Concrete With Demolished Concrete As Coarse Aggregate And Quartz Sand As Fine Aggregate

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Abstract- *For enhancing the recycling of concrete, the wastes produced from demolition of buildings can be used for further constructions. In this project, the replacement of coarse aggregate is done with demolished concrete at 10%, 30% and 50%. To reduce the cost of construction we used quartz sand as an alternative of fine aggregate. By adding demolished concrete with quartz sand in concrete, the strength of concrete has improved.*

Keywords- Demolished concrete, Quartz sand, Compressive strength test Split-tensile strength test, Flexural strength test.

I. INTRODUCTION

Concrete is a composite material that consists essentially of a binding medium in which are embedded particles or fragments of aggregates. Its a hard strong building material made by mixing a cementing material and a mineral aggregate with sufficient water. Concrete is used to provide strength, and durability during the construction of a structure. Upon hydration of the cement by the water, concrete becomes stone like in strength, hardness and durability. Concrete can be easily mixed to meet a variety of special needs and formed to virtually any shape.

The concrete wastes produced from demolition of buildings can be utilized for construction. By reusing these materials the need for traditional wastes provides better strength to the concrete. It’s a cheaper alternative to quarried stones. Also these concrete wastes provides increased protection from seepages.

Quartz sand also known as silica sand is the purest form of sand which contains high percentages of silicon content. It consists of silicon in crystalline form with high specific surface. These sand contains high percentage of silica upto 99%. Also it can be used as a replacement of fine aggregate in concrete. By incorporating quartz sand in concrete, it offers better strength and durability.

II. LITERATURE REVIEW

Ali S Alqarni, et al., (2022) investigated the parameters influencing the concrete. These parameters include the effect of various replacement levels of RCA of 33%, 67%, 100% and the effect of maximum RCA sizes of 10 and 20mm and the effect of proposed treatment methods. The treatment methods utilized in this study were either for the hardening of the adhered mortar or its removal.

Bassam A Tayeh, et al., (2020) Karthika S, et al.,conducted various examinations on reusing concrete. Moreover, reusing recycled aggregates in the creation of HPC can add to the decrease in waste delivered every year. In addition, and reuse would help to decrease worldwide carbondioxide emissions. It is even possible to obtain HPC with total replacement and also can be used as both fine and coarse aggregate.

M Etxberria, et al., (2007) studied the use of recycled aggregate on the beams shear strength depend on the percentage of coarse aggregate substituted, specially for beams without transverse reinforcement. The use of recycled coarse aggregate reduced the cracking load in beams without shear reinforcement.

A S Manikantha, et al., (2020) conducted investigations and identified the concept of green concrete by using supplementary cementatious materials like silica sand minimises the environmental impact of concrete.

Natt Makul, et al., (2021) concluded that as a substitute for natural aggregate, RCA are useful for the production of concrete of standard strength and properties. The main problem with using RCA in new concrete is their incompatible qualities, especially when they come from the demolition of old concrete buildings. The performance of RCA can be improved by long term curing, new mixing methods.

III. MATERIALS AND METHODOLOGY

3.1 MATERIALS USED

3.1.1 Cement

Ordinary Portland cement of OPC 53 grade were used.

Table 1 : Physical properties of cement

Sl no	**Properties**	**Result**
1	Specific gravity	7%
2	Fineness	2.79

3.1.2 Fine aggregate

M sand is used as fine aggregate. It is a granular material produced from rocks.

3.1.3 Coarse aggregate

Well graded aggregates having a size of 20mm were used.

3.1.4 Demolished concrete

Crushed demolished concrete were used. Aggregates retained on 6.3mm sieve were used.

Table 2:Physical properties of demolished concrete

Sl no	**Properties**	**Result**
1	Fineness	6.75
2	Specific gravity	3.22

3.1.5 Quartz sand

Quartz sand of white colour having a particle size of 1.19 mm to 2 mm were used.

Table 3: Physical properties of quartz sand

Sl no	**Properties**	**Result**
1	Fineness	2.56
2	Specific gravity	2.65

Fig 3 Quartz sand

3.1.6 Water

Potable water suitable for mixing concrete were used.

3.2 METHODOLOGY

3.2.1 Mix design

M30 grade concrete were selected .
Cement = 387.5 kg/m3
Fine aggregate = 663.33kg/m3
Coarse aggregate = 1178.77 kg/m3
Water = 186 litre

3.2.2 Experimental progress

The demolished concrete wastes from the site were collected. The collected demolished concrete were crushed into smaller pieces by using a hammer. After breaking into smaller pieces the demolished concrete were sieved. Particles retained on 6.3mm sieve were used. Then these concrete particles were mixed in concrete at varying proportions of 10%, 30%, and 50% and concrete specimens were casted and tested after 7 and 28 days of curing period. From the results obtained from different results, 30% replacement of demolished concrete shows an optimum strength.

Quartz sand were collected. The collected quartz sand were cleaned, dried . Particle size of 1019 mm to 2 mm were collected. It is then mixed with concrete at varying proportions of 25%, 50%, and 75%. Concrete specimens such as cubes, cylinders and beams were casted and cured for a period of 7 and 28 days of curing period. The cured specimens were tested and from the results obtained, 50% replacement of fine aggregate with quartz sand shows the optimum value.

3.2.3 Preparation of concrete specimens

The concrete specimens such as cube of size 150 x 150 x 150 mm , cylinder of size 150 mm diameter and 300 mm length, and beam of size 100 x 100 x 500 mm were prepared.

The prepared concrete specimens were cured for 7 and 28 days.

Fig 4 Mixing of concrete specimens

Fig 5 Casting of concrete specimens

3.2.4 Tests for concrete

Compressive strength test

Compressive strength can be defined as the of concrete to withstand loads before failure. capacity The compressive strength can be find out by the equation,

Compressive strength = load/area

$f_{ck} = P/A$

Where, P : Failure load in N

A : Area of cube in mm2

f_{ck} : Compressive strength in N/mm2

Split tensile strength test

Split tensile strength test is the simplest way to assess the tensile strength of concrete. The split tensile strength can be find out by using the equation,

$f_{sp} = 2P / \pi DL$

Where, fsp = Split tensile strength in N/mm2

P = Maximum load applied in N

L = Length of cylinder in mm

D = Diameter of cylinder in mm

Flexural strength test

Flexural test evaluates the tensile strength of concrete indirectly. It tests the ability of unreinforced concrete beam to withstand failure in bending. The flexural strength can be find out using the equation,

$f_b = PL / bd^2$

Where, f_b = flexural strength in N / mm2

P = Maximum load applied in N

L = Length of specimen in mm

d = depth of specimen in mm

b = width of specimen in mm

IV. RESULTS

4.1 Compressive strength test

Table 4 : Compressive strength result

% of replacement with demolished concrete	**% of quartz sand**	**Compressive strength (N/mm^2)**	
		7 days	**28 days**
0	0	17.3	30.07
10	50	21.18	31.42
30	50	25.47	33.01
50	50	18.07	30.57

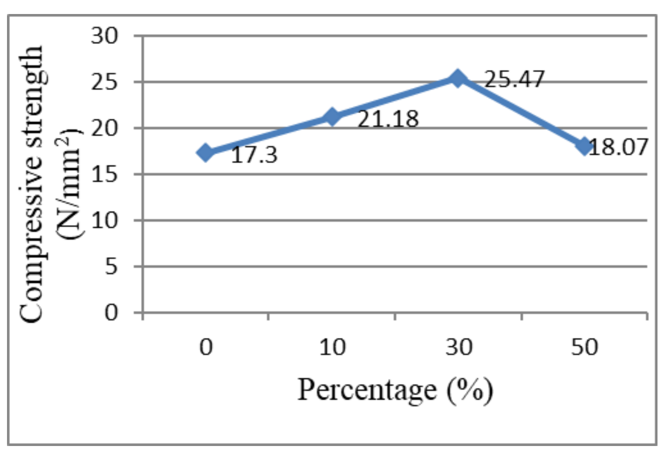

Fig 6 : Compressive strength after 7 days

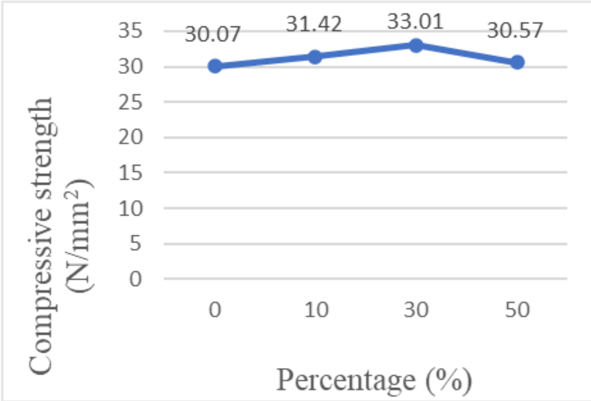

Fig 7 : Compressive strength after 28 days

4.2 Split tensile strength test

Table 5 :Split tensile strength result

% of replacement with demolished concrete	**% of quartz sand**	**Split tensile strength (N/mm^2)**	
		7 days	**28 days**
0	0	1.72	2.37
10	50	2.33	3.42
30	50	3.13	3.60
50	50	2.26	3.31

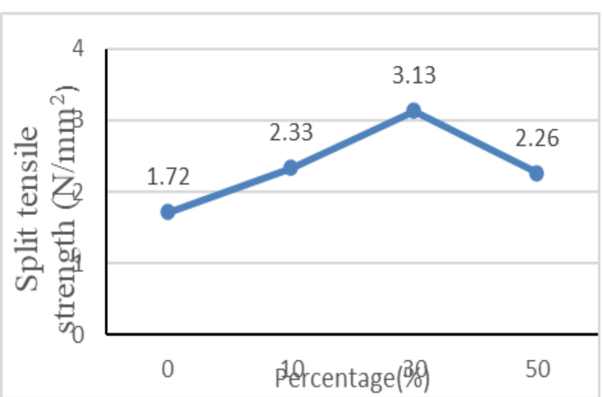

Fig 8 : Split tensile strength after 7 days

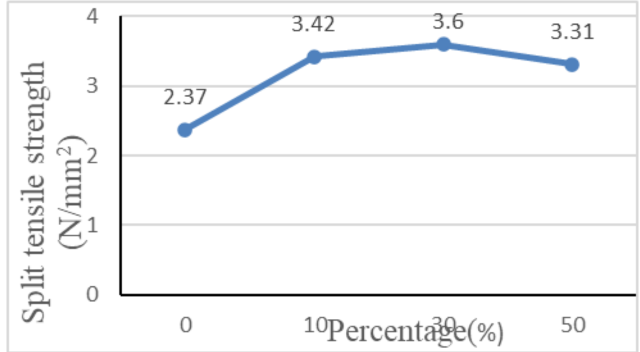

Fig 9 : Split tensile strength after 28 day

Table 6 : Flexural strength test

% of replacement with demolished concrete	**% of quartz sand**	**Flexural strength (N/mm^2)**	
		7 days	**28 days**
0	0	2.6	4.03
10	50	3.50	4.50
30	50	4.12	4.99
50	50	3.83	4.23

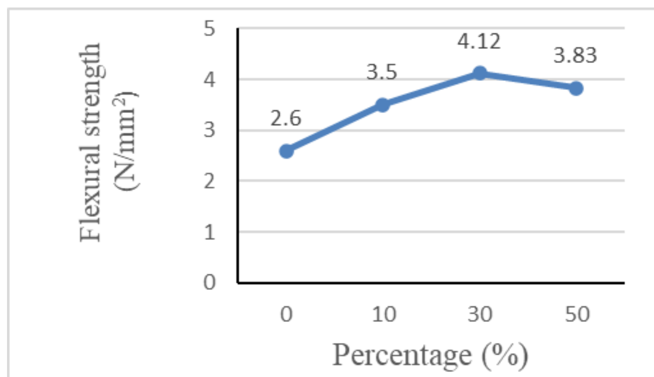

Fig 10 : Flexural strength after 7 days

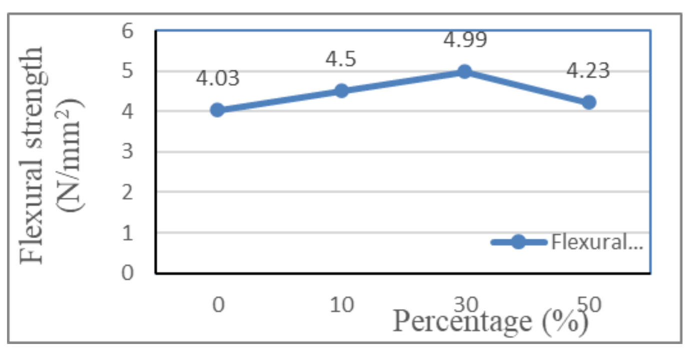

Fig 11 : Flexural strength after 28 days

V. CONCLUSIONS

In this paper, coarse aggregate is replaced with demolished concrete at varying proportions of 10%, 30% and 50% with adding quartz sand at an optimum value of 50%. The tests such as compressive strength, split tensile strength and flexural strength test is conducted on concrete specimens. From the results obtained, 30% of replacement of coarse aggregate with demolished concrete shows optimum value and on further more replacement the strength decreases.

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