

## **DIFFERENT PROPERTIES OF COX'S BAZAR SEA SAND**

**A. S. M. Fahad Hossain<sup>\*1</sup>, Md. Nayem Hasan<sup>2</sup>, Md. Tauhidul Islam Akanda Tonmoy<sup>3</sup> and Moumita Khan Raka<sup>4</sup>**

<sup>1</sup>*Assistant Professor, Department of Civil Engineering, Ahsanullah University of Science and Technology (AUST), Bangladesh, e-mail: fahadrubel@gmail.com*

<sup>2</sup>*Graduate Student, Department of Civil Engineering, Ahsanullah University of Science and Technology (AUST), Bangladesh, e-mail: nayem16641664@gmail.com*

<sup>3</sup>*Graduate Student, Department of Civil Engineering, Ahsanullah University of Science and Technology (AUST), Bangladesh, e-mail: tonmoyaust744@gmail.com*

<sup>4</sup>*Graduate Student, Department of Civil Engineering, Ahsanullah University of Science and Technology (AUST), Bangladesh, e-mail: khanmoumitaraka@gmail.com*

***\*Corresponding Author***

### **ABSTRACT**

The sea beach in Cox's Bazar is sandy and has a gentle slope with a unbroken length of 120 km (75 mi), it is the longest natural sea beach in the world. There is a huge chance of using these vast sources of sand if the property is properly analyzed. If Cox's Bazar sea beach is used as a source of sand, Bangladesh will be benefited. In this research work, Cox's Bazar sea sand was collected from two spots and some laboratory tests were conducted in Geotechnical Engineering Laboratory of Ahsanullah University of Science and Technology. Direct Shear Test, Proctor Compaction Test, Grain Size Analysis, Moisture Content, Specific Gravity Test and Compressive Strength of mortar were conducted for all the collected sea sand samples. To ascertain the strength properties of the sea sand, mortar made from sea sand were tested. It was found in the research that: the angle of friction of sea sand varied from 2.2° to 8.46°. Sample was uniformly graded with moisture content 11.32% to 11.90% and optimum moisture content varied from 23% to 28%, where, the dry density varies from 1.59 to 1.66 g/cm<sup>3</sup>. Specific gravity varied from 2.638 to 2.661 and the compressive strength of mortar varied from 1.1 MPa to 13.70 MPa.

***Keywords:*** *Sea sand, Physical properties of sea sand, Mechanical properties of sea sand, Soil improvement.*

## 1. INTRODUCTION

Sand has a large business, meeting many demands for growing cities, from residential, commercial, and municipal construction, paving roads and driveways. It has various uses, including being used for mixing cement materials, such as concrete, mortar, and plaster. Construction projects couldn't be completed without the use of sand and our homes and cities wouldn't be what they are today. At present, river dredging is the main source of sand used for construction purpose. This has an adverse effect on environment. If Cox's Bazar sea sand can be used as a source of sand, this could minimize the adverse effect on environment. The objectives of this research were to collect sea sand from the Largest Cox Bazar Sea Beach and explore different properties of it.

## 2. METHODOLOGY

### Sample Collection

The first step of this research work is sample collection. A team of two members was formed in order to collect the sample from Cox's Bazar sea beach. A small shovel was used for taking large samples from soil surface. Sample was taken from two spots. From spot 01 samples were collected from 6 and 24 inches respectively. Moreover, from spot 02 samples were collected from 6 and 18 inches respectively. All the samples were preserved in airtight plastic jars. 5kg from each depth were collected for the test purpose. The jars were airtight so that the sample could represent the actual moisture content and other properties of field condition. The locations of sample 01 and 02 are 21°20'23.0"N, 92°01'47.0"E and 21°21'21.5"N 92°01'24.9"E respectively.

### Laboratory Tests

Direct shear, particle size analysis, proctor compaction test, moisture content determination, specific gravity determination and compressive strength of mortar determination tests were performed according to ASTM D3080, ASTM D422, ASTM D698, ASTM D2216, ASTM D854 and ASTM C109 respectively.

## 3. LABORATORY TEST RESULTS & DISCUSSION

### Figures and Graphs

#### 3.1.1 Direct Shear

From the tests, it is found that the angle of friction of sea sand of spot 1 and 2 varies from 2.2° to 8.46° which is very low. The result is provided from figure 1 to figure 9.

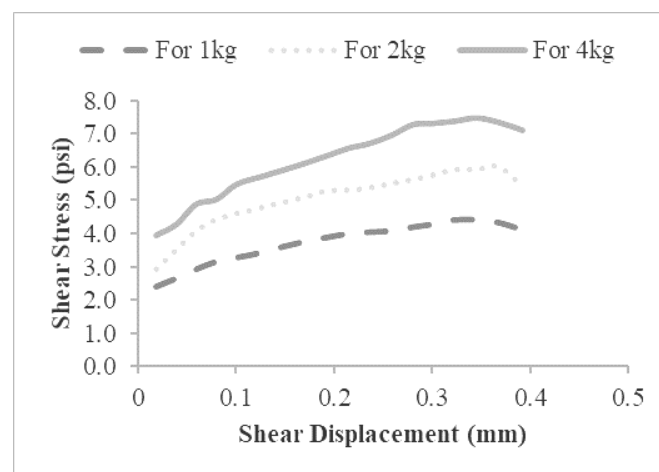


Figure 1: Shear Stress vs Shear Displacement (Spot 01 Depth 6 inch)

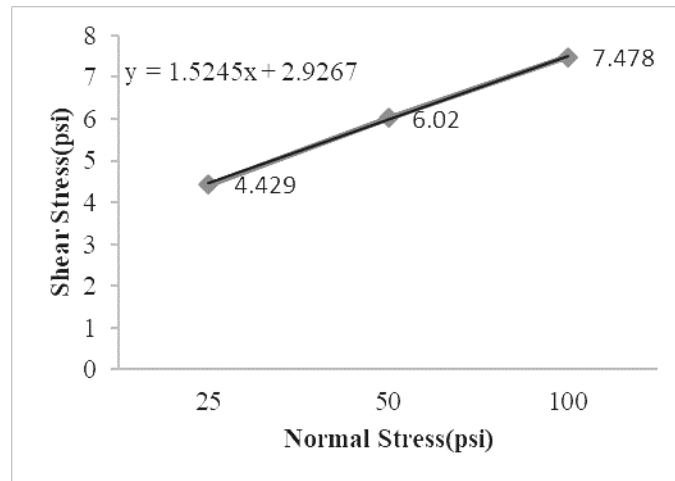


Figure 2: Shear Stress vs Normal Stress (Spot 01 Depth 6 inch)

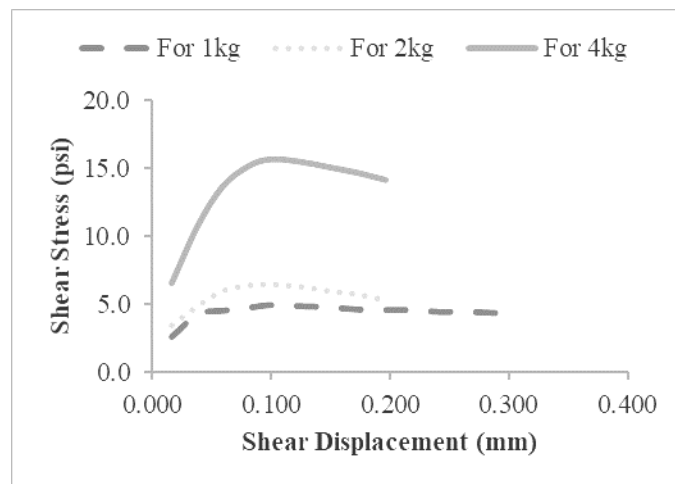


Figure 3: Shear Stress vs Shear Displacement (Spot 01 Depth 24 inch)

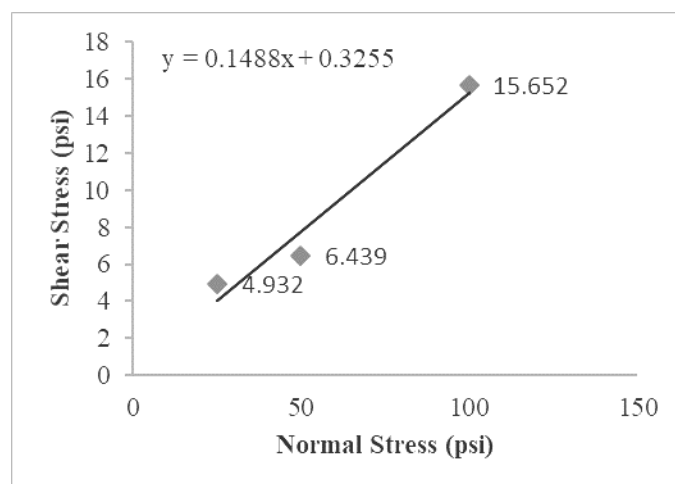


Figure 4: Shear Stress vs Normal Stress (Spot 01 Depth 24 inch)

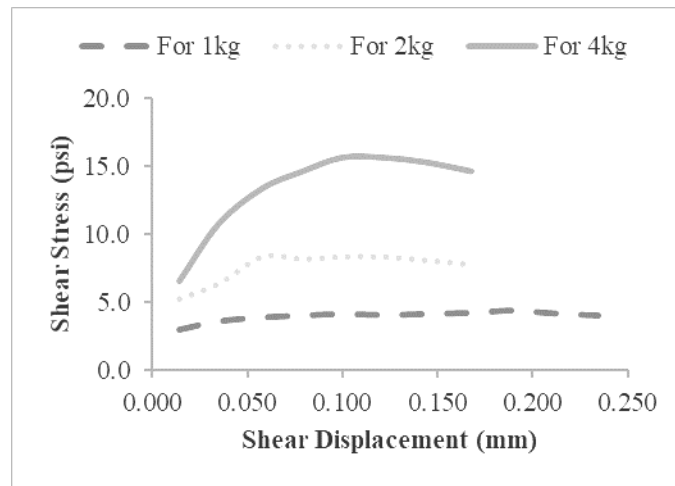


Figure 5: Shear Stress vs Shear Displacement (Spot 02 Depth 6 inch)

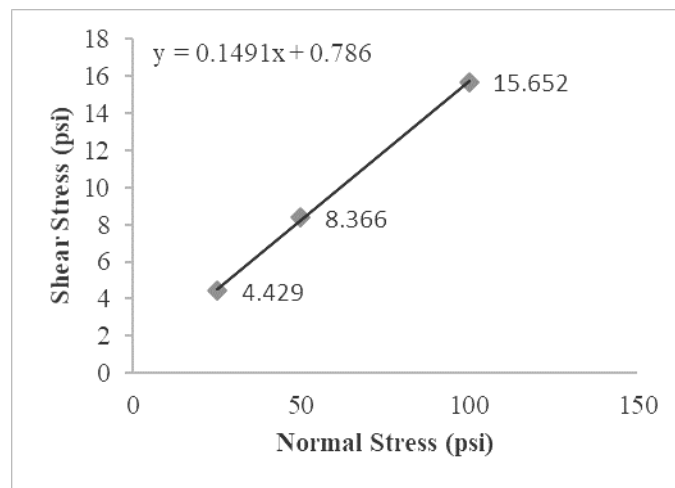


Figure 6: Shear Stress vs Normal Stress (Spot 02 Depth 6 inch)

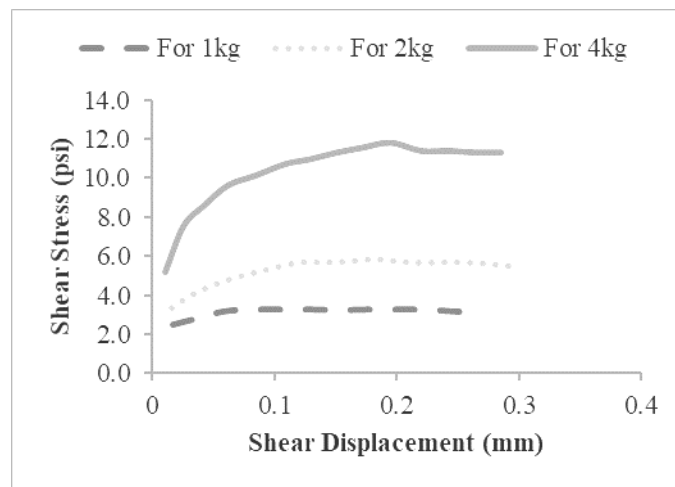


Figure 7: Shear Stress vs Shear Displacement (Spot 02 Depth 18 inch)

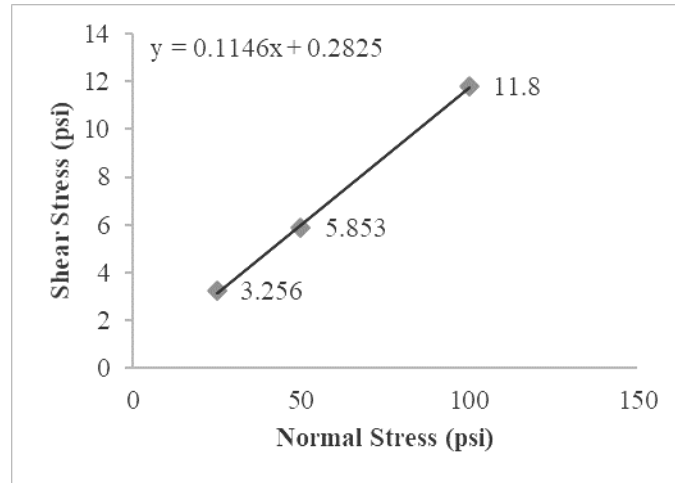


Figure 8: Shear Stress vs Normal Stress (Spot 02 Depth 18 inch)

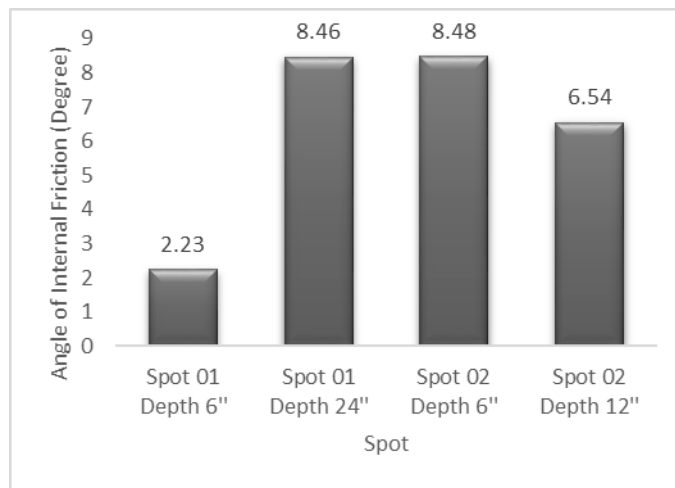


Figure 9: Angle of Internal Frictions of Different Spots

### 3.1.2 Particle Size Analysis

From gradation curve of all samples it is quite clear that sand samples are uniformly graded. 75-80% is between 0.11 to 0.12mm. The results are given in figures 10 to figure 13.

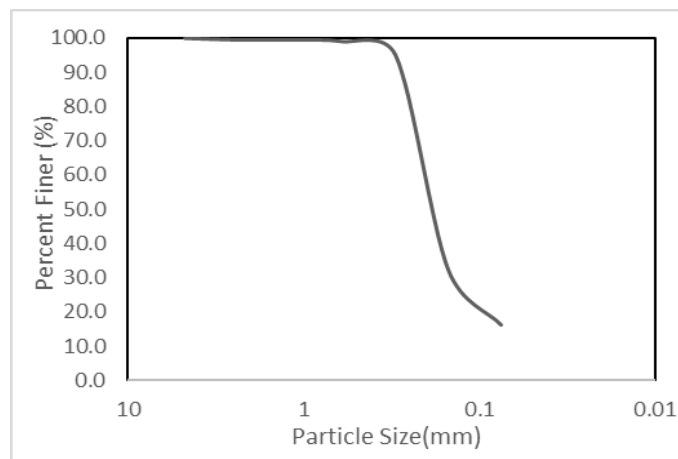


Figure 10: Grain Size Distribution Curve (Spot-01 Depth- 6 inch)

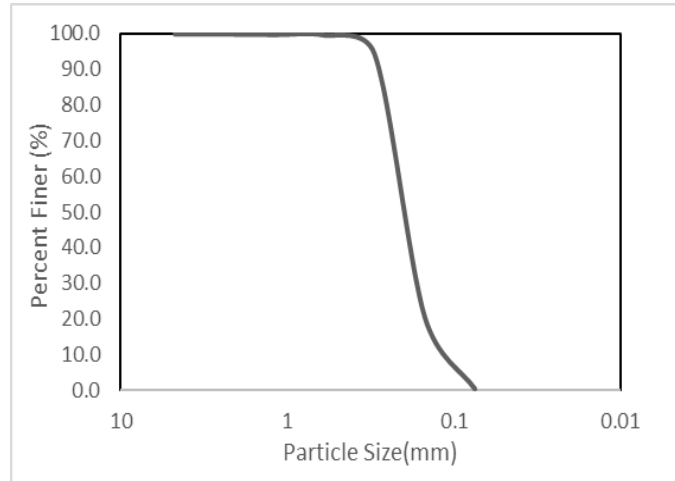


Figure 11: Grain Size Distribution Curve (Spot-01 Depth- 24 inch)

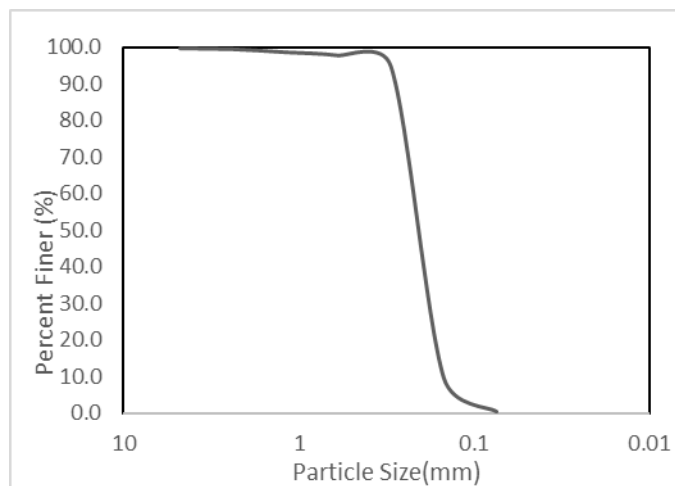


Figure 12: Grain Size Distribution Curve (Spot-02 Depth- 6 inch)

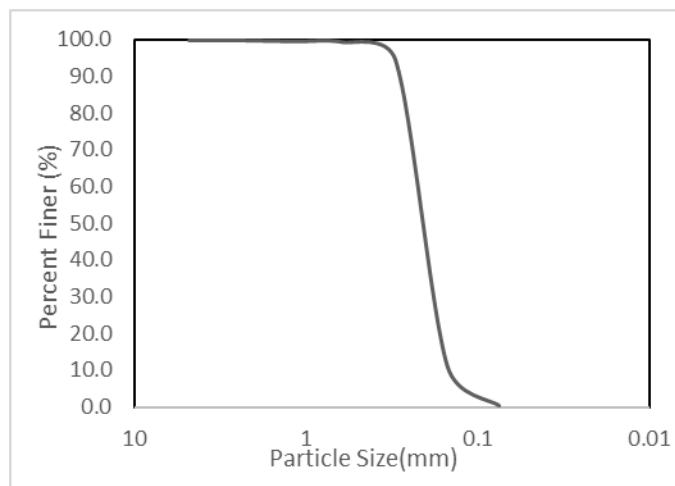


Figure 13: Grain Size Distribution Curve (Spot-02 Depth- 18 inch)

### 3.1.3 Proctor Compression Test

From the tests, it is found that the optimum moisture content of sea sand of spot 1 and 2 varies from 23% to 28%. Moreover, the dry density varies from 1.59 to 1.66 g/cm<sup>3</sup>. The results are shown in figure 3.14.

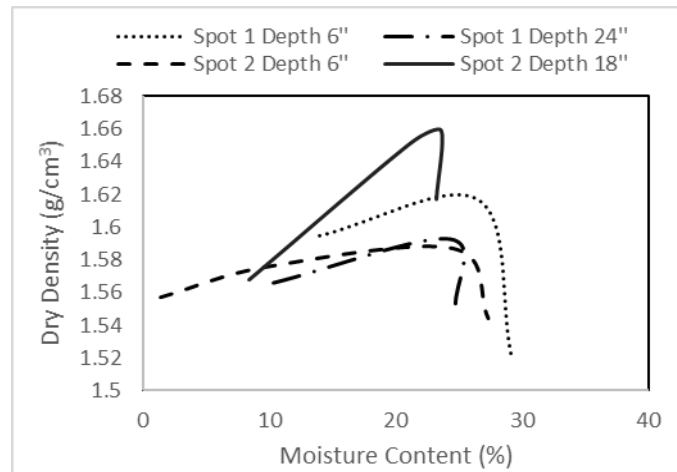


Figure 14: Optimum Moisture Content and Maximum Dry Density Determination of Different Locations

### 3.1.4 Moisture Content Determination

Moisture content of sea sand of spot 1 and 2 varies from 11.32% to 11.90%. The result is shown in the figure 15.

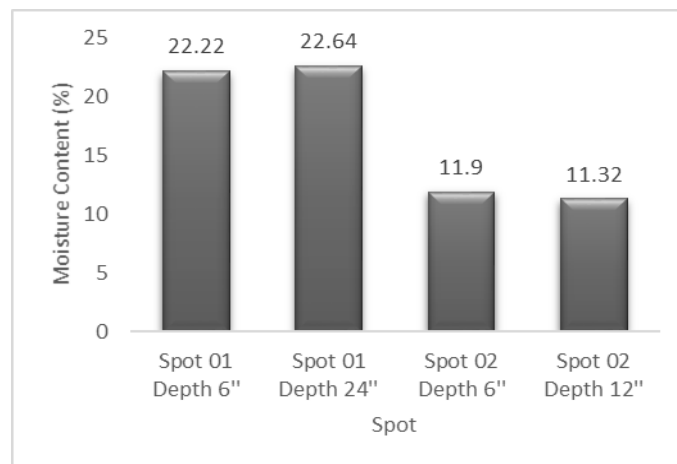


Figure 15: Moisture Content of Different Spots

### 3.1.5 Specific Gravity

Specific gravity of sea sand of spot 1 and 2 varies from 2.638 to 2.661. The result is illustrated in figure 16.

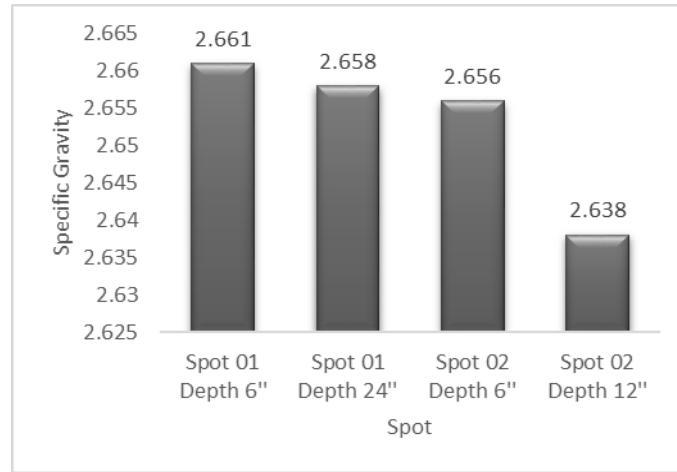


Figure 16: Specific Gravity of Different Spots

### 3.1.6 Compressive Strength of Mortar

The mortar using this sand has very low strength that varies from 1.1 MPa to 13.70 MPa. The result is shown from figure 17 to figure 20.

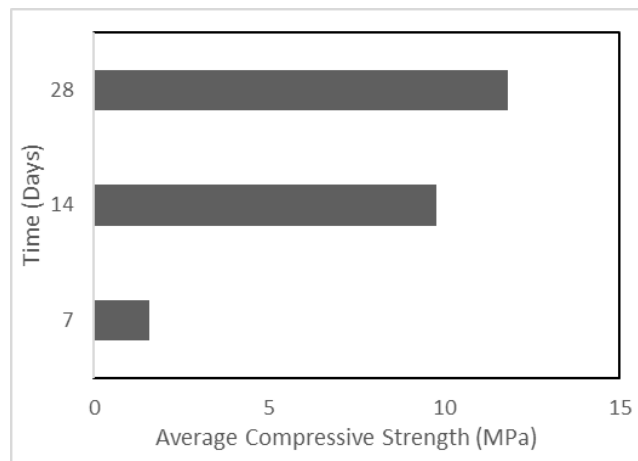


Figure 17: Variation of Compressive Strength (Spot-01 Depth- 6 inch)

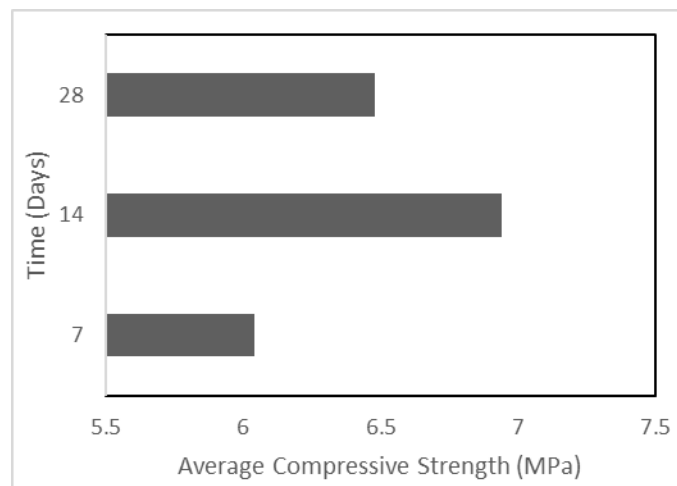


Figure 18: Variation of Compressive Strength (Spot-01 Depth- 24 inch)



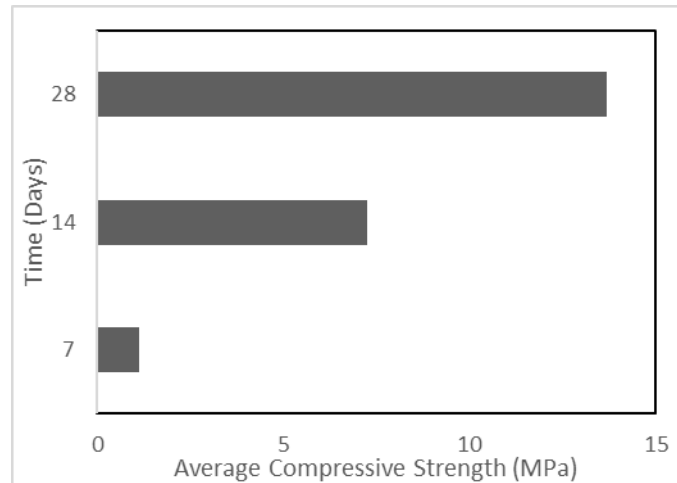


Figure 19: Variation of Compressive Strength (Spot-02 Depth- 6 inch)

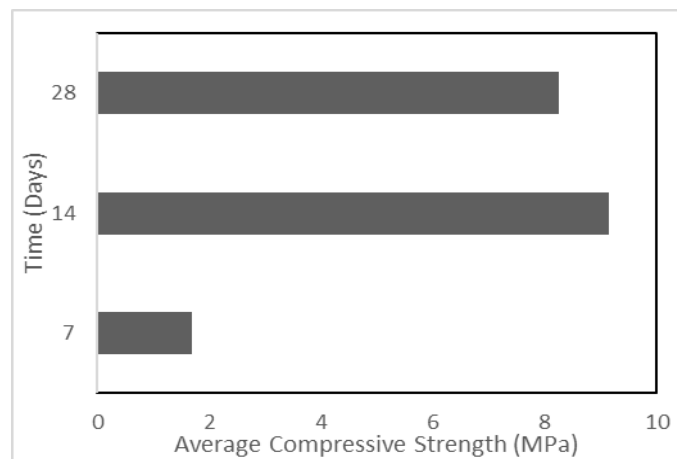


Figure 20: Variation of Compressive Strength (Spot-02 Depth- 18 inch)

## 5. CONCLUSIONS AND RECOMMENDATIONS

Though sand is a universal material and it has a lot of uses, different analysis of this material is required regarding its availability in nature. In this research paper sea sand was collected from two spots only and some laboratory tests were conducted only for determining some engineering and index properties. But further analysis with more samples should be performed for determining other index and engineering properties and also its salt concentration and extraction should be performed in future research work.

## ACKNOWLEDGEMENTS

Thanks to the Civil Engineering Department of Ahsanullah University of Science and Technology for the laboratory support. Also thank to Amin Design and Consultancy (ADC) for the assistance at the fieldwork.

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