ISSN: 0974-5823 Vol. 7 No. 1 January, 2022

International Journal of Mechanical Engineering

CHARACTERIZATION OF CONVENTIONAL SAND AND SEA SAND, THERE BY APPLICATION OF SEA SAND IN CONSTRUCTION

Sk. Subhan Alisha
Assistant Professor, Department of Civil Engineering, Vishnu Institute of Technology, Bhimavaram-534202Andhra Pradesh, India.

K. S. Sai Kumar
Assistant Professor, Department of Civil Engineering, Vishnu Institute of Technology, Bhimavaram-534202Andhra Pradesh, India.

P. Manoj
Assistant Professor, Department of Civil Engineering, Vishnu Institute of Technology, Bhimavaram-534202Andhra Pradesh, India.

M. Mani Kanta
Assistant Professor, Department of Civil Engineering, Vishnu Institute of Technology, Bhimavaram-534202Andhra Pradesh, India.

B.Devika
Assistant Professor, Department of Civil Engineering, Vishnu Institute of Technology, Bhimavaram-534202Andhra Pradesh, India.

Abstract

The top most part of the earth which is abundant is sand, which has mostly been used in the construction industry. There are different types of sand. The aim of this project titled "Characterization of conventional sand and sea sand, there by application of sea sand in construction" is to compare the difference between the two types of sand by conducting experiments. When sea sand is mixed with cement in place of normal river sand to make concrete for buildings, the high content of chloride in sea sand leads to structural integrity problems. This composition absorb humidity, which causes erosion. And also excessive dredging of river sands cause problems to aquatic life
So in the present work, a comparative study is carried out to study the characterization of conventional sand and sea sand by physical analysis ,chemical analysis. The grain size distribution, PH of sand, bulking of sand, comes under physical examination and apart from that chloride test in analysis. The experimental part of advanced testing involves spatial imaging analysis by using Scanning Electron Microscope (SEM). This project highlights the study of using sea-sand in concrete construction in replacement of conventional sand. Presence of chloride in sea sand was compromised by using a combination of fly ash, blast furnace slag cement and chemical admixture, which in turn helps to increase the strength, workability and durability of concrete. Reinforcement with anticorrosive measures can effectively solve the durability problem associated with the abundance of chloride ions in sea-sand in concrete.

Keywords: Strength, Workability, Durability, Anticorrosive measures, Chemical admixtures.

1. Introduction

Sand is a naturally occurring granular material composed of finely divided rock and mineral particles. The composition of sand is highly variable, depending on the local rock sources and conditions, but the most common constituent of sand in inland continental settings and non-tropical coastal settings is silica (silicon dioxide, or SiO_2), usually in the form of quartz.

The second most common type of sand is calcium carbonate, for example aragonite, which has mostly been created, over the past half billion years, by various forms of life, like coral and shellfish. It is, for example, the primary form of sand apparent in areas where reefs have dominated the ecosystem for millions of years like the Caribbean.

1.1. Composition of Sand

ISO 14688 grades sands as fine, medium and coarse with ranges 0.063 mm to 0.2 mm to 0.63 mm to 2.0 mm. In the United States, sand is commonly divided into five sub-categories based on size: very fine sand (1⁄16 – ⅛ mm diameter), fine sand (⅛ mm – ¼ mm), medium sand (¼ mm– ½ mm), coarse sand (½ mm – 1 mm), and very coarse sand (1 mm – 2 mm). These sizes are based on the Krumbein phi scale, where size in $\Phi = -\log_2 D$; D being the particle size in mm. On this scale, for sand the value of Φ varies from −1 to +4, with the divisions between sub-categories at whole numbers.

The most common constituent of sand, in inland continental settings and non-tropical coastal settings, is silica (silicon dioxide, or SiO_2), usually in the form of quartz, which, because of its chemical inertness and considerable hardness, is the most common mineral resistant to weathering.

Sand, as one of the most accessible natural resources, has been used mostly as a construction material since the earliest days of civilization. It is defined as "continuously graded unconsolidated material (sediment) present on the earth's surface as a result of the natural disintegration of rocks.

Texturally soil is not one material but a compound of three ingredients, derived from the same parental rock . They are sand, silt and clay. Though mostly soil occurs as a combination of the three materials, there are places where stretches of sand do occur alone building activity has to be carried out. River sand is used in the construction industry mainly for concrete production and cement-sand mortar production. River sand is obtained by dredging from river beds. It has the major characteristics that since it has been subjected to years of abrasion, its particle shape is more or less rounded and smooth, and since it has been subjected to years of washing, it has very low silt and clay contents.Research to use sea sand for construction, especially, using sea sand to make the cement concrete is aimed to exploit maximally the potential of a local material being available, cheap for socioeconomic developing and prevent from its harmful impaction. However the study to use sea sand cement concrete is a big problem in the civil engineering field.

In many countries sea sand has been used for making cement concrete since a long time ago, naturally, its technology depends on the research achievement and specific conditions of each country. When sea sand is mixed with cement in place of normal river sand to make concrete for buildings, the high content of chloride in sea sand leads to structural integrity problems. This composition absorbs humidity which causes erosion and rusting in the steel rods used in reinforced concrete. The building structural integrity is therefore damaged.Buildings made with reinforced concrete containing sea sand can only last 6-10 years before they must be abandoned. The root cause of structural failure is the high chloride content in the sand. Only with costly special treatment of sea sand can chloride be reduced to a safe level

1.2. Sea Sand

Sea sand can become a potential resource capable of supplying fine aggregate material for domestic civil engineering and construction usage. In addition, using sea sand is economic than using river sand because river sand is more expensive. Sea sand mainly contains much salinity as sodium chloride. If the salt is not treated and sea sand is directly utilized for civil engineering and construction concrete projects these sands are generally suitable for making concrete for base and sub base and tests have been shown that even reinforced concrete could be made of them. The sand dunes are formed by sand particles blown by wind from sea shore. The top most layers of sand dunes contain higher chloride content due to continuous exposure to sea breeze. However, when sea sand is actually utilized, the first problem encountered is the salt contained in the sea sand. A distinction must also be made between sea sand and sand deposits in dry coastal areas. The latter would tend to have very high chloride contents resulting from salt spray and evaporation over long periods of time.

Advantages of sea sand

- It is more rounded or cubical like conventional sand.
- Being natural deposits the grades are generally good and consistent.
- Consists no organic containment .
- Abundantly available.

1.3. Chloride in Sea Sand

The chloride content in sea sand depends on the chloride content in sea water. The sea water contains relatively constant chloride content but more moisture content in sand retains more chloride around particles. In hot climates, though the moisture content is less, due to evaporation of moisture chloride coating will be formed around particles. BS 5328 Part 1: 1991 specifies total chloride limit to 0.4% by weight specified. Sea water has an ion chloride (Cl^-) content of 1.98%, although there would be local fluctuations.

Chang (2008) studied that the determination of the salt content of seawater is an important area of research since ocean currents and global climate are affected by salt content. The primary ionic components of seawater are shown in the Table. These include large amounts of chloride (CI-) and sodium (Na)ions

Effects of chloride sea sand:

- It corrodes the reinforcement present in concrete.

- It not only corrodes but also causes efflorescence due to oozing out of salts from concrete.

1.4. Slag cement

It is formed when granulated blast furnace slag is ground to suitable fines and blended with Portland cement. It has good resistance to chloride ion, improves drying shrinkage, water absorption, corrosion resistance thus improves durability of concrete. Bharathi Portland Slag cement was used in our work which about 40% slag blended in it.

1.5. Fly ash

Fly ash is a by-product from thermal power plant and it is fine as well as spherical in shape. Due to its spherical shape it has greater workability and helps in reducing water requirement during casting. It reduces segregation and bleeding and lowers heat of hydration the colour varies according to it carbon contents from light to dark grey. To ensure better durable concrete, fly ash is an essential element which reduce the attack of sulphates and other components.

Cement reaction:

C3S + H → C – S – H + Ca(OH)2

Pozzolanic reaction:

Ca(OH)2 + S →C – S – H

(Silicate from Fly ash)

The initial setting time of fly ash is low, with increment of age the hydration degree of cement improves and pozzolonic activity of fly ash appear.

Table 1. Properties of Slag Cement

Properties	**Result**
Specific Gravity	2.95
Standard Consistency - % of Water Content	34%
Initial setting time	40 minutes
Compressive Strength	40 N/mm²

Scope Of The Project

Demand for manufactured fine aggregates for making concrete is increasing day by day as river sand cannot meet the rising demand of the construction sector. Because of its limited supply, the cost of Natural River sand has skyrocketed, and its consistent supply cannot be guaranteed. Under these circumstances use of manufactured sand becomes inevitable. In many countries sea sand has been used for making cement concrete since a long time ago, naturally, its technology depends on the research achievement and specific conditions of each country. Therefore studying the differences in properties of both river and sea sand will give an idea whether sea sand can be altered in such a way that it can be used as a substitute for the depleting river sand.

Table 2. Properties of Flyash

Properties	**Results**
Specific Gravity	2.5
Initial setting time	170 minutes
Final setting time	240 minutes

1.7. Objective

- Study the physical properties such as particle shape, avg. size, bulk & tap densities.
- Characterize the sand by XRD, SEM analysis.
- Usage of sea sand in concrete construction in replacement of river sand

2. Literature Review

MARATHE(2014) - During the present investigation the sediments of the Tapti River have been analysed by the XRD and SEM techniques. In this investigation the minerals found are Quartz, Kaolinites, Calcite, Vermiculite, Palygorskite, Micas and Gibbsite. Among them Quartz is the most abundant material in Igbokoda area in Nigeria. So that samples were collected in those areas and X-ray analysis were conducted .Therefore quartz has got the highest wavelength .So he concluded that Quartz is more abundant in that area.

ARABINDA BANDYOPADYOPADHYAY - Traditionally, river sand has been the main source of supply but the restriction imposed by the Green Tribunal because of environmental degradation considerations has led to investigations into alternate sources. He provides sea sand with behaviour of mixture with respect to workability was specific gravity of 2.51 and fineness modulus of 2.39 was used and observed.

SAMPATH and MOHAAN KUMAR - The journal is to provide the construction industries expect a series shortage Sand Near future to overcome exploitation of river sand, this journal deals with the use of Sea sand as substitute for conventional sand.

ATUL VERMA - Report deals with the comparison of materialistic differences between sea and river sand. Experimental part involved in testing of sand by scanning electron microscope , X-ray fluorescence, X-ray diffractometer, optical microscope to find average grain size.

SRI LAKSHMI, GIRI PRASAD - The use of river sand can be replaced with other materials to protect the environment of the river as well as prevent erosion and flooding. This journal provides abundant sea sand is one of the alternatives for the reduction and usage of conventional sand.

SIDHARDHAN, JANSI SHEELA- Authors provide, if the sea sand is used instead of conventional sand then the sea sand must be characterized by surface procedures like X-ray analysis and then physical properties are to be recorded

2.1 CHARACTERIZING THE SEA AND CONVENTIONAL SAND

A series of tests were carried out to characterize the sea and conventional sand.In present study to examine the properties of river and sea sand physical and chemical,surface analysis were carried out for both types of sand.After examination comparison is to be done between sea and river sand to know how the characteristics were varying .
For this the sea sand is collected from 3 different places they are Antharvedi, Podu, Perupalem and 2 different river sands they are krishna and godavari.

2.2 SPECIFIC SCOPE OF STUDY

Usage of sea sand is a quite complex in practice and the river sand is limited. So it is necessary to know what are the differences between sea and conventional sand properties. Hence the present study is focused on Characterizing the sea sand and conventional sand, usage of sea sand in concrete construction by using admixtures
.

3.0 Methodology

3.1 Physical Analysis

The sea sand and conventional sand were collected at 5 different places at Antharvedi, perupalem, podu, godavari, krishna. These five samples were tested according to IS, to determine the engineering properties like Bulking of sand, Sieve analysis, Specific gravity.

3.2 .Chemical Analysis

Among five samples, three are marine sands so these sands are majorly rich in chloride when compared to conventional sands. So as to know how much of chloride present in marine sands ,chloride test have to be conducted in chemical analysis.

3.3 . Imaging And Surface Analysis

Sand is a mixture of many minerals, so as to identify the minerals peasant in sea and conventional sand X-ray diffraction method was used and also to analyse the sand structure scanning electron microscope methods were used.

4.0 Experimental Work

The various methods to characterize the conventional and sea sand.
Physical Analysis
Chemical Analysis
Imaging and Surface Analysis

4.1 Physical Analysis

Inorder to study the Soil Properties like grain size, increase in volume of grains in contact of water and also to characterize the sand and also specific gravity, these analysis have to be done**.**
To determine the above mentioned properties, physical analysis done in 3 methods:

- Bulking of san
- Sieve Analysis
- Specific Gravity

4.2 Chemical Analysis

- **Soil** is the biologically active ,porous material that has developed in the uppermost layer of earth crust.

- These are many organic material and inorganic material of soil
- Topography and presence of living organisms determines the quality of soil.
- Soil generally contains 40-50% of inorganic,5% organic matter,25% water,25% air.
- Among many organic chemicals chloride and sulphide are very harmful to construction, and its causes corrosion.
- These chemicals are very abundantly available in marine soils.
- To check for permissible limits of chloride and sulphide in soil these tests were conducted for sea and conventional sands.

4.2.1 Chloride Test

Chloride is estimated by chloride is precipitated by silver nitrate with potassium chromate indicator. The chemical reactions involved in this are

$AgNo3+Cl^-$ → Agcl+No3.

2AgNo3+K2Cr2O4 → Ag2CrO4+2KNO3.

PROCEDURE

The various steps involved to perform the test are:

1. Sample preparation.

2. Titration against silver nitrate solution.

Extraction of chloride from sample

4.3 Image and Surface Analysis

- These analyses would help to determine structure and metamorphism of soil.
- The top most part of the soil contains so many minerals and metals.
- These minerals can be identified by SCANNING ELECTRON MICROSCOPE

5. Results and discussions

5.1.General

samples were collected in different sea and river lands. Which are saturated sands of sea and river water.
The places were samples collected are
ANTARVEDI,
PERUPALEM
PODU
GODAVARI
KRISHNA.
Among the first three samples are marine sands, and Godavari, Krishna are river sands. The various tests had been conducted and sub categorized into physical, chemical and surface analysis.

5.2.Bulking of Sand

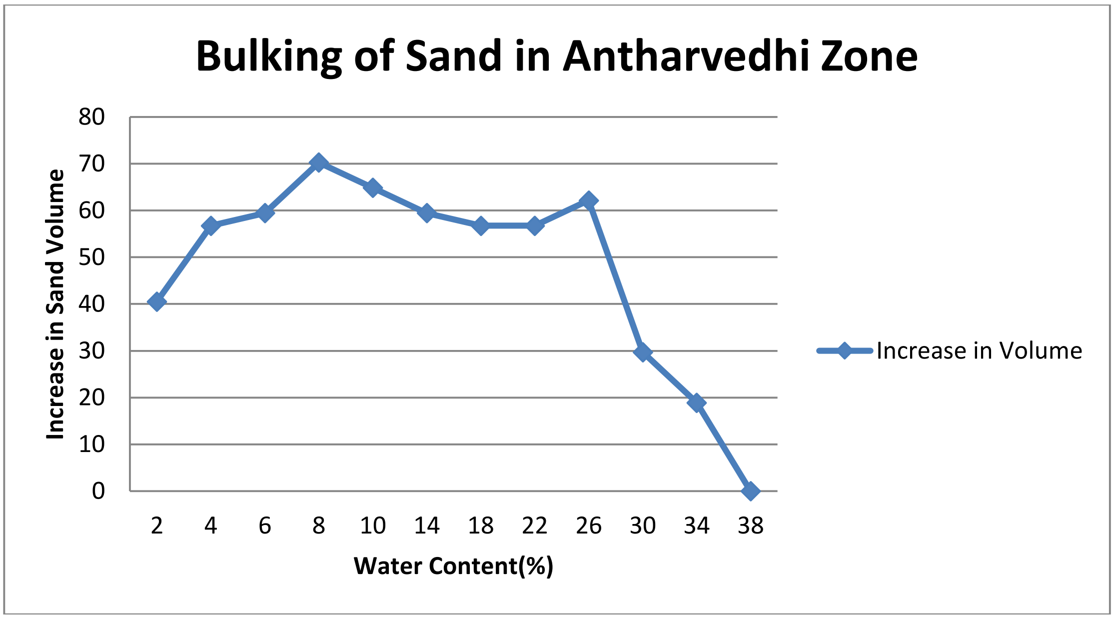
This test was conducted for above 5 samples, the results were tabulated below

5.2.1.Antarvedi Zone

Table 3. Bulking of Sand in Antarvedi Zone

S.NO	**%WATER ADDED**	**VOLUMEOF WATER ADDED**	**VOLUME OF SAND (V_2)**	**%INCREASE IN SAND VOLUME V_2-V_1/V_1 *100**
1.	2%	10ml	520ml	40.540
2.	4%	10(20ml)	580ml	56.756

3.	6%	10(30ml)	590ml	59.459
4.	8%	10(40ml)	630ml	70.270
5.	10%	10(50ml)	610ml	64.864
6.	14%	20(70ml)	590ml	59.459
7.	18%	20(90ml)	580ml	56.756
8.	22%	20(110ml)	580ml	56.756
9.	26%	20(130ml)	600ml	62.162
10.	30%	20(150ml)	480ml	29.72
11.	34%	20(170ml)	440ml	18.91
12.	38%	20(190ml)	370ml	0



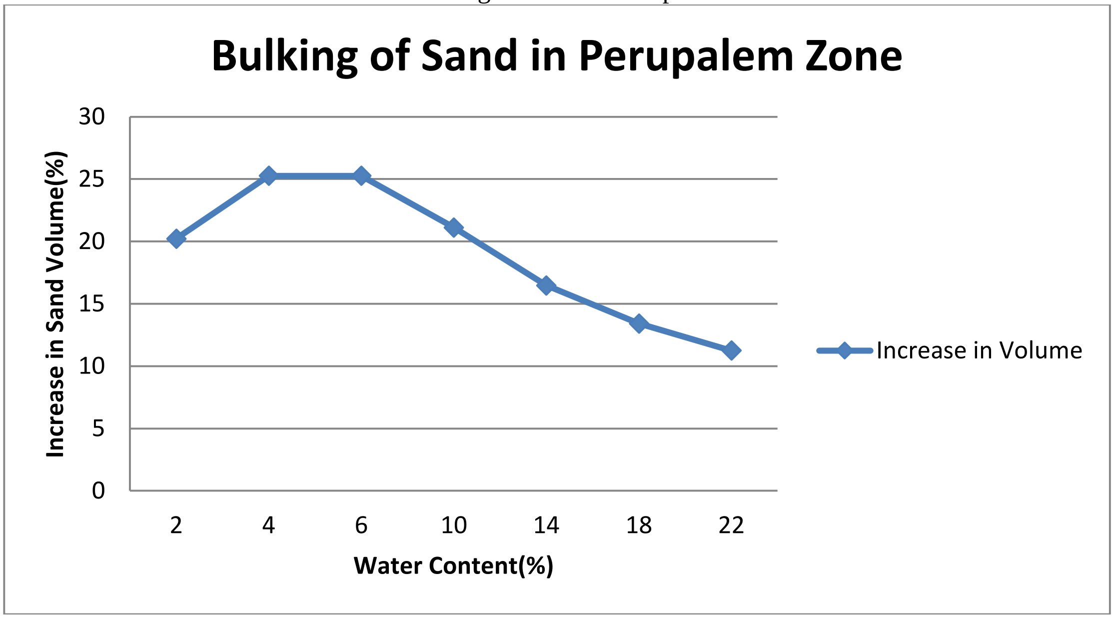
Graph-1 Bulking of Sand in Antharvedhi Zone

The highest percentage increase in volume of sand was observed at 70% at water content of 8%.

5.2.2. Perupaalem Zone

volume V_1=710ml.

Table 4. Bulking of Sand in Perupaalem Zone



Graph. 2. Bulking of Sand in Perupaalem Zone

The highest percentage increase in volume of sand was observed at 26% at water content of 5%.

5.2.3. Poodu Zone

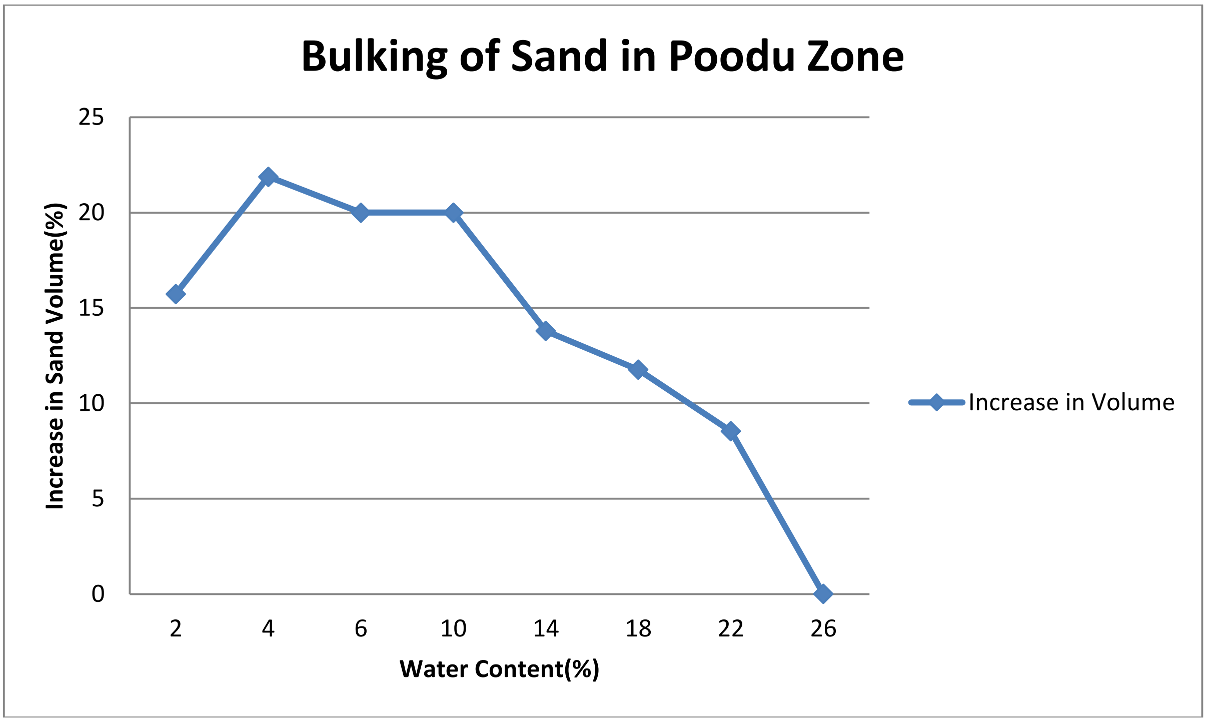
Table 5. Bulking of Sand in Poodu Zone

S NO:	**% WATER ADDED**	**VOLUME OF SAND (V_2)**	**%INCREASE IN SAND VOLUME V_2-V_1/V_1 *100**
1.	2%	890	20.22
2.	4%	950	25.26
3.	6%	900	25.26
4.	10%	900	21.11
5.	14%	850	16.47
6.	18%	820	13.41
7.	22%.	800	11.25

S NO:	**% WATER ADDED**	**VOLUME OF SAND(V2)**	**% INCREASE IN SAND VOLUME**
1.	**2%**	**890**	**15.73**
2.	**4%**	**960**	**21.875**

3.	6%	900	20
4.	10%	900	20
5.	14%	870	13.79
6.	18%	850	11.76
7.	22%	820	8.54
8.	26%	760	0.013

Initial volume is observed = 750ml



Graph. 3. Bulking of Sand in Podu Zone

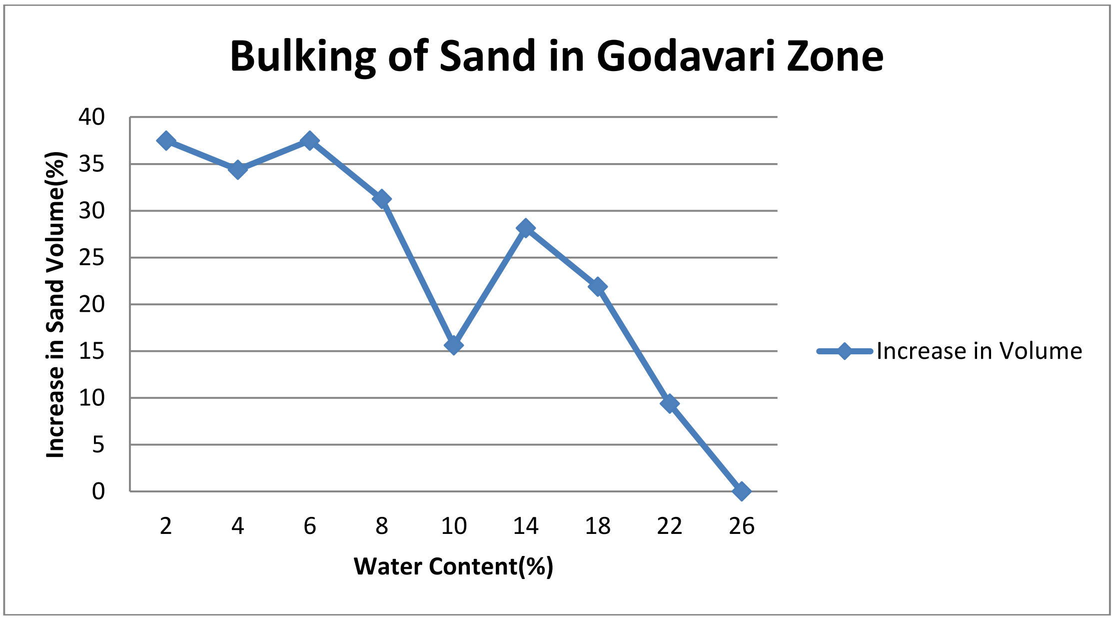
5.2.3. Godavari Sand

Table 6. Bulking of Godavari Sand

S NO	% WATER ADDED	VOLUME OF WATER ADDED	VOLUE OF SAND (V)	%INCREASE IN SAND VOLUME V_2-V_1/V_1 *100
1.	2%	10ml	440	37.5
2.	4%	10(20ml)	430	34.375
3.	6%	10(30ml)	440	37.5
4.	8%	10(40ml)	420	31.25
5.	10%	10(50ml)	370	15.625
6.	14%	20(70ml)	410	28.125

7.	**18%**	**20(90ml)**	**390**	**21.875**
8.	**22%**	**20(110)**	**350**	**9.375**
9.	**26%**	**20(130)**	**320**	**0**

The highest percentage increase in volume of sand was observed at 37.5% at water content of 6%.

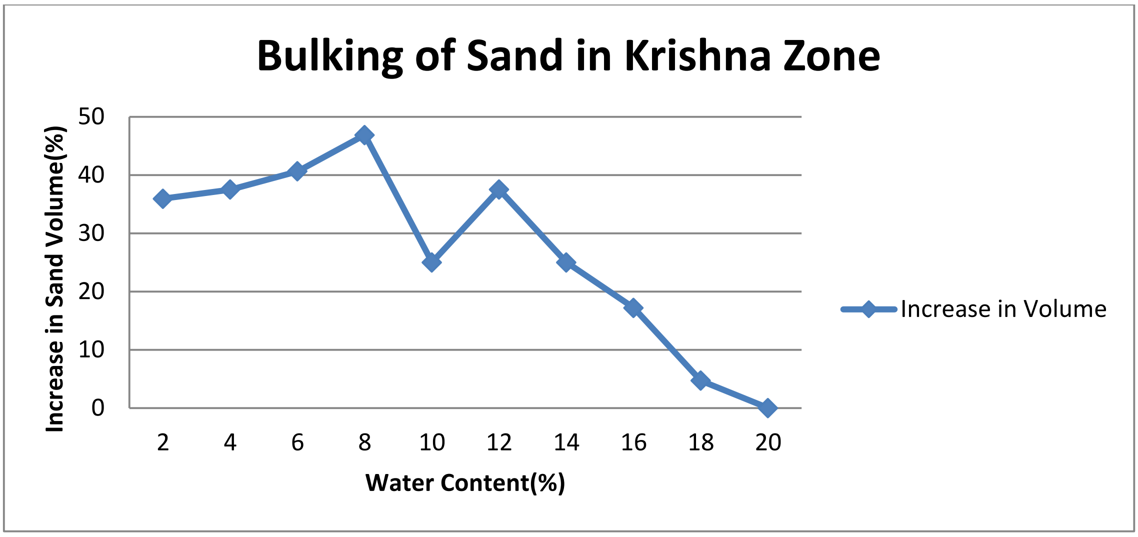


Graph. 4. Bulking of Sand in Godavari Zone

5.2.4. Krishna Sand
Initial volume V_1=640ml.
Weight taken=1000grams.
The highest percentage increase in volume of sand was observed at 47% at water content of 8 %.

Table 7. Bulking of Krishna Sand

S NO	% WATER ADDED	VOLUME OF WATER ADDED	VOLUME OF SAND (V_2)	%INCREASE IN SAND VOLUME V_2-V_1/V_1 *100
1.	2%	20ml	870	35.937
2.	4%	40ml	880	37.5
3.	6%	60ml	900	40.625
4.	8%	80ml	940	46.875
5.	10%	100ml	800	25
6.	12%	120ml	880	37.5
7.	14%	140ml	800	25
8.	16%	160ml	750	17.187
9.	18%	180ml	670	4.687
10.	20%	200ml	640	0



Graph. 5. Bulking of Krishna River Sand

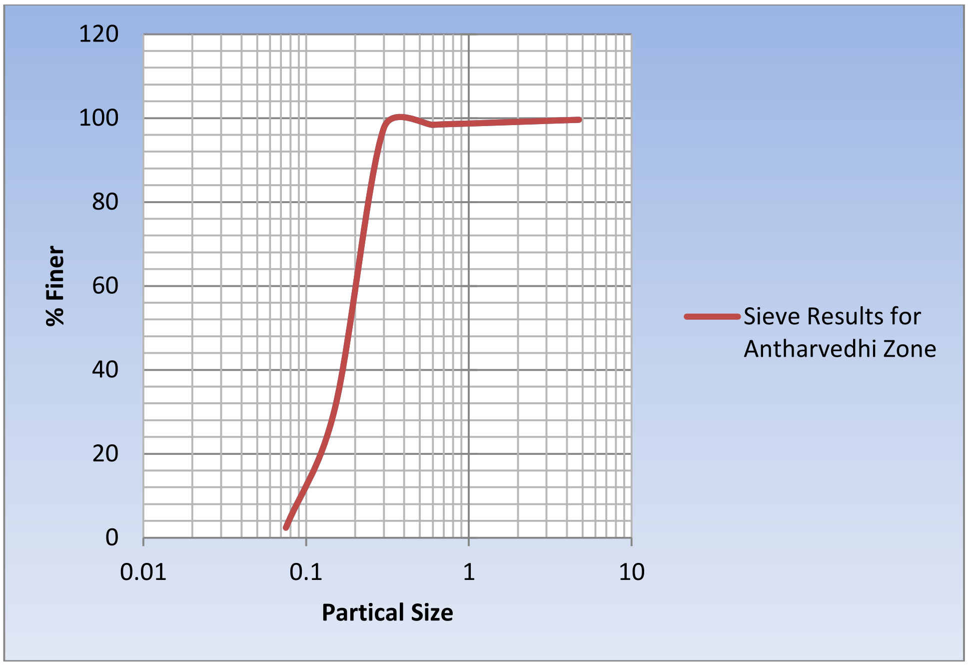
5.3.0. Sieve Analysis

Same like Bulking of sand , Sieve analysis is done for same 7 samples. The results were tabulated below.

5.3.1. Antarvedi Zone

Table 8. Sieve Analysis of Antarvedi Sand

IS Sieve No (mm)	Weight Retained	Cumulative Weight	Cumulative Percentage	%Cumulative Passing
4.75	0.002	0.002	0.4	99.6
2.36	0.002	0.004	0.8	99.2
1.18	0.002	0.006	1.2	98.8
600µ	0.002	0.008	1.6	98.4
300µ	0.004	0.012	2.4	97.6
150µ	0.334	0.346	69.2	30.8
75µ	0.142	0.488	97.6	2.4
PAN	0.012	0.5	100	0



Graph. 6. Sieve Analysis Log Curve for Antharvedhi Zone

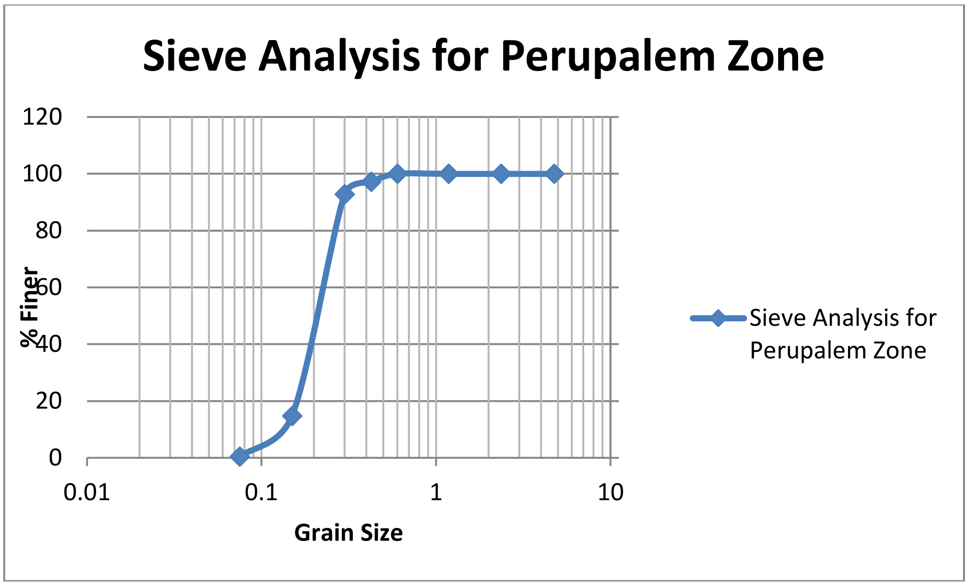
- Fineness Modulus = 2703.2/100 = 2.732
- According to Indian Standards, the normal range for fineness modulus of fine aggregate in fine sand is "2.2 to 2.6".
- The sand is slightly higher than normal range.
- D_{60} = 0.2, D_{30} = 0.15, D_{10} = 0.09
- C_u = 0.2/0.09=2.22, C_c = 1.25
- C_u>6, 1<=C_c<=3
- The above conditions are not satisfied so these are poorly graded Sands(SP).

5.3.3. Perupalem Zone

Table 9. Sieve Analysis of Perupalem Sand

ISSIEVE NO (mm)	WEIGHT RETAINED	CUMULATIVE WEIGHT	CUMULATIVE PERCENTAGE RETAINE	%CUMULATIVE PASSING
4.75	0	0	0	100
2.36	0	0	0	100
1.18	0	0	0	100
600µ	0	0	0	100
425µ	14	2.8	2.8	97.2
300µ	22	4.4	7.2	92.8
150µ	390	78	85.2	14.8
75µ	72	14.4	99.6	0.4

PAN	**2**	**0.4**	**100**	**0**



Graph. 7. Sieve Analysis of Perupalem Sand

- Fineness Modulus = 294.8/100 = 2. 948

5.3.4. Godavari Sand

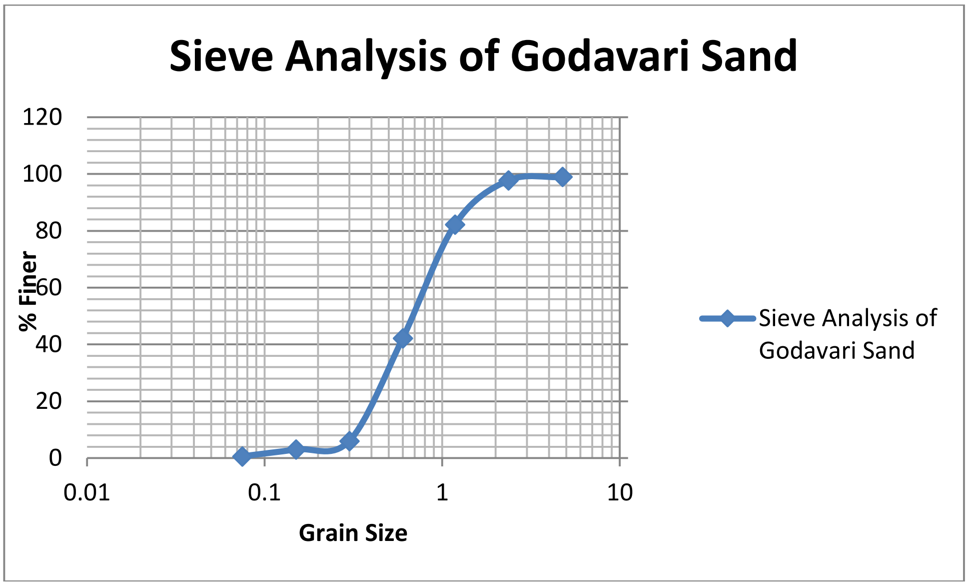
Table. 9. Sieve Analysis of Godavari Sand

IS SIEVE NO (mm)	WEIGHT RETAINED	CUMULATIV E WEIGHT	CUMULATIVE PERCENTAGE RETAINED	%CUMULATIVE PASSING
4.75	**0.01**	**0.01**	**1**	**99**
2.36	**0.012**	**0.022**	**2.2**	**97.8**
1.18	**0.156**	**0.178**	**17.8**	**82.2**
600µ	**0.4**	**0.578**	**57.8**	**42.2**
300µ	**0.362**	**0.94**	**94**	**6**
150µ	**0.03**	**0.97**	**97**	**3**
75µ	**0.24**	**0.994**	**99.4**	**0.6**
PAN	**0.006**	**1**	**100**	**0**

- Fineness Modulus = 469.2/100 = 4.692
- According to Indian Standards, the normal range for fineness modulus of fine

aggregate in "Coarse sand" is "2.9 to 3.2".

- But this sand has higher fineness modulus than its normal range



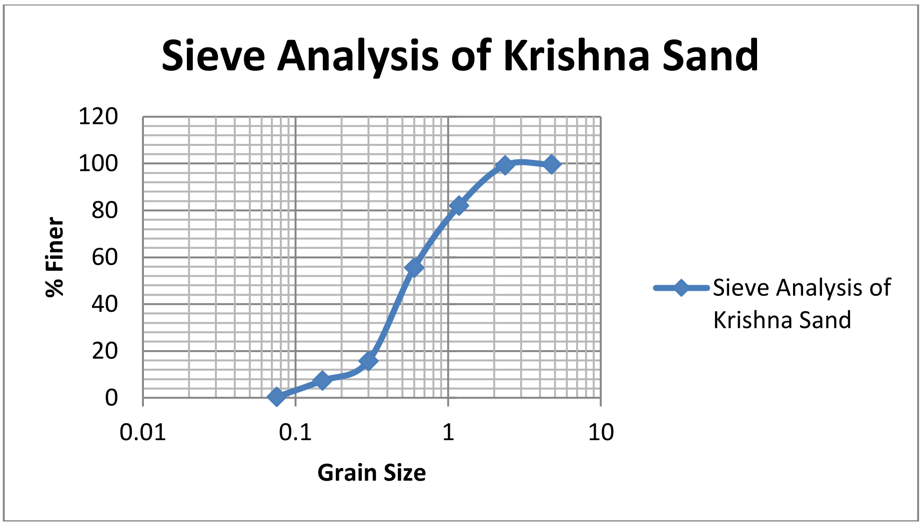
Graph. 8. Sieve Analysis of Godavari Sand

5.3.5. Krishna Sand

Table. 10. Sieve Analysis of Krishna Sand

IS SIEVE NO (mm)	WEIGHT RETAINED	CUMULATIVE WEIGHT	CUMULATIVE PERCENTAGE RETAINED	%CUMULATIVE PASSING
4.75	0.002	0.002	0.4	99.6
2.36	0.002	0.004	0.8	99.2
1.18	0.086	0.09	18	82
600µ	0.132	0.222	44.4	55.6
300µ	0.1991	0.4211	84.22	15.78
150µ	0.042	0.4631	92.62	7.38
75µ	0.0349	0.498	99.6	0.4
PAN	0.002	0.5	100	0

- Fineness Modulus = 440.04/100 = 4. 4004
- According to Indian Standards, the normal range for fineness modulus of fine aggregate in " Medium sand" is " 2.6 to 2.9"
- But this sand has more fineness modulus than standard range.
- D60 = 0.69, D30 = 0.4, D10 = 0.23
- Cu = D60/D10=0.69/0.23=3, Cc = D230/(D60 * D10) = 0.42/ (0.69*0.23) = 1.008 For sand
- Cu>6, 1<=Cc<=3
- So this is poorly graded Sand, therefore it is "SP".



Graph. 9. Sieve Analysis of Krishna Sand

5.4.0. Specific Gravity

5.4.1. Poodu Sand

W_1 = Empty weight of pycnometer=616 gms.
W2 = Pycnometer + ⅔ of dry sand=972 gms
W3 = Pycnometer + sand + water=1720GMS.
W4 = Full of water=1500.
SPECIFIC GRAVITY=$(W_2-W_1)/((W_2-W_1)-(W_3-W_4))$
=(972-616)/((972-616)-(1720-1500))
=2.61.

5.4.2. Perupalem Sand

W_1 = Empty weight of pycnometer=616 gms
W_2 = Pycnometer + ⅔ of dry sand=1058gms
W_3 = Pycnometer + sand + water=1774gms
W_4 = Full of water=1500gms
SPECIFIC GRAVITY=$(W_2-W_1)/((W_2-W_1)-(W_3-W_4))$
=(1058-616)/((1058-616)-(1774-1500))
=2.63.

5.4.3. Antarvedi Sand

W_1 = Empty weight of pycnometer=0.634kg
W_2 = Pycnometer + ⅔ of dry sand=1.452kg
W_3 = Pycnometer + sand + water=2.034kg
W_4 = full of water=1.526kg
SPECIFIC GRAVITY=$(W_2-W_1)/((W_2-W_1)-(W_3-W_4))$
=(1.452-0.634)/((1.452-0.634)-(2.034-1.526))
=2.638.

5.4.4. Krishna Sand

W_1 = Empty weight of pycnometer= 0.616 kg W_2 = Pycnometer + ⅔ of dry sand= 1.498kg W_3 = Pycnometer + sand + water=2.056 kg W_4= Full of water=1.52 kg SPECIFIC GRAVITY=$(W_2-W_1)/((W_2-W_1)-(W_3-W_4))$ =(1.498-0.616)/((1.498-0.616)-(2.056-1.52))
=2.54913.

5.5.0. Chloride Analysis

5.5.1. Antarveedi Sand

Table. 11. Chloride Analysis of Antarveedi Sand

S NO	INITIAL READING	FINAL READING(ml)	SILVER NITRATE CONSUMED.(ml)

Trial-1	**0**	**16.5**	**16.5**
Trail-2	**0**	**16**	**16**
Trail-3	**0**	**16.5**	**16.5**

chloride (mg/L)=(ml of $AgNO_3$*35.46*1000*Normality of silver nitrate)/(ml of sample taken) = (16.5*35.46*1000*0.0141)/(25)

=329.990mg/l.

Chloride in soil sample(if 50gm of dry soil is dissolved in 250ml distilled water)

= 329.990*5

=1649.95 microgram/gram.

=0.164995%.

ASTM(American Society for Testing and Materials)suggests, for fine aggregate the total chloride is less than

0.1%.

But this soil has more chloride content that its permissible value.

5.5.2. Peerupalem Sand

Table. 12. Chloride Analysis of Peerupalem Sand

S NO	INITIAL READING	FINAL READING(ml)	SILVER NITRATE CONSUMED.(ml)
Trial-1	**0**	**12.7**	**12.7**
Trail-2	**21**	**33.8**	**12.8**
Trail-3	**34.4**	**47.2**	**12.8**

chloride (mg/L)=(ml of $AgNO_3$*35.46*1000*Normality of silver nitrate)/(ml of sample taken)

=(12.8*35.46*1000*0.0141)/25

=255.992mg/l

Chloride in soil sample(if 50gm of dry soil is dissolved in 250ml distilled water)
=225.992*5

=1279.96 microgram/gram.
=0.127%

ASTM(American Society for Testing and Materials)suggests, for fine aggregate the total

chloride is less than

0.1%.
This soil has slightly higher than its permissible value.

5.3. Poodu Sand

Table. 13. Chloride Analysis of Poodu Sand

S NO	INITIAL READING	FINAL READING(ml)	SILVER NITRATE CONSUMED.(ml)
1	0	37.7	37.7
2	0	38.3	38.3
3	0	40.8	40.8
4	0	36.2	36.2
5	0	36.5	36.5

AVERAGE VALUE=38

chloride (mg/L)=(ml of $AgNO_3$*35.46*1000*Normality of silver nitrate)/(ml of sample taken)
=(38*35.46*1000*0.0141)/25

=759.978mg/l
Chloride in soil sample(if 50gm of dry soil is dissolved in 250ml distilled water)
=759.978*5
=3799.893 microgram/gram.

=0.379%

ASTM(American Society for Testing and Materials)suggests, for fine aggregate the total chloride is less than 0.1%

This soil has slightly higher chloride content than its permissible value

5.5.4. Krishna Sand

Table. 14. Chloride Analysis of Krishna Sand

S NO	INITIAL READING	FINAL READING(ml)	SILVER NITRATE CONSUMED.(ml)
1	0	10	10
2	0	6	6
3	0	5	5
4	0	10	10
5	0	5	5

AVERAGE VALUE=7.2.

chloride (mg/L)=(ml of $AgNO_3$*35.46*1000*Normality of silver nitrate)/(ml of sample taken)

=(7.2*35.46*1000*0.0141)/25

=143.99mg/l

Chloride in soil sample(if 50gm of dry soil is dissolved in 250ml distilled water)

=143.99*5

=719.97micro gram/gram.

=0.0719%

ASTM(American Society for Testing and Materials)suggests, for fine aggregate the total chloride is less than 0.1%.

This soil is in permissible value.

5.5.5. Godavari Sand

Table. 15. Chloride Analysis of Godavari Sand

S NO	INITIAL READING	FINAL READING(ml)	SILVER NITRATE CONSUMED.(ml)
1	0	9	9
2	3.9	4.8	0.9
3	4.9	5.8	0.9

Chloride (mg/L)=(ml of $AgNO_3$*35.46*1000*Normality of silver nitrate)/(ml of sample taken)

=(0.9*35.46*1000*0.0141)/25

=17.999mg/l

Chloride in soil sample(if 50gm of dry soil is dissolved in 250ml distilled water)

=17.99*5

=89.99micro gram/gram.

=0.0089%

ASTM(American Society for Testing and Materials)suggests, for fine aggregate the total chloride is less than

0.1%.

This soil was in its permissible value.

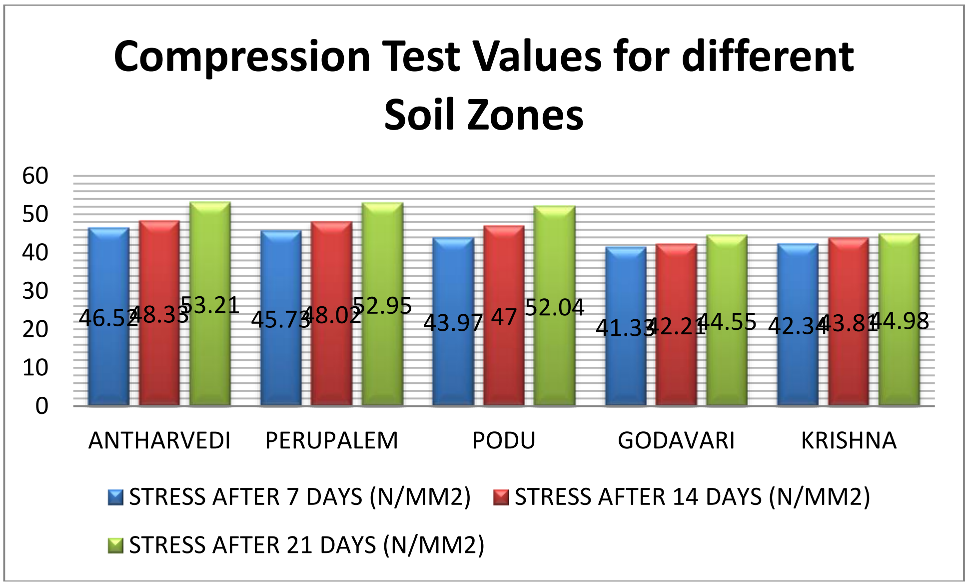
5.6.0. Compression Test

Table. 16. Quantity of materials required for 15cm*15cm*15cm of concrete

S.No	**DISCRIPTION**	**QUANTITY**
1.	GRADE	M40
2.	VOLUME OF CONCRETE	3375CM3
3.	WEIGHT OF CEMENT	1.43KG
4.	WEIGHT OF FINE AGGREGATE	2.3KG
5.	WEIGHT OF COARSE AGGREGATE	4.15KG
6.	WEIGHT OF FLY ASH	0.2875KG
7.	WATER CEMENT RATIO	0.36
8.	QUANTITY OF WATER USED	0.517L
9.	QUANTITY OF SUPER PLASTICIZER USED	0.0071L

Table. 17. Compression Test Values for different Soil Zones

S.No	SAMPLE	STRESS AFTER 7 DAYS (N/MM2)	STRESS AFTER 14 DAYS (N/MM2)	STRESS AFTER 21 DAYS (N/MM2)
1.	ANTHARVEDI	46.52	48.33	53.21
2.	PERUPALEM	45.73	48.02	52.95
3.	PODU	43.97	47.00	52.04
4.	GODAVARI	41.33	42.21	44.55
5.	KRISHNA	42.34	43.81	44.98



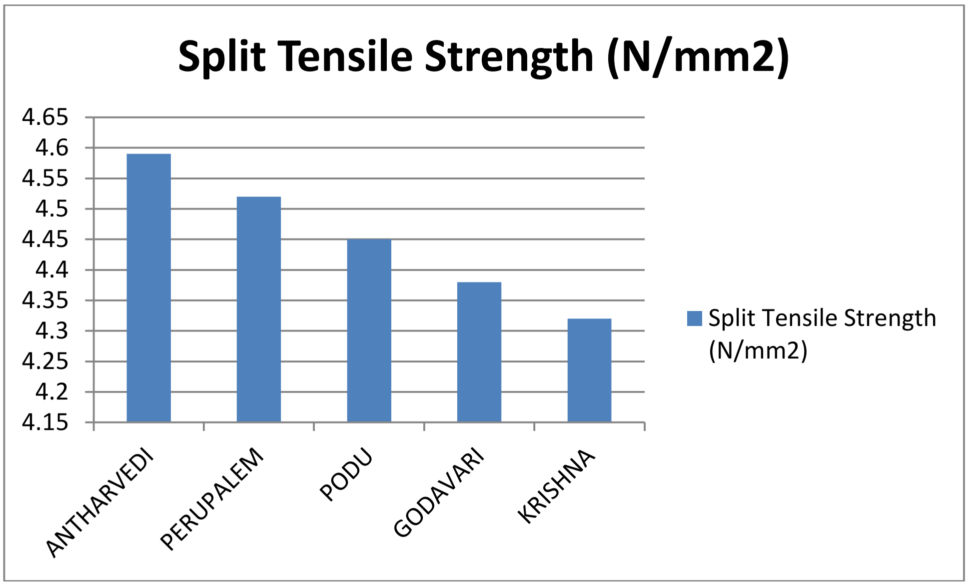
Graph. 10. Compression Test Values for different Soil Zones

5.7.0. Split Tensile Strength Test Values

Table. 18. Split Tensile Strength Values for different Soil Zones

S.No	SAMPLE	MAXIMUM LOAD (KN)	SPLITTING TENSILE STRENGTH (N/MM2)
1.	ANTHARVEDI	325	4.59
2.	PERUPALEM	323	4.52
3.	PODU	318	4.45
4.	GODAVARI	310	4.38

5.	KRISHNA	309	4.32



Graph. 11. Split Tensile Strength Values for different Soil Zones

5.8.0. Accelerated Corrosion Test Values

Table. 19. Accelerated Corrosion Test Values for different Soil Zones

S.No	**SAMPLE**	**INITIAL MASS (KG)**	**FINAL MASS (KG)**	**% MASS LOSS**
1.	ANTHARVEDI (SEA SAMPLE)	0.106	0.104	0.018
2.	GODAVARI (RIVER SAMPLE)	0.110	0.110	0

5.9.0. Results for Scanning Electron

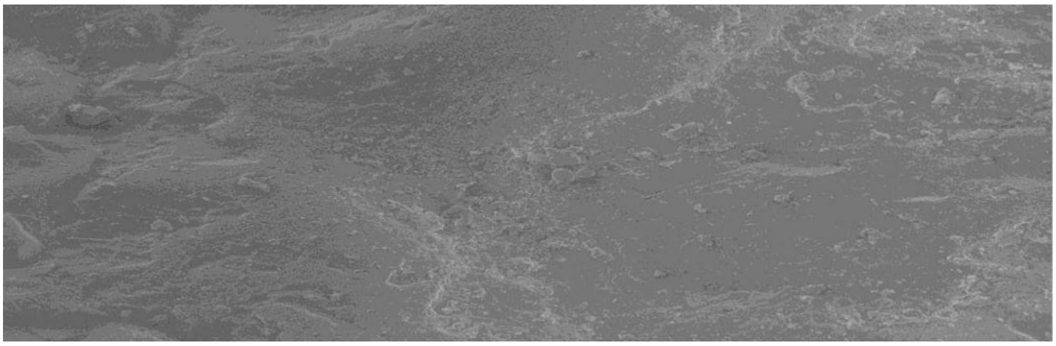


Figure.1. Microscopic view of Godavari Sand

Figure.2. Microscopic view of Antharvedi Sand

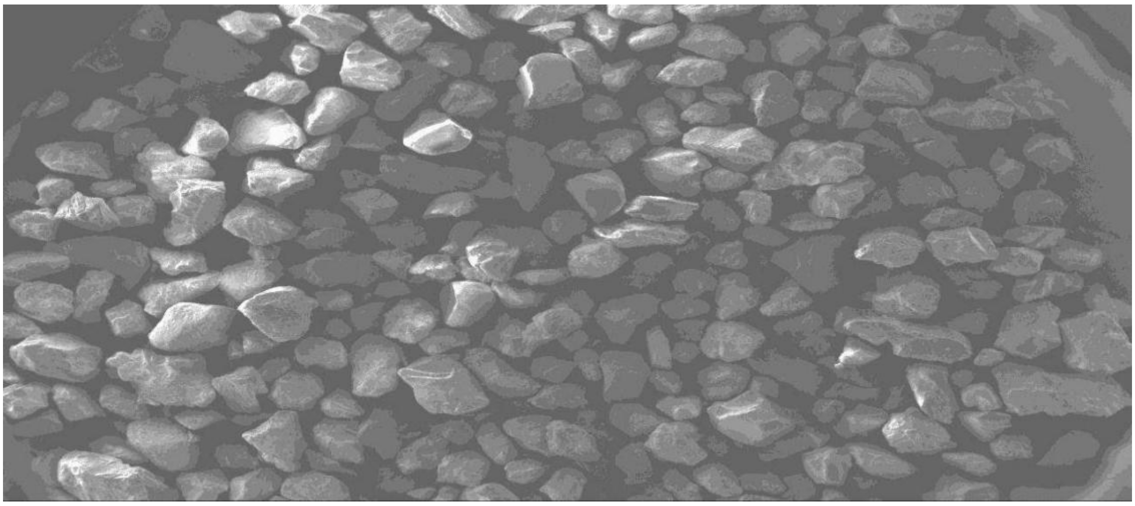


Figure.3. Microscopic view of Peerupalem beach Sand

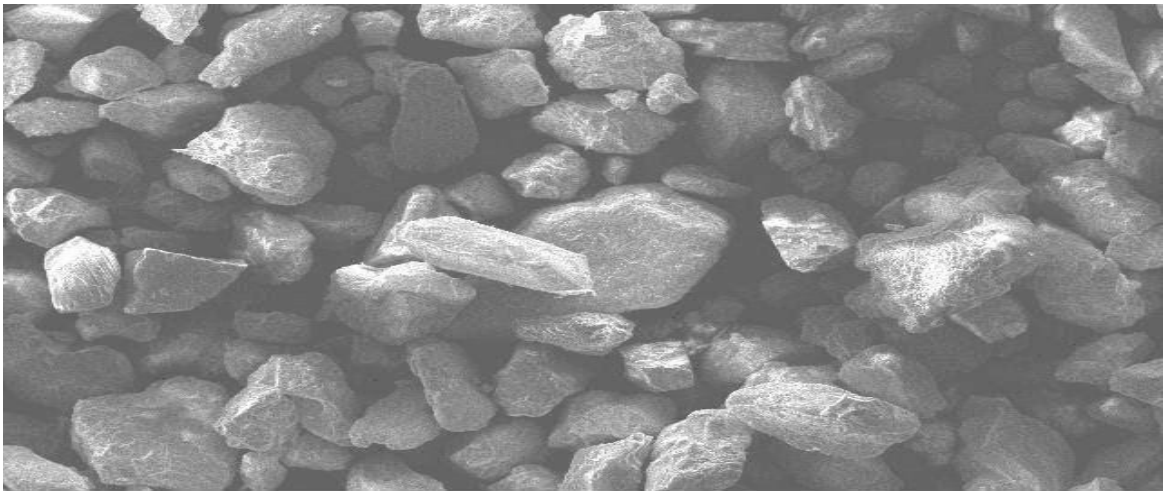


Figure.4. Microscopic view of Poodu beach Sand

6. Summary

6.1..Sea Sand

From the test results studied in chapter 5,Bulking of sand from 5.2.1 to 5.2.5 shows that the Antharvedi sand has highest increase in volume about 70 % with a water content of 8%,and in the same way odalarevu sand had highest water absorbing capacity about 9%,and the pedhapatnam sand occupied least percentage increase in volume of about 22% at 4% water absorption.

From sieve analysis chapter 5.3.1 to 5.3.5,the experimental results shown that Pedhapatnam sand was a Well graded sand (SW),and all other sands are poorly graded sands.Only Machilipatnam and Pedhapatnam sands fineness modulus are in normal range i.e in between 2.2 to 2.6.

The pedhapatnam sand had high chloride content for about 0.3791%.and it was very much greater than Permissible limit

6.2 .Conventional Sand

From the test bulking of sand conducted in 5.2.6 to 5.2.7 River krishna occupied highest percentage of increase in volume 47% at water absorption of 8% when compared to godavari. Both the sands are poorly graded (SP), and both sands has fineness modulus greater than 3. These two sands has very less amount of chloride content and which are in permissible limits.

6.3 .Application of Sea Sand in Construction

Using sea sand in concrete to replace river sand, has been evaluated by conducting strength test. Blast furnace slag cement and epoxy coated reinforcement has been used to solve the durability problem associated with the chloride content in sea sand. Accelerated corrosion

Test has been conducted to determine the effect of using epoxy coated reinforcement in concrete to reduce corrosion rate. In compressive strength test sea sand and normal water combination expressed the highest final day compressive strength. In splitting tensile strength sea sand and normal water combination attained maximum strength. By the implementation of this method in construction large amount of construction materials used can be replaced by low rate economic materials with better strength and durability

7. Conclusion

From the study carried out from the Physical analysis, Chemical analysis and surface analysis, the following conclusions were made,

- The sea sand samples were very much finer than the conventional sand samples.
- In comparison of sea sand and conventional sands, sea sands had highest increase in volume with high water absorbency
- Sea sands comes very closure to well graded conditions compared to river sands.
- Chloride content was very high in sea sands than conventional sands.
- Using sea sand in concrete to replace river sand, has been evaluated by conducting strength test.
- Blast furnace slag cement and epoxy coated reinforcement has been used to solve
- The durability problem associated with the chloride content in sea sand.
- Accelerated corrosion test has been conducted to determine the effect of using epoxy coated reinforcement in concrete to reduce corrosion rate.

8. Acknowledgementn

The satisfaction that accompanies the successful completion of any work would be incomplete without mentioning the people who made it possible and whose encouragement and guidance has been a source of inspiration throughout the course of the project.We are thankful to the sanctum VISHNU INSTITUTE OF TECHNOLOGY for giving the opportunity to fulfill our aspirants

9. Reference

[1] Arora, K.R "Soil mechanics and foundation engineering", published by Standard publishers Distributors, 1987.

[2] Gopal Ranjan., Rao A.S.R.,"Basic and applied soil mechanics", published by New Age International, 2007.

[3] Hashida Matsunaga.N and Komatsu.Tcostal,(1992)"Present situation of sea-sand mining in Kyushu Island, Japan, and it's influence on coastal environment", engineering proceedings, volume 23.

[4] IS 2386" Bulking of sand", and Bureau of Indian Standards.

[5] IS 2720(part IV)-1985 "Sieve analysis of soil", Bureau of Indian Standards.

[6] IS 2720 (part III)- 1980"Determination of specific gravity for fine grained and coarse grained soils", Bureau of Indian standards.

[7] BS 812(port 117) : Method of determination of total soluble chloride in soil.

[8] ASTM - American Society for Testing and Materials for fine aggregate.

[9] Marathe (2014),"Invested tapati river by characterizing the sand with XRD and SEM".

[10] Sampath and mohan kumar "Studied the behaviour of sea and river sands and invested alternate source for river sand due to shortage may come to river sand in near future".

[11] Arabinda Bandyupayopadhyay, "This journal deals with the behaviour of sea and conventional sand characteristics".

[12] Sri lakshmi and Giri prasad,"journal deals with the study of alternatives of the river sand".

[13] Sidhardhan and jhansi sheela," This journal deals with, if sea sand were used then its characters of sea sand were investigated by this journal.

[14] G.J.OSBORNE : Durability of Portland blast-furnace slag cement concrete, Cement and Concrete Composites, Volume 21, Issue 3, 1999, Pages 233.

[15] J MARTIN : Superplasticizers are additions that allow a given degree of workability to be obtained at a reduced water/cement ratio, Materials for Engineering (Third Edition), 2006.

[16] Chemical Admixtures for Concrete, ACI Committee 212.3R-91 Report.

[17] Chemical and Air Entraining Admixtures for Concrete, ACI Education Bulletin No. E4-95.

[18] Ramachandran V S - Concrete Admixtures Handbook, Properties, Sciences, and Technology, 2nd edition, 1995.

[19] IMPOSE B. MUHIT : Dosage Limit Determination of Super plasticizing Admixture and Effect Evaluation on Properties of Concrete ,International Journal of Scientific and Engineering Research 4(3).

[20] J.H POTGIETER, D.J. DELPORT, S. VERRYN AND S.S POTGIETER- VERMAAK (2011) : Chloride – binding effect of blast furnace slag in cement pastes containing added chlorides, Research Article, pp.108-114.

[21] MOHAMMAD ABUSHAD, MISBAH DANISH SABRI (2017): Comparative study of concrete with fly ash replacement by cement, International Research Journal of Engineering and Technology, Vol. 4, Issue 7, pp.2627-2630.

[22] Irfan, Osama Mohamed. "Influence Of Specimen Geometry And Lubrication Conditions On The Compressionbehavior Of AA6066 Aluminum Alloy." International Journal of Mechanical Engineering (IJME) 5.1 (2015): 14-24.

[23] El-Shennawy, M., et al. "Effect of boron content on metallurgical and mechanical characteristics of low carbon steel." International Journal of Mechanical Engineering (IJME) 5.2 (2016): 1-14

[24] El–Shennawy, M., et al. "Heat treatment effect on micro–alloyed low carbon steel with different Boron content." International Journal of Mechanical Engineering (IJME) 5.4 (2016): 9-20.
[25] Ahmad, M. Mustafaiz, et al. "Optimization of Process Parameters in Electric Discharge Machining Process." International Journal of Mechanical Engineering (IJME) 5.4 (2016): 45-52.
[26] Jha, Bishnu M., And A. Mandal. "Neural Network Based Models For Surface Roughness Obtained During Electrochemical Machining Of Sg Iron." International Journal of Mechanical Engineering (IJME) 5.5 (2016) 7-18
[27] Patel, Jayg, And Falgun Patel. "To Study And Optimize The Process Parameter Throw Roller Burnishing Process On EN19 Material." International Journal of Mechanical Engineering (IJME) 5.6 (2016) 33-40