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Experimental Investigation of Replecement of Fine Agrigate by Demolished Waste Concrete

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ABSTRACT
When we talk about any construction work the main component which comes to our mind is concrete. As we know concrete comprises of cement, fine aggregates, coarse aggregates and water. The easy access to these construction resources has no doubt boosted the construction throughout the world. But the rapid depletion of these resources and increasing cost is emerging as an attention seeking issues.
Due to which construction industries are facing crises for the easy availability of these resources but we would like to make prime emphasis on fine aggregates as our research moves that way. At many place digging rivers forsandhas been made illegal. So it's becoming a tough job to get river sand at cheap rate .
That is why various alternatives is being adopted to counter this problem such as reuse and recycling of construction waste. So keeping all the facets in our mind we begin with our project of reuse of recycled demolished concrete. In this project we replaced fine aggregates with the demolished concrete in the range, 20%,50%,100% using M25 grade of concrete. Sieve analysis is also performed for recycled demolished concrete and coarse aggregates.
The prepared concrete mix is compared and test in terms of compressive strength, tensile strength and flexure test to conventional concrete test was performed at3,7and28days in order to evaluate the strength properties. Percentage of replacement of cement with 0% ,20% and 40% of sugarcane bagasse ash and lime gives the better results when compared with other percentages.
KEY WORDS *–Demolished Waste Concrete, compression strength, Flexural Strength, Pozzolanic material.*

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I .INTRODUCTION

Concrete has been around with us from many centuries, the first known use of a material resembling concrete was found by the Minoan Civilization around 2000BC.

A huge amount of solid waste is generated annually from construction and demolition activities. This has lead to the promotion of waste recycling as a major measure to reduce waste and to mitigate the harmful effects of construction activities on the environment. Among these waste, concrete apportions more than half of the total. The construction industry conspicuous consumer of raw material of many types and thus large material inventories are required to us in the growth. Among the various raw materials used in construction, aggregates are important components for a lathe construction activities and the demand in 2007 has seen increase by 5%, to over 21 billion tones the largest being in developing countries like china, India etc]. The use of swine manure, animal fat, silica fume, empty palm fruit bunch, citrus peels, fly ash, foundry sand, glass, plastic, carpet, and concrete aggregate in construction is becoming increasinglypopularduetotheshortageandincreasingcostofrawmaterials. This study present an initial understanding of the current strengths and weaknesses of the practices intended to support construction industry in developing effect policies regarding uses of waste and recycled materials as construction material.

Regardless of there placement ratio, recycled aggregate concrete (RAC) had a satisfactory performance, which did not differ significantly from the performance of control concrete in this experimental research. However, for this to be fulfilled, it is necessary to use quality recycled concrete waste rubble and to

follow the specific rules for design and production of this new concrete type.

II.LITERATURE REVIEW

1. Rangaraj, A. (2021)

There has been a rise in the volume of constructiondebris over the past few years, and as are sult , there has been an increase in The biological effects of recycling old building materials. Rapid urbanization has led to the frequent spectacle of the demolition of historic buildings in order to make way form ore modern structures. Practically none of the concrete from demolition projects is put to any productive use. Getting rid of demolition waste is hard because environmental rules are strict and there aren't enough good places to dump it in cities. Recently, this perfect-sum fine aggregate has been used to plan new concrete made from recycled materials. The goal of the study was to find out how long concrete will last when some of the natural fine aggregate is replaced with recycled fine aggregate. A small amount of glass fiber and silica fume was mixed into the concrete to make it denser. Also, the tests were made to see what would happen if fine aggregate was replaced with recycled concrete aggregate that had 0%, 5%, 10%, or 20% of glass fiber and silica fumes.

Saha, S., Rajasekaran, C. et al,(2017) The demand for construction materials is rising rapidly in response to the expanding construction sector. In order to meet this increasing demand, the supply of natural building materials is expected to decline. the same vein, the amount of trash left over from building project and demolitions is becoming increasingly problematic. Reusing building and demolition debris is one of the most effective solutions to prevent the depletion of natural fine aggregates. concrete, recycled fine aggregates can be utilized in varied amounts in place of naturalfine aggregates (river sand).

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2. Kaarthi k, M., & Maruthachalam, D. (2021)

Despite being the most frequently used construction material in the world, concrete has never been marketed as a green building material due to its significant resource consumption. It has been suggested thata same an so environmental preservation and long-term economic viability, recycled materials or industrial wastesbe used as aggregate in concrete. How ever, it is estimated that 75million tons of concrete debris is produced annually by the construction sector. This is why we conducted these tests in the lab to determine which materials from building sites can be used as aggregates in concrete. It was reported by Travakoli and Soroushian what percentage of recycled aggregates were wet and how much volume they were used. De Oliveira and Vazquez claim that the durability of concrete using recycled aggregates is on par with that of concrete using a conventional mix ratio. A specimen made with treated aggregates was found to have weak flexural strength.

3. Padmanaban,I.,Nithila,S.,etal,(2020)

The aggregate used in concrete production accounts for roughly 70% of the total volume of the finished product. Natural sand is expensive to utilize as a fine aggregate, and there is a growing need for environmentally responsible building practices, therefore the construction industry must look else where. Produced as a byproduct during the steel making process, steel making slag (SS) is a very prevalent form of industrial waste. The outcomes are weighed against those of more traditional concrete mixes. Variable levels of steel powder in place of fine aggregate affect the concrete's strength qualities. Concrete made with steel powder aggregates as opposed to using natural aggregates is a very encouraging idea.

4. Sathish, T., Palanikumar, B. et al, (2020)

Concerns about the environment's ability to recycle demolition debris have grown in tandem with the ever- increasing volume of construction debris producedin recent decades. In this study, we gather concrete debris from sites where buildings have been demolished and mix itwith coarse aggregate at an optimal ratio for use in new concrete. The purpose of aggregate and coarse aggregate.

5. Gokulnath, V. (2017)

Republic of India and other emerging countries produce an excessive amount of demolition debrise very year. Because so much of it is recovered for new uses. Since such garbage necessitates a massive amount of storage space, getting rid of it could be a huge issue. This research could be a component of a larger program inwhich experimental investigations are carried out to evaluate how the compressive strength and workability of DAC are affected when coarsemixture is partially replaced by demolished debris(Demolished mixture Concrete).Compressive strengths were measure date 7,14,and 28days through out the study. Previous research on this topic demonstrates that DAC (Demolished mixture Concrete compressive)'s strength is comparable to that of conventional concrete when used in the appropriate quantity for up to 30 minutes. In this study, we used a deconstructed concrete mixture that was either 100%, 15%, or 2% by weight of the

conventional coarse mixture to cast concrete cubes, and the results were comparable to those achieved with conventional concrete in terms of workability and compressive strength for the DAC.

6. Memon, B. A., & Buller, A. H. (2016)

New building sand roads are being constructed to accommodate the increasing urban population and the peoplewho have relocated there. As are silt, there is a tremendous amount of broken concrete and an increase in the use of natural aggregates. Most of this trash ends up inland fills . Because of this, there are economic and environmental issues associated with transporting this garb age. The concept of using recycled aggregates as a solution to these issues has begun to gain traction and is currently a hotspot for academic inquiry. The paper investigates the new trends in recycling concrete debris into aggregates.It is hoped that this research will serve as a useful spring board for future studies in the sector.

II. MATERIALS USED.

1. CEMENT

Cement has different properties and characteristics which depend upon their chemical compositions. By changing in fineness of grinding, oxide compositions cement has exhibit different properties and different kind of cement. The use of additives, changing chemical composition, and use of different raw materials have resulted the availability of many types of cements. Cement used in the experimental work is ORDIRARY PORTLAND CEMENT of 53 grades conforming to IS: 8112/1989.

Properties of cement physical properties of the cement in the present experimental work are given below.

1.1 Physical Properties of Cement

S.No	Property of Cement	Value
1	Fines of cement	7.5 %
2	Grade of cement	53 Grade (OPC)
3	Specific gravity of cement	2.7
4	Initial setting time	30 Min
5	Final setting time	60 Min
6	Normal consistency	0.32

2. FINE AGGREGATE: -

Fine aggregate which satisfied the required properties for experimental work and conforms to zone as per the specification of IS: 383-1970.

Properties of Fine Aggregate Physical properties of the fine aggregate used in the present work are given below.

1.1 Physical Properties of Fine Aggregate

S.NO	PROPERTIY	VALUES
1	Sand zone	Zone- III
2	Specific Gravity	2.72
3	Fineness Modulus	2.25
4	Water absorption	1.5%

3. WATER: -

Water plays a vital role in achieving the strength of concrete. For complete hydration it requires about 3/10th of its weight of water. It is practically proved that minimum water-cement ratio 0.35 is required for conventional concrete. Water participates in chemical reaction with cement and cement paste is formed and binds with coarse aggregate and fine aggregates. If more water is used, segregation and bleeding takes place, so that the concrete becomes weak, but most of the water will absorb by the fibers. Hence it may avoid bleeding. If water content exceeds permissible limits it may cause bleeding. If less water is used, the required workability is not achieved. Potable water fit for drinking is required to be used in the concrete and it should have pH value ranges between 6 to 9.

4. COARSE AGGREGATE : -

Crushed granite of 10mm & 20mm size are used as coarse aggregatePhysical Properties of Coarse Aggregate

S.NO	PROPERTIY	VALUES
1	Specific Gravity	2.7
2	Size of Aggregates	20mm
3	Fineness Modulus	5.96
4	Water absorption	2.0%

5. Demolished waste

Amidst growing awareness on protection of environment and conservation of natural resources and this study is anattempt to explore recycled concrete as a material of hope for 21st century. Mainly made up of concrete. Demolished wastehas several foreign matter such as various type of finishes ladding materials, lumber, dirt, steel,hardware's, woods plastics etc, attached to them directly or indirectly.

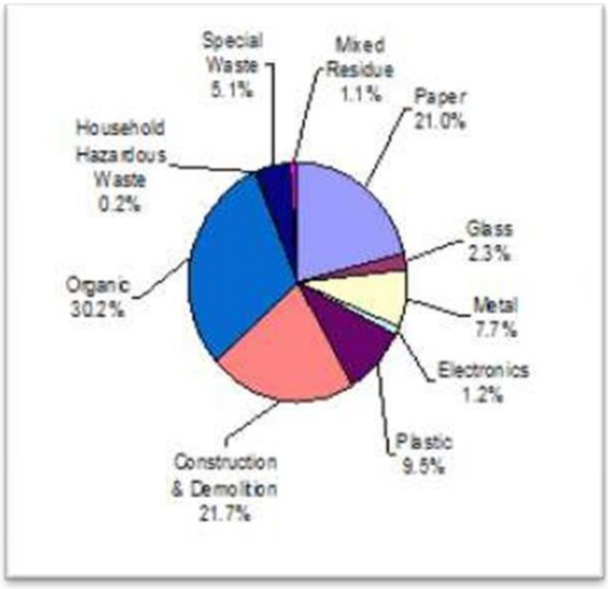

Fig.1.1: Waste Characterization Study (Year2015).

The process of removal of impurities and crushing of rubble into suitable and desirable aggregate particle size can be carried out in a continuous and sequential manner using appropriate mechanical devices such as jaw crushers, impact crushers, swing hammer crushers etc. There are three processes,for processing of demolished waste :Dry, Wet and Thermal, which are used individually or in combination with one another. Duet of high water absorption of recycled aggregates, it is sometimes suggested to use pre- soaked aggregates for production of recycled aggregate.

IV- MIX DESIGN

GradeofConcreteM25(100%CrushedSand)(IS10262– 1982 /IS456:2000)Grade designation **M25**
Characteristic compressive25 Mpastrength at 28days(fck)

Type of cement OPC53 grade

Maximum nominal size of 20 mmaggregate

Standard deviation for good control 4.0Mpaof specified grade(s)
Minimum cement content 300 kg/m3Maximum water-cement ratio 0.50
Workability for pumping at site 170 – 180 mmasperIS-4926

Tolerance factor (t) 1.65
Exposure condition Severe

Method of concrete placing Manually

Degree of supervision Good Type of aggregate. Crushed angularGradingoffine aggregate ZoneII

MIX PROPORTION BY REPLACEMENT OF SAND

◉Sample1: Portlandcement+Coarseaggregate+80%Crushedsand+20%Reucretesand+ Water

◉Sample2: Portlandcement+Coarseaggregate+50%Crushedsand+50%Reucretesand+ Water.

◉Sample3: Portlandcement+Coarseaggregate+100%Reucretesand +Water

V- RESULT AND ANALYSIS

The tests were taken for the specimens such as cube, cylinder and prismatic interval of 7th day,14th day and 28th day testing

1. Compressive Strength Test

The internal resisting force to the load applied called compressive strength.(CTM)Compression testing machine is used for testing the cube strength.
Concrete cubes were casted for the standard size of (150mm×150mm×150mm)for M25 grade of concreteand strength is calculated for 3,7,28days. The result obtained are as follows in table.

Figure :2 Testing on cube

Compressive strength result

S.N	**Concrete type**	**Compressive strength N/mm^2**		
		3day	**7day**	**28day**
1	20%replacement	13.58	19.51	30.16
2	50%replacement	13.30	19.32	28.14
3	100%replacement	12.4	18.37	23.17

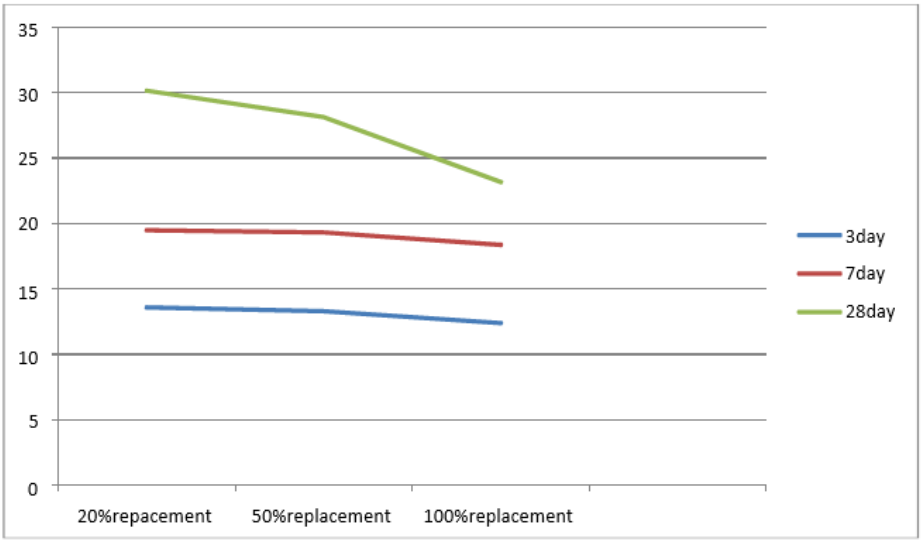

Fig Graph for compressive strength test

2. Flexural Strength

In order to investigate the true behavior of the concrete it's important to test reinforced beam. The beam will fail after reach its maximum capacity to take load.

This can be observed by testing the beam with two point loading and deflection can also bemeasured by placing deflect meters at the bottom of the beam.

The wooden molds of size 1500mm×150mm×230mm are used for the casting of the beams .10mm bars are used for the reinforcement and 6mm bars used as stirrups withaspacingof150mmc/c.

Table Flexural strength

S.N	Concrete type	Breaking load(tons)	Max. Deflection(mm)
1.	20%replacement	14.3	6.10
2.	50%replacement	13.4	5.83
3.	100%replacement	13.0	5.79

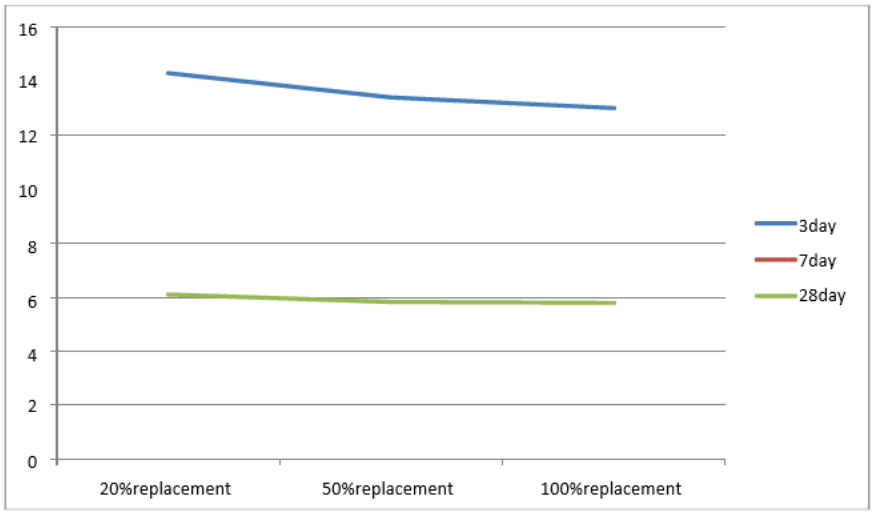

Fig Graph for flexural strength test

VI- CONCLUSION

This investigation was conducted to evaluate the performance of concrete containing different percentages 20%, 50% and 100% of demolished waste concrete replacement of sand. The compressive strength tests are conducted on the materials of concrete and the reports were given for different percentages. From the test results taken for 7^{th} day, 14^{th} day and 28^{th} day of Compressive strength of concrete for various percentages (20%, 50% and 100%) of RFA the maximum strength attains at the replacement of20% Metakaolin and 50% RFA and it was found to be appropriate, economic a land gives the best resultfor the future use.

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