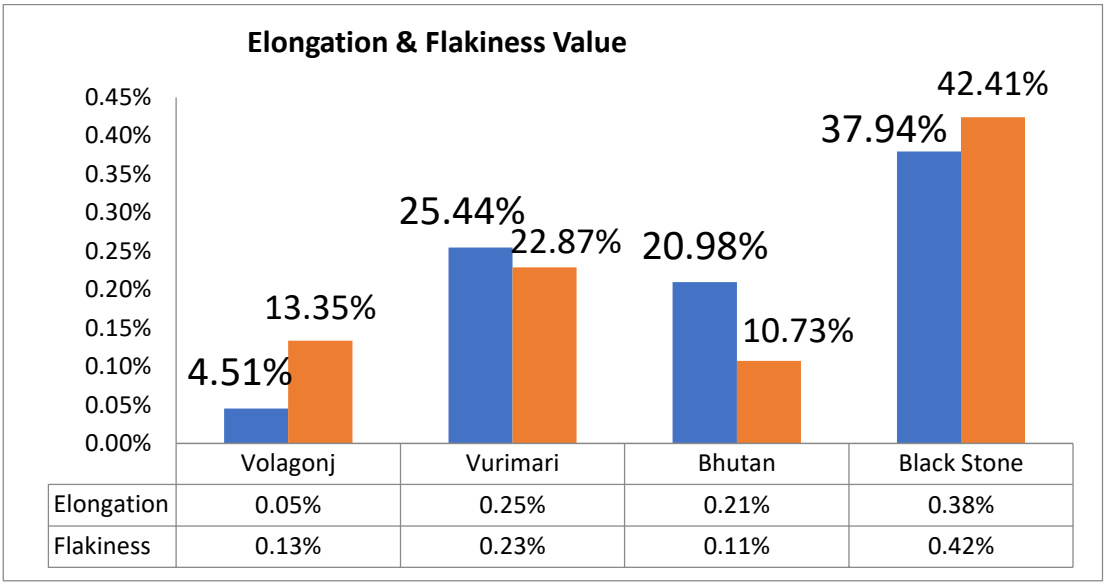


Figure: 4.2.3 (b)

Standard Data Chart of Elongation & Flakiness:



	Volagonj	Vurimari	Bhutan	Black Stone
Elongation	0.05%	0.25%	0.21%	0.38%
Flakiness	0.13%	0.23%	0.11%	0.42%

Figure: 4.2.3 (c)

4.3 Discussion

The following conclusions can be drawn on the basis of this study

- Black stone and Bhutan stone are exceptionally strong having Aggregate Impact value less than 10.
- Black stone possess aggregate crushing values less than 20 and can be termed as the best aggregates in Bangladesh as long as the crushing strength is concerned.
- All the four Aggregates possess least flakiness and elongation index.

CHAPTER 5

Conclusions and Future Works

5.1 Conclusions

- All the four aggregates have good quality but in all of them Black stone show significant value in the entire test.
- Although, Volagonj stone our local stone and its cost also less than others comparatively. The time and cost involved in the transportation of these aggregates always cause significant increase in the overall cost of the construction project.
- Selection of aggregates for any construction must be based on the applicability

5.2 Future Recommendations:

- In future, must check the compressive strength from cylinder test.
- Also can check creep and shrinkage of concrete.
- Due to unavailability in the laboratory abrasion test cannot be done.

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