A COMPARATIVE STUDY OF COMPRESSIVE STRENGTH OF CONCRETE WITH DIFFERENT TYPES OF FINE AGGREGATE

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“**Dedicated**

To

“Our Beloved Parents
and
Teachers”

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ABSTRACT

The compressive strength of concrete is significantly influenced by the type of sand used as fine aggregate. This study examines the effects of Sylhet sand, Panchagar sand, and Durgapur sand on concrete strength, considering their physical and mechanical properties.

Sylhet Sand is widely recognized for its high silica content, fine texture, and low impurity levels, making it a preferred choice for high-strength concrete. Its optimal grain size distribution enhances bonding with cement, leading to improved compressive strength.

Panchagar Sand exhibits moderate compressive strength in concrete applications. Its specific gravity and fineness modulus play a crucial role in determining its effectiveness in concrete mixes. While not as widely studied as Sylhet sand, it is still used in construction where availability and cost are factors.

Durgapur Sand is commonly used in construction and provides adequate compressive strength. However, variations in its absorption capacity and specific gravity may affect the final strength of the concrete mix. Proper mix design and curing methods can help optimize its performance.

Experimental studies have shown that Sylhet sand generally produces higher compressive strength compared to Panchagar and Durgapur sands. However, the final strength of concrete depends on factors such as mix ratio, water-cement ratio, curing conditions, and aggregate properties.

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CHAPTER-1
INTRODUCTION

1.1 Introduction and Statement:

Concrete is one of the most widely used construction materials in the world. Its compressive strength is an essential property that determines its ability to withstand loads and stresses without failure. The compressive strength of concrete is affected by various factors such as the type of cement, water-cement ratio, curing conditions, the type of stones and the type of fine aggregate used.

In recent years, there has been a growing interest in studying the effect of fine aggregate on the compressive strength of concrete. The use of different types of fine aggregate in concrete can significantly affect its strength and durability. The properties of the fine aggregate, such as size, shape, texture, and strength, influence the interfacial bonding between the aggregate and cement paste, which ultimately affects the strength of the concrete.

This study aims to investigate the compressive strength of concrete with different types of fine aggregate. The study will compare the strength of concrete made with different types of fine aggregate, such as Sylhet Sand, Panchagar Sand and Durgapur Sand.

The findings of this study will provide valuable insights into the effect of fine aggregate on the compressive strength of concrete. This information can be used by engineers and construction professionals to design and construct durable and sustainable concrete structures.

Statement

The compressive strength of concrete varies depending on the source and properties of fine aggregate used. Among the commonly used sands in Bangladesh:

Sylhet Sand: Sylhet Sand, known for its coarse texture and high silica content, generally provides higher compressive strength due to better interlocking and reduced voids in the concrete matrix.

Panchagar Sand: Panchagar Sand, being moderately graded and cleaner than many local sands, yields medium to high compressive strength, depending on its grading and mix design.

Durgapur Sand: Durgapur Sand, which tends to be finer and sometimes contains more silt or clay particles, may result in comparatively lower compressive strength unless properly washed and graded.

The variations in mineral composition, particle, shape and cleanliness of these sands significantly affect the bonding and compaction characteristics of concrete, thereby influencing its compressive strength.

1.2 Objectives

The primary objective of this study is to analyze the compressive strength of concrete using Sylhet sand, Panchagar sand, and Durgapur sand as fine aggregates. The research aims to:

1. Evaluate the physical properties of these sands and their impact on concrete strength.
2. Compare the compressive strength of concrete made with different sands to determine the most suitable option for construction.
3. Provide recommendations for improving concrete performance based on experimental findings.

1.3 Limitations

Despite the comprehensive approach, certain constraints exist:

- Geographical Limitation: The study is restricted to sands from Sylhet, Panchagar, and Durgapur, excluding other regional variations.
- Environmental Factors: Variations in temperature, humidity, and curing conditions may affect results.
- Material Availability: Differences in sand quality and sourcing could influence findings.
- Testing Constraints: Laboratory conditions may not fully replicate real-world construction environments.

CHAPTER-2
LITERATURE REVIEW

2.1 Methods of Curing

Curing is a crucial process in concrete construction that ensures proper hydration of cement, leading to improved compressive strength. The curing method used can significantly impact the strength of concrete made with Sylhet sand, Panchagar sand, and Durgapur sand. Here are some common curing methods and their effects:

Water Curing (Immersion or Sprinkling)

- Effectiveness: Provides the best results for strength development.
- Process: Concrete specimens are either fully immersed in water or sprinkled with water at regular intervals.
- Impact: Ensures continuous hydration, leading to higher compressive strength.

Membrane Curing (Plastic Sheeting)

- Effectiveness: Less effective than water curing.
- Process: Concrete is covered with plastic sheets to retain moisture.
- Impact: Reduces evaporation but may not provide optimal hydration, affecting strength.

Steam Curing

- Effectiveness: Accelerates strength gain.
- Process: Concrete is exposed to high-temperature steam in a controlled environment.
- Impact: Useful for precast concrete applications but may cause thermal cracking if not properly managed.

Curing Compounds

- Effectiveness: Moderate.
- Process: Chemical compounds are applied to the concrete surface to seal in moisture.
- Impact: Helps retain water but may not be as effective as direct water curing.

Findings from Research

Studies indicate that water curing provides the best results for concrete strength. Concrete made with Sylhet sand tends to achieve higher compressive strength compared to Panchagar and Durgapur sands. Proper curing methods can enhance the durability and performance of concrete structures.

2.2 Maintain of Moisture

Moisture content plays a crucial role in determining the compressive strength of concrete, especially when using different types of sand such as Sylhet sand, Panchagar sand, and Durgapur sand. The presence of moisture affects the workability, curing process, and final strength of concrete.

Impact of Moisture on Compressive Strength

1. Sylhet Sand:
    - Known for its high silica content and fine texture, Sylhet sand has a relatively low absorption rate.
    - Excess moisture can lead to reduced bonding between cement and aggregates, affecting strength.
    - Proper water-cement ratio is essential to maintain optimal strength.
2. Panchagar Sand:
    - Exhibits moderate moisture absorption due to its grain size and mineral composition.
    - If moisture content is too high, it can increase porosity, leading to lower compressive strength.
    - Controlled curing can help mitigate strength loss.
3. Durgapur Sand:
    - Has a higher absorption capacity, which can impact the water demand in concrete mixing.
    - Excess moisture can cause segregation and weaken the concrete structure.
    - Proper mix design and curing methods are necessary to optimize strength.

Best Practices for Moisture Control

- Maintain an optimal water-cement ratio (typically between 0.4 to 0.6) to prevent excess moisture from weakening the concrete.
- Use moisture-resistant curing methods, such as water curing or steam curing, to ensure proper hydration.
- Test moisture content in sand before mixing to adjust water requirements accordingly.

2.3 Maintaining of Temperature

Maintaining the temperature during the curing process is crucial for achieving optimal compressive strength in concrete made with Sylhet sand, Panchagar sand, and Durgapur sand. Temperature affects the hydration rate of cement, which directly influences the strength development of concrete.

Effects of Temperature on Concrete Strength

1. Sylhet Sand:
    - Due to its high silica content, Sylhet sand contributes to better bonding in concrete.
    - Higher curing temperatures (above 30°C) can accelerate hydration but may lead to thermal cracking.
    - Optimal curing temperature: 20–25°C for steady strength development.
2. Panchagar Sand:
    - Exhibits moderate compressive strength, and temperature fluctuations can impact its performance.
    - Cold weather curing (below 10°C) slows down hydration, reducing early strength gain.
    - Optimal curing temperature: 18–24°C for balanced hydration.
3. Durgapur Sand:
    - Has higher absorption capacity, which affects water retention during curing.
    - Extreme heat (above 35°C) can cause rapid moisture loss, weakening the concrete structure.
    - Optimal curing temperature: 22–26°C to maintain moisture balance.

Best Practices for Temperature Control

- Use insulated curing blankets in cold weather to maintain hydration.
- Avoid direct sunlight exposure in hot climates to prevent rapid moisture loss.
- Steam curing can be used for accelerated strength gain in controlled environments.

2.4 Evaporation From Freshly placed Concrete on Site

Evaporation from freshly placed concrete is a critical factor affecting its compressive strength, especially when using different types of sand such as Sylhet sand, Panchagar sand, and Durgapur sand. Rapid evaporation can lead to plastic shrinkage cracks, reduced hydration, and lower final strength.

Factors Influencing Evaporation

1. Temperature: Higher ambient and concrete temperatures accelerate evaporation.
2. Wind Speed: Strong winds increase moisture loss from the surface.
3. Relative Humidity: Low humidity conditions cause faster evaporation.
4. Sand Type:

    Sylhet Sand: Fine texture retains moisture better, reducing evaporation effects.
    Panchagar Sand: Moderate absorption rate; evaporation impact depends on curing methods.
    Durgapur Sand: Higher absorption capacity may lead to increased moisture loss.

Methods to Reduce Evaporation

Fogging or Spraying Water: Helps maintain surface moisture.
Use of Curing Compounds: Forms a protective layer to reduce evaporation.
Covering with Plastic Sheets: Prevents direct exposure to wind and heat.
Optimized Mix Design: Adjusting water-cement ratio to compensate for moisture loss.

CHAPTER-3
METHODOLOGY

3.1 MATERIALS

In this study, cement, fine aggregate, coarse aggregate and fresh water are used to reduce desired concrete mix. Sand was used as fine aggregate and stone chips were used as coarse aggregate and potable water was used in the investigations for both mixing and curing.

3.1.1 CEMENT

Cement, in general, adhesive substances of all kinds, but, in a narrower sense, the binding materials 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.



Figure 3.1.1: Cement (Fresh Cement)

Specifications of Cement:

- Name : **Fresh cement** (Portland Composite Cement)
- Specific gravity of cement: 3.15
- Setting times of cement : i) initial setting time: 30minutes,
  ii) Final setting time:10 Hours
- Weight : 50 Kg.
- BDS EN 197-1 : 2003 CEM II / B – M (S-V-L) 42.5N
- Clinker : 70-79%
- Limestone : 21-30%
- Gypsum : 0-5%

3.1.2 FINE AGGREGATE

Aggregate significantly influences rheological and mechanical properties on both mortars and concrete. Fine aggregate being a main component in concrete production has a significant part to play in influencing concrete strength. Sand is commonly used as the standard material for a fine aggregate. **In this same type of sand was used as the fine aggregate for both with admixture and without admixture in this study as shown in below figure. The sand was washed with water and air dried before being used to obtain Saturated Surface (SSD) condition. In this study three different type of sand (Panchagar Sand, Durgapur Sand and Sylhet Sand) had been used as a fine aggregate as shown in the Figure.**



Figure 3.1.2: Sand as Fine Aggregate

3.1.3 COARSE AGGREGATE

Aggregate materials help to make concrete mixes more compact. They also decrease the consumption of cement and water and contribute to the mechanical strength of the concrete, making them an indispensable ingredient in the construction and maintenance of rigid structures aggregate materials help to make concrete mixes more compact. They also decrease the consumption of cement and water and contribute to the mechanical strength of the concrete, making them an indispensable ingredient in the construction and maintenance of rigid structures. Coarse aggregates are particulates that are greater than 4.75mm. The usual range employed is between 9.5mm and 37.5mm in diameter.

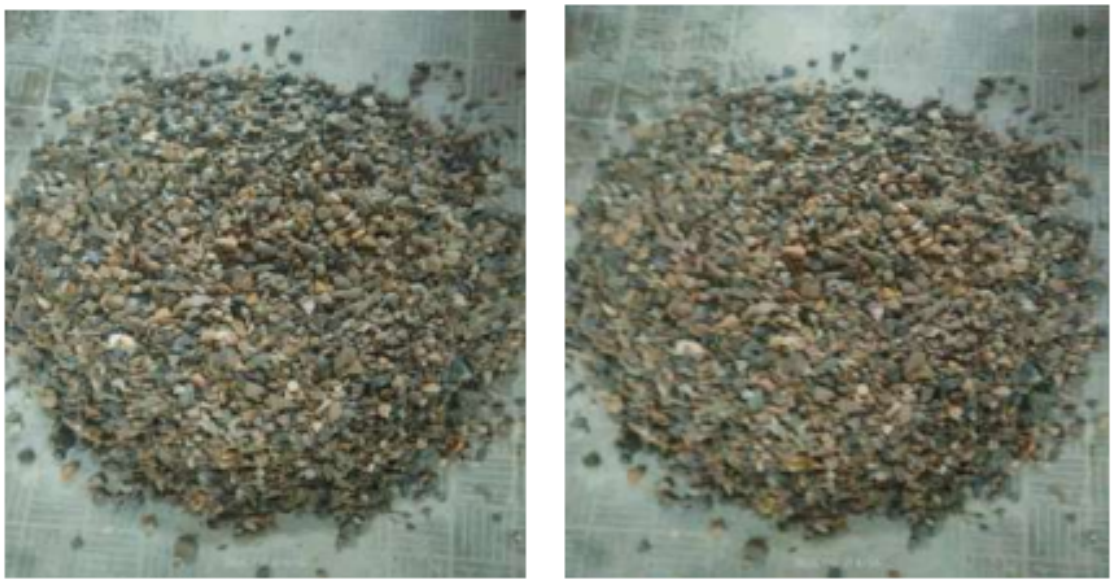


Figure 3.1.3: Stone Chips

3.1.4 WATER

Water is critical in the making of concrete. Adding water to the mix sets of a chemical reaction when it comes into contact with the cement. The water used in the mixing of concrete is usually of a potable standard. Using non-drinking water or water of unknown purity risks the quality and workability of the concrete.

3.2 SEIVE ANALYSIS

For particle size distribution for both coarse and fine aggregate sieve analysis method ware used according ASTM Cl36.

3.2.1 Apparatus

For sieve analysis, following apparatuses ware used-
a) Balance;
b) Sieves;
c) Oven and
d) Containers.
e) Brush.

3.2.2 Test procedure

- Clean the sieves of sieve shaker using cleaning brush if any particles are struck in the openings.
- Record the weight of each sieve and receiving pan.
- Dry the specimen in oven for 3-4 minutes to get the dried specimen (ignore, if the specimen is already dried).
- Weigh the specimen and record its weight.
- Arrange the sieves in order as the smaller openings sieve to the last and larger openings sieve to the top. (Simply, arrange them to the ascending order of sieve numbers – No.4 sieve on top and no.200 sieve at bottom)- Sieve numbers and the particle sizes are provided below in a chart for further understanding.
- Keep the weight recorded specimen on the top sieve and then keep the complete sieve stack on the sieve shaker (Don't forget to keep the lid and receiving pan).
- Allow the shaker to work 10-15 minutes – use the clock here..!
- Remove the sieve stack from the shaker and record the weight of each sieve and receiving pan separately.



Figure 3.2.1: Sieve Test

3.

Figure 3.2.2: Sieve Test

3.3 CONCRETE MIX PROPERTIES

For this Research mixture proportion of concrete were determine in accordance with following condition: -

a) Water/Cement Ratio 0.45
b) Same maximum grain size (20mm)
c) Variable type and quantity of fine aggregate
d) Same type and quantity of coarse aggregate
e) Mixing Ratio 1:1.5:3

3.4 CONCRETE MOULDING PROCEDURE

a) For compressive and tensile strength test, steel cylindrical mold was used. Height and diameter of the mold were 200mm and 100mm respectively.
b) Molds were cleaned and grease was applied on the inner surface of the mold.
c) Concrete was filled in the mold in 3 layers.
d) Each layer was rodded 25 time in an even pattern using a tamping rod.
e) After tamping, the top surface is leveled.
f) The molded specimens were kept at normal temperature to dry.

Molding of cylinder concrete specimens are shown in figure:



Figure 3.4.1: Mold of Cylinder







Figure 3.4.2: Mixing of Concrete



Figure 3.4.3: Finishing of Concrete Cylinder

3.5 CURING PROCESS OF CYLINDERS

After 24 hours of casting, the concrete specimens were removed from the mold and allowed for curing. Here Curing Method:



Figure 3.5: Curing Process

3.6 COMPRESSIVE STRENGTH TEST OF CYLINDERS:

We can use the Universal Testing Machine (UTM) for compressive strength tests of RCC cylinders. There are some images of compressive strength test-



Figure 3.6.1: Compressive Strength test of Concrete Cylinder



Figure 3.6.2: Compressive Strength test of Concrete Cylinder

CHAPTER - 4
RESULT AND ANALYSIS OF LAB TEST

This result can be used to determine the correlation of compressive strength of concrete cylinder and the recommended curing period respectively. The result as the strength increases with the decreases of curing time interval.

4.1.1 Sieve analysis of sylhet sand

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

Aggregate with at least 85% passing No. 4 Sieve 500gm and more than 5% retained on a No. 8 Sieve.
Aggregates with at least 95% passing No. 8 Sieve 100gm.

Table No-01: Sieve analysis of sylhet sand

Sieve No.	Materials Retained (gm.)	% of Materials Retained	Cumulative % Retained	% of passing	FM
# 4	26	2.6	2.6	97.4	261.7/100 = 2.61
# 8	57	5.7	8.3	91.7	
# 16	130	13	21.3	78.7	
# 30	226	22.6	43.9	56.1	
# 50	430	43	86.9	13.1	
#100	118	11.8	98.7	1.3	
Pan	13	-	-	0	
Total	1000 gm	Total=	261.7		

4.1.2 Table No-02: Sieve analysis of Panchagar sand

Sieve No.	Materials Retained (gm.)	% of Materials Retained	Cumulative % Retained	% of passing	FM
# 4	19	1.9	1.9	98.1	263.8/100 = 2.63
# 8	87	8.7	10.6	89.4	
# 16	143	14.3	24.9	75.1	
# 30	208	20.8	45.7	54.3	
# 50	397	39.7	85.4	14.6	
#100	129	12.9	98.3	1.7	
Pan	17	-	-	0	
Total	1000 gm	Total=	263.8		

4.1.3 Table No-03: Sieve analysis of Durgapur sand

Sieve No.	Materials Retained (gm.)	% of Materials Retained	Cumulative % Retained	% of passing	FM
# 4	09	0.9	0.9	99.1	245.8/100 = 2.45
# 8	63	6.3	7.2	92.8	
# 16	137	13.7	20.9	79.1	
# 30	196	19.6	40.5	59.5	
# 50	397	39.7	80.2	19.8	
#100	159	15.9	96.1	3.9	
Pan	39	-	-	0	
Total	1000 gm	Total=	245.8		

4.2 Table No-04: Sieve analysis of Stone

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.	Materials Retained (gm.)	% of Materials Retained	Cumulative % Retained	% of passing	FM
# 3/4	224	14.9	14.9	85.1	
# 3/8	1149	76.6	91.5	8.5	
# 4	127	8.4	99.9	0.1	
# 8	0	0	100	0	
# 16	0	0	100	0	706.3/100 = 7.06
# 30	0	0	100	0	
# 50	0	0	100	0	
# 100	0	0	100	0	
Total	1500 gm	Total=	706.3		

4.3.1 Specific Gravity of Sylhet Sand

Table No-05: Data sheet for specific gravity of Sylhet Sand

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
657 gm	293 gm	840 gm	300 gm

Table N0-06: Specific gravity of Sylhet Sand

Test	Formula	Calculation	Result
Apparent Specific Gravity	$\frac{A}{B+A-C}$	$\frac{293}{657+293-840}$	2.6
Bulk SG (Oven Dry Basic)	$\frac{A}{B+S-C}$	$\frac{293}{657+300-840}$	2.5
Absorption Capacity, D%	$\frac{S-A}{A} * 100$	$\frac{300-293}{293} * 100$	2.3
Bulk SG (S.S.D. Basic), G	$\frac{S}{B+S-C}$	$\frac{300}{657+300-840}$	2.5

The specific gravity of the Sylhet sand as fine aggregate after oven drying was found 2.6. Specific gravity for fine aggregate we found the specific gravity of the apparatus to be 2.5 and bulk specific gravity oven dry ac obtained from 2.5. Apparent capacity redaction received 2.3 and bulk SSD received 2.5.

4.3.2: Specific Gravity of Panchagar Sand

Table No-07: Data sheet for specific gravity of Panchagar Sand

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
654 gm	289 gm	835 gm	300 gm

TableNo-08: Specific gravity of Panchagar Sand

Test	Formula	Calculation	Result
Apparent Specific Gravity	$\frac{A}{B+A-C}$	$\frac{289}{654+289-835}$	2.6
Bulk SG (Oven Dry Basic)	$\frac{A}{B+S-C}$	$\frac{289}{654+300-835}$	2.4
Absorption Capacity, D%	$\frac{S-A}{A}*100$	$\frac{300-289}{289}*100$	3.8
Bulk SG (S.S.D. Basic), G	$\frac{S}{B+S-C}$	$\frac{300}{654+300-835}$	2.5

The specific gravity of the panchagar sand as fine aggregate after oven drying was found 2.6. Specific gravity for fine aggregate we found the specific gravity of the apparatus to be 2.4 and bulk specific gravity oven dry ac obtained from 2.4. Apparent capacity redaction received 3.8 and bulk SSD received 2.5.

4.3.3: Specific Gravity of Durgapur Sand

Table No-09: Data sheet for specific gravity of Durgapur Sand

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
655 gm	291 gm	833 gm	300 gm

Table No-10: Specific gravity of Durgapur Sand

Test	Formula	Calculation	Result
Apparent Specific Gravity	$\frac{A}{B+A-C}$	$\frac{291}{655+291-833}$	2.5
Bulk SG (Oven Dry Basic)	$\frac{A}{B+S-C}$	$\frac{291}{655+300-835}$	2.3
Absorption Capacity, D%	$\frac{S-A}{A}*100$	$\frac{300-291}{291}*100$	3.0
Bulk SG (S.S.D. Basic), G	$\frac{S}{B+S-C}$	$\frac{300}{655+300-833}$	2.4

The specific gravity of the Durgapur sand as fine aggregate after oven drying was found 2.5. Specific gravity for fine aggregate we found the specific gravity of the apparatus to be 2.3 and bulk specific gravity oven dry ac obtained from 2.3. Apparent capacity redaction received 3.0 and bulk SSD received 2.4.

4.4 Specific Gravity of Stone Chips

Table N0-11: Data sheet for specific gravity of stone chips

Wt. of S.S.D sample in air , B (gm)	Wt. of S.S.D. sample in water, C (gm)	Oven dry Wt. of sample in air, A (gm)
2000 gm	1207 gm	1923 gm

Table No-12: Specific gravity of stone chips

Test	Formula	Calculation	Result
Apparent Specific Gravity	$\frac{A}{A-C}$	$\frac{1923}{1923-1207}$	2.7
Bulk Specific Gravity (Oven Dry Basic)	$\frac{B}{B-C}$	$\frac{2000}{2000-1207}$	2.5
Bulk Specific Gravity (S.S.D. Basic), G	$\frac{A}{B-C}$	$\frac{1923}{2000-1207}$	2.4
Absorption Capacity, D %	$\frac{(B-\mathrm{A})*100}{A}$	$\frac{(2000-1923)*100}{1923}$	4.0

4.5 Table No-13:14 Days Cylinder Test Results

Type of Sand	Dia of Cylinder (mm)	Height of Cylinder (mm)	Weight of Cylinder (gm)	Crushing Value (KN)	Compressive Strength (MPa or N/mm^2)	Average Compressive Strength (MPa)
Sylhet Sand	102.97	207	4060	210	25.23	26.16
	103.37	205	4055	217	25.87	
	103	205	3835	228	27.37	
Panchagar sand	102.85	206	4097	185	22.27	22.28
	102.77	206	3854	177	21.32	
	103.61	205	4007	196	23.24	
Durgapur Sand	102.5	205	3961	206	24.97	25.84
	102.6	205.5	4105	220	26.60	
	102.7	206	3948	215	25.95	

It is observed from the test results that those three type of sand gave better strength of cylinder for Sylhet Sand at 14 days.

4.6 Table No-14: 28 Days Cylinder Test Results

Type of Sand	Dia of Cylinder (mm)	Height of Cylinder (mm)	Weight of Cylinder (gm)	Crushing Value (KN)	Compressive Strength (MPa or N/mm^2)	Average Compressive Strength (MPa)
Sylhet Sand	102.73	206	3932	227	27.39	28.30
	102.52	206	4032	235	28.47	
	103	205	3987	242	29.05	
Panchagar sand	101.96	205	4096	210	25.74	25.68
	102	205	4050	207	25.33	
	102.66	206	4062	215	25.97	
Durgapur Sand	103.17	205	4102	218	26.09	26.62
	102.29	206	3932	215	26.17	
	102.57	206	3889	228	27.61	

It is observed from the test results that those three types of sand gave better compressive strength value for Sylhet Sand at 28 days. On the Panchagar Sand showing lowest strength at 28 days compressive strength test.

4.7 Table No-15: Summary of the Cylinder Test Results

Type Of Sand	14 Days Test Results (MPa)	28 Days Test Results (MPa)
Sylhet Sand	26.16	28.30
Panchagar Sand	22.28	25.68
Durgapur Sand	25.84	26.62

Chapter 5

5.1 Conclusion

In most cases, the compressive strength of concrete cylinders was higher when used to compare different type sand. After 14 days of curing, the compressive strength of Sylhet sand, Panchagar sand and Durgapur sand under wet covering curing were recorded as 26.16 MPa, 22.28 MPa and 25.84 MPa respectively. Next, we discovered that after 28 days of curing, the compressive strength of Sylhet Sand under wet covering curing was 28.30 MPa, while Panchagar Sand and Durgapur Sand exhibited a strength of 25.68 MPa and 26.62 MPa. Therefore, it can be inferred that the Sylhet Sand result in higher compressive strength compared to Panchagar sand and Durgapur sand, respectively.

5.2 Findings and Recommendation:

Findings:

1. Sylhet Sand:
    - Concrete made with Sylhet sand tends to have higher compressive strength due to its better grain size distribution and fineness modulus.
    - A study found that 28-day compressive strength of concrete with Sylhet sand was 12.51% higher than other local sands.
    - The fineness modulus of Sylhet sand plays a crucial role in improving concrete durability.
2. Panchagar Sand:
    - Concrete using Panchagar sand is suitable for construction, but its compressive strength may be slightly lower than Sylhet sand.
    - Research suggests that partial replacement of natural sand with manufactured sand can improve strength.
    - Workability of concrete decreases with increasing proportion of manufactured sand, but compressive strength improves.
3. Durgapur Sand:
    - Studies indicate that Durgapur sand can be effectively used in concrete, but mix design adjustments are necessary.
    - A comparative analysis found that river sand-based concrete generally performs better than dredged sand.
    - Manufactured sand alternatives can enhance compressive strength and durability.

Recommendation:

- Mix Optimization: Adjust mix ratios based on sand type. For Sylhet sand, a 1:1.5:3 mix ratio is recommended for high strength.
- Curing Methods: Ensure proper curing (7, 14, and 28 days) to achieve maximum strength.
- Sustainable Alternatives: Consider partial replacement of natural sand with manufactured sand to improve strength and reduce environmental impact.
- Quality Testing: Conduct grain size distribution and fineness modulus tests before selecting sand for concrete.

REFERENCES

Here are some reference books and authors related to the compressive strength of concrete, including studies on different types of sand such as Sylhet sand, Panchagar sand, and Durgapur sand:

1. "Compressive Strength of Concrete" – Edited by Pavlo Kryvenko
    - This book provides an in-depth analysis of concrete strength, including factors affecting compressive strength.
2. "Concrete Microstructure Characterization and Performance" – By Cristian Druta
    - Discusses the microstructure of concrete and its impact on strength.
3. "Investigation of the Quasi-Static and Dynamic Confined Strength of Concretes" – By Saman Hedjazi
    - Explores different testing methods for concrete strength.
4. Sonargaon University Journal, Vol. 2, No. 2 – By T. Akter, B. Siddique, and Ferdous Wahid
    - Research on compressive strength testing methods in Bangladesh.
5. "Compressive Strength of Concrete" – By Pavlo Kryvenko (PDF version)
    - Covers various aspects of concrete strength and durability.