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The Properties of Concrete Incorporating Red Sand (RS) as Fine Aggregate

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ABSTRACT:
The aggregate comprises a substantial portion of concrete. Including coarse and fine aggregates it is normally obtained from natural sources. Fine aggregate in India is usually extracted from River. As the demand for concrete production increases, more natural sand is needed. The need for fine aggregate should be addressed in an environmentally friendly manner, considering the diminishing sources of natural sand. Various industrial by-products, such as fly ash, ground granulated blast-furnace slag and silica fume, have been used in concrete to improve its properties. This also enables any environmental issues associated with their disposal. Another material that is available in large quantities and requiring alternative methods of disposal is the Bauxite Reside (Red Sand) from the Bayer process used to extract alumina from bauxite.

Enormous quantity of Red Sand is generated worldwide every year posing a very serious and alarming environmental problem. Hence an investigation was carried out to establish its potential utilization as a sand replacement material in concrete. In addition to fresh properties of concrete containing Red Sand up to 100% by mass of Portland cement, mechanical and durability properties were determined. These properties indicated that Red Sand can be used to replace natural sand up to 100% by mass of cement to improve the properties of concrete without detrimentally affecting their physical properties. Combining these beneficial effects with environmental remediation applications, it can be concluded that there are specific applications where concretes containing Red Sand could be used.

Keywords:
Bauxite Residue, Red Sand, Seawater neutralization, Utilization.

1.Introduction:

1.1 CONCRETE:

Concrete is the most commonly used construction material, and the demand for it will increase as the demand for infrastructure development increases. Unfortunately, Ordinary Portland Cement (OPC) production depletes significant amounts of natural resources as it is a high energy-intensive construction material to produce, third only after the production of steel and aluminium. Furthermore, natural aggregate constitutes a substantial portion of traditional concrete. The natural source of coarse aggregate is crushed rock; and fine aggregate is naturally extracted from sand quarries [1]. The production of one tonne of OPC also releases one tonne of carbon dioxide into the atmosphere. The worldwide cement industry is responsible for about 7% (and rising) of the world‘s total carbon dioxide generation. Apart from environmental issues associated with the concrete industry, traditional concrete is not very durable in harsh environments, such as exposure to freezing weather, sea water or sulphuric soils. Thus, it is essential to find methods to increase the durability of traditional concrete by using appropriate replacements for concrete constituents; e.g. aggregate [2].

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It is now believed that using more durable and less energy intensive construction materials is inevitable for the construction industry.

1.1.1 Importance :

It is estimated that the present consumption of concrete in the world is of the order of 10 billion tonnes (12 billion tons) every year. Humans consume no material except water in such tremendous quantities. The ability of concrete to withstand the action of water without serious deterioration makes it an ideal material for building structures to control, store, and transport water [3].

The ease with which structural concrete elements can be formed into a variety of shapes and sizes. This is because freshly made concrete is of a plastic consistency, which permits the material to flow into prefabricated formwork. After a number of hours, the formwork can be removed for reuse when the concrete has solidified and hardened to a strong mass. It is usually the cheapest and most readily available material on the job [4].

1.2 COMPONENTS OF MODERN CONCRETE

Concrete is a composite material that consists essentially of a binding medium within which are embedded particles or fragments of aggregate. In hydraulic cement concrete, the binder is formed from a mixture of hydraulic cement and water [5].

1.2.1 Portland Cement:

Joseph Aspdin (1779-1835)patented the clay and limestone cement known as Portland cement in 1824.Joseph's son, William Aspdin‘skilnused to make the first genuine Portland cement. Portland cement was first used in the civil engineering project by Isambard Kingdom Brunel (1806-1859), as the lining of the Thames Tunnel [6].

Figure 1.1 Ordinary Portland Cement

While cement in one form or another has been around for centuries, the type we use was invented in 1824 in Britain. It was named Portland cement because it looked like the stone quarried on the Isle of Portland. Portland cement is produced by mixing ground limestone, clay or shale, sand and iron ore. This mixture is heated in a rotary kiln to temperatures as high as 1,600 degrees Celsius. The heating process causes the materials to break down and recombine into new compounds that can react with water in a crystallization process called hydration [7]. The raw ingredients of Portland cement are iron ore, lime, alumina and silica. These are ground up and fired in a kiln to produce a clinker. After cooling, the clinker is very finery ground. Cement is a finely pulverized, dry, material that by itself is not a binder but develops the binding property as a result of hydration. A cement is called ***hydraulic*** when the hydration products are stable in an aqueous environment.

2. PROJECT METHODOLOGY

2.1 OVERVIEW

This project was focused primarily to determine whether red sand and its derivatives can be used as an alternative to natural sand as fine aggregate M20 grade concrete. As stated earlier, the scope of this project was to have Six different mixes, each with a characteristic strength of 20 MPa which is suitable for footing and residential application [8].

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The constituents of the concrete consisted of cement, coarse aggregate (10 mm, 12.5 mm and a grading of both), fine aggregate (NS and RS) and water. It was trialed as the only fine aggregate in one concrete batch and in order to provide a comparison, a concrete mix using NS was used as a control mix. NS was chosen as it is already widely accepted and used within the construction industry as a fine aggregate in concrete [9].

2.2 CONCRETE MIXES:

For low strength concrete, a total of six mixes were considered to be batched and tested at the first stage. The Mix 1 was a control mix containing NS and 10 mm and 12 mm aggregate. Mixes 2 to 6 both contained RS with the former using 10 mm and 12 mm coarse aggregate [10].

2.3 CHOSEN TESTS:

Each mix underwent a series of tests. These tests were chosen to assess the individual characteristic of the aggregates as well as the workability, strength and durability indicators of the concrete. A complete list of the tests is given in Table 3.1. To assess workability of the fresh concrete mixes, a slump test was used.

Table 3.1 Tests to Assess the Characteristics of the Various Concrete Mixes

Test to assess the characteristics of the various Fine aggregate and Concrete Mixes		
Aggregate Characteristics	Mechanical Properties	Durability
Absorption	Compressive Strength	Water Absorption
Fineness Modulus	Tensile Strength	
Particle Size Distribution		
Specific Gravity		

2.4 MATERIALS USED

2.4.1 Introduction

Concrete is a variable material. It is not practical to expect that the characteristics of a concrete mix can be identically replicated on a consistent basis. One of the main reasons for the variability in the concrete is because of the variability in the materials used to make the concrete. The four basic constituents of ordinary Portland cement concrete are:

- Cement
- Water
- Fine Aggregate
- Coarse Aggregate

There is also a growing market for the use of value adding waste products. These waste products include silica fume, ground granulated blast furnace slag and fly ash. These are used as partial substitutes for cement and also to achieve certain characteristics in the concrete, such as increased plasticity in fresh concrete.

2.4.2 Cement

- **Strength/grade of cement:**

Grade of cement 53 grade can influence the mix design. Grade of cement indicates minimum strength of cement in N/mm² tested as per standard conditions laid down by IS codes (OPC 53 grade – IS 12269 – 1987 e.g. a 53 grade cement should give minimum strength of 53 N/mm2 at 28 days).

3. RESULTS AND DISCUSSION

Results presented in this chapter consist of the control mixes plus mixes that incorporated red sand. Results of mechanical properties of the concrete specimens, including compressive, indirect tensile, the durability testing result (water absorption) are presented and discussed. Test results for various mix are presented and discussed.

Parameters	Specific gravity	Bulk density,[kg/m3]	Moisture content, [%]	pH
SAND	2.52	1.61	36	7-7.5
RED SAND	2.45	1.43	42	8.07

4. SUMMARY AND CONCLUSION

With natural sand deposits the world over drying up, there is an acute need for a product that matches the

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properties of natural sand in concrete.
In the last 15 years, it has become clear that the availability of good quality natural sand is decreasing. With a few local exceptions, it seems to be a global trend. Existing natural sand deposits are being emptied at the same rate as urbanization and new deposits are located either underground, too close to already built-up areas or too far away from the areas where it is needed, that is, the towns and cities where the manufacturers of concrete are located.

5. FURTHER STUDIES

Further research is required to explore other aspects of Red Sand concrete. Because of the improved durability performance of Red Sand observed in this investigation, it is recommended that future research is focused on Red Sand for this application. The results presented in this thesis gave an indication of the strength (compressive and tensile) and durability characteristics (water absorption), however in order to enable Red Sand concrete to become accepted as a common construction material, the following experimental studies can be conducted in future with respect to Red Sand concrete

REFERENCE:

[1] ASTM C109/C109 M (Cement Standards and Concrete Standards).

[2] Barbhuiya S.A, Basheer P.A.M., Clark M.W., Rankin G.I.B, ―Effects of seawater-neutralized bauxite refinery residue on properties of concrete‖, Research Article Cement and Concrete Composites, Volume 33, Issue 6, July 2011, Pages 668-679

[3] Cooling, DJ, ―Improving the Sustainability of Residue Management Practices‖— Alcoa World Alumina Australia, 5 July 2008.

[4] Craig klauber, Markus Graife, ―Review of Bauxite Re-use Options‖, Department of Resources, Energy and Tourism (DRET) 2009.

[5] Glenister DJ, Thornber MR, ―Alkalinity of red mud and its applications for management of acid wastes. Chemica 1985, pg: 100-113‖.

[6] IS 383-1970, Specification for Coarse and Fine Aggregate from Natural Sources for Concrete.

[7] IS 456-2000, Plain And Reinforced Concrete - Code Of Practice (Fourth Revision).

[8] IS 516-1959, Methods of tests for strength of Concrete.

[9] IS 5816-1998, Splitting Tensile Strength of Concrete Method of Test.

[10] IS 12269-1987, IS Specifications for 53 Grade Ordinary Portland Cement.