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LOCAL SAND IN CEMENT CONCRETE: SILCHAR

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ABSTRACT

Sand plays a crucial role as an important component of concrete. Concrete is a widely used construction material. By examining the role of sand in enhancing workability, strength, and durability, we gain insight into its importance in shaping the structural integrity of concrete. Sand available in different Mohal of Barak Valley like Taranathpur river of Dwarbond, Katakhal river , Jatinga river, are found to be fail in zoning after Particle size Distribution Test . It is found to be fine to very fine in nature. So, for important Structure like multistorey buildings and bridges it does not give target strength in mix design. To achieve target strength, we have to mix crusher sand 5mm down with local sand subject to other property of sand ,cement and stone clips .This technique not only gives us target strength but saves cement 20-25% per cubic meter concrete. Crusher sand is easily available from stone crusher in this region.

KEYWORDS: *Crucial, target strength,mix design, river, local sand, stone crusher.*

1. INTRODUCTION

Sand is a crucial component in the production of concrete, one of the most widely used construction materials in the world. Sand is also known as Silica (Sio2) in chemical term. It is formed by the decomposition of sand stone due to various weathering effects of nature. So from the origin point of view, it is a crucial part of sand stone, hill or other rocks in nature which is found as deposits in soil by excavating pits in some places, river banks or beds and sea shores. In modern days it plays an important role in the Civil Engineering field of activity and development.

Sand is the most important ingredient of Plain Cement Concrete (P.C.C) Reinforced Cement Concrete (RC.C.), Pre -stressed Cement Concrete (P.S.C) and Mortar etc. In other words, this crucial part of its origin sacrifices himself for a novel cause of humanity. So, I used the term Reinforced Cement Concrete in spiritual expression as a paste formed by mixing- quality sand as symbol of sacrifices, stone as sincerity, cement as spirituality, steel as serenity and water as soul of serviceability in some specific proportion or magnitude to feel the magnificent strength of holy spirit depending upon the quality control as sacredness maintained during the entire process to fulfil the desirous dream of mankind.

The Concrete is the foundation of modern civilization and all most all structures stand on this foundation. The sand used in concrete is known as fine aggregate in Civil Engineering term. In R.C.C. single storeyed or multistore building or any R.C.C. structure, concrete is the soul backbone. So objective of this article is to emphasize on to provide quality sand or fine aggregate to produce quality concrete.

A good quality sand or fine aggregate should be hard, strong, durable, free from injurious amounts of clay, loam, vegetable, and other such foreign matter. It should be properly washed to ascertain that is should be free from clay, silt and other such organic matter before used in concrete or mortar. Such material below 4.75 mm size is termed as fine aggregate or sand and it should not contain more than 9 to 10% of silt particles.

Grading or particle size distribution of aggregate is a major factor determining the quality of concrete. The grading of fine aggregate has been found to influence the workable concrete can be made with various grading of aggregate, there are identifiable properties of fresh concrete more than that of the coarse aggregate (store). Although good workable concrete can be made with grading of aggregate, there are certain limits which a grading must lie to produce a satisfactory concrete. The grading of fine aggregate, Zone-

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I, II, II and IV. Where the grading falls outside the fine aggregate or sand shall be within the limit given in table 1 of 1.S.:383-1970 and describe of any particular Grading Zone of sieves other than 600 micron I.S. Sieve by a total amount not exceeding 5%, it shall be regarded as falling within the Grading Zone. This tolerance shall not be applied to percentage passing any other size on the coarse limit of Grading Zone-1 or the finer limit of Grading Zone-IV. Please find below grading table of fine aggregate as per LS.383-1970.

Grading of Fine Aggregate Based on Zoning As per IS: 383-1970

Table 1.

I.S Sieve Designation	Grading Zone-I	Grading Zone- II	Grading Zone-III	Grading Zone-IV
10mm	100	100	100	100
4.75mm	90-100	90-100	90-100	90-100
2.36mm	60-95	75-100	85-100	95-100
1.18 mm	30-70	55-90	75-100	90-100
600 micron	15-34	35-59	90-79	80-100
300 micron	5-20	8-30	12-40	15-50
150 micron	0-10	0-10	0-10	0-15

2. CASE STUDY AREA

Barak Valley is situated in the southern part of the Indian state of Assam .It is located in between 24° 49' N latitude & 92° 48'E longitude. The pioneer city of the Barak valley is Silchar. The Region is named after the Barak River. Barak valley mainly consists of three districts namely Cachar , Karimganj, and Hailakandi. Karimganj is the second largest city in this region which is considered as the cultural centre of Barak valley. The official language of Barak valley is Bengali. Majority of the people speak a dialect of Bengali, which is known as Sylheti. Religious composition of the valley population is Hindu: 50%, Muslim: 46%, and others 4%. Hindus are majority in Cachar district (60%) while Muslims are majority in Karimganj district (53%) and Hailakandi district (57%). Apart from the Bengali nation, Barak Valley is the home land of Kacharis, Hmar, Manipuris (Both Bishnupriya and Meitei), Rongmei Nagas and tea garden labourers.

In our Barak Valley area, no sand of any Mohal falls within the limit of any particular Grading Zone as given in the above table. Sand of some mohal even does not fit for making mortar as well. But here it is in use for making both concrete and mortar causing jeopardy to the structural members or items.

2.2 Location of study area

Silchar and its hinterland the pioneer city of Barak Valley, has been selected as the study area in this dissertation. The study area includes Silchar and its nearby rural and semi urban areas. The study area has been concentrated along the main roads within the study area

The trial mix design involved two variations: one using natural local sand and the other utilizing blended sand. This undertaking was extensive as we aimed to achieve a concrete strength target of 260 kg/cm² (M20) while ensuring that the sand grading fall within the acceptable limits for any Grading Zone, as previously mentioned. During our investigation, we discovered that the combination of sand with 5mm down crusher chips/dust yielded positive results. We observed that incorporating clean and fine sand (with larger grain sizes) sourced from various locations in Barak Valley, such as Taranathpur of Dwarbond , Jhatinga river, and Kathakal river, along with clean 5mm down crusher chips, proved beneficial.To achieve optimal outcomes, it was crucial to incorporate 21% to 25% of the total fine aggregate as 5mm down crusher dust in a well-balanced manner.

For example:

By Weight

For 1 kg total Fine Aggregate.

i) Above mentioned river sand -770 gms (77%)

ii) 5 mm down crusher chips- 230 gms (23%)

Total- 1000 gms (100%)

i.e. 23% Crusher chips to the total wt. of fine aggregate in each batch. This will very nearly match with the grading limit of the Grading Zone-III. The concrete with this fine aggregate will speak the rest in cube test.

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3. MATERIAL USED

Cement:

The investigation made use of locally available 43-grade Ordinary Portland cement, which was tested for various properties in accordance with the IS:4031-1988 standard. The cement met the specifications outlined in the IS:12269-1987 standard.

Coarse Aggregate

The machine is employed as a coarse aggregate alongside crushed annular granite metal, which has an average size of 20mm. It is required to be devoid of dust, clay particles, organic matter, and similar impurities. Various properties of the coarse aggregate are examined and presented in the table. The grading of the coarse aggregate complies with the specifications of IS 383-1970.

Fine Aggregate

The fine aggregate used in this context consists of locally available natural sand and blended sand. This aggregate is carefully selected to ensure it is free from clay, slit, organic impurities, and other contaminants. Various properties of the sand, such as specific gravity and bulk density, are tested following the guidelines specified in IS:2386-1963. The examination of the particle size distribution reveals that the fine aggregate closely aligns with the specifications outlined in zone III of IS:383-1970.

Water

Clean water must be used for the purpose of mixing and healing, ensuring it is free from excessive amounts of oils, acids, alkalis, salts, organic substances, or any other harmful materials. It should be noted that concrete can be adversely affected by impure water. According to the guidelines outlined in IS:456-2000, water that meets the necessary criteria can be used for both blending and curing concrete.

4. PARTICLE SIZE DISTRIBUTION OF SAND BARAK VALLEY REGION

Local Sand obtain from river in barak valley, Silchar are tested. Local Sand mix with stone dust obtained from crusher , quatity of (20-30)% and particle size distribution was conducted . After the particle size distribution it was found that the grading of zone obtain is zone III. It is gives better compressive strength for cement concrete.

4.a) Blended Sand

Total Weight 1000 grm.

Above mentioned river sand -750 gms (75%) (Taranathpur)

5 mm down crusher chips- 250 gms (25%)

Table (4.a)

Sieve Size	Weight retained in grm.	Percentage retained	Cumulative percentage of Fine Aggregate	Percentage of Fine Aggregate passing
10mm	0	0	0	100
4.75mm	8.10	0.8	0.81	99.19
2.36mm	22.50	2.25	3.06	96.94
1.18 mm	64.20	6.42	9.48	90.52
600 micron	281	28.1	37.58	62.42
300 micron	450	45.0	82.58	17.42
150 micron	161	16.1	98.68	1.32
75 micron	12.5	1.25	99.93	0.07

Silt Content 0.07%

Fineness modulus 2.3

Zone-iii

4.(b) Blended Sand

Total Weight 1000 grm.

Above mentioned river sand -700 gms (70%) (Kathal)

5 mm down crusher chips- 300 gms (30%)

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Table (4.b)

Sieve Size	Weight retained in grm.	Percentage retained	Cumulative percentage of Fine Aggregate	Percentage of Fine Aggregate passing
10mm	0	0	0	100
4.75mm	8.20	0.82	0.82	99.18
2.36mm	22	2.2	3.02	96.98
1.18 mm	64	6.4	9.42	90.58
600 micron	280	28.0	37.42	62.58
300 micron	451	45.1	82.52	17.48
150 micron	162	16.2	98.72	1.28
75 micron	12	1.2	99.92	0.08

Silt Content 0.08 %
Fineness modulus 2.32
Zone-iii

4.(c) Sieve Analysis Sand Katakhal river (Barak Valley Region)
Total Weight 1000 grm.

Table(4.c)

Sieve Size	Weight retained in grm.	Percentage retained	Cumulative percentage of Fine Aggregate	Percentage of Fine Aggregate passing
10mm	0	0	0	100
4.75mm	7	0.7	0.7	99.3
2.36mm	16.5	1.65	2.35	97.65
1.18 mm	18.2	1.82	4.17	95.83
600 micron	62	6.2	10.37	89.63
300 micron	721	72.1	82.47	17.53
150 micron	148	14.8	97.27	2.73
75 micron	20.5	2.05	99.32	0.68

Silt Content 0.68 %
Fineness modulus 1.97
Zone-iv

4.d) Blended Sand
Total sample 1000 gm
Above mentioned river sand -770 gms (77%)(Jhatinga)
5 mm down crusher chips- 230 gms (23%)

Table (4.d)

Sieve Size	Weight retained in grm.	Percentage retained	Cumulative percentage of Fine Aggregate	Percentage of Fine Aggregate passing
10mm	0	0	0	100
4.75mm	32	3.2	3.2	96.8
2.36mm	55	5.5	8.7	91.3
1.18 mm	125	12.5	21.2	78.8
600 micron	180	18	39.2	60.8
300 micron	250	25	64.2	35.8
150 micron	300	30	94.2	5.8
75 micron	50	5	99.2	0.8

Silt Content 0. 8%
Fineness modulus 2.30
Zone-iii

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5. RESULTS AND DISCUSSION

Compressive strength, a crucial characteristic in concrete design, can be achieved by natural river sand or with blended sand. We conducted a study over a 28-day period to assess the resulting compressive strength. Three Cubes for each set are used. Compressive Strength of M_{20} grade of concrete used in both sample

Table : Comparison between natural local river sand and blended sand.

Evaluated properties	Local River Sand	Blended Sand
Average Compressive Strength	180 kg/cm^2	260 kg/cm^2

The findings revealed that combining clean and courser sand with a smaller grain size sourced from specific locations in the Barak Valley, including Taranathpur of Dwarbond , Jhatinga river, and Kathakal river, yielded favourable results. The addition of clean crusher chips measuring 5mm down contributed to enhancing the overall strength and performance of the concrete. The trial mix design involving the combination of natural local sand, blended sand, and 5mm down crusher chips resulted in positive outcomes. The incorporation of clean and coarser sand from various sources along with a well-balanced proportion of 5mm down crusher dust helped achieve the desired concrete strength target. These findings can serve as a valuable reference for concrete mix design in the Barak Valley region, but further research and experimentation are necessary to adapt the mix design for other locations.

6. RECOMMENDATIONS

The utilization of a mix consisting of 5mm down crusher sand and local sand, along with proper consideration of other properties of sand, cement, and stone clips, enabled us to achieve the desired target strength. This approach not only resulted in cost savings but also utilized readily available resources effectively. By implementing this technique, we can enhance the efficiency and sustainability of concrete construction while maintaining the required structural integrity.

7. CONCLUSION

From this investigation, it is found that blended sand gives better compressive strength as compared to natural river sand of Silchar for same grade of cement concrete. By using this technique, we were able to achieve the desired target strength while significantly reducing the amount of cement required per cubic meter of concrete. The availability of crusher sand from the stone crusher region made it convenient for us to access this material for our project. We conducted a trial mix design that compared the performance of natural local sand with blended sand. The experimental goal was to find a solution that would not only meet the strength requirements but also ensure that the sand grading complied with the acceptable limits for any Grading Zone. Through testing ,it was found that the combination of 5mm down crusher chips with local sand yielded positive outcomes. We sourced the clean and coarser sand from various locations in Barak Valley, such as Taranathpur of Dwarbond, Jhatinga river, and Kathakal river. Incorporating this blend of sand with the 5mm down crusher chips proved to be beneficial in achieving the desired concrete strength. To achieve optimal results, it was crucial to carefully balance the incorporation of 21% to 25% of the total fine aggregate as 5mm down crusher dust. This careful blending of materials played a significant role in attaining the target strength while reducing the cement requirement by 20-25% per cubic meter of concrete. This technique will save money as well as structure enhancing strength of Civil Engineering structure.

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