THE COMPARATIVE ANALYSISAND EXAMINATION OF STRENGTH PROPERTIES USING CRUSHED NALLAH STONE DUST AND RECYCLED CRUSHED CONCRETE

PANNU OVAIS MANZOOR[1], SHIVANI BHARDWAJ[2]

[1]PG STUDENT,DEPARTMENT OF CIVIL ENGINEERING, SRI SAI COLLEGE OF ENGINEERING AND TECHNOLOGY.BADHANI PATHANKOT
[2]ASSISTANT PROFESSOR, DEPARTMENT OF CIVIL ENGINEERING, SRI SAI COLLEGE OF ENGINEERING AND TECHNOLOGY.BADHANI PATHANKOT

Abstract:– The paper is based on the tremendous advancement in construction in India as well as other developing countries increases, the utilization and consumption of energy and resources is also increasing in a panic way. In this present work a comparative analysis is done on the fresh and hardened concrete with different replacement ratios of natural coarse aggregates and natural fine aggregates with recycled coarse aggregate (RCA) and crushed nallah stone dust (CNSD) respectively. The major advantages of using the dumping waste materials i.e. crushed Nallah stone dust and recycled crushed concrete to reduce the problem of disposal of these wastes which as a result helps to reduce environmental pollution and the chronic diseases caused by it. The use of crushed Nallah stone dust and recycled crushed concrete improves the properties of concrete like compressive resistance, tensile strengthetc.

Key Words: RCA,CNSD,coarse aggregate.fine aggregate, properties

1. INTRODUCTION

CONCRETE: Concrete is the most common building material used in today's construction Industry. It can be cast in any desired shape and fashion and is therefore applicable for most building purposes. Its long life and relatively low maintenance requirements add to its popularity. It is second only to water as the most utilized substance on the planet. Concrete does not rot, rust or decay and is resistant to wind, water, rodents and insects. It is a non-combustible material making it fire resistant and able to withstand high temperatures. Concrete is a mixture of cement, water and aggregate and sometimes admixtures in required proportion. The mixture when placed in forms and allowed to cure hardens into a rock-like mass known as concrete. The aggregate consists of a mixture of various sizes of gravel and sand. When water is added to cement, a chemical reaction takes place causing the mix to harden.

CEMENT: The basic raw materials used in the manufacture of cement are calcium carbonate found in lime stone or chalk, and silica, alumina and iron oxide found in clay or shale. The word "cement" can be traced back to the roman term opus caementicium, used to describe masonry resembling modern concrete that was made from crushed rock with burnt lime as binder. In present day concrete, cement is a mixture of lime stone and clay heated in a kiln to 1400 - 1600ºc. This amount represents about two minutes of output from a 10,000 ton per day cement kiln.

Portland cement is the most common type of cement in general usage. Portland cement is the most common type of cement in general usage. It is a basic ingredient of concrete, mortar and many plasters. British masonry worker Joseph Aspdin patented Portland cement in 1824. It was named because of the similarity of its colour to Portland limestone, quarried from the English Isle of Portland and used extensively in London architecture. It consists of a mixture of calcium silicates (alite, belite), aluminates and ferrites compounds which combine calcium, silicon, aluminum and iron in forms which will react with water.

AGGREGATE: The term "aggregate" refers to all those materials which do not undergo chemical transformation even although they contribute to the final result of the structure being treated: stones, sand, and bricks. They form the reinforcing structure of the mortar, occupying approx. 65-70% of its total volume. The aggregate is the main contributor to the strength of concrete. Aggregates are simply any collection of rocks. In the aggregates industry, these rocks are classified as crushed stone, sand, gravel and slag. Using aggregate consisting of particles with varying size provides a more dense and strong concrete. Fine aggregate is normally made up of sand with particle sizes ranging from 0.3 to 5 mm, while the coarse aggregate may contain stone up to 40 mm. Aggregate is obtained from various sources. Natural aggregate for direct use without any mechanical treatment can be extracted from riverbeds, gravel pits, lakes and dunes. This aggregate normally consists of round and polished particles. Before using aggregates for concrete manufacture it is important to make sure that the particles are of sufficient strength and are not prone to erode or deteriorate.

1.1 CRUSHED RECYCLED CONCRETE CONCRETE (RCA)

There are many reasons why concrete has been the most widely used material in the world for many decades now. The most advantageous characteristics of concrete can be listed as: relatively low cost, grand scale availability of its raw components, durability, workability, how adaptable concrete is to be shaped into any form and its fire resistance. But there is a price to pay for all these benefits, namely, the colossal energy consumption and devastating pollution that results from the manufacturing of cement .To reduce this impact and achieve a more sustainable product, waste materials can be incorporated into concrete in the form of RA. The most extensively researched material used in the production of RA is waste concrete, that is, fine and coarse debris from demolition sites. Also, less common components such as glass, coal fly ash, plastic, tyres, volcanic ash and foundry sand have been investigated by several researchers. Concrete with RA as a component in the mixing process is referred to as recycled aggregate concrete

FIGURE 1: RECYCLED AGGREGATE

1.2 CRUSHED NALLAH STONE DUST

Crushed nallah Stone dust can be defined as residue tailing or other non-valuable material obtained after the extraction and processing of rock to form fine particles of 75 mm**.** Stone dust is like a darker, coarser version of sand. It is a byproduct of running stones through a crushing machine to make crushed stone. The machine has a screen that traps the larger material (that is, the crushed stone). The smaller material or "screenings" falls through the screen. Stone dust has rough, sharp and angular particles and as such causes a gain in strength due to better interlocking.

Table 1. Physical properties of CNSD

Properties	Stone dust	Natural Sand	Test method
Specific gravity	2.54-2.60	2.60	IS 2386 (Part III) 1963
Bulk relative density (kg/m^3)	1720-1810	1460	IS 2386 (Part III) 1963
Absorption %	1.20-1.50	Nil	IS 2386 (Part III) 1963
Moisture content %	Nil	1.50	IS 2386 (Part III) 1963
Fine particle less than 0.075mm%	12-15	06	IS 2386 (Part I) 1963
Sieve analysis	Zone II	Zone II	IS 386 - 1970 1970

Table 2. Chemical properties of CNSD

Constituent	Stone dust %	Natural Sand %	Test method
SiO_2	62.48	80.78	IS 4032 – 1968
Al_2O_3	18.72	10.52	
Fe_2O_3	06.54	01.75	
CaO	04.83	03.21	
MgO	02.56	00.77	
Na_2O	Nil	01.37	
K_2O	03.18	01.23	
TiO_2	01.21	Nil	
Loss of ignition	00.48	00.37	

2. PROBLEM IDENTIFICATION

In the recent past, many investigations have been carried out on the properties of concrete by using either the stone dust as a partial replacement of fine aggregates or crushed recycled concrete as partial replacement of coarse aggregates separately. Hence the present work is planned to study the properties of concrete at the fresh and hardened stage containing both Nallah stone dust as a partial replacement of fine aggregates and crushed recycled concrete aggregate as a partial replacement of coarse aggregates together in different combinations.

3. MATERIALS USED

The materials used are as follows:

OPC CEMENT 43 GRADE: Ordinary Portland cement (OPC 43) of brand Khyber was used in this study. Cement bags were bought from the local dealer. The physical properties of the cement as determined from various tests should conforming to Indian standard IS 1489-1991.

TABLE 3. physical properties of cement

Sr. No.	Properties	Observations
	Bulk density	1450 kg/m^3
1	Specific gravity	3.15
2	Initial setting time	30 min
3	Final setting time	600 min
4	Standard Consistency	5-7%
5	Fineness (90 micron IS Sieve)	5%
6	28-days compressive strength	42.17Mpa

JHELUM RIVER SAND: Fine aggregate used in this investigation was taken from River Jhelum clean sand passing through 4.75 mm IS sieve. Sieve analysis of fine aggregate is performed for particle size distribution. The total sample taken of Natural fine aggregates (NFA) was 2000 grams..

CRUSHED RECYCLED CONCRETE AGGREGATE: : The Crushed recycled concrete aggregates used for making concrete, which is obtained from tested concrete cubes from the lab and demonized structure. Sieve analysis results and other physical properties are listed in Table 4. The total sample taken of coarse aggregates was 2000 grams.

CRUSHED WASTE NALLAH STONE DUST FROM CRUSHER PLANTS: Crushed Nallah stone dust used in this investigation was taken from dumping site of crusher plant located at Nepora Anantnag in J&K. Sieve analysis of Crushed nallah stone is performed for particle size distribution and other physical properties are listed in table 4 . The total sample taken of crushed Nallah stone dust (NSD) was 1500 grams.

Table 4. Physical properties of fine aggregate

Sr. No.	Properties	Crushed Nallah stone dust (CNSD)	Normal fine aggregate (NFA)
1.	Fineness modulus	2.80	2.52
2.	Specific gravity	2.74	2.71
3.	Water absorption (%)	1.82	1.41

WATER: Water is the most important and least expensive ingredient of concrete. A part of mixing water is utilized in the hydration of cement to from the binding matrix in which the inert aggregates are held in suspension until the matrix has hardened. The remaining water serves as a lubricant between the fine and coarse aggregate and making concrete workable i.e. readily peaceable in forms.
Generally, cement requires about three-tenth of its weight of water for hydration. Hence water cement ratio required is 0.30.But the concrete containing in this proportion will be easy very harsh and difficult to place .addition water must be kept to minimum, since too much water reduces the strength of concrete.

4. SUPER-PLASTICIZER

In order to achieve desired slump, high range water reducing admixture of Auramix 400 was used. Auramix 400 complies with IS: 9103-1999(2007). It also complies with ASTM C494 Type G depending on the dosage used.

Auramix 400 is a unique combination of the latest generation superplasticisers, based on a polycarboxylic ether polymer with long lateral chains. This greatly improves cement dispersion. At the start of the mixing process an electrostatic dispersion occurs but the cement particle's capacity to separate and disperse. This mechanism considerably reduces the water demand in flowable concrete. Auramix 400 combines the properties of water reduction and workability retention. It allows the production of high performance concrete and/or concrete with high workability.

1) Dry mix cement, fine and coarse aggregates.

2) Add Auramix 400 in gauging water the normal dosage range is between 0.5 to 3.0 ltrs/100 kg of cementitious material and stir well.

3) Pour water in the dry mix and complete mixing to get a cohesive mix.

4) For better results Restrict water between 20-25 liters per 50kg bag of cement.

5) Mix should be used within 30 minutes.

6) Adjust water depending on floe and cohesively desired.

4.1 PROPERTIES OF AURAMIX 400

The properties of Auramix 400 are given in table 5 below:

Table 5: Properties of Auramix 400 Super plasticizer

Properties	Specifications
Appearance	Light yellow coloured liquid
pH	Minimum 6.0
Volumetric mass @ 200^0 C	1.09 kg/litre
Chloride content	Nil to IS:456
Alkali content	Typically less than 1.5 g Na2O equivalent / litre of admixture.
Minimum shelf life	1 years
Temperature	20C to 500 C.

4.2 ADVANTAGES OF AURAMIX 400

Advantages of Auramix 400 are as under:

1. Improved adhesion to reinforcing and prestressing steel.
2. Better resistance to carbonation.
3. Lower permeability.
4. Better resistance to aggressive atmospheric conditions.
5. Reduced shrinkage and creep.
6. Increased durability.
7. High performance concrete and/or concrete with high workability.

5. COCLUSION

In this paper I had discussed about the cement concrete with good strength by using both recycled crushed concrete as partial replacement of coarse aggregates and crushed nallah stone dust as a partial replacement of natural fine aggregates together in different combinations. In the present examination, crushed Nallah stone dust and recycled crushed concrete were used to examine the strength properties.

REFERENCE:

1) D. Soares, J. de Brito, J. Ferreira and J. Pacheco , “Use of coarse recycled aggregates from precast concrete rejects mechanical and durability performance” , Construction and Building Materials, Vol. 71 pp 263-272, 2014.

2) G. Dobbelaere, J. de Brito and L. Evangelista, “ Definition of an equivalent functional unit for structural concrete incorporating recycled aggregates”, Engineering Structures ,Vol. 122, pp 196-208,2016.

3) George Dimitriou, Pericles Savva and Michael F. Petrou, “ Enhancing mechanical and durability properties of recycled aggregate concrete”, Construction and Building Materials, Vol. 158 pp228-235, 2018.

4) J. Montero and S. Laserna , “Influence of effective mixing water in recycled concrete” , Construction and Building Materials, Vol. 132,pp 343-352 2017.

5) Jonathan Andal , Medhat Shehata and Philip Zacarias, “ Properties of concrete containing recycled concrete aggregate of preserved quality” , Construction and Building Materials, Vol. 125,pp 842–855, 2016.

6) Kho Pin Verian, Warda Ashraf and Yizheng Cao, “ Properties of recycled concrete aggregate and their influence in new concrete production Resources” , Conservation & Recycling , Vol. 133 pp 30-49, 2018.

7) Liam Butler , Jeffrey S. West b and Susan L. Tighe, " Effect of recycled concrete coarse aggregate from multiple sources on the hardened properties of concrete with equivalent compressive strength", Construction and Building Materials,Vol. 47 , pp 1292-1301,2013.

8) M. Etxeberria, E. Vázquez, A. Marí, and M. Barra, " Influence of amount of recycled coarse aggregates and production process on properties of recycled aggregate concrete" ,Cement and Concrete Research,Vol. 37, pp 735-742, 2007.

9) B.V.Bahoriaa,D.K.Parbatb and P.B.Nagarnaik , "XRD Analysis of Natural sand, Quarry dust, waste plastic (ldpe) to be used as a fine aggregate in concrete", Materials Today,Vol. 5 ,pp 1432–1438

10) Bismark K. Meisuh, Charles K. Kankam and Thomas K. Buabin, "Effect of quarry rock dust on the flexural strength of concrete", Case Studies in Construction Materials,Vol. 8, pp 16–22,2018.

11) Charles K. Kankam, Bismark K. Meisuh, Gnida Sossou,and Thomas K. Buabin, "strain characteristics of concrete containing quarry rock dust as partial replacement of sand",Case Studies in Construction Materials,Vol. 7 ,pp 66–72,2017.

12) Er. Lalit Kumar and Er. Arvinder Singh, " A Study On The Strength Of Concrete Using Crushed Stone Dust as Fine Aggregate", International Journal for Research in Applied Science & Engineering Technology (IJRASET) , Volume 3 Issue I, ISSN: 2321-9653 pp 308-316, January 2015.