MECHANICAL PROPERTIES OF WASTAGE OF CONCRETE DUST BY USING PARTIAL REPLACEMENT OF SAND

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ABSTRACT: Nowadays the greatest crisis faced by the construction industry is the availability of sand. As the digging of river sand destroys the river bed and causes danger for people using the river, digging of river sand has been made illegal in most rivers. So getting river sand is really expensive nowadays as its availability is very limited. So more importance is now given nowadays for replacement of river sand as fine aggregate.

In our project we are trying to replace sand with crushed used (demolished) concrete. The concrete created with this aggregate showed almost the same strength of concrete with natural sand. This is not only much cheaper than river sand and but also helps to decrease the disposal of construction wastes, which environmentalists say degrades the land. So in the end use of this crushed concrete is beneficial not only to the contractor but also to our environment.

In this research an experiment investigation has been carried out to determine the influence of compressive strength of M30 grade concrete were cast. In a grade of concrete 10%, 15% and 20% of sand was replaced with wastage of concrete dust.

Concrete is weak in tension and strong in compression so the concrete should be strong to attain high compression. In this study for each mix 3-samples were tested and the average strength is compared with nominal mix of M30 grade. Compressive strength test finds out the high amount of compressive load.

Compressive Strength on Concrete M30 Cubes Percentage Replacement Compressive Strength (N/mm²) of 3days, 7 Days & 28 Days.

KEYWORDS: Fine aggregate, Course aggregate, concrete dust, cement, mechanical properties and physical properties.

I. INTRODUCTION

Cement, sand and aggregate are essential needs for any construction industry. Sand is a major material used for preparation of mortar and concrete and plays a most important role in mix design. In general consumption of natural sand is high, due to the large use of concrete and mortar. Hence the demand of natural sand is very high in developing countries to satisfy the rapid infrastructure growth. The developing country like India facing shortage of good quality natural sand and particularly in India, natural sand deposits are being used up and causing serious threat to environment as well as the society. Rapid extraction of sand from river bed causing so many problems like losing water retaining soil strata, deepening of the river beds and causing bank slides, loss of vegetation on the bank of rivers, disturbs the aquatic life as well as disturbs agriculture due to lowering the water table in the well etc are some of the examples. The heavy-exploitation of river sand for construction purposes in Sri Lanka has led to various harmful problems . Options for various river sand alternatives, such as offshore sand, quarry dust and filtered sand have also been made (W.P.S. Dias et al 2008). Physical as well as chemical properties of fine aggregate affect the durability, workability and also strength of concrete, so fine aggregate is a most important constituent of concrete and cement mortar. Generally river sand or pit sand is used as fine aggregate in mortar and concrete. Together fine and coarse aggregate make about 75- 80 % of total volume of concrete and hence it is very important to fine suitable type and good quality aggregate nearby site (Hudson 1997). Recently natural sand is becoming a very costly material because of its demand in the construction industry due to this condition research began for cheap and easily available alternative material to natural sand. Some alternatives materials have already been used as a replacement of natural sand such as fly-ash, quarry dust or limestone and siliceous stone powder, filtered sand, copper slag are used in concrete and mortar mixtures as a partial or full replacement of natural sand (Chandana Sukesh et al 2013). Even though offshore sand is actually used in many countries such as the UK, Sri Lanka, Continental Europe, India and Singapore, most of the records regarding use of this alternative found mainly as a lesser extent of practice in the construction field.

According to „waste management world' statistics, in India, 48 million tonnes of solid waste is produced per annum, construction and demolition waste contributes about 15 million tonnes. In the year 2014, Rs 70 crores was integrated for solid waste management facility to meet Delhi's garbage disposal needs for the next 20 years.

The total non-reusable waste from the construction industry in India is estimated to be between 12 million to 14.7 million tonnes per year, out of which 7 to 8 million tonnes are concrete and brick waste. Most of this waste is land filled in rural areas.

In India 650million kg sand is used per year which is dug exponentially from rivers, if 20% to 25% of sand is replaced by concrete waste as fine aggregate around 150 million kg of sands can be saved.

This use of construction debris as coarse and fine aggregate is an alternative for the replenishing quarry and river sand.

CEMENT:
Cement is produced by burning together, in a definite proportion, a mixture of siliceous (containing silica), argillaceous (containing alumina) and calcareous (containing lime) material in a partial fusion, at a temperature of 1400 to 1450°C. By doing so, a material called clinker is obtained. It is cooled and then grounded to the required fineness to get cement. Different types of cement are obtained by varying the proportions of the raw materials and also adding small percentage of other chemicals.
Three types of cement are available in Indian Market. They are:
1. Ordinary Portland Cement (OPC) may be used in normal condition
2. Portland Pozzolona Cement (PPC) may be used in normal condition but after checking the mortar setting
3. High-early-strength Cement (quick setting cement) may be used in cold climate zones and also in places where early setting and strength gaining is desirable.
In the project we have used Ordinary Portland Cement.
Fine Aggregate:
Fine aggregate is material which passes through 4.75 mm sieve and retained on 75 micron sieve. It may be natural sand if it results from the natural disintegration of rock or crushed stone sand or crushed gravel sand if it is produced by crushing hard stone or gravel, respectively.
In the project we have used river sand and crushed C&D wastes as fine aggregate
Coarse Aggregates:
Coarse aggregate is material which passes through 80 mm sieve and retained on a 4.75 mm sieve. It may be uncrushed gravel if it results from the natural disintegration of rock or crushed stone or crushed gravel if it is produced by crushing hard stone, gravel.
Demolished concrete dust:
Demolished waste was collected from Gnit bulding near ibrahimpatnam, India. Demolished waste on being tested in laboratory showed pozzolanic properties. Demolished waste as a pozzolanic material was used to partially replace cement and similarly fine aggregate.
Demolished concrete dust as fine aggregate:
Demolished particles are used as reinforcing material for investigation. Shell particles of size between 20 mm – 600 µ are prepared in grinding machine. Demolished concrete dust aggregates are potential candidates for the development of new composites because of their high strength and modulus properties.

OBJECTIVES
The main objective of this paper is to prove that the replacement of construction debris as aggregates in concrete without altering their conventional properties.

- This partial replacement of crushed construction debris as both fine and coarse aggregate helps in solid waste management.
- Mentioning the replacement ratio up to which the values are within the permissible limits and not effect the requisites of the concrete
- To Study the physical and mechanical performance of recycled aggregate used in concrete.
- To check the possibility of using recycled aggregate in concrete mixes.
- The bonding strength can be investigated between reinforcement bars and concrete from recycled aggregate.
- To optimize the ratio of recycled aggregate to natural aggregate which produce better result of concrete mix.

II. LITERATURE REVIEW

There are various literature reviews are available some of them are given below.
2.1 Ayed Ahmad Zuhud, (2008)[ibid]

- Due to light weight of recycled aggregate and bad compaction becauseof the nature of recycled aggregate and its texture, the density of recycled aggregate concrete is lower than that of natural aggregate by5.5%.
- The absorption capacity of recycled aggregate is more than two times of natural aggregates; due to this the workability of recycled concrete is reduced.
- Using the same quantity of cement, the recycled aggregate concrete can provide strength almost equivalent to a corresponding concrete with natural aggregates. If we replace 60 % of recycled coarse aggregate in concrete mixes it is found that the compressive strength decrease by 24.6.0%.

2.2 G.Murali(2012)

- According to G.Murali, By replacing 10 % natural aggregate by recycled aggregate without chemical admixtures, the tensile strength has been gradually increased as 5.88% & with chemical admixtures, the tensile strength was noted as 8.82%.
- If they replace 20 % natural aggregate by recycled aggregate without chemical admixtures, the tensile strength has been gradually increased as 11.40% & with chemical admixtures, the tensile strength was noted as 16.91%.
- If they replace 30 % natural aggregate by recycled aggregate without chemical admixtures, the tensile strength has been gradually increased as 21.70% & with chemical admixtures, the tensile strength was noted as 28.3%.
- If they replace 40 % natural aggregate by recycled aggregate without chemical admixtures, the tensile strength has been gradually increased as 15.7% &

with chemical admixtures, the tensile strength was noted as 19.85%. The test results indicated that the replacement of coarse aggregate by 30% had attained a good strength.

2.3 .BaharDemirel,(2010)ibid

- The compressive strength of concrete has increased with increasing percentages of marble dust additions a tall curing ages.
- The concrete series that employed waste marble dust as the substitute for the very fine aggregate passing through 0.25 mm sieve performed better than the series without any addition of marble dust in terms of compressive strength.
- The porosity of the concrete decreased and Ultrasonic pulse velocity increased with addition of percentage of marble dust increases.

2.4 . M. ShahulHameed,(2009)ibid

- The replacement of fine aggregate with 50% marble sludge powder and 50% Green concrete gives an excellent result in strength aspect and quality aspect.
- The result of his study shown that, the M4 mixes induced higher compressive strength, higher splitting tensile strength.
- If they increase the marble sludge powder content by more than 50%, it improves the workability but affects the compressive and split tensile strength of concrete.
- Green concrete induced higher workability and it satisfy the self compacting concrete performance having the slump flow is 657mm without affecting the strength of concrete.

2.5 .Nelson, Shing Chai NGO(2004)

- When the percentage of recycled aggregate increases, the slump test indicates a decreasing trend of workability.
- The compaction factor test indicated that, the compacting factor ratio is decreases as the percentage of recycled aggregate increases.
- The compression test indicated that, the concrete specimen with more replacement of recycled aggregate will get the lowest strength when compared to the concrete specimens with less recycled aggregate.
- The tensile test concluded that, the tensile strength is gradually decreases if more percentage replacement of recycled aggregate used in the concrete specimen.

2.6 .BabooRai,et.al.,(2011)

- The partial replacement of cement and usual fine aggregates by varying percentage of marble powder and marble granules reveals that increased waste marble powder (WMP) or waste marble granule (WMG) ratio result in increased workability and compressive strengths of the mortar and concrete.

2.7. Haliza Bite Mohd Jeffery Ong, (2010)

- The control mixture showed better results compared with the mixture of using recycled aggregate. Research shows that more recycled aggregate is used, the compressive strength of concrete decreases. However, recycled aggregate can be used for structures that do not require a high specification.

2.8. Suraya Hani Adnan,et.al.,(2010)

- The compressive strength of concrete containing recycled aggregate &Micronised Biomass Silica (MBS) have more compressive strength than concrete containing only MBS.
- MBS acts as a micro-filler in the concrete due to this MBS be able to lower the water permeability of normal and recycled aggregate concrete.

2.9. V.R Ramkumar, et.al., (2012)

- The result shows that, the flexural strength of concrete with natural aggregate is more than the concrete containing recycled aggregate.
- However by providing water & acid treatment the strength of recycled aggregate concrete can be improved.

2.10. P.A. Shirule , et.al.,

- If they add 10% of waste marble powder by weight of cement the Compressive strength of Cubes are increased and further any addition of waste marble powder the compressive strength of cubes are decreases.
- If they add 10% of waste marble powder by weight of cement the Split Tensile strength of Cylinders is increased and further any addition of waste marble powder the Split Tensile strength of Cylinders decreases.

Hence it can be concluded that the optimum percentage for replacement of marble powder with cement and it is almost 10%cement for both cubes and cylinders.

III. MATERIAL AND METHODOLOGY

3.1 Introduction of Materials:

Demolished Waste: Demolition waste is collected from residential building near police station Ibrahimpatnam RR district telengana. It is light grey in colour.

3.2 .1. Cement

A cement is a binder, a substance that sets and hardens and can bind other materials together. The word "cement" traces to the Romans, who used the term opus caementicium to describe masonry resembling modern concrete that was made from crushed rock with burnt lime as binder. The volcanic ash and pulverized brick supplements that were added to the burnt lime, to obtain a hydraulic binder, were later referred to as cementum, cimentum, cäment, and cement. Cements used in construction can be characterized asbeing either hydraulic or non-hydraulic, depending upon the ability of the cement to be used in the presence of water.

Non-hydraulic cement will not set in wet conditions or underwater, rather it sets as it dries and reacts with carbon dioxide in the air. It can be attacked by some aggressive chemicals after setting.

3.2.2 Types of cements

i. Portland cement
ii. Energetically modified cement
iii. Portland cement blends
iv. Portland blast furnace cement
v. Portland fly ash cement
vi. Portland Pozzolana cement
vii. Portland silica fume cement
viii. Masonry cements
ix. Expansive cements
x. White blended cements
xi. Colored cements
xii. Very finely ground cements
xiii. Pozzolana-lime cements
xiv. Slag-lime cements
xv. Super-sulphated cements
xvi. Calcium sulfo aluminate cements
xvii. Natural cements
xviii. Geo polymer cements

3.2.3 Cement: In this work, ordinary Portland cement of Ultratech (53 grade) brand obtained from a single batches trough out the investigation was used. The ordinary cement content mainly has two basic ingredients namely, argillaceous and calcareous. The physical properties of OPC as determined. The cement satisfies the requirement of IS: 8112-1989.

3.2.4 Curing

Cement sets or cures when mixed with water which causes a series of hydration chemical reactions. The constituents slowly hydrate and crystallize; the interlocking of the crystals gives cement its strength. Maintaining a high moisture content in cement during curing increases both the speed of curing, and its final strength. Gypsum is often added to Portland cement to prevent early hardening or "flash setting", allowing a longer working time. The time it takes for cement to cure varies depending on the mixture and environmental conditions; initial hardening can occur in as little as twenty minutes, while full cure can take over a month. Cement typically cures to the extent that it can be put into service within 24 hours to a week.

3.2.4 Safety issues

Bags of cement routinely have health and safety warnings printed on them because not only is cement highly alkaline, but the setting process is exothermic. As a result, wet cement is strongly caustic and can easily cause severe skin burns if not promptly washed off with water. Similarly, dry cement powder in contact with mucous membranes can cause severe eye or respiratory irritation. Some ingredients can be specifically allergenic and may cause allergic dermatitis. Reducing agents are sometimes added to cement to prevent the formation of carcinogenic chromate in cement. Cement users should wear protective clothing.

3.3 Aggregates: Fine Aggregates

3.3.1 Introduction

Fine aggregate (Sand) is a naturally occurring granular material composed of finely divided rock and mineral particles. It is defined by size, being finer than gravel and coarser than silt. Sand can also refer to a textural class of soil or soil type; i.e. a soil containing more than 85% sand-sized particles (by mass).

The composition of sand varies, depending on the local rock sources and conditions, but the most common constituent of sand in inland continental settings and non-tropical coastal settings is silica (silicon dioxide, or SiO_2), usually in the form of quartz. The second most common type of sand is calcium carbonate, for example aragonite, which has mostly been created, over the past half billion years, by various forms of life, like coral and shellfish. It is, for example, the primary form of sand apparent in areas where reefs have dominated the ecosystem for millions of years like the Caribbean.

3.3.2 Composition

In terms of particle size as used by geologists, sand particles range in diameter from 0.0625 mm (or 1⁄16 mm) to 2 mm. An individual particle in this range size is termed a sand grain. Sand grains are between gravel (with particles ranging from 2 mm up to 64 mm) and silt (particles smaller than 0.0625 mm down to 0.004 mm). The size specification between sand and gravel has remained constant for more than a century, but particle diameters as small as 0.02 mm were considered sand under the Albert Atterberg standard in use during the early 20th century.

3.3.3 Study

The study of individual grains can reveal much historical information as to the origin and kind of transport of the grain. Quartz sand that is recently weathered from granite or gneiss quartz crystals will be angular. It is called Grus in geology or sharp sand in the building trade where it is preferred for concrete, and in gardening where it is used as a soil amendment to loosen clay soils. Sand that is transported long distances by water or wind will be rounded, with characteristic abrasion patterns on the grain surface. Desert sand is typically rounded.

Fine aggregate: The fine aggregate is locally available river sand, which is passed through 4.75 mm sieve.

3.4 Aggregates: Coarse Aggregates

3.4.1 Introduction

The coarse aggregate locally available crushed stone aggregate, 12 mm maximum of single lot size has been used trough out the experiment the specific gravity of coarse aggregate was 2.7

Simply “aggregate”, is a broad category of coarse particulate material used in construction, including sand, gravel, crushed stone, slag, recycled concrete and geosynthetic aggregates. Aggregates are the most mined materials in the world. Aggregates are a component of composite materials such as concrete and asphalt concrete; the aggregate serves as reinforcement to add strength to the overall composite material. Due to the relatively high hydraulic conductivity value as compared to most soils, aggregates are widely used in drainage applications such as foundation and French drains, septic drain fields, retaining wall drains, and road side edge drains. Aggregates are also used as base material under foundations, roads, and railroads. In other words, aggregates are used as a stable foundation or road/rail base with predictable, uniform properties (e.g. to help prevent differential settling under the road or building), or as a low-cost extender that binds with more expensive cement

3.4.2 History
People have used sand and stone for foundations for thousands of years. Significant refinement of the production and use of aggregate occurred during the Roman Empire, which used aggregate to build its vast network of roads and aqueducts. The invention of concrete, which was essential to architecture utilizing arches, created an immediate, permanent demand for construction aggregates.

3.4.3 Modern production
The advent of modern blasting methods enabled the development of quarries, which are now used throughout the world, wherever competent bedrock deposits of aggregate quality exist. In many places, good limestone, granite, marble or other quality stone bedrock deposits do not exist. In these areas, natural sand and gravel are mined for use as aggregate. Where neither stone, nor sand and gravel, are available, construction demand is usually satisfied by shipping in aggregate by rail, barge or truck. Additionally, demand for aggregates can be partially satisfied through the use of slag and recycled concrete. However, the available tonnages and lesser quality of these materials prevent them from being a viable replacement for mined aggregates on a large scale. Large stone quarry and sand and gravel operations exist near virtually all population centres. These are capital-intensive operations, utilizing large earth-moving equipment, belt conveyors, and machines specifically designed for crushing and separating various sizes of aggregate, to create distinct product stockpiles.

3.4.4 Recycled materials for aggregates
The largest-volume of recycled material used as construction aggregate is blast furnace and steel furnace slag. Blast furnace slag is either air-cooled (slow cooling in the open) or granulated (formed by quenching molten slag in water to form sand-sized glass-like particles). If the granulated blast furnace slag accesses free lime during hydration, it develops strong hydraulic cementitious properties and can partly substitute for Portland cement in concrete. Steel
furnace slag is also air-cooled.

3.5 WATER
Potable water is used for mixing and curing. On addition of higher percentage of demolished waste the requirement of water increases for the same workability. Thus a constant slump has been the criteria fir water requirement but the specimens having 0% demolished waste, w/c of 0.43 has been used.

IV. EXPERIMENTAL INVESTIGATION

test report on cement

Physical property	Test result
Normal consistency	34%
Initial setting time	33 minutes
Final setting time	6 hours 33 minutes
Specific gravity	3.12
Fineness	4.5%
Soundness	4mm

test report on concrete dust

Physical property	Test result
Specific gravity	2.19
Fineness	6.5%
Normal consistency	3.23%

4.2 TESTS CONDUCTED ON AGGREGATES
Grading of Fine Aggregates

Size	Weight of soil retained	% of sol retained	Cumulative % of weight retained	% of fine passing through
1.18mm	260	26	26	74
1mm	120	12	38	62
600µ	200	20	58	42
300µ	390	39	97	3
150µ	20	2	99	1
panµ	10	1	100	0
Total	1000	--	418	--

4.3 TEST RESULTS FOR MATERIALS
Fine aggregate results

Physical property	Test result
Specific gravity	2.69
Bulking of sand	17.64%
Sieve analysis	Zone-ii
Water absorption	70%

Coarse aggregate results

Physical property	**Test result**
Specific gravity	2.64
Aggregate impact value	6%
Aggregate crushing value	10%
Water absorption	20%

Demolished concrete dust results

Physical property	Test result
Maximum size(mm)	20
Water absorption	28
Specific gravity	1.56

Aggregate impact value	8.55%
Aggregate crushing value	2.49%

V. CONCRETE MIX DESIGN

MIX DESIGN

- Taken M 20 Grade
- Type of cement (O.P.C) = 53 grade
- Size of coarse aggregate = 20 mm and 12.5mm.

Design considerations (as per 10262-1982)

- Mix proportion is 1:1.65:2.95
- Target strength=26.4 N/mm2
- w/c=0.51
- Water content=202kg/m3
- Cement =403kg/m3.
- Coarse aggregate=1128kg/m3.
- Fine aggregate=626kg /m3.

VI. TEST RESULTS AND ANALYSIS

The target of the experimental program was to determine the contribution of natural material aggregate type to the development of the strength behavior of the confined concrete. The experimental program comprises the following:
a. To Compute and compare the Compressive strength of M20 mix concrete cube specimens with 10%, 20%, 30% & 40% replacement of aggregate by coconut shell concrete cube specimens.
b. To check various properties of coconut shell concrete mix like
- Density
- Modulus of Elasticity
- Workability
- Water-cement ratio
- Water absorption
- Slump cone
c. To investigate the feasibility of the combination of coconut shell as coarse aggregate in concrete by determining its compressive strength and durability.
d. To investigate the effect of the combination of coconut shell as coarse aggregate in concrete content and length to the workability as lightweight aggregate in concrete.
e. To determine the optimum content of the combination of coconut shell as coarse aggregate in concrete to improve the ductility and does not cause reduction in the compressive strength.
f. To compute applications of such lightweight concrete in construction & its economy.

6.1 MATERIALS

The constituent materials used in this investigation were procured from local sources. Ordinary Portland cement of C53 grade conforming to both the requirements of IS: 12269 and ASTM C 642-82 type I was used. Fly ash used in this investigation was procured from local suppliers. Chemical composition of the materials is presented in Table 1 along with specific gravities of the materials. Normal aggregate, that is, crushed blue granite of maximum size 20 mm was used as coarse aggregate. Well graded river sand passing through 4.75 mm was used as fine aggregate. The specific gravities of coarse and fine aggregates were 2.65 and 2.63 respectively. Coconut shells which were already broken into two pieces were collected from local temple; air dried for five days approximately at the temperature of 25 to 30oC; removed fibre and husk on dried shells; further broken the shells into small chips manually using hammer and sieved through 12mm sieve. The material passed through 12mm sieve was used to replace coarse aggregate with CS. The material retained on 12mm sieve was discarded. Water absorption of the CS was 8% and specific gravity at saturated surface dry condition of the material was found as 1.33.

6.2 MIX PROPORTIONS

In order to investigate properties of CS concretes, six mixes were employed. Control mix (M1) that is, without CS was made. Coarse aggregate was then replaced with CS in 10 (M2), 15 (M3), 20 (M4) percentages to study effect of CS replacement. Furthermore, a mix with both CS and fly ash (M5) was also employed, in which, 20% of CS was replaced with aggregate and 25% of fly ash was replaced with cement. M6 mix contained 20% of coconut shells and 5% of fly ash both replaced with aggregate. Free water to cementitious ratio was maintained constant at 0.6 for all concrete mixes. Extra water was added in the mixes depending on the CS replacement to compensate water absorption of the CS particles.

6.3 MIXING, COMPACTION, SPECIMEN PREPARATION AND CURING:

The concretes were mixed in a planetary mixer of 100l capacity. The mixing time kept to about 3 to 4 min. Mixing of the materials was in a sequence: (i) portion of design water poured into mixture drum; (ii) cement gently placed; and (iii) aggregate and CS was spread over the cement and started mixing. During mixing, the remaining design water was poured into the mix for thorough mix of concretes. Specimens were then prepared and left for 24 hours. The specimens were demoulded after 24 hours and immersed in normal water for curing until the test.

6.4 WORKABILITY

The word ‘workability’ signifies much wider and deeper meaning than the other terminology “consistency” often used loosely for workability. Consistency is to indicate the degree of fluidity or degree of mobility. Two tests basically have done for workability namely slump test and compaction factor test with fresh mix.

6.4.1 Introduction

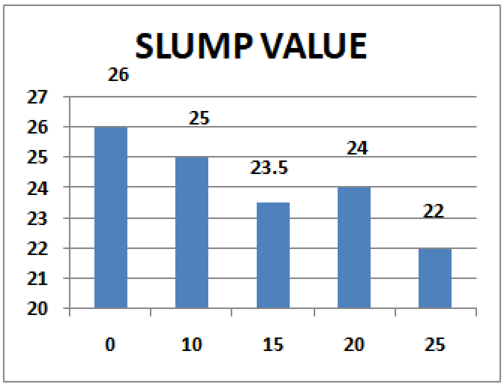
Series of test was carried out on the concrete cylinder to obtain the strength characteristics of scrap for potential application in high density Concrete. This chapter discuss on the result that obtained from the testing. The results are such as slump test, compacting factor test, compression test, indirect tensile test and modulus of elasticity.

6.4.2 Slump Test Result and Analysis

The slump test indicates a decreasing trend of workability when the percentage of Scrap increased. Table shows the average slump recorded during the test. Figure 7.1 below shows a graphical representation of slump height. According

to the result, the highest slump obtained was 84mm and the lowest slump was 66mm. The average slum for each batch of mix was 76mm. Therefore, target slump had been achieved, where the range is from 50mm to 120mm.The workability was good and can be satisfactorily handle for 0%
Replaced scrap to 30% Replaced Scrap. The slump from 0% Replaced scrap to 30%Replaced scrap were considered moderate due to the drop in the range of 5mm to 9mm.The average slump that obtained for 30% Replaced scrap (with 0.51 water cement ratio) was 66mm.
6.5 Slump values:

Replacements	SLUMP(cm)
Conventional concrete	26
10% FA	25
15% FA	23.5
20% FA	24
25% FA	22

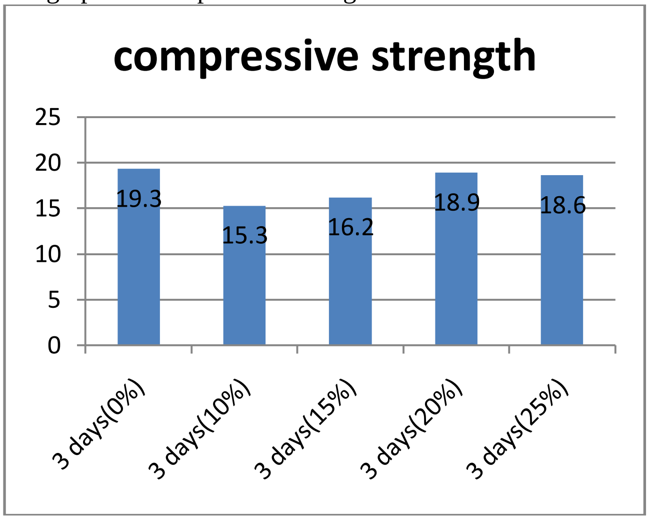


SLUMP CONE TEST
6.6 CASTING OF CONCRETE CUBES
The moulds of size 150×150×150 mm3 are kept ready before mixing. Total 36 cubes are casted. The bolts of the moulds carefully tightened because if bolts are not kept tight the concrete mixture coming out of the mould when vibration takes place. Then moulds are cleaned and oiled on all contact surfaces of the moulds and place the moulds on vibrating table. The concrete is filled into moulds in layers and then vibrated. The top surface of concrete is struck off level with a trowel. The number and date of casting are put on the top surface of the cubes.
6.7 TEST FOR COMPRESSIVE STRENGTH OF CONCRETE CUBES
For compressive strength test cubes of size 150×150×150 mm3 made. Test was done on the hydraulic testing machine. Compressive strength is defined as resistance of concrete to axial loading. Cubes are put in the machine and after tighten its wheel start button is pressed as pressure is begin to apply. RTo calculate the compressive strength of concrete cubes the universal testing machine(UTM) having capacity of 2000 KN was used. In this test the strength obtained in KN. The measured compressive strength of the specimen shall be calculated by dividing the maximum load applied to the specimen during the test by the cross sectional area calculated from mean dimensions of the section and shall be expressed to the nearest N/mm2. Compressive strength is defined as resistance of concrete to axial loading. Cubes are put in the machine and after tighten its wheel start button is pressed as pressure is begin to apply. Reading of meter is note down when cracks are there on cubes. Compressive strength is calculated by following formula:
Compressive Strength = P/A
Where P is load and A is area of cube

compressive strength values for different ages:

Day	Conventional 0%	10% FA	15% FA	20% FA	25% FA
3	19.3	15.3	16.2	18.9	18.6

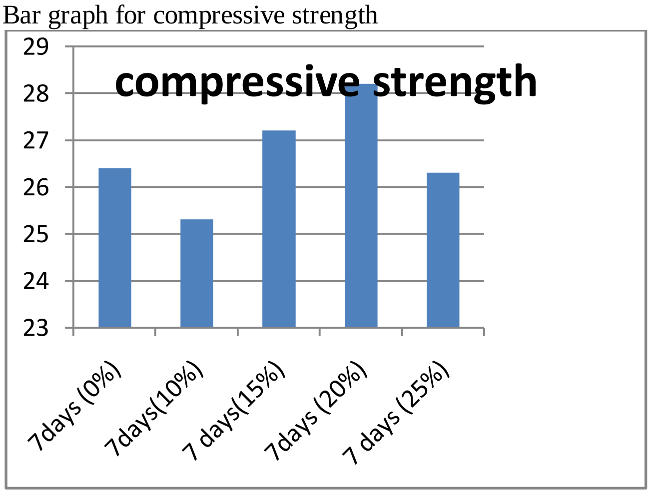
Bar graph for compressive strength



compressive strength values for different ages:

Day	**Conventional 0%**	**10% FA**	**15% FA**	**20% FA**	**25% FA**
7	**26.4**	**25.3**	**27.2**	**28.2**	**26.3**

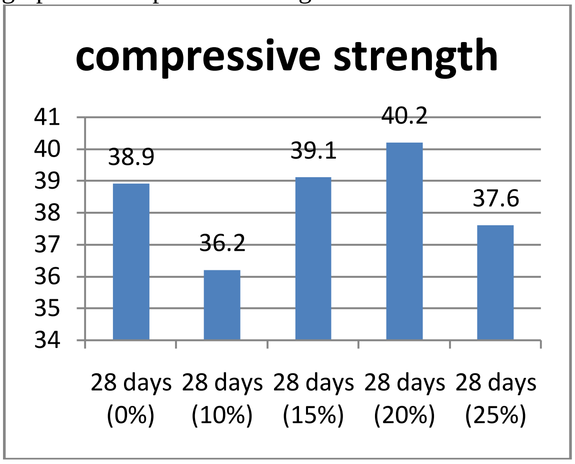
Bar graph for compressive strength



compressive strength values for different ages:

Day	conventional	10% FA	15% FA	20% FA	25% FA
28	38.9	36.2	39.1	40.2	37.6

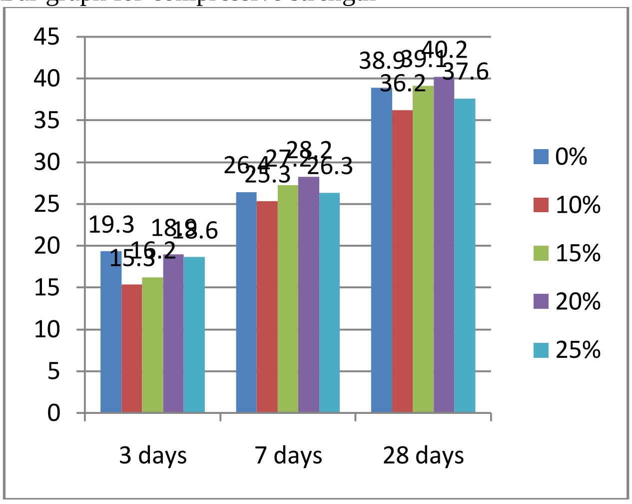
Bar graph for compressive strength



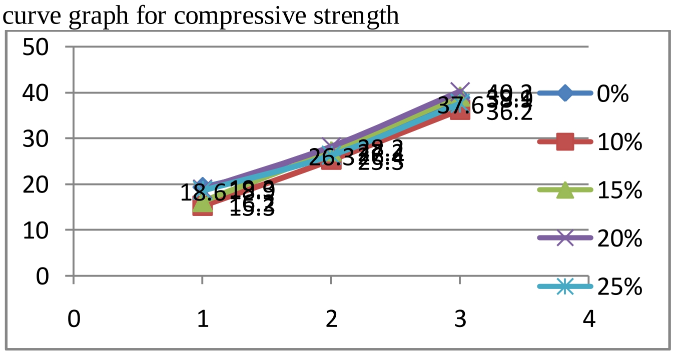
compressive strength values for different ages:

Days	Conventional	10% FA	10%CS & 20% FA	15%CS & 30% FA	20%CS & 40% FA
3	10.13	9.19	7.89	6.77	5.47
7	15.84	14.66	13.12	11.81	8.85
28	26.13	24.13	22.23	20.39	18.20

Bar graph for compressive strength



curve graph for compressive strength



VII. CONCLUSION

The following conclusions are drawn from the experimental study.

1. Recycled aggregate concrete may be an alternative to the conventional fine aggregates.
2. Water required producing the same workability increases with the increase in the percentage of demolished waste.
3. Up to 20% replacement of fine aggregate with recycled aggregate concrete was comparable to conventional concrete.
.4. Up to 20% of fine aggregate replaced by demolished waste gave strength closer to the strength of plain concrete cubes and strength retention is in the range of 86.84 - 94.74% as compared to conventional concrete.

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