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Utilization of Recycled Coarse Aggregate with Artificial Stone/Rock's Crushed Sand in Concrete

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A B S T R A C T

RCA with Shahabad sand In Concrete

Researchers are investigating several artificial sand kinds and their effects upon that qualities of demolish recycled aggregate concrete. Crushed stone sand from shahabad is being used to identify the ideal coarse aggregate recycled as a percentage of the new aggregate for natural sand in concrete. Artificial sands are oftenly utilised materials to substitute natural sand as an alternate for fine aggregate in concrete, which may be good for environmental protection when used in concrete. River sand, a key component into production of concrete, is becoming more scarce and costly. This necessitates searching for alternate to river sand. As result, synthetic sand, also known as Robosand, may be utilised in place of natural sand. It was necessary to conduct this experiment in accordance with Indian standard norms, and concrete specimens were cast utilizing recycled coarse aggregate as well as specimens were continual 100% replacing of natural sand with no additions. For our investigation, we utilised concrete with compressive strength of 20 N/mm2 (M20 Grade). There were a total of 18 sets, each with three cubes.

RCA with M- sand In Concrete

Construction and demolition waste in India currently amounts to 23.76 million metric tonnes per year, and this volume is expected to more than double in next few years. There's also a perception that demolition waste, particularly concrete, provides resources for developed countries.Artificial sands mostly utilised substitutes for natural sand in recycled aggregate concrete, which may help conserve the environment. River bedded sand, key ingredient in concrete production, is becoming increasingly scarce and expensive. This necessitates searching a alternative to river sand. The Robo sand, or synthetic sand, can therefore be used as substitute for natural sand. Specimens were cast utilising recycled coarse aggregate, with artificial sand replacing 100 percent of natural sand, and materials were tested in accordance with Indian standard codes. For this investigation, we utilised concrete of M20 grade. Every set of three cubes was cast and tested in a total of 18 sets.

RCA With Bellary Granitic Stone Sand in concrete

There's also a lot of destroyed concrete and riverbed sand being generated these days, and their use is damaging environment. As a result, little study has been pulverized on use of reuse coarse aggregates in concrete production with crushed granitic rock as fine aggregate. That's how they got idea for this study, which is why they did it. The coarse aggregates employed in this study are fully recycled. It's also replaced entirely by Granitic stone Bellary sand, which has finer particle size. Casting cubes and curing these for 7, 14, and 28 days are used to test strength and durability of M20 Grade concrete in this inquiry. With 100% replacement Granitic stone Bellary sand, compressive strength of concrete specimens make ready with this sand is comparable to that of riverbed sand. Granitic stone Bellary Sand, which is much less expensive than riverbed sand, may be used into production of concrete.

Keywords: RCA, M-Sand, Slump test, Compaction Factor test, Compressive strength test.

1Introduction

1.1 RCA with Shahabad sand In Concrete

In every construction industry in India and throughout world, concrete is principal building material. As demand for concrete grows, so does need to remove natural aggregates, which results in the loss of natural resources or a shift in ecological equilibrium. This has resulted in shortage of natural sand, which has pushed up price of material dramatically, making it more difficult to construct new buildings, as well as those that have already been built and have shown to be environmentally friendly. As a result, my idea calls for using recycled coarse material and artificial sand. A large quantity of

demolition waste trash is generated when buildings are torn down and demolished, as well as when natural disasters inflict damage. The processing, transportation, and disposal of this garbage is a major issue as well. The manufacturing process, mixing proportion, physical property, durability, fundamental mechanical behaviour, and structural performance of recycled aggregate are all factors that contribute to its durability. R.C.A. is solid. Polluting ecosystem and disrupting natural balance are consequences of dumping this garbage. In addition, owing to lack of available dumping grounds, an urgent search for substitutes is required. There are valuable aggregates in construction and demolition debris that may be recycled and re-used in the production of fresh concrete.

1.2 RCA with M- sand In Concrete

In every construction industry in India and throughout world, concrete is principal building material. Due to fast expansion in infrastructure development and building activities in India and throughout world, demand for concrete is also rising, resulting in immoderate removal of natural aggregates, excess exploitation of pure aggregates for concrete manufacture, depletion of natural resources, and therefore harming the ecological balance. Old buildings built in past and those that have successfully finished their lifespans are occasionally dismantled and destroyed in order to make room for new ones. Crushing sedimentary rock yields M-sand, form of fine aggregate. A huge proportion of demolition waste is required when natural disaster occurs. There's also lot of rubbish that has to be handled, transported, and disposed of. Polluting the ecosystem and disrupting natural balance are consequences of dumping this garbage. Additionally, owing to lack of available dumping grounds, it's indeed imperative that other options be explored. Concrete may be made using recycled and reused aggregates found in construction and demolition debris. Because of a variety of environmental concerns, government also has outlawed riverbed exploitation of natural sand, which has led to a large rise in the price of natural sand. As result, my idea calls for use of RCA and synthetic sand. RCA is more water-absorbing, therefore it holds more water in its structure. Concrete's compressive strength is third factor. Normal concrete specimens formed with 100% substitution of riverbed sand by M-Sand have same tensile strength.

1.3 RCA With Bellary Granitic Stone Sand in concrete

In every construction industry in India and throughout world, concrete is principal building material. Concrete as well as cement mortar can't function without fine aggregate. So, from the standpoint of structural longevity, clean sand is required in building. Using Robo sand instead of natural river river sand is solution to this issue, as several jurisdictions have already outlawed usage of river sand for building because of its environmental impact. Granite Bellary Robo sand's component graduation and 0% impurity are cited as reasons for its widespread usage in reports. To replace Granite Bellary Robo sand entirely with river sand, the study's main objective was to discover workability and strength of concrete made with synthetic fiber-reinforced sand. research used M20 concrete with a w / c of 0.48 percent, cement mortar, and a w / c ratio of 0.45. In our study, we used concrete mix of M20 grade, and all basic tests and compressive strength tests were carried out in our KBN Engineering college lab material testing laboratory as well as concrete lab fine aggregate. However, it must meet the requirements like workability and strength. Granite Bellary Robo sand is used. It is preferable to use river-bed sand because of its compatibility with artificially created sand. The water absorption and moisture content of reuse coarse aggregate is greater than that of native coarse aggregates.

2.Related Work

[1].Due to dwindling supplies of natural building materials, it's becoming more necessary to find substitutes. Excessive energy usage, environmental obstacles, and waste removal are few of pressing challenges driving demand for raw material reuse. A product that mimics qualities of real sand in concrete is urgently needed because of depletion of natural sand resources. Building and demolition debris, ROBO sand, and other such emerging resources may be used to replace mineral-based components. In this study, river sand was substituted with ROBO Sand in lieu of natural coarse aggregate in plain cement concrete at varying percentages. effects of ROBO Sand and recycled aggregate on strength were studied in a series of strength tests. Because of its 30 N/mm2 compressive strength (M30 grade), concrete was employed in our investigation. Every set included 6 cubes, therefore total of 16 sets were made and evaluated in total.

[2]. Influence of recycled aggregates on compressive strength of concrete Abstract

The building industry is becoming more interested in using demolition and construction debris as resource of concrete aggregates. It is generally agreed that employing recycled aggregates has environmental advantages, but performance qualities of concrete in comparison to those made with natural aggregate must be reconsidered. Recycled aggregates have been used in this research to examine qualities of concrete. Using recycled coarse aggregates from 0% to 100% of overall coarse aggregate, concrete blends with such goal compressive strength of 25 MPa may be made The impact of these factors on compressive strength of concrete is being studied. As a consequence, we discovered that amount of coarse aggregate replaced affects the compressive strength of the concrete. It may be argued that this effect is almost nonexistent at lower percentages of replacement (less than 25%). Aside from providing a solution to the issue of insufficient concrete aggregates, usage of recycled aggregates in concrete manufacturing may assist tackle critical environmental issue of crucial importance**.**

[3]. Improving the Commercial viability of Reuse Aggregate Concrete by using Construction and Demolition Waste as Recycled Aggregates

Researchers and practitioners alike have shown that crushed building and demolition debris may be used as recycled aggregate into manufacture of fresh concrete. Recycled aggregate concrete (RAC) has yet to gain broad acceptance and use, despite its acceptable performance. It's possible to find wide range of uses for RAC, from non-structural hardscaping to pavements to structural applications, as metropolitan areas grow and infrastructure is rehabilitated and retrofitted at an unprecedented rate.

We wanted to prove that recycled aggregates can be used in concrete cheaply and technically. availability as well as need for recycled aggregates in rapidly expanding southeast metropolitan region were researched in order to clarify impeding issues. For purpose of estimating higher costs associated with creating concrete-grade recycled aggregates, additional work necessary in source segregation as well as other quality assurance processes was studied. Several forms of concrete have been made from recycled aggregates that were defined in the lab and tested in a case study conducted in Charlotte, North Carolina. Local concrete suppliers were canvassed to see whether they were OK with RAC being used in these applications. Deconstruction contractors, concrete suppliers, and developers all weighed in on pros and downsides of RAC production incentives. Using the data from case study plus survey, we were able to establish whether or not wider range of recycled aggregates goods might be successfully introduced to market.

[4]. Recycled Concrete Aggregate Replaces Natural Aggregate in the Compressive Strength of Concrete. compressive strength of concrete may be improved by using reused concrete aggregate in lieu of natural aggregate in concrete manufacturing, as detailed in this research. Concrete made with natural aggregates and concrete made with recycled aggregates were both used to produce 2 sets of concrete mixes with mass ratios of 1:3:6, 1:2:4, 1:11/2:3, and 1:1:2. There was a 33% drop in strength, a 20% reduction, an 11% decline, and a 20% reduction in compressive strength after 28 days for 1:1:3:6, 1:2:4, 1:11/2:3, and 1:1:2 concrete made with recycled concrete aggregates compared to concrete made with natural aggregate. Natural aggregate concrete had better density and compressive strengths than equivalent recycled aggregate concrete. Using recycled aggregate in lieu of natural aggregate in manufacturing of structural and non-structural concrete is possible, according to study's findings.

[5].Use of building rubbles as recycled aggregates Every nation has challenge when it comes to proper disposal of construction debris left behind after building has been damaged or removed. This material might be used as reused aggregate in concrete after crushing and screening. A number of studies were carried out utilising recycled aggregate from construction debris of varied compositions. Recycled aggregate might be made from construction debris with adequate processing, according to findings of tests. Concrete's strength will be lowered if it contains unclean recycled aggregate. Lower water/cement ratios will make impact more apparent. The harmful impacts of recycled aggregate washing were considerably reduced. The recycled concrete's flexural strength is a good example of this. When the water / cement ratio is low, reused coarse aggregate is weaker phase. Because of this impact, recycled concrete's strength will be dominated by its recycled content. Recycled mortar lacks this mechanism. The mortar's strength is determined by the amount ofrecycled fine aggregate it contains.

[6]. Study of Recycled Concrete Aggregates

This study explains how recycled concrete aggregates have been introduced and how they have been used in construction sector. There are references to recycled aggregates' qualities as well as their comparison to natural aggregates. RCA suggestions for future are offered as well.

Strength Characteristics Of Concrete With Reused Aggregates And Artificial Sand

Concrete's increasing use of sand and rock has prompted a search for more environmentally friendly methods of construction. The use of C&D waste in concrete might be a solution to these issues. Some or all of aggregate in structural concrete may be made from recycled material. Concrete with grade M25 is designed using IS10262:2009 as a guideline and recycled concrete aggregates and machine-made sand (artificial sand) as a test case. Conventional sand may be replaced by machine-made sand. Research is conducted on fresh and hardened features of new concrete, as well as standard concrete. Comparing the compressive strength, split tensile strength, and flexural strength of reused aggregate with those of a control mix can help determine whether or not it is OK to substitute conventional or artificial sand for recycled aggregate in concrete.

[7]. Influence Of Recycled Concrete Aggregates On Strength Parameters Of Concrete

As a result of our experiments, we established that compressive strength of hardened concrete created using recycled concrete aggregates was lesser than that of new concrete manufactured with natural aggregates. In the experiments, natural aggregates were used to replace recycled concrete aggregates in proportions of 0,25,50,75, and 100%. During experiments, cube compressive strength, cylinder split tensile strength, and beam flexural strength were all examined. Compressive strength, split tensile strength, and hardened density of RCA-concrete decrease as amount of recycled concrete aggregates rises, according to research.

[8].Assessment Of Recycled Aggregate Concrete For both environmental and economic reasons, usage of recycled aggregate in concrete may be beneficial. Recycled aggregates are always materials of future.. Many building projects in Europe, United States, and Asia are now using recycled aggregate. In order to boost usage of recycled aggregate, numerous governments have relaxed a number of infrastructure rules. Reused fine aggregate and reused coarse aggregate are described in this paper. Natural aggregates are also compared to these qualities. Concrete work may be affected by significant developments throughout all aggregate qualities, which were thoroughly investigated. Furthermore, here, characteristics of recycled aggregate concrete also were described and analysed in greater detail. In this section, the basic qualities of concrete as compressive strength, flexural strength, workability, and so on are described for other permutations of reused aggregate with natural aggregate. Many nations' requirements for using recycled aggregates in construction industry have been outlined in this document. Recycled aggregate's current situation in India, together with country's anticipated need for it infuture, and its effective usage were all explored in length here..

[9]. Recycled Aggregate Concrete as Material for Reinforced Concrete Structures When making fresh concrete, one typical way to make it more eco- friendly is by smashing concrete into coarse aggregate. Recycled aggregate from building and demolition debris is increasingly being used as an alternative to natural aggregate as way to lessen civil engineering's significant usage of natural resources. An experimental examination was carried out in the research project to examine the consequence of steel fibre reinforcing on the load-strain behaviour of recycled aggregate concrete beams. Concrete strength attributes were also studied, along with chosen recycled aggregate characteristics. Natural fine aggregate and 100% reused coarse aggregate were used in the concretes evaluated. Model reinforced concrete beams were used to examine the flexural behaviour. As well as steel bars, steel fibres with an aspect ratio of 37.5 and a length of 6mm were employed in volume fraction of 0.52%. Steel fibre and recycled aggregate enhanced mechanical strength that altered flexural behaviour and fracture process compared to recycled aggregate concrete, according to study findings.

[10]. Structural Concrete Production Using Recycled Concrete Aggregate. New and hardened concrete qualities are compared in research based on results of experiments using natural and recycled coarse aggregate replacement ratios. Crushing concrete debris from test cubes as well as precast columns yields recycled aggregate. To compare the performance of different kinds of concrete, three different combinations were used: one with just

natural aggregate (NAC) as a control and two others with natural fine and recycled coarse aggregate (50 percent and 100 percent substitution of coarse recycled aggregate). There were a total of 89 hardened concrete specimens prepared for evaluating fundamental qualities of material. Reinforced concrete beams produced of examined concrete kinds are also included in study for purpose of assessing their load bearing capacity. In this experiment, the performance of recycled aggregate concrete (RAC) was comparable to that of control concrete irrespective of replacement ratio. It is, however, essential that quality recycled concrete coarse aggregate be used and that design and manufacture of this new concrete type adhere to particular regulations.

[11]. Properties Of Recycled Aggregate Concrete. The study cites development of recycling sector by global superpowers in wake of natural catastrophes and wars, and suggests that recent floods in Bosnia and Herzegovina and Serbia might create enormous volumes of building and demolition trash. An overview of recycled aggregate concrete's fundamental qualities and applications is offered, based on years of comprehensive experimental study and the work of recognised specialists. To generate high-quality and even acceptable structures using recycled concrete aggregates, it is necessary touse coarse reused aggregates in concrete mixes. The features of crushed destroyed concrete are key.

[12]. Experiments on Robosand as a Fine Aggregate Replacement in Regular Concrete. Natural sand's scarcity, coupled with an ever-increasing demand from building sector, is major source of worry. River sand, a key component in the production of concrete, is becoming more difficult to come by and hence increasingly costly. This necessitates searching for in an alternate to river sand. As an alternative to river sand, crusher dust, commonly known as Robosand, may be employed. Because of its similarities to river sand's characteristics, robosand is widely used as a construction material. For M40 and M30 mix designations, this article investigates the highest percent substitution of river sand with Robosand at varied percentages of 0%, 25%, 50%, 75%, and 100%. Compressive and flexural strengths of concrete are determined by casting cubes, cylinders, and prisms of various sizes and performing tests on them.

[13]. **Study on Strength of Concrete Using Robo Sand as a Partial Replacement of Fine Aggregate.**

Among most often utilised alternatives to river sand in concrete is robo sand, which may be used as a fine aggregate instead of river sand. Concrete cubes, cylinders, and prisms of M25 and M35 grades were tested for workability and strength by replacing natural sand with Robo sand in proportions of 0 percent, 50 percent, 75 percent, and 100 percent. The workability of material is evaluated using slump cone technique., Cylinders, Concrete Cubes, Prisms were poured and evaluated at 7 and 28 days of age for strength criteria. Robo sand is used to replace natural sand in current experiment on concrete grades M25 and M35. The compressive strength as well as water absorption of concrete sample were evaluated.

3.Objective

- Experimental testing of M20-grade concrete constructed from recycled coarse aggregate and crushed sand (Shahabad) will be conducted to determine
- the concrete's compressive strength. When compared to regular concrete.
- Concrete constructed with RCA in complete substitution of natural riverbed sand by M-sand for M20 grade of concrete, in compared to regular concrete, is the primary purpose of this research.
- Using Granitic Bellary robo sand as a complete substitution for fine aggregates in M20 grade concrete, this research aims to determine the workability and strength of the material.

4.Materials and Methodology

Concrete grade = M20 Design – IS 10262 :1980 Molding of specimen:cube-18NO's (15x15x15cm There were two kinds of concrete mixes tested: one produced entirely of recycled coarse aggregate (RCA) as control, and other composed entirely of recycled fine aggregate (RCA) with 100% recycled coarse aggregate or destroyed waste RCA. Concrete specimens were created for investigating fundamental characteristics of hardened cement. Basic test on fine aggregate and R.C.A and compr. str. of concrete test conducted as per I.S Code recommendation concrete mix of M20 grade is used for our study and all basic test and compressive strength test tested in our K.C.T Engineering college laboratory.

Cement The IS: 4031 – 1988 standard was used to evaluate physical and chemical characteristics of ordinary Portland cement grade 53 from local market, and results showed that cement met all of requirements of the IS: 12269 – 1987 standard. Table 1 displays the cement's properties .

Table No.1 Test on Cement

SL No.	Properties	Value
1	Normal consistency	31%
2	Initial Setting time	35 Min
3	Compressive Str. (7 days)	38 N/mm^2
4	Compressive Strength (14 days)	47 N/mm^2
5	Compressive Strength (28 days)	53 N/mm^2
6	Specific Gravity	2.95

Fine aggregate

a) Artificial sand: - Artificial sand from local market is employed as fine aggregate in this study. Figures in table 2 depict results of tests on fine aggregate.

Table No.2 Test on Fine Aggregate (Shahabad Stone crushed Sand)

SL No.	Properties	Value
1	Sp. Gravity	2.46
2	Fineness Modulus	3.50%
3	Water absorption	1.6%
4	Surface Texture	Smooth
5	Bulk Density	1616kg/m^3
6	Zone	I

Table No.3 Test on Fine Aggregate (M.Sand)

SL No.	Properties	Value
1	Sp. Gravity	2.63
2	Fineness Modulus	3.160%
3	Water absorption	1.8%
4	Surface Texture	Smooth
5	Bulk Density	1616kg/m^3
6	Zone	I

Table No.4 Test on Fine Aggregate (Granite Bellary Robo Sand)

SL No.	Properties	Value
1	Sp. Gravity	2.40
2	Fineness Modulus	4.64%
3	Water absorption	1.5%
4	Surface Texture	Smooth
5	Bulk Density	1584kg/m^3
6	Zone	I

Fig. 1 : Artificial Sand

Table No.5 Test on Fine Aggregate(River Sand)

SL No.	Properties	Value
1	Sp. Gravity	2.46
2	Water absorption	3.50%
3	Moisture content	1.6%
4	Zone	II

To perform this research, we utilised river sand that was readily accessible in area, and results of our laboratory experiments on natural sand are shown in table 5.

Coarse aggregate

Recycled 20mm downsize C.A has been rounded. Recycled coarse aggregate by our local city's destroyed buildings was employed in this investigation. Table No. 6 shows tests results on coarse aggregate.

Table No.6 Test on Demolished RCA

Sl No.	Properties	Value
1	Sp. Gravity	3
2	Fineness Modulus	0.372%
3	Water absorption	25%
4	Particle Shape	Angular
5	Impact Value	8.5%
6	Crushing Value	20.1
7	Bulk Density	1658.28kg/m^3

Fig. 2 Natural C.A & Recycled C.A

Mix Design:

Concrete mix design is process of choosing appropriate concrete materials and calculating their relative amounts in order to produce concrete with needed strength, durability, and workability at lowest cost achievable. Table 7 shows concrete mix proportion

Table 7 Mix Proportion (SHAHABAD SAND)

Mould	Volume (m^3)	Cement (kg)	FA (Kg)	CA (Kg)
Cube	0.003375	1.95	1.41	2.25

Table 8 Mix Proportion M-SAND

Mould	Volume (m^3)	Cement (kg)	FA (Kg)	CA (Kg)
Cube	0.003375	2.10	1.20	2.40

Table 9 Mix Proportion Granite Bellary SAND

Mould	Volume (m^3)	Cement (kg)	FA (Kg)	CA (Kg)
Cube	0.003375	1.95	1.39	2.16

5.Experimental Results :

Table 10 Slump and compaction factor tests SHAHABAD SAND

Sl.No	100% Replacement of R.C.A	Slump(mm)	Compaction Factor
1	C.C	95	0.90
2	100%	94	0.92

Table 11 Compaction factor and Slump tests result of m20grade concrete M-SAND

Sl.No	100% Replacement of R.C.A	Slump(mm)	Compaction Factor
1	C.C	92	0.89
2	100%	96	0.90

Table 12 Compaction factor and Slump tests result of m20grade concrete Granite Bellary SAND

Sl.No	100% Replacement of R.C.A	Slump(mm)	Compaction Factor
1	C.C	95	0.90
2	100%	94	0.92

Table 13 Compressive Strength Test Results on Cubes (IS: 5816 – 1959)

SL No.	100% recycled coarse aggregate With 100% A-Sand	Compressive strength For 7days curing (N/mm^2)	Compressive strength For 14days curing (N/mm^2)	Compressive strength for 28 days curing (N/mm^2)
1	100%	8.446	15.301	19.99

Table 14 Compressive Strength Test Results on Cubes(IS: 5816 – 1959)

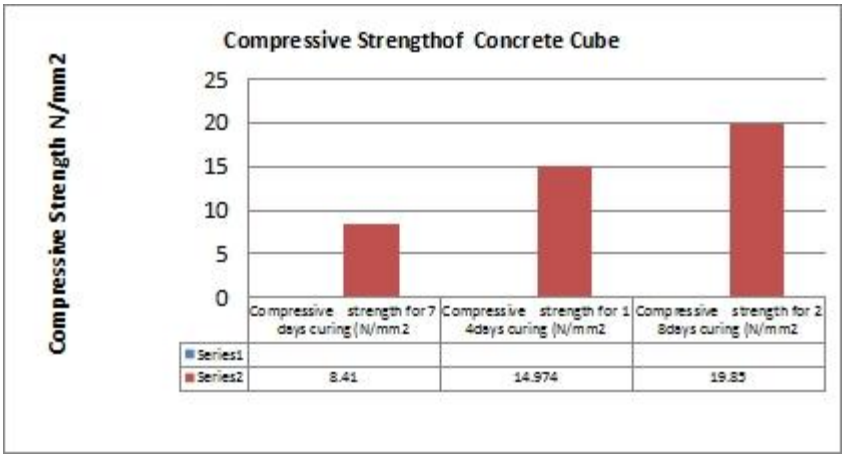
Sl. No	100% recycled coarse aggregate With 100% A-Sand	Compressive strength for 7days curing (N/mm^2)	Compressive strength for 14days curing (N/mm^2)	Compressive strength for 28days curing (N/mm^2)
1	100%	9.056	16.410	20

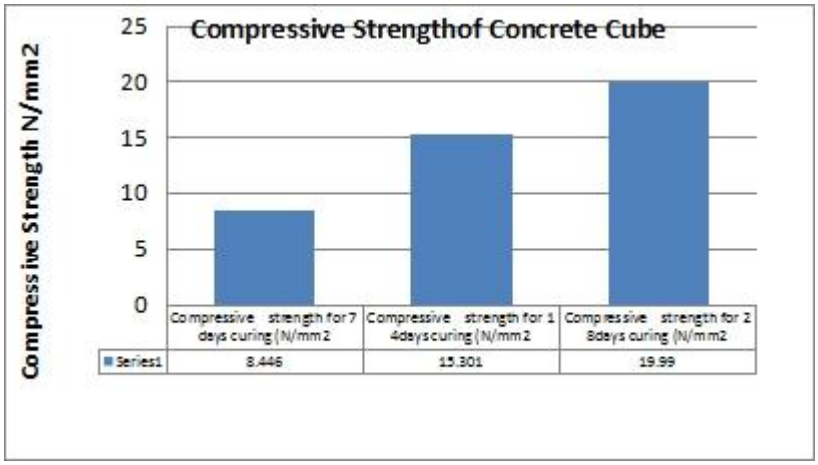
Table 15 Compressive Str. Test Results on Cubes(IS: 5816 – 1959):

SL No.	100% recycled coarse aggregate With 100% A-Sand	Compressive strength for 7days curing (N/mm^2)	Compressive strength for 14days curing (N/mm^2)	Compressive strength for 28days curing (N/mm^2)
1	100%	8.410	14.9740	19.85

Therefore compressive strength of cubes throughout 7-14-28-day curing is addressed in the following data. As can be seen in graph , both conventional concrete and replacement material achieve the same overall level of strength. When recycled destroyed concrete was used, it was shown to have an improved strength above standard concrete.

Test on Concrete Cubes:





6.Conclusion

These are main findings of this research. Reusing waste material is highly exciting and encouraging, especially if it helps to minimise devastation to earth's crust as well as green forest cover through reducing mining. This building approach is quite efficient. The protection of the environment against concrete trash from demolitions. The destroyed concrete's compressive strength is now higher than that of regular concrete.

As a remedy to issue of dumping thousands upon thousands of tonnes of trash, construction waste recycling and reuse has been shown to be acceptable. Usage of recycled aggregates in concrete is a cost-effective, environmentally friendly, and technically sound construction material. The usage of reused coarse aggr. in construction has a amount of proven uses. Our design standards and requirements, as well as our procedures for using recycled aggregate concrete, might benefit from greater study into the usage of RCA. It is imperative that usage of RCA in construction projects in India be given the attention it deserves, considering the upcoming commissioning of large infrastructure projects. Reduced mining can help protect the earth's crust as well as green forest cover if waste material can be repurposed. This is a very exciting and hopeful prospect. In construction industry, this strategy is quite effective. Protection of the environment from the trash generated during demolition, namely, demolition concrete. The destroyed concrete has higher compressive strength than regular concrete**.**

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