REPLACEMENT OF COARSE AGGEGRATE BY DISMENTAL RECYCLED CONCRETE WITH RICE HUSK AS FIBERS.

Submitted in partial fulfillment of the requirements of the award of the degree of

Master of Technology

In

Civil Engineering

by

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CERTIFICATE

This is to certify that the project work entitled " **REPLACEMENT OF COARSE AGGEGRATE BY DISMENTAL RECYCLED CONCRETE WITH RICE HUSK AS FIBERS.**" submitted by **Yogendra Kumar (18SOCE2010004)** to the School of Civil Engineering, Galgotias University, Greater Noida, for the award of the degree of **Master of Technology in Civil Engineering** is a bonafide work carried out by him under my supervision and guidance. The present work, in my opinion, has reached the requisite standard, fulfilling the requirements for the said degree.

The results contained in this report have not been submitted, in part or full, to any other university or institute for the award of any degree or diploma.

(Dr. Suprakash Biswas)
Professor
Guide

(Prof. (Dr) Manju Dominic)
Dean,
School of Civil Engineering

External Examiner

DECLARATION

I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Abstract:*Concrete is one of the world's most common materials: asphalt mixture, fine aggregate, field aggregate, and soil mixture... The strength of concrete depends upon the ingredients which are used in preparing this .The cost of constructional materials increases day by day due huge demand of it. The concrete technicians look to the alternative material which not only enhances concrete strength but replaces cement content that contributes internally to the cost of our construction work. The main advantage of incorporating the supplementary cementing material not only improves the strength but also help in preventing the pollution. It also improves the durability. Durability is consistent with substrate and permeability thermal, chemical and mineralogical properties. Ash (RHA) Rice Husk. Various studied products such as Rice Husk Ash in developing countries, including Thailand, Pakistan and Brazil, not only improve concrete properties but add to the green climate. In eastern and south-east Asia, rice husk is highly prevalent due to the development of rice in this area. The rich land and tropical environment provide perfect conditions for rice cultivation and these Asian countries benefit. Rice husk is stripped before being marketed and eaten by the farming process. Burning this rice husk in kilns to create different items was considered beneficial. The rice chicken ash is then placed in cement for removal or blending. Therefore an economical and environmentally sustainable solution to the whole rice stock is used. Rice husk ash is produced globally in large amounts every year and may cause RHA in the rice-producing countries to become an environmental hazard and potentially lead to air and water contamination because of the difficulties involved in its disposal. Rice husk ash is a naturally occurring pozzolan, a substance which has cement properties when mixed with lime. Several studies have shown that rice husk ash can be effectively used in conjunction with cement as a substitute cement source for the manufacturing of concrete goods due to its high content of amorphous silicon. The purpose of this experiment was to evaluate the possibility of replacing cement with RHA in concrete.The conclusion presented during the examination that use of rice husk in concrete will conserve the natural resources used in the cement.*

Table of Contents

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

INTRODUCTION

1.1 Introduction

In recent years, a considerable amount of efforts have been made throughout the world to reuse by-products to maintain our environment sustainably. In this context, rice husk is also a bi-product for cultivation, and its ash has been used extensively to substitute cement from Portland in construction since it is rich in pozzolanic material. However, we have not carried out any experiments to evaluate the temperatures at which rice husk is heated in order to obtain the right qualities for concrete development. This led us to see if it was also suitable for use in partial replacement of the cement to use ground rice husk. This will conserve time and other money for rice husk-to-ash cooking. For water absorption, the findings were negative since introducing unburnt rice husk in the field contributed to an improvement in the water uptake for concrete. The working properties of concrete for some building works differ with the inclusion of soil unburnt rice husk but always under the approved cement limits. On this basis, it can be concluded that with burnt ground rice husk, cement can be reduced up to 10 percent.

1.2 Concrete

Concrete is the most popular building material in the world and, owing to its longer lifespan relative to most constructional materials, is also regarded as indestructible. Continued exposure to heavy weathering therefore contributes to an improvement in concrete porosity, thus raising the mechanical characteristics. The concrete's permeability depends on porosity and the connectivity and/or pores' structure. A single route in concrete construction, known as microbial concrete, has been applied to cross-breed biology and engineering, which require the use of bacteria to enhance concrete strength and longevity. The microorganisms used for concrete calcium carbonate precipitation are particularly attractive because of the pollution-free and normal calcite precipitation arising from microbial action. The precipitation in calcite occupies the vacuums between cement matrices, leading to denser concrete. The approach does not waste natural resources, because by cultivation process the bacteria used can be reproduced easily. The implementation of biological approach in concrete also is regarded as a green technology because greenhouse gas emissions are not part of its development.Aggregates are small particulate-like rock substance composed of a range of $<$ 0.1 mm to $>$ 50 mm particles. It comprises of dirt, fractured soil, sand and recycled asphalt, slag and organic compounds. Aggregate is a granular substance used for either concrete or mortar, as sand, dirt, grinding stone, broken steel or iron blast-furnace slack.

1.3 Aggregate Origin and Geology

Aggregates are commonly obtained by crushing naturally occurring rock. Aggregates own properties depend on the sedimentary or metamorphic source material. The source material. Components are tested through tests in order to decide if they are suitable for specific applications. The suitability is often measured by the mineralogy, the grain size, hardness and the petro graphing definition of the rock samples.

1.3.1 Types of Aggregates

1.3.1.1 Coarse Aggregate

Coarse-grained aggregates with 4.75 mm gaps do not move into a sieve (No. 4). The so-called earth aggregate is certain particles that are primarily deposited on 4.75 mm (No. 4) and move across a panel of 3 inches. The tougher the number, the cheaper the combination. Larger parts have fewer particle surface area than tiny pieces of an equal diameter. Using the biggest permitted maximum size of rough aggregates, the cement and water specifications may be that. The use of aggregates greater than the average allowable size of coarse aggregates will contribute to interlocking and creating arches or blocks in a particular shape. This causes the region beneath to become a vacuum or to be filled with smaller sand and cement particles only and contributes to a deteriorated environment.

For Coarse Aggregates in Roads following properties are desirable:

1. Strength
2. Rigidity
3. Durability
4. Shape of aggregates
5. Adhesion with bitumen

1.3.1.2 Fine Aggregate

The other form of aggregates is a small aggregate, which is defined as the particles passing the 9.5 mm (3/8 in.) sieve, almost entirely passing the 4.75 mm (number 4) seve and mostly kept on the 75 µm (number 200). The fine aggregate will have a rounded form, indicating improved operability and economies by utilizing less cement. Aggregate products often have an effect on the concrete resulting. E.g. scale, gradient, thickness, form, and intensity differences in the resultant concrete products.

1.4Purpose & Uses of Aggregates

In concrete, a combination is used to reduce cracking and particularly to give structural strength to its economic factor.

1. Aggregates in various forms are used as a basis, subsoil and/or road surface
2. It is used for the storage of the load on roads and railway ballasts and for promoting ground water runoff.
3. The amount of concrete rises and thus the expense decreases. 60-75% of concrete and 79-85% of PCC 's weight is measured by aggregates
4. Give stability in dimension
5. Hardness of control, abrasion tolerance, elastic frame and other concrete properties to ensure its reliability, durability and economic performance.
6. Fills, backfills, drainage and filtration applications are other applications.

1.5Properties of Aggregate Concrete

While inert filler is the greatest widely recognized, the effects of aggregate products on concrete have a solid, robust, workable and economic impact on concrete. Such numerous properties of the unit allow designers and contractor to satisfy their design and development requirements and to efficiently control concrete costs. In varying conditions and for specific cases, multiple forms of aggregates are used.

1.5.1 Consequence of Size

The grading or dimensions of the aggregate greatly impacts concrete. Therefore, the optimum scale of aggregations will be used to enable shipping, storage, compaction and finishing of concrete. Variation in aggregate size affects the need for energy, cement material, concrete micro cracking (strength). It also impacts welding and construction longevity.

The largest difference between particles is identical in scale but the vacuum gaps are met as a variety of sizes are used and the specifications for paste are reduced. The larger these voids, the less workable the concrete becomes, thus, necessary to achieve a balance between feasibility and economy.

1.5.2 Consequence of Grading

Concrete such as aggregate deterioration rely on raw and fine aggregate proportions. If aggregate classification is special, the quality of cement paste (costs saved), mixing viability, density and porosity shift as well.

It is an essential consideration and affects its workability as much as possible. Well-graded aggregates correspond to the lowest number of voids. Fewer voids contribute to increased pulp disponibility and greater lubrication in the unit volume. The combination is thus coherent and avoids isolation.

1.5.3 Properties of Surface Texture

The form and structure of the material rather than hardened concrete influences the properties of fresh concrete. Concrete may be rendered more workable because the aggregate is smooth and spherical rather than rugged, angular or elongated. For the achievement of the same degree of working ability, porous aggregates need more water than nonabsorbent aggregates.

1.5.4 Effects of absorption & Surface Moisture

In determining the water / cment ratio, the moisture content of an aggregate is a major element. The moisture content in very porous sandstone and expanded shale will vary from fewer than one percent in gravel to 40 percent. The bulk of fine aggregates are always wet with a soil humidity of up to 5%. This surface humidity in the fine aggregate produces the dense film that moves them apart and raises their evident volume on the surface of the particles. This is generally referred to as bulking and may cause major volume errors.

1.6. Applications

In general, applications without any processing include:

- many types of general bulk fills
- bank protection
- base or fill for drainage structures
- road construction
- noise barriers and embankments

After reduction of pollutants by systematic destruction, filtering and/or air isolation and reduced thickness in an overall crusher form, crushed cement can be used as: fresh concrete in pavements, shoulders, median walls, sidewalks, curbs and canopy bases; bridge foundacies The bulk of unprocessed crushing concrete aggregates are marketed in 11⁄2 inches or 2 inch fraction for pavement subcases.

1.7Rice Husk

The rice husk, also called rice hull, is the coating on a seed or grain of rice. It is formed from hard materials, including silica and lignin, to protect the seed during the growing season. Each kg of milled white rice results in roughly 0.28 kg of rice husk as a by-product of rice production during milling.

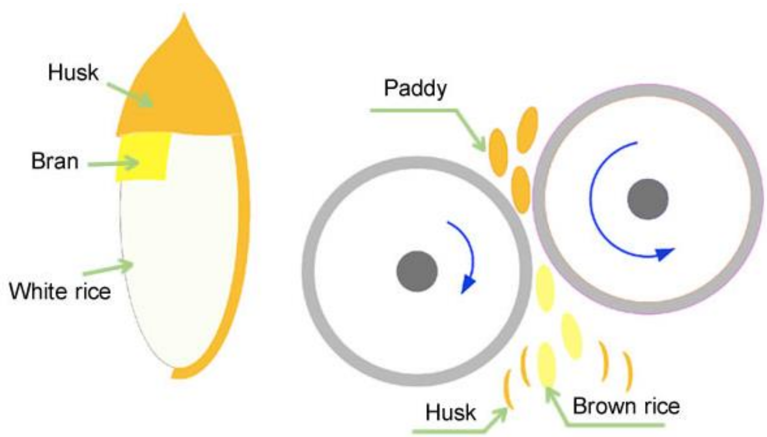


Figure 1.1 Structure of rice products after husking.

Rice husk items are common: strong fuel (i.e., loose coal, briquettes and pellets), rice husk carbonized during combustion and rice husk remaining during coal combustion. The loose shape of rice husk (Fig. 1.2) is used primarily for the processing of oil, including combustion and gasification. Combustion is the mechanism by which rice husk consumes carbon that absorbs CO2 and produces thermal energy. The densification of rice husk briquettes (Fig. 1.3) and pellets (Fig. 1.4) is used to improve content density and combustion efficiency. The residual by-product after combustion is rice husk ash (Fig. 1.5). The amount of carbon remaining in the ash may rely upon the efficiency of the combustion (i.e. absolute or partial combustion). Rice husk ash may be used in soil alteration and as a cement and steel filler for example. For these purposes, however, only limited amounts are used compared with overall rice husk output.

The carbonized rice husk (Fig. 1.6) is formed by the thermal decomposition of rice chicken at a relatively small temperature (less than 700 ° C) with a minimal supply of oxygen (O2). Carbonized bio char may be used as soil alteration, nutrient production and activated carbon, etc.

Figure 1.2 Rice husk (loose form).

Figure 1. 3 Rice husk briquettes.

Figure 1. 4 Rice Husk pellets.

Figure 1. 5 Rice Husk ash.

Figure 1. 6 Carbonized ricehusk.

1.7.1 Characteristics of the rice husk

The rice husk is already dried and stored in the field when it is produced during rice milling. The uncompressed rice husk weight is approximately 100 kg / m3. The average husk characteristics as shown in tables 1 and 2, respectively, by Beagle (1978), Jeng, and al. (2012) and Jenkins (1998) on rice husk in the next study a and ultimate study.

Table 1.1 Rice husk composition in % of weight

Fixed carbon (%)	Volatile matter (%)	Ash (%)
15	67	18

*The next step is the classification into six feed groups of substances dependent on their chemical properties. Six specific types are: dirt, smoke, crude protein, crude food, synthetic fiber and extracts without nitrogen (digestible carbohydrates).

Table 1. 1 Compositions of ricehusk in % of weight (dry basis) founded.

C (%)	H (%)	O (%)	N (%)	S (%)	Ash (%)	HHV (MJ/kg)
40	5	34.8	0.8	0.1	19.5	14.8

Source: (Encyclopedia, accessed 2016)

Rice husks may be described as follows in conjunction with other solid fuels:

- Its high silica content causes the pieces of processing machinery such as transporters and grinders unnecessary rust and hampers animal digestion. The volatile material content of the rice husk is higher and far higher than that of the coal; while stable fuel is slightly smaller than oil. The rice husk produces ash far more than the wood and charcoal content, which creates barriers to conversion of resources.

- The high ash, alkali, and potassium content allow the components of combustibles or boilers to agglomerate, foul, and melted.

1.7.2 Application of the rice husk

Rice husk has long been deliberated a rice milling waste and was often discarded and/or burnt. It is a strong additive to the steel and concrete industries owing to its high silica content of rice husk ash Rice husk ash is used in smaller amounts as a soil conditioner, activated charcoal, insulator among others. In recent years, electrical power has been piloted around Asia on small to medium scaled – up to 5 megawatts – with some successful solutions, but with some limitations seen. The shortage has mostly been triggered by the feedstock manufacturer problems as the formerly free waste rice husk has become a publicly exchanged product. Figure 1.7 below displays a schematic of rice husk use.

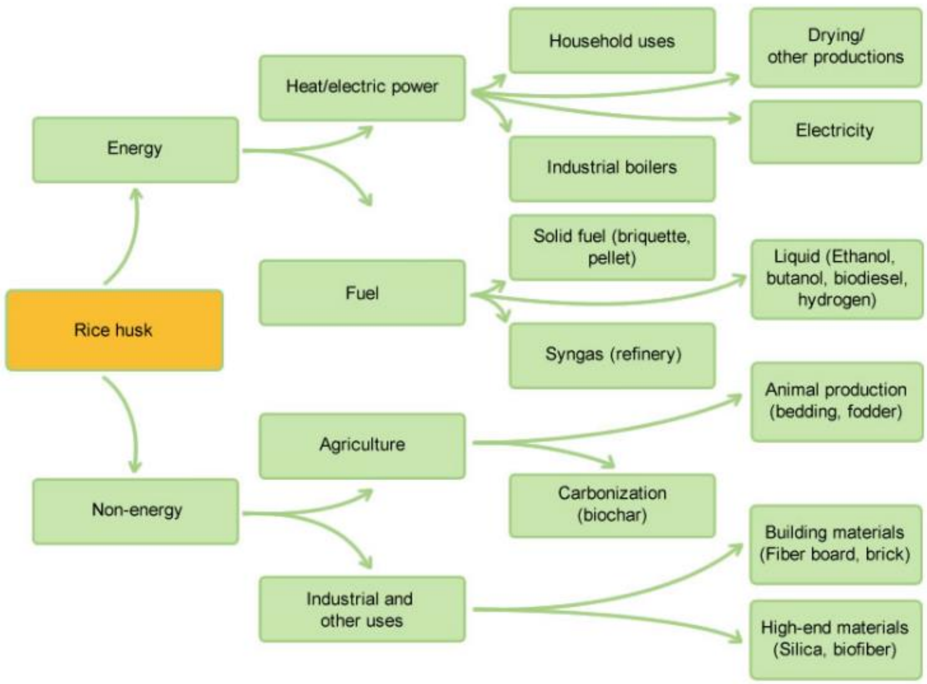


Figure 1.7 Options for the use of rice husk.

1.8 Application of Rice Husk

The suitability of RH for different applications depends on the husk's physical and chemical properties, including ash content, silica content, etc. In electricity plants direct usage of rice as fuel was seen. In addition to being a heat, RH uses it for synthesizing and producing new phases and compounds as source raw material. The following has been given a comprehensive overview of the use of rice husk in industrial and other industries.

A. Rice husk is mainly used in the production of paddy and pump steam as fuel in boilers. As a fuel in power plants. The direct combustion produces heat capacity. Partial and incomplete burning of gasoline results in gases being emitted and gasoline performance declines. The boiler output and combustion speed have gained the latest publicity as husks are practically accessible at no expense. Plants with a potential spectrum of 2-10 MW may become economically feasible, with a far greater use of this biomass resource than currently achievable. It has been shown that 1MWh requires about 1 tonne of rice. The technical and economic factors therefore determine whether rice husk is effectively used as a power source fuel. Rice husk was also used to make household energy a useful and alternative fuel. RH often utilizes to some degree a modern design, i.e. mixed cement, to satisfy the growing demand for better and more long lasting building materials. Mixing reactive rice husk ash in cement has become a standard guideline for nearly any foreign building code. A detailed work on RHA as a mineral additive was carried out to enhance concrete efficiency. RHA is commonly used as a substitute for silica fume as a highly reactive pozzolanRHA.

B. Use in ceramic and refractory: Rice husk ash is used because of its isolating properties in the production of refracting bricks. It was used in the development of lightweight, low-cost isolation frames. For the development of cordierite RHA was used as silica source. Substitution of kaolinite with rice husk silica in the mixture composition yields higher cordierites with lower crystallizing temperature and decreases crystallization activation strength.

C. Isolating RH bricks constructed from rice husk, a heat-treatment method produces a significant number of pores owing to the burning of organic matter. The more brittle will be a stone and stronger thermal insulation the rice husk in a mortar. The pores have the heat isolating properties of compressed gas, rendering the porous fire brick framework suitable for back-up isolation

D. Rice husk ash is used in the manufacture of refractory bricks owing to its insulating qualities, in the ceramic and refractory industries. It was used in the development of lightweight, low-cost isolation frames. For the development of cordierite RHA was used as silica source. The replacement of kaolinite with rice husk silica in the mixture composition results in lower crystallize-temperature higher cordierites and a decrease in energy amplification of crystallization.

E. Isolating RH bricks formed from rice husk, a heat-treatment method produces a significant number of pores owing to the burning of organic matter. The more brittle will be a stone and stronger thermal insulation the rice husk in a mortar. The pores have the heat isolating properties of compressed gas, rendering the porous fire brick framework ideal for back-up isolation

F. Many applications: RH is used as the raw material for xylitol and furfural processing, ethanol production, acetic acid production and lingo-sulphonic acid development. It is used in the metal and machine industry as a cleaning or polishing item, in the manufacture of construction materials etc. RH was used as raw resource for the manufacture of panel boards, plastic fillers, lining products, building materials, activated carbon etc. Composite products based on two rice husk surface frames have been made with little effort. Given too many well-known applications, little portion of processed rice is used successfully, the remainder of the rice increasing be burnt or discarded in open piles.

CHAPTER 2

REVIEW OF LITERATURE

[1] Subramani et al. (2017) published a paper **"Experimental Investigation of Waste Plastic Fiber in Reinforced Cement Concrete Using Recycled Coarse Aggregate"** This study aimed at investigating the shear strength and work ability characteristics of Fiber Reinforced High Strength Concrete (FRHSC) which use recycled coarse aggregates that have originated from demolished construction wastes. Different mixes were taken with 20%, 40% replacement of natural coarse aggregate with recycled coarse aggregate. To improve the ductility and performance, 1% steel fiber is also added to the concrete.

The biggest benefit of the concrete is that the compressive strength is higher. The concrete's compressive strength may be defined as the compressive intensity of the circle or ring. Concrete compressive power depends on the scale and shape of the research specimens. In this analysis, the plastic fibers collected from industrial waste bottles have strengthened traditional concrete. A laboratory calculated the cube and cylindrical compressive power of modern reinforced concrete and plastic fibers. The tests have been conducted on the M30 stages of concrete and two fibre structure of volume percentages of 0.0 to 3.0 percent. After age 28 days, both specimens have been examined. This paper established and compared the relationship between the compressive resistance cube and cylinders for conventional and plastic fiber reinforced concrete.

- The behavior of green concrete under slump and compaction factor tests shows that workability is reduced in PFRC. It was due to resistance offered by the fibers to the movement of aggregates. The dry density is also reduced in PFRC but it is beneficial to reduce dead weight of concrete.
- Utilization of fibers in plastic concrete in various proportions to improve the strength.
- Plastic fibers along with steel fibers can be used to improve the strength of concrete.
- This preliminary study thus showed that relationships between compressive strength can be applied to concrete containing PET fibers as used in the European Standard for flat concrete.
- The compressive strength relationship is linear between the cube and the cylinder.

- In Our Project We Discuss 100% Of Recycled Aggregate with Various Percentage Of plastic fiber as 20%, 40%.
- Replacement Level Of 40% Recycled Aggregate in concrete mixes was found to be the optimum level to obtain higher value of the strength at the age of 28 days.
- The Optimum Level of Compressive Strength Is 49.6 N/mm2 With the Replacement Of 40% plastic fiber.
- In this preliminary analysis, therefore, the relationships between compression intensity may be extended to concrete that includes PET-fibers as used in the European level for flat concrete.

[2] Krishnamurthy et al. (2016) published a paper **"Repair of deteriorating pavement using recycle concrete materials"** They concentrated primarily on rubber-type shredded; polypropylene, PP, installed plastic bottles; coarse aggregates. The products used to treat concrete are toxic waste. Shredded rubber tires, and polypropylene plastic tubes, PP, have been reused in the concrete mix respectively as coarse cement substitutions and clean river air.

The sand was supplemented by 10% by 20%, 40% by scrapped rubber and by compressed plastic bottleneck (PP), respectively, and by 50% by coarse sand and healthy rivers. It is noticed that, for the good benefit of indirect friction power, the ideal proportion of recycled concrete content may be used in the region of 10 per cent to 30 per cent materials to save costs and improve roadway paving performance and to establish an indirect tensile strength of the roads.

[3] Badr, A. (2016) published a paper **"Using standard repair methods on recycled aggregate concrete"** This paper presents the results of an experimental system to determine the appropriateness of conventional repair approaches for more advanced, renewable concrete as recycled materials. There were three phases in the experimental method. First, concrete structures of different forms of recycled aggregates will be degraded and impaired. In the second level, conventional restoration methods were used to restore degraded and weakened concrete samples comprising various recycled aggregates. Throughout the third step the restored specimens were also examined with regard to mechanical properties and the relation between the substrate and repair content. Results from the test show that concretes generated with recycled aggregates can successfully be restructured to shape monolithic elements behaving in a composite manner and exhibiting characteristics similar to the initial non-deteriorated specimen.

- Specimens comprising different forms of recycled coarse aggregates, for example RA, WG, and ST, may be effectively restored using modern repair mortars for typical concrete.
- The effects on the solidity of recycled concrete of the different kinds of coarsely recycled aggregates (RA, WG and ST) were identical in terms of their impact on their strength. In general, the absolute strength values of the repaired RAC were slightly less than the repaired control concrete. However, because of the usage of reclaimed coarse aggregates, the disparity was the same as that found in the initial blend.
- Owing to restoration of load-damaged specimens, the average recovered strength, compressive or fracturing, stood at about 90% of initial power. For specimens without RA, this compares favorably with the restored strength of about 80 percent. The repair of concrete samples comprising recycled coarse aggregates is therefore proposed to be as effective as repairing concrete samples made of LM.
- The specimens were so degraded after freeze-thaw processes that they could no longer be restored in blends with RA (SC2-RA) and ST (SC4-ST). On the control mix (SC1-LM) and the WG (SC3-WG) containing mix are only patched with affected specimens. At least 150 percent of the residual strength of the specimens from those two blends was restored and there was additional evidence that RAC could be repaired as effectively as LM concrete can be repaired.

  The visual examination of broken replacements indicated that the initial and destroyed specimens was connected to the fix mortar. The analysis was adequate. No delamination was carried out and monolithic part parts were presented for the restored specimens.

[4] Gokulnath, V. (2017) published a paper **"Use of Demolished Waste in Partial Replacement of Coarse Aggregate with Concrete**" they emphasized mainly DCW (Demolished Concrete Waste), Coarse Aggregate, Fine Aggregate, Cement, Demolished Waste.In the Republic of India and alternative developing countries an over dimensional amount of dismantled waste is created each year. Since this material is enormously processed or reused. Thus, waste management may be an incredibly big issue since a huge quantity of the house is required. This study may form part of a comprehensive program of experimental studies to evaluate the effect on the compressive strength and working ability of the dissolved concrete mix of the partial replacement of the coarse mixture with the decommissioned waste. The compression strengths of seven, 14 and 28 days were reported for the test. The previous project survey reveals that, if used in the right quantities for half an hour, the compressive power of the DAC is almost like conventional concrete. Thus, in this analysis we took 100%, 15%, two-hundredths by weight of the typical coarser combination, and even the broken concrete cubes as all the tests carried out such as workability, friction intensity in this DAC and the product of the test which was seen to be comparable to the regular concrete. The results of the research were identical to the traditional concrete. The following results are focused on the experimental analysis.

a. Mixture concrete recycled may be similar of regular concrete as well. Compared to the standard blend, the razed combination has comparatively low mass grinding, density and effect rates and increased water absorption.

b. The constant workability of the water needed for production will rise as the proportion of rubbed waste increases.

c. Typical concrete looks like up to twenty substitutions for coarse mixed of recycled material.

d. Up to 20 field mixtures, superseding normal concrete, is substituted by razed waste.

e. The effects of the ruptured concrete thus outweigh the normal concrete.

[5] Dodds et al. (2017) published a paper **"Durability performance of sustainable structural concrete: Effect of coarse crushed concrete aggregate on rapid chloride migration and accelerated corrosion"** Most notably focus was put on crushed concrete aggregates (CCA), recycled (RCA), chloride ion entry, additional cementititious products, corrosion, accelerated corrosion. The expanded usage of CCAs, previously recycled concrete aggregates (RCAs), has contributed to the analysis of higher value structural applications of coarse CCAs. Gradually, the impacts of CCAs are being measured. There are concerns about the effects of reinforced concrete on entry into chloride ions that could lead ultimately to deterioration. The existing European and British concrete quality requirements represent this issue, as restrictions prohibit their usage in conditions where chlorides are present. In order to ascertain the impact on the intake of chloride ion, a strong chloride migration factor and rapid corrosion rate for structural cement CEM I and CEM III / A are calculated. The findings indicate that coarse CCA typically detrimental effects on the chloride content of structural concrete is assessed by three sources of coarse CCA. The inclusion of GGBS for structural CEM III / A concretes can, however, mitigate these effects, thereby allowing higher levels of CCA coarse. GGBS and coarse CCA content should be restricted to 50 % and 60% respectively because this reduces the risk of significant adverse effects on the introduction of chloride ions. The findings also indicate that the shortcomings under present European and British requirements, with the introduction of the CCA coarse, may be a feasible choice for responsible ventures in future, given the source of CCA can be a credible and coherent one. This is a good development for broader usage of gross CCA in reinforced concrete applications.

[7] Sonawane et al. (2019) published a paper **“The Use of Dismantled Construction Waste as an Alternative in Fresh Concrete”** they emphasized mainly Dismantled Construction Waste.The dissimilarly massive construction quantities and thus the demolition waste that is produced endlessly and dropped directly inside the sites. It includes large amounts of land and today it is incredibly challenging to locate.

The most effective resolution would be to recycle and use the razed waste which might not solely facilitate in protective the atmosphere however conjointly facilitate in managing construction wastes. Consequently, it have a grave issue to provide ecological waste matter and additionally, obligatory a large total of liberty. that claims concerning the project use waste crushed concrete maters (WCC) from the slat wastage of crushed concrete substitution from coarse combination 2 hundredth, 30%, 40% (WCC), three-D of crushed coarse combination (lathe waste) to scale back the generation of demolition wastes. (The analysis of razed crushed concrete combination (DCCA) concrete in regular mildew solid is to be prepared in (7, 14, 28) days association and examination to be conduct lying on concrete. like compressive strength, split lastingness, &flexural strength.) The substitution of coarse combination uses of waste mother and needed strength attain within the standard M20 grade concrete.

The use of reprocessed aggregates from any demolished construction waste is showing very positive and adoptable applications in any new construction, and also by using this we can reduce the waste material which is coming from old deployed buildings, The compressiveness of recycled mixture concrete is comparatively below natural mixture concrete. However, these variations area unit addicted to the first concrete from that the aggregates are obtained.

[8] Bhavani&Sai (2019) published a paper **on** recycled Aggregates Concrete. Which is the only construction material to satisfy the strength and durability characteristics, they stressed mainly coarse aggregates. Beton that is porous, has a propensity, by definition, to produce cracks over time. Cracks grow causes serer issues as salts, chlorides and liquids are intrude red by these cracks. And the idea of self-healing concrete is carried out in this research in order to combat this question using the Bacillus subtilis process. The use of these materials as recycled aggregates is therefore greatly harmful to the environment. This can be minimized. In this study, the bacteria in which gross agglomerates is substituted by 10 % , 20% and 30% of recycled aggregates are applied to the concrete by 5ml, 10ml, 15 ml and 20ml.

- Split tensile strength and Flexural strength of the concrete are increasing with addition of bacteria up to 10ml of bacteria (for each 500ml of water) and then strength are decreasing with increasing in addition of bacteria for M40.
- The compressive strength of concrete containing 10% RCA has strength in close proximity to that of normal concrete.
- Tensile splitting test shows that concrete has good tensile strength when replace of recycled aggregates with 10%.

According to the comparative studies undertaken it is clear that with 10% replacement of coarse aggregate by recycled aggregates a maximum compressive strength.

- Usage of Recycle aggregates is ecofriendly and by using the recycle aggregates the usage of coarse aggregate is partially reduced in concrete, thereby the mining activities can be minimized and also minimizing the waste by reusing the materials.

[9] Kumar et al. (2016) published a paper **"Preliminary study on the use of quartz sandstone as a partial replacement of coarse aggregate in concrete based on clay content, morphology and compressive strength of combined gradation"** they emphasized mainly coarse aggregate, clay content.

This replacement is based on many variables, such as mineralogy, microstructure, the absorptiveness of moisture, carbonate concentration and many other parameters. In this specific area, sandstone waste generations are far higher, and it is reported that Rajasthan alone generates 900 million tons of sandstone waste, which implies that these waste materials are mostly discarded without any practical usage. A study on the effective utilization of the sandstone waste in concrete was conducted Experiments were undertaken in order to explore the possible usage of quartz sandstone as a partial replacement for coarse concrete aggregates. This analysis will draw the following significant conclusions.

The analysis of microstructure revealed relatively strong divisions and elongations impacting concrete rheology. This trend was observed by growing the quartz sandstone aggregates of super plasticizers. Compressive strength findings showed a rising trend for natural aggregates up to 55:45 (20 mm: 10 mm) with different ratios of combined gradations, with a similar tendency being noticed in sandstone aggregates up to 60:40 (25 mm: 10 mm). In a specific gradation, the drop in compressive strength outcome was induced by segregation and a rise in void space from the usage of greater aggregates.

[10] Nuaklong et al. (2018) published a paper **"Properties of met kaolin-high calcium fly**

ash geopolymer concrete containing recycled aggregate from crushed concrete specimens" they emphasized mainly recycled aggregate, fly ash geopolymer concrete. The goal of this research is to test the impact of metakaoline (MK) on the properties of a 100% recycled coarse fly ash geopolymer concrete from crushed laboratory specimens. MK was used in geopolymer binders as a partial replacement for the heavy calcium fly ash (HCF). The findings demonstrated a stronger strength, porosity, absorption of water and acid resistance in geopolymer concrete with MK. Growing the usage of MK results in improved strengths for both new and recycled geopolymer concrete aggregates. The high calcium fly ash combined with the recycled concrete comprising MK geopolymer is ideal to be built environmentally-friendly, and is equivalent to standard geopolymer concrete with a natural aggregate in terms of mechanical efficiency.

The partial substitution of strongly calcium fly ash in geopolymer binders with met kaolin (MK) contributes to a substantial improvement in the efficiency of geopolymer concrete in relation to its mechanical properties, tolerance to abrasion, transport and acid attack. The fine design of MK allows the geopolymerisation a greater degree and a stronger pore structure. In addition, with MK, geopolymer concrete's mechanical and transport properties were strengthened significantly and, in related words, MK quality was expanded by up to 30 percent. MK is the same as standard geopolymer (0MK-L). With 30% of MK incorporated in the recycled aggregate geo-polymer concretes with corresponding values of 134%, 69% and 89% respectively, increased compressive power, porosity and water absorption substantially, to those of concrete without MK.

[11] Bhee et al. (2018) published a paper **on** building material all around the world which causes the raw materials to be heavily depreciated. In the building sector, the use of this commodity increases daily. In the other side, pollution is dumped as pollution from collapsed concrete buildings. These pollutants are not a positive indication for developed countries and must be managed correctly by turning them into usable items. This research is also an effort to utilize collapsed waste concrete by turning them into rough aggregates. In this analysis, up to 10% of cement weight was substituted by RHA. For experimental applications in the universal testing machine (UTM), a minimum of 135 different concrete experiments have been packed, cured and checked. Finally, the findings of the test have been contrasted with natural and recycled coarse aggregates in terms of tensile strength compression and separation. All the specimens were provided by 0.50 w / c ratio at 1:1.5:3 and measured at a curing ages of 7, 14, 21, 28 and 56 days. Moreover, the compressive strength decreases with more than 10% RHA cement replacement. This research will enable design experts use surplus concrete to create new construction designs for usage.

From detail examination on RCA and RCA with 10% RHA concrete of 1:1.5:3 mix ratio at 0.50 water-cement ratio, the experimental results can be concluded as:

- RCA with 10% RHA in fresh concrete can be used for construction site which require higher strength. Thus, such type of concrete not only utilizes the waste but reduce the cost of project also.
- Workability reduced up to 7.7% and 11.4% in RCA and RCA with 10% RHA concrete. Hence the special kind of additive for e.g. plasticizers or super plasticizers should be the part of concrete made up of RCA in future to overcome the resistant in flow of concrete
- Cubical compressive strength is lower when RCA is added. This reduction is higher at 7 days and lower at 56 days curing period. Overall, reduction in strength ranges between 14.83 to 23.45% when compared with normal concrete.
- Cubical compressive strength is higher when RCA with 10% of RHA is added. This improvement arched upward as curing age increases and ranges in between 1.8% to 4.83% as compare to normal concrete. Hence utilization of RCA only, should be avoided and supplementary material like RHA should be added.
- Cylindrical compressive strength with RCA is plummeted more at lower curing ages than later ages. This reduction ranges between 22.17 to 27.77% when compare to normal concrete.
- Cylindrical compressive strength of concrete having RCA with 10% of RHA is increases with curing ages. Generally, it ranges between 2% to 6% when compared with normal concrete.
- Splitting tensile strength of concrete with RCA drastically lowered down at earlier age as compared with long curing time. This decrease, as compare to normal concrete, is about 33.33% to 40.9%. Hence it is not recommended to use RCA for higher demand of tensile stresses in structures.
- Splitting tensile strength of concrete, with RCA and 10% RHA, is soared at around 2.27% to 4% as compare to normal concrete.

From the above conclusion the study strongly recommends the use of RCA with RHA at 10% by weight. Furthermore, due to the extreme high reduction in tensile strength of concrete, the study recommends another exclusive study on similar research to work out the appropriate size of aggregates, mixing percentages and other supplementary materials to overcome the problem of tensile strength.

[12] Shi et al. (2019) published a paper "**Economic input-output life cycle assessment of concrete pavement containing recycled concrete aggregate"** they focused mainlyrecycled concrete aggregate. For certain states in the United States, concrete floor recycling has been a popular activity. Although comprehensive characterization of the material characteristics and structural strength of floors replacing virgin concrete aggregates with recycled concrete (RCA), no attempt was made to determine the possible environmental benefits of this method. The life cycle using the Chemical and Other Impact Reduction and Assessment Tool (TRACI). The findings indicate that RCAs would invariable gain for all types of sustainability during the manufacturing and development process of products, but the RCA-PCC pavement would have more detrimental consequences during the pavement existence period of usage. Only with improved understanding of the climate, a continued reduction in the amount of local virgin aggregate supplies, and a dramatic rise in disposal costs for potential building development debris will the environmental gain from using RCA for concrete pavement applications be magnified.

In addition, the usage of RCA in PCC floors may also yield major environmental gains, which not just is a technologically successful approach. Such gains can only be exacerbated by a declining understanding of the climate, a continued reduction in new, local aggregate supplies and a significant rise in waste disposal costs in the future. The drawbacks of this analysis are that the specificity of the economic input forecasts for the VOC model implementation process and the stressors of the EIO-LCA is unclarified. Future work into how much more affordable building demolition waste can be accomplished by through the prices for the transport of new aggregates and disposal.

[13] Silva et al. (2016) published a paper **"Properties of self-compacting concrete on fresh and hardened with residue of masonry and recycled concrete"** they focused mainly recycled concrete, A scientific report on self-compacting concrete (SCC) produced. Effects on the SCC's own property were determined by utilizing the recycled aggregate. There have been five types of SCC mixes in which 0-100% by volume are replaced by the pure coarse aggregate. At 480 kg/m3 the mixed concrete (Portland cement + admixture) was stable, and by weight of RM 20 percent.

The study findings show decreases the mechanical properties of the hardened SCC (compressive pressure and splitting stress). Likewise, permeability properties are increasing; nevertheless, they should be measured in terms of the economic and social cost-benefit ratio in the application under which the final concrete characteristics of the concrete are admissible for classification of the usage of SCCs with RCA integration. This findings allow for the usage of RCA in the processing of SCC in areas anywhere natural aggregates are limited, and wherever the overuse of such non-renewable materials has a significant environmental effect that limits their viability in the future or where there is no disposal, and where long roads contribute to bad problems for m.

[14] Sai et al. (2018) published a paper “An Experimental Study on Bacterial Concrete by Partial Replacement of Coarse Aggregates with Recycled Aggregates”Coarse Aggregates, Recycled Aggregates, were mainly emphasized. Beton is the only building material that fulfills the strength and durability properties. Beton that is porous, has a propensity, by definition, to produce cracks over time. Cracks grow causes serer issues as salts, chlorides and liquids are intrude red by these cracks. And the idea of self-healing concrete is carried out in this research in order to combat this question using the Bacillus subtilis process. The use of these materials as recycled aggregates is therefore greatly harmful to the environment. This can be minimized. In this study, the bacteria in which gross agglomerates is substituted by 10 % , 20% and 30% of recycled aggregates are applied to the concrete by 5ml, 10ml, 15 ml and 20ml. The following points can be inferred on the basis of the findings of the research study

- Bacterial addition to every content increases the strength of the concrete's compressive and tensile properties. However, for every 500 ml water for M30 the optimum bacterial content can be added 10 ml.
- Thus, 10 ml of bacteria are found to be optimal for each 500 ml of water based on the results.
- The comparative studies have shown that the maximum pressure resistance was substituted by recycled aggregates by 10%. The ideal obtained percentage is 10%.
- When the concrete is applied to bacteria that have reclaimed aggregate, their efficiency is increased as opposed to standard concrete with 10ml of bacteria at 10% reclaimed aggregate substitutes relative to H2So4.

CHAPTER 3
TEST AND ANALYSIS

3.1 Workability - Slump Test

The concrete slump tests fresh concrete strength until it settles. Check the working power and thus the speed of the concrete flows of freshly manufactured concrete. The mixed batch indicator can also be used. Due to simple devices and easy processes, the test is popular. The slump method is used to provide uniformity with specific concrete loads under field conditions.

For cement too fluid to assess with the traditional slump test, a different test is used, as the concrete does not maintain its shape when the cone is removed. The workability or consistency of concrete mixes prepared at the laboratory or building site during suit advance shall be assessed by concrete slump test or slump cone examination. Concrete slump checks are carried out from batch to batch to check the consistency of the concrete during construction.

The slump test is a measure of the strength of fresh concrete. Indirectly, it is used to check whether the correct amount of water has been added to the mix. New concrete testing according to BS EN 12330-2. Slump search. The slumped cone of steel has three equal layers filled with fresh concrete in a solid, waterproof, level base. Each layer is rodded twenty-five times for compaction. The third layer with the tip of the cone is completed off-level. The upward cone is placed on the base and the gap between the top and top of the concrete is determined and recorded in the nearest 10 mm in order to indicate the concrete slump. It is then placed on the base, leaving the layer of asphalt marginally sinking or slumping.

The depression can take one of three forms when the cone is removed. Yes, clear supports in a true recession, which remain more or less. The top part of the pavement slides downwards and shears off. During a shear. Beton falls in recession completely. Even a real recession is useful to control. Take a new sample and repeat the test if a slump in shear or collapse is reached. In the general case, a collapse slump would mean that the mix is too wet or that the flow check is best suited to the mix (see separate entry).

Figure 3. 1 Slump test

3.1.1 Slump Test Apparatus

- Slump cone,
- Scale for measurement,
- Temping rod (steel)

3.1.2 Procedure for Concrete Slump Cone Test

1. Clean and apply oil on the inner surface of the mould.
2. On a horizontal flat, non-porous base plate, position the mold.
3. In 4 layers approximately equal fill the mold with the prepared concrete mix.
4. Tamp every layer uniformly over the cross section of the mold with 25 strokes of the round end of the tamping rod. The tamping will reach the underlying substrate for the corresponding layers.
5. Remove the excess concrete from the floor and level it with a pot.
6. Clean the mortar or water that leaks from the base plate to the mould.
7. Immediately then gradually remove the mold from the concrete vertically.
8. Measure the slump as the difference between the mold height and the height of the test specimen.

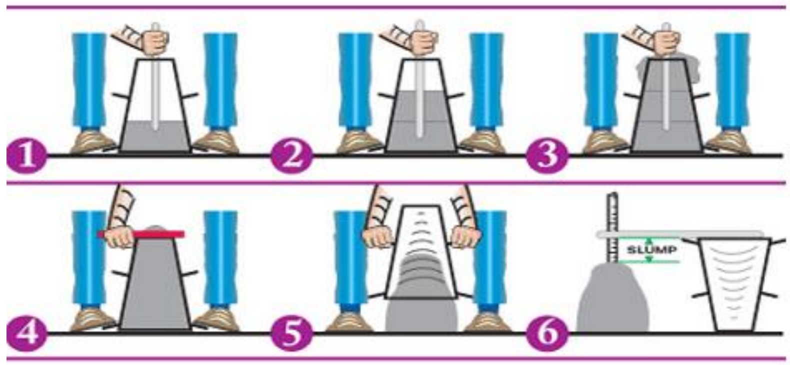


Figure 3. **2**Concrete Slump Test Procedure

3.1.3Type of Slump

3.1.3.1 Collapse Slump

The concrete breaks completely in a crash. In general, a collapse slump implies that the blend is too damp or a strong workability combination, which is not ideal for a slump check. It implies that the water cement ratio is too high, i.e. the mixture of concrete is too hot, so it is a strong usable blend, and does not require a slump check.

3.1.3.2 Shear Slump

The upper section of the concrete is sliding in a shear off and laterally falling. The depression is considered to be a shear depression because one half of the cone slows down a sloping path. The shear slump indicates that the analysis is insufficient and that clear conclusions be re-tested.

a. A fresh sample will be taken and the check replicated if a move or fall downturn is reached.
b. If, as with harsh blends, the shear slump continues, that indicates the lack of consistency in the mix.

3.1.3.3 True Slump

The actual downturn merely subsides and retains its form more or less

a. that is the only slowdown seen by various experiments.

b. Stiff quality blends have a zero drop, and no difference between mixes with varying workability can be observed inside the very dry set.

However, a true slump can quickly be adjusted into or even failure in a lean mix with a inclination for harshness and significantly varying slum value can be derived from the same mix in separate specimens; thus the slump check for leane mix. The slump test is not accurate.

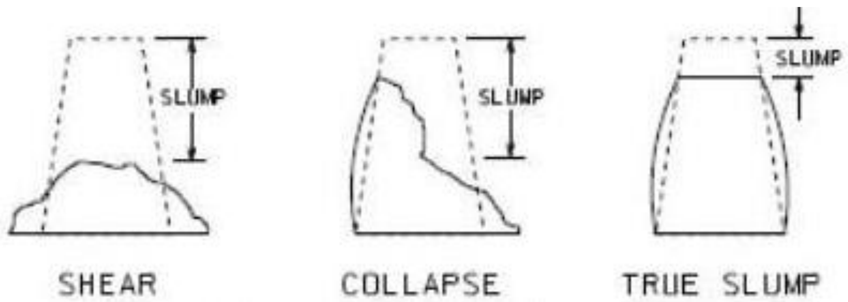


Figure 3. 3 Type of slump

3.1.3.4 Zero Slump

If concrete maintains the actual shape of the mould, it is called zero slump which represents stiff, consistent and almost no workability. The true slump is the only reliable condition to get an idea about the Workability of concrete. If other types occur, the test should be repeated.

3.1.3.5 Limitations of the slump test

The slump test is suitable for slumps of medium to low workability, slump in the range of 5 – 260 mm, the test fails to determine the difference in workability in stiff mixes which have zero slump, or for wet mixes that give a collapse slump. It is limited to concrete formed of aggregates of less than 38 mm (1.5 inch).

3.1.3.6 Factors which influence the concrete slump test

a. Properties such as chemical, fineness, distribution of particle sizes, moisture. The cementitious material content and temperature. The aggregates' scale, shape, total value, cleanliness and humidity content,

b. Dosage, form, composition, relationship, addition sequence and efficacy of chemical admixtures;

c. Concrete air safety,

d. Methods and methods for concrete batching, grinding and shipping,

e. Concrete size,

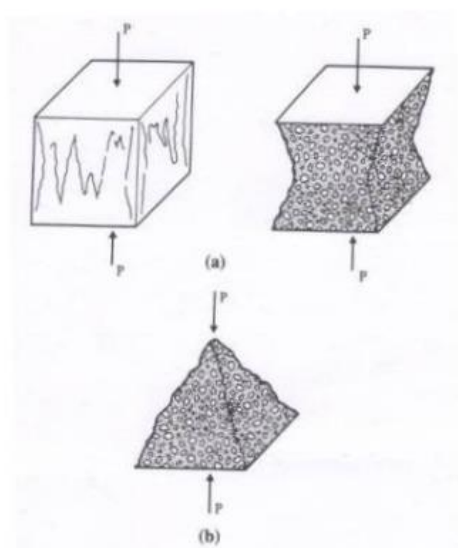
f. Concrete analysis, drop monitoring and laboratory system conditions;

g. The sum in the concrete of free space, and

h. Period after the concrete was blended during the drill.

3.2 Compression Test

The Concrete Specimen Compression Test is the most commonly performed compressive strength test. The Cubes & Cylinders used for this reason are two styles of concrete specimens: 150 mm tubes in Asia are more common. Russia and the countries of Europe, while in USA and Australia cylinders of 150 mm and 300 mm diameter are common.



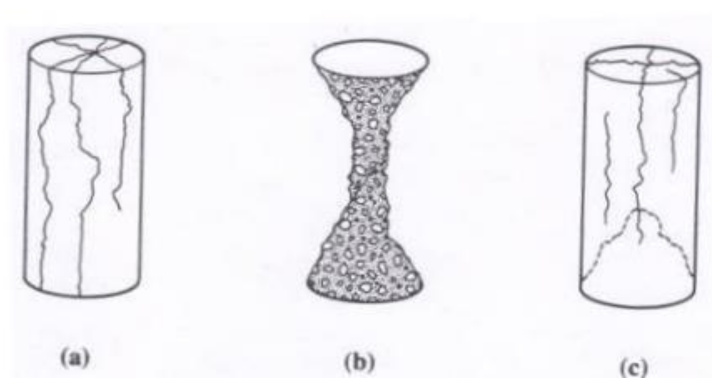


Figure 3. 4 Various Failure Modes of a Concrete Cube & Cylindrical Specimen under the Compression Loading Test

Compression test cubes are formed in the specified dimensional steel or cast-iron mounds. BS 1881: The mold requires in layers of roughly 50 mm to be filled. Section 108: Each layer compacts with a limit of 35 strokes in 150 mm cubes or 25 strokes in 100 mm cubes. For this reason, there is a regular tamping bar with a steel segment 25 mm long. Compaction can also be used by vibration.When the cubes are to be checked for more than 7 days after completing, they should be stored at a temperature between 15 ° C and 25 ° C. The temperature to be held is 18 ° C to 22 ° C when the check days are less than 7 days. Also, 90 percent relative moisture must always be maintained. Just before the tests at 24 hours the cube is dismantled. Dismolding takes place for years longer upon application of water to a concrete mix, between 16 and 28 hours and the specimens are placed at 18 ° C and 22 ° C in the cure tank up to the target level. Tests are most commonly conducted for 28 days but can also be checked for 1, 3, 7 and 14 days. With some cracks established at an angle to the applied load Practically speaking, the compression testing system developed a complex stress system based on the end constraints of steel plates.

Figure 3. 5 Concrete Cube Undergoing Compressiontested under CTM

It is obvious that the Poisson effect corresponds to a lateral expansion of the cube or cylinders. The plates of steel are not stretched laterally in the same manner as in concrete. The lateral expansion of plates of steel and the cubic faces of the concrete is distinct. The degree of final restraint can be removed by applying graft, graphite, or paraffin wax on the carrying surfaces of the specimen dependent on the friction at the interfaces. It allows the specimen to experience greater and consistent lateral expansion and breaks the kill length of the specimen. The compression test results in the higher cube intensity value due to the full effect of the end constraints.

3.2.1Test procedure for Compression Test

Samples of field concrete are packed, cured and checked in compliance with the normal ASTM procedures. Concrete materials from different building sites are planned. The compression resistance of cylindrical concrete specimens is calculated by following methods and measurements.

3.2.2.1 Standard Test Method (ASTM Designation: A 370 – 03)

This check procedure requires the application of a compressive axial load on cylinder at a rate in the specified range before the malfunction takes place. By comparing the average load obtained during the examination with the cross sectional region of the specimen, the compressive force of the specimen is determined. This intensity is typically defined as a characteristic concrete strength calculated at a mixing date of 28 days.

3.2.2.1 Making and Curing Concrete Test Specimens

Succeeding procedures are conducted to ensure that specimens follow the norm before processing.

a. Under all circumstances of use, molds shall have their proportions and form.

b. Where appropriate to avoid leakage across joints, a suitable dye such as strong grate shall be used.

c. The molds shall be kept securely by constructive means in favor of the foundation plates.

d. Until use, reusable molds should be coated loosely with gasoline.

Sampling

A comparison sample from the wide piece of concrete is the first step. This is important as soon as the concrete is discharged. The sample would reveal the supplied concrete.

Tamping Rods

In ASTM approaches, two sizes are suggested. The large, straight steel rod shall be of each dimension and the tamping end at least pointed at the hemisphere tip with the same diameter as the thread. Width little larger, 6/8 in. Diameter (16 mm) and about 24 inches. For tamping purposes (600 mm) long can be required.

3.2.2 Test Procedure

a. Specimen placement: the flat (lower) bearing block is placed directly under the (upper) bearing block on the measuring system table with its hardened face up. Top and bottom loading blocks are separated and the research specimen is mounted on the bottom loading board.

b. Zero Control and Block Seating: the load indicator is established at zero prior to testing the specimen. The output is changed if the indicator is not set to zero properly.

c. Loading rate: the load is constantly and shocklessly applied.

d. Standards state that the moving head shall travel at a rate of approximately 0.05 in for the test machines of the type of screw. (1mm)/min of idle service of the computer. For hydraulically operated devices, the load must be added at a specimen range of 20 to 50psi / sec (015-0.35 MPa / sec) for moving speeds (plate for crosshead measurement).

e. A higher loading rate is permitted during execution of the first half of the planned loading period.

f. There is no adjustment at all times in the flat movement rate, while a specimen yields quickly immediately prior to failure.

g. Load is added so long as the experiment does not operate and the full load borne by the specimen is reported during the study. It is also important to remember the form of defect and the look of the concrete.

3.2.3 Calculations

The specimen's compressive strength is determined by dividing the specimen's full load during the examination by the average cross-sectional area. The outcome to the nearest 10 psi (0.1 MPa) is calculated and clear.).

3.2.4 Data Logger

An electronic system that collects data over time or in relation to a location, either through an instrument or a sensor built-in or by external instruments or sensors is a data logger or data recorder. They are largely focused on a digital processor (or computer), though not absolutely. Generally they are lightweight, battery-powered, and compact, with a microprocessor, internal data storage memory and sensors.

3.2.5 Acquirement of Data from the Data Logger

The transducer is linked to a state-of - art "application logger". This device is also knitted with a modern data acquisition method. The transmitter is attached by means of a transducer cable to the data logger and can then be weighed. A dial indicator is attached to the cement cylinder in order to measure movement, and a steel plate of horizontal surface for standardized load distribution is mounted on the cylinder. The loading cell is positioned on a plate of steel. Universal check machine applies load before sample loss. The data obtained in the data logger was sent to the machine and evaluated after that. After data analysis, stress-strain curves are drawn for the concrete cylinders.

3.3 Flexural Test

Flexural test on concrete based on the ASTM standards are explained. Differences if present in specification or any other aspects of flexural test on concrete between ASTM standard, Indian standard, and British standard are specified.

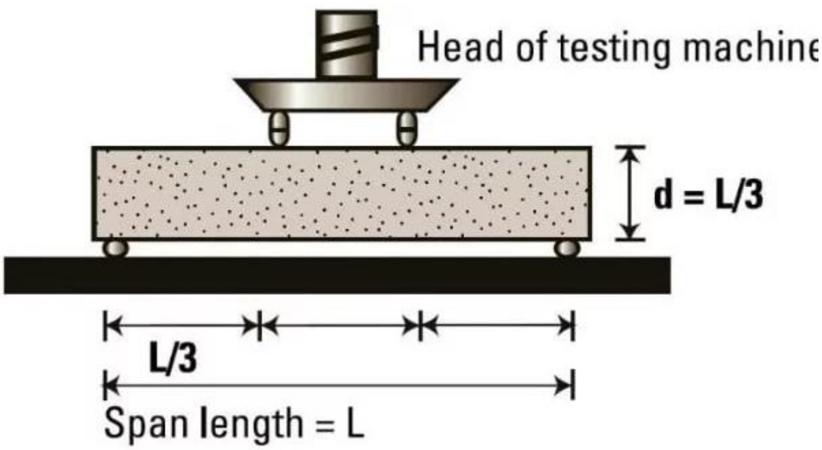


Figure 3. 6 Flexural Test on Concrete (Three Point Loading Test)

3.3.1 Flexural Test on Concrete

Flexural checks partially measure concrete's tensile strength. It checks to be able to withstand bending loss of the unreinforced concrete beam or surface. Reports of bent experiments on concrete presented as a break modulus that denotes MPa or psi as (MR).

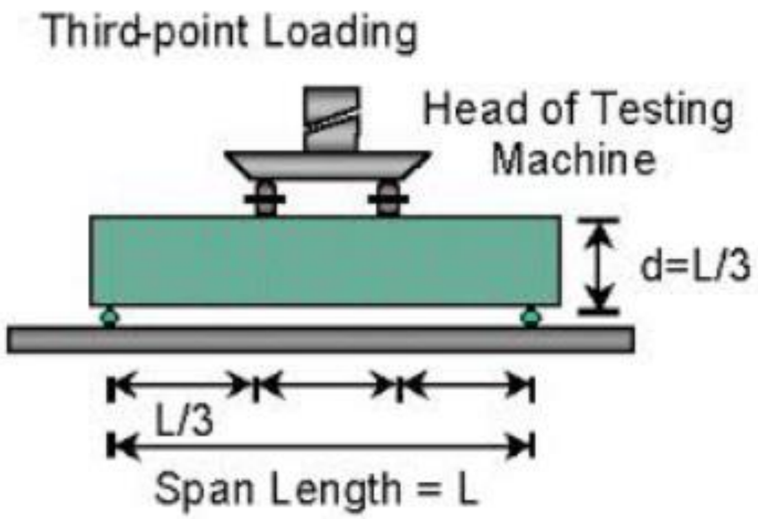


Figure 3. 7 Three-Point Load Test (ASTM C78)

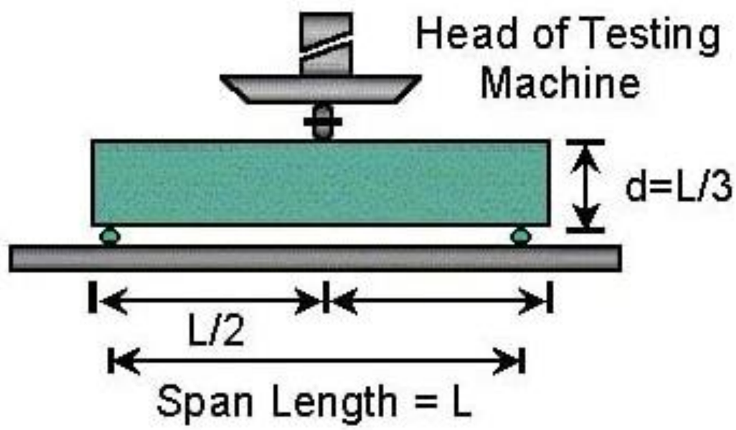


Figure 3. 8 Center Point Load Test (ASTM C293)

It is notable that the rupture value module obtained in the center point load test set-up is about 15 percent smaller than the three-point load test set-up. In addition, small rupture modulus is observed when attention is extended to larger concrete specimens. In fact, the rupture assembly is about 10 to 15% compressive solids of concrete. The dimensions, scale and gross aggregate volume used in specimen construction are affected by these. The following equation may also be used to calculate the rupture modular, but laboratory tests must be used to ascertain whether it matters to the concept:

$$f_r = 7.5\sqrt{f'_c} \quad \rightarrow \text{Equation-1}$$

Where:

f_r: Modulus of rupture

f_c‘: concrete compressive strength

Figure 3. 9 Flexural Test Machine and Concrete Specimen (ASTM C78)

3.3.2Size of Concrete Specimen for Flexural Test

The scale of the example according to ASTM is 150 mm long, 150 mm deep and should not be at least 3 times as large. The sample will be 150 mm. The size of the specimen in Indian standard is determined by 150 mm width, 150 mm depth and 700 mm span. It says, that if the actual aggregate size used is not bigger than 19 mm, it may use 100 mm width, 100 mm depth and duration of 500 mm. The UK standard specifies the square cross-sectional specimen with a size of 100 mm or 150 mm and a width of four to five times its diameter. However, the specimen chose 150 mm in width, 150 mm in depth and 750 mm in length.

3.3.3Sample Preparation of Concrete

Determine content amounts such as asphalt, sand , gravel and wind.

- Mix in barrels of a 10% scale greater than molding test model, either by hand or by utilizing the appropriate mixing machine.

- Measure the decline after mixing of each concrete sample.

- It should be prevented to position molds on a horizontal surface and lubricate within the surface with a suitable lubrication medium.
- In three rows, insert fresh concrete into the molds.
- Compact every layer with a rod of 16 mm and use a vibrating table for 25 strokes for each layer or fill the mold with the entire compact concrete.
- Remove excess cement from the top of the mold and smooth it with no pressure.
- Cover the top of the molds and store in a 24-hour temperature room.
- Enter molds and moist treatment specimens at a temperature range of 23+/-2 o C until test time.
- The research period is 14 days and 28 days, with 3 specimens to be prepared for each examination (the specimen is placed in water for 48 hours at 24-30oC and then tested according to the Indian Code).

3.3.4Procedure of Flexural Test on Concrete

• A surface drying process that reduces bending strength should be conducted directly after the departure of a treatment condition. A test should be performed.

• On the loading points position the specimen. No interaction between the finished surface of a hand and loading points should be permitted. This means that the specimen and the loading points are suitable.

• Center the loading system with respect to the force applied.

• Bring the device force block into contact at the loading points with the specimen sheet.

• Loads between 2 and 6% of the final calculated load. •

• Eliminate any gap greater than 0.10 mm with the use of leather cords (6.4 mm thick and 25 to 50 mm long).

• To close holes in excess of 0.38 mm, capping or grinding should be required.

• Constantly fill the specimen without any shocks until they are on a steady rate (Indian standard defined fill rate: 0.06 + -0.04N / mm2.s compared to British standard: 400 Kg / min for 150 mm specimen.

3.4. Absorption Test

Testing absorption is a common method for assessing concrete water resistance. Testing Concrete: Water Absorption Determination Method measures water amount penetrating concrete samples in the submerging process, for example, BS 1881-122: 2011. However, as with other robust studies, there are drawbacks. The lower the absorption, the stronger the result:

• This does not take into consideration any sensitive mechanism linking water;

• The belief that water accounted for all weight gains;

• There is only a short dip in comparison with what could happen in long-term circumstances.

Figure 3. 10 Sample Concrete for Test

In addition, absorption testing can lead to false findings when the concrete admixtures are used. Chemicals like Krypton'sCrystol Internal Membrane (KIM) react with water and unhydrated cement, for example in hydrophilic crystalline waterproofing mixtures and shape millions of crystals like needles and block the flow of water through concrete. Unfortunately, absorption measurements do not take into consideration the volume of water that penetrates concrete materials while submerged nor the usage of water inherent in this method, in particular in the early stages of the treatment phase. The absorption tests will be improved in time – with the concrete continuing to grow and saturated. The absorption in later stages would lead more objectively when measuring the toughness of the concrete using a crystalline admixture in the mixing method process. Check the concrete at 56 or 90 days instead of at the beginning of 28 days in an acquisition with the most precise tests.Ultimately, in this phase you are searching for the most conclusive proof. No one can underestimate the importance of concrete durability, especially in order to build a sustainable and long-term concrete structure. This is much better than the RCP test, which we are going to discuss later. Another test, though, removes other drawbacks of the absorption test.

3.4.1 Specific Gravity and Water Absorption Tests on Aggregates

A specific test of applied gravity is carried out to assess material intensity or consistency, while a test of water absorption measures the capacity of coarse and fine aggregates to retain water. This test is primarily aimed at

- Measuring the material's intensity or consistency.
- The absorption of aggregates by water must be calculated.

Figure 3. 11 Aggregate Model

The specified accumulated quantity with the weight of equivalent water volume. The intensity or consistency of the particular substance is measured. Aggregates of low exact gravity are usually lower than those of advanced specific gravity.

3.4.2 Procedure of Water Absorption and Specific Gravity Test on Aggregates

Specific gravity is the weight ratio of a specified accumulated quantity with the weight of equivalent water volume. The intensity or consistency of the particular substance is measured. Aggregates of low specific gravity are usually lower than those of higher specific gravity.

Figure 3. 12 Water Absorption and Specific Gravity Test

3.4.3 Apparatus Compulsory

a. Capacity balance roughly 3 kg to weigh precisely 0.5 g, of this kind and shape to allow sample container to be measured while it is immersed in water.

b. A heat-controlled oven to sustain 100-110 degrees Celsius temperature.

c. A wire basket with a mesh not reaching 6.3 mm or a compact tub with thin cable hangers for hanging from the edge.

d. A tub for water loading and basket suspension

e. An air tight size container close to the basket

f. Two submerged clothes and a shallow layer, each not less than 75x45 cm.

3.4.4 Procedure

Around 2 kg of the composite sample is carefully washed away, drained and placed in a wire tube, then immersed in distilled water at 22-32o C and at least 5 cm above the surface.

Directly after immersion, compressed air is removed from the sample by raising the basket 25 mm above the tank base and allowing it to decrease by around one decrease per second. The basket and mixture shall remain fully submerged in mud for up to 24 hours.

Measure the basket and sample at a temperature of 22 ° –32 ° C. During suspension, the weight is noted in water = W1 g.

Basket and aggregates are isolated from water, then poured into dry-absorbing clothing for a few minutes. The empty bucket is weighted 25 times in water = W2 g. The tank is then released.

The aggregates on the absorbing clothes are dry in soil until this fabric loses no more moisture. The aggregates are then put on the second dry cloth in one layer and dried for at least 10 minutes, until the aggregates are completely dry on the soil. The dry compound weighs = W3 g.

The aggregate is placed in a shallow tank and deposited in an oven at 110 ° C for 24 hours. It is then extracted, refrigerated and weighted = W4 g in an airproof bag.

3.4.5 Observations of Test

Weight of saturated aggregate suspended in water with basket = $\mathbf{W_1 g}$

Weight of basket suspended in water = $\mathbf{W_2\ g}$

Weight of saturated surface dry aggregate in air = $\mathbf{W_3}$g

Weight of oven dry aggregate = $\mathbf{W_4\ g}$

Weight of saturated aggregate in water = $\mathbf{W_1 - W_2\ g}$

Weight of water equal to the volume of the aggregate = $\mathbf{W_3 - (W1 - W_2) g}$

(1) Specific gravity = $\mathbf{W_3 / (W_3 - (W_1 - W_2))}$

(2) Apparent specific gravity = $\mathbf{W_4 / (W_4 - (W_1 - W_2))}$

(3) Water Absorption = $\mathbf{((W_3 - W_4) / W_4) \times 100}$

3.5 Mix Design

The concrete mix design was done by using IS 10262 for M-25 grade of concrete.

Table 3. 1 Design stipulations for proportioning

Grade designation	M25
Type of cement grade	OPC 53 grade confirming to IS12269:1987
Maximum nominal size of aggregates	20 mm
Minimum cement content kg/m^3	300 kg/m^3 **(IS456:2000)**
Maximum water cement ratio	0.5
Workability	100-120mm (slump)
Exposure condition	Mild
Degree of supervision	Good
Type of aggregate	Crushed angular aggregate
Maximum cement content	340 kg/m^3
Chemical admixture	RHA

Table 3. 2 Test Data for Materials

Cement used	OPC 53 grade confirming to IS 12269:1987
Specific gravity of cement	3.15
Specific gravity of Coarse aggregate Fine aggregate	 2.67 2.65
Sieve analysis Coarse aggregate Fine aggregate	Coarse aggregate : Conforming of IS: 383 Fine aggregate : Conforming IS: 383

3.5.1 Target Strength for Mix Proportioning

f'ck = fck + 1.65 s

Where,

f'ck = Target average compressive strength at 28 days,

fck = Characteristic compressive strength at 28 days,

s= Standard deviation

From standard deviation, s = 4.6 N/mm^2

Therefore target strength = 25+ 1.65 x 4.6 = 32.6 N/mm^2

3.5.2 Selection of Water Cement Ratio

From Table 5 of IS: 456-2000, maximum water cement ratio = 0.55 (Mild exposure)

Based on experience adopt water cement ratio as 0.50

0.5 < 0.55, hence ok

Table 3. 3 Selection of water and sand content From Table 4 of IS 10262:1982

Maximum Size of Aggregate(mm)	Water Content including Surface Water, Per Cubic Meter of Concrete(kg)	Sand as percent of Total Aggregate by Absolute volume
20	186	35

Table 3. 4 Adjustments from Table 6 of IS 10262:1982

Change in condition	Percent adjustment required	
	Water Content	Sand in total Aggregate
Increase or decrease in water- cement ratio that is 0.05	0	-2
Increase or decrease in value of compacting by 0.10	0	0
For Sand	0	-1.5

Therefore, required sand content as percentage of total aggregate by absolute volume =35-3.5=31.5%

Volume of aggregate= 100-31.5=68.5%

Table 3. 5 The mixture proportions used in laboratory for Experimentation are shown in table

Mix	%	w/c ratio	Water (Kg/m^3)	Cement (Kg/m^3)	Fine Aggregate (kg/m^3)	Coarse Aggregate (Kg/m^3)	RHA (Kg/m^3)
Control	-	0.50	186	372	562	1217	-
Rice Husk Ash	5	0.50	186	353.4	562	1217	18.6
	10	0.50	186	334.8	562	1217	37.2
	15	0.50	186	316.2	562	1217	55.8
	20	0.50	186	297.6	562	1217	74.4

CHAPTER 4

EXPERIMENT RESULTS

4.1 Research Methodology

Numerous experimental revisions had been conducted by diverse researchers to analyses the different properties of concrete prepared with recycled aggregates. However, this study is an attempt in same queue of research and in addition to it, the Rice husk ash (RHA) was included.

For this reason, debris or generated concrete waste (demolished beams, columns and lintels of buildings) were collected from a city, Noida, India. Following step by step procedure were adopted to obtain RA.

- The obtained debris was dismantled, segregated and broken into small pieces with the help of a hammer.
- The dismantled waste material was brought to laboratory for further processing like preliminary testing.
- The 19.5, 12.5, 9.5 and 4.75 mm sieves were used for classification of recycled aggregates and to obtain the required grading of aggregates.

Moreover, for analyzing the harden properties of concrete, total 100 specimens, which includes cubes of 4” x 4” x 4” and cylinders of 4” x 8” size were caste whose detail is illustrated in **Table 4.1**. All specimens were tested in Universal Testing Machine (UTM) at 7, 14 and 28 days curing period.

Table 4.1 All specimens were tested in Universal Testing Machine (UTM) at 7, 14 and 28 days curing period.

Specimens	Curing Ages	Plain Concrete	RCA + 5% RHA	RCA+10% RHA	RCA+15% RHA	RCA+20% RHA
Cylinders for Splitting tensile strength	7 days	3	3	3	3	3
	14 days	3	3	3	3	3
	28 days	3	3	3	3	3
Total		9	9	9	9	9

Cubes for Cubical Compressive strength	7 days	3	3	3	3	3
	14 days	3	3	3	3	3
	28 days	3	3	3	3	3
Total		9	9	9	9	9

4.2 Materials

4.2.1 Rice Husk Ash (RHA)

Rice husk (RH) is considered as waste stuff after separation of rice grains. Either it is dumped in agriculture field whereby it works as organic fertilizer, or it is dumped on open dumps where it takes years to decompose. Rice Husk was taken from R. K. Enterprises, Bhangrotu, (Mandi), Himachal Pradesh, India. Rice husk firstly wash with portable water then dried in the sun. After then rice husk burnt in the open atmosphere so as to convert it into ash as shown in Figure 4.1 is used in concrete manufacturing.

Figure 4. 1 Rice husk ash before and after sieving

4.2.2 Cement

The ordinary Portland cement (OPC) was used as a binding material. The locally available brand name Lucky Cement is used. The preliminary properties of cement were investigated and found as: normal consistency 33%, initial and final setting time 30 and 120 mints respectively.

4.2.3 Fine, Coarse and Recycled Aggregates

Material properties were evaluated in laboratory for assuring the quality of materials. The physical properties are listed in Table 4.2 beside it, RCA is 0btained as menti0ned ab0ve thr0ugh manually by hammering 0f remaining's of dem0lished buildings. Large pieces of destr0yed buildings like beams, c0lumns, slab etc. were hammered manually int0 small pieces as sh0wn in Figure 4.2 further, flne, n0rmal c0arse and recycled c0ncrete aggregates are sieved through standard sieves t0 assure the size of aggregates, results are graphically shown in **Figure 4.3 and 4.4** in addition to it different physical properties as illustrated in Table 4.3 were conducted on RCA before using in concrete

Figure 4. 2 Recycled concrete aggregates after processing

4.2.1 Fine Aggregates

The sand used for the work was locally procured and conformed to Indian Standard Specifications IS: 383-1970. The results are given below in Table 4.2.1 (A) and 4.2.1(B). The fine aggregated belonged to grading zone III.

Table 4.2.1(A): Sieve Analysis of Fine Aggregate

Weight of sample taken =1000 gm					
Sr. No	**IS-Sieve (mm)**	**Mass Retained (gm)**	**Cumulative mass Retained**	**Cumulative %age mass Retained**	**Cumulative %mass passing through**
1	4.74	1	1	0.1	99.9
2	2.36	22	23	2.3	97.7
3	1.18	77	100	10	90
5	600µ	153	253	25.3	74.7
6	300µ	264	517	51.7	48.3

7	150 µ	425	942	94.2	5.8
8	Below150µ	58	1000	100	0
	Total			**Σ283.6**	

FM of fine aggregate = 283.6/100=2.836

Table 4.2.1(B): Physical Properties of fine aggregates

Characteristics	Value
Specific gravity	2.63
Bulk density	5%
Fineness modulus	2.83

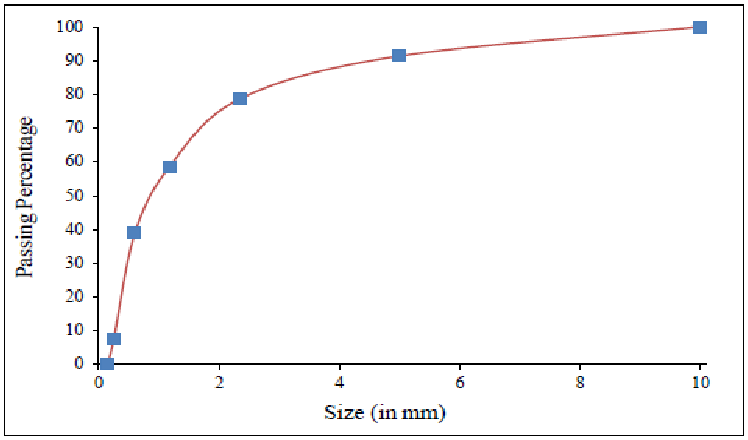


Figure 4. 3 Sieve analysis results of fine aggregates

4.2.2 Coarse Aggregates

Locally available coarse aggregate having the maximum size of 20 mm was used in this work. The aggregates were tested as per IS: 383-1970. The results are shown in Table 4.2.1(A) and Table4.2.2(B).

Table 4.2.2(A): Sieve Analysis of Coarse Aggregate (20 mm)

Weight of sample taken =2000 gm					
Sr. No	**IS-Sieve (mm)**	**Mass Retained (gm)**	**Cumulative mass retained**	**Cumulative %age mass Retained**	**Cumulative % mass passing through**
1	40	0	0	0	100

2	20	145	145	7.25	92.75
3	10	1829	1974	98.7	1.3
5	4.74	124	1998	99.9	0.1
6	2.36	0	1998	99.9	0.1
7	1.18	0	1998	99.9	0.1
8	600µ	0	1998	99.9	0.1
9	300µ	0	1998	99.9	0.1
10	150 µ	0	1998	99.9	0.1
11	Below150µ	2	2000	100	0
	Total			**Σ805.35**	

FM of Coarse aggregate = 805.35/100=8.0535

Table 4.2.2(B): Properties of Coarse Aggregates

Characteristics	**Value**
Type	Crushed
Colour	Grey
Shape	Angular
Nominal Size	20 mm
Specific Gravity	2.62
Total Water Absorption	0.89
Fineness Modulus	8.05

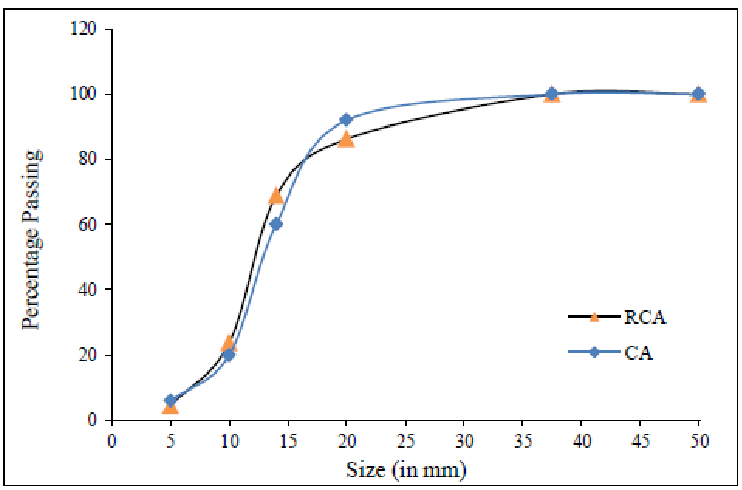


Figure 4. 4 Sieve analysis results of normal (CA) and recycled concrete (RCA) aggregates

Table 4.2 Properties of fine and coarse aggregates

Sr. No.	Properties	Fine Aggregates	Coarse Aggregates
01	Fineness Modulus	2.25	--
02	Specific Gravity	2.8	2.7
03	Water absorption	3%	1.5%
04	Bulk density (compacted)	1921.89 kg/m^3	1559.878 kg/m^3

Table 4.3 Physical properties of RCA

S. No	Physical Property	Result
01	Size of aggregate	20 mm
02	Specific Gravity	2.49
03	Water absorption	2.33 %
04	Bulk Density (compacted)	1384.9563 kg/m^3

4.3 RHA

In this work, Rice Husk was taken from R. K. Enterprises, Bhangrotu, (Mandi), Himachal Pradesh, India. Rice husk firstly wash with portable water then dried in the sun. After then rice husk burnt in the open atmosphere so as to convert it into ash.

Table 4.3: Physical properties of Rice Husk Ash

Appearance	Fine powder
Particle Size	Sieved through 90 micron sieve
Specific gravity	2.21
Color	Light grey

4.3 Slump Test

This test was conducted to measure the w0rkability of c0ncrete. Slump test was conducted on normal concrete and concrete with RC aggregates and 5% ,10% ,15% and 20% of RHA. The slump value of all the mixture are represented in Table 4.5

Table 4. 4 Slump Tests Results

Mix Control	Percentage	Slump Value
RHA	0%	100mm
	5%	75mm
	10%	65mm
	15%	35mm
	20%	30mm

Table 4.5 revealed the recession worth v/s percentage of replacement. When a higher RHA was used,

the depression reduced.

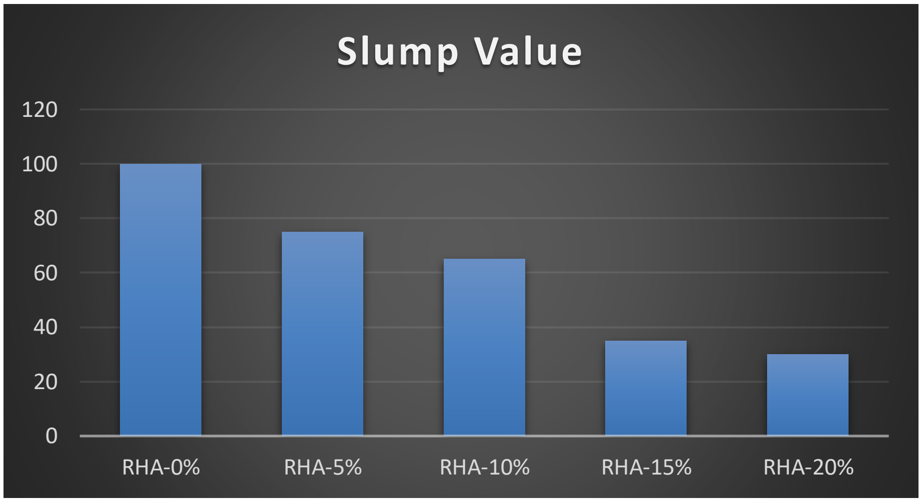


Figure 4. 5 Slump Value

4.3.1 Compaction Factor Test

The Compaction factor standards of all the mixture are signified in Table 4.6

Table 4.5 Compaction Factor Results

Mix Control	Percentage	Compaction Factor
RHA	0%	0.93
	5%	0.90
	10%	0.87
	15%	0.83
	20%	0.82

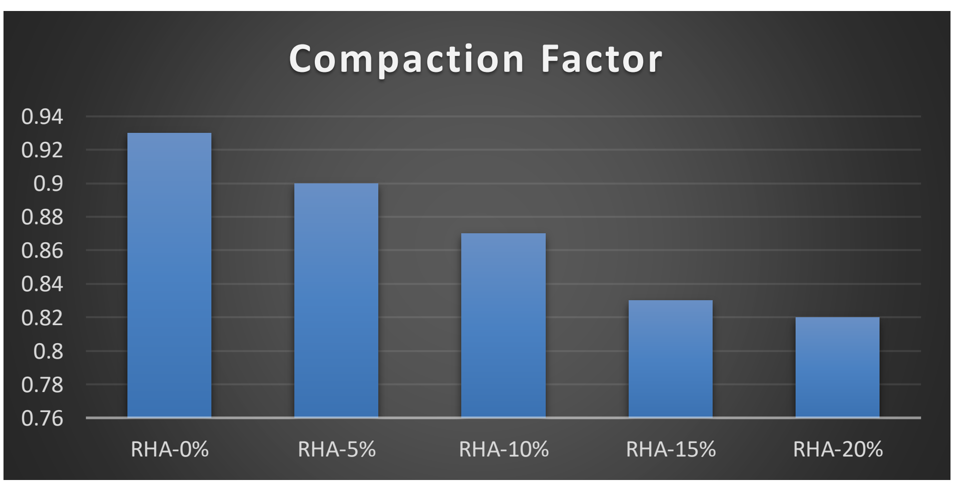


Figure 4. 6 Compaction Factor

Replacement of cement with the RHA from 5 to 20% the compaction factor value decreases from 0.92 to 0.82. The control concrete's compaction factor value is 0.93. The compaction factor meaning increases from 5 % to 20% from 0.92 to 0.82 as we raise the percentage replacement of cement with RHA.

4.3.2 Hardened Concrete

4.3.2.1 Effect of Age on Compressive Strength

Compressive strength test is conducted on cubical test. This test conducted in UTM machine as shown in Figure 4.5

Figure 4. 7 Experimental setup for compressive strength; (a) Cubical test

The intensity of the M25 Grade Control concrete for 28 days is 33.93 N / mm2. The performance tests displayed in Table No 4.7 indicate statistical differences of compressive strength relative to the proportion of cement replacement.

Table 4. 6 Compressive Strength of Control concrete in N/mm^2

Grade of concrete	7 - Days	14- Days	28- Days
M25	25.4	29.7	33.93

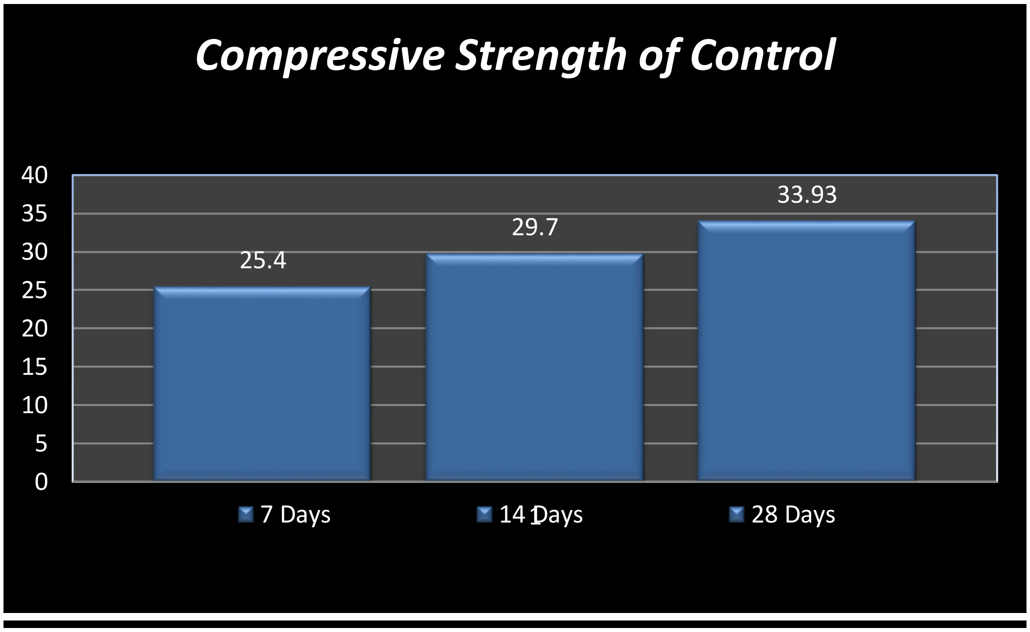


Figure 4. 8 Compressive Strength of Control

The strength achieved at different days namely, 7, 14 and 28 for Control concrete. The power of concrete regulation rises as the era advances. It is obvious enough. At a cure time up to 28 days, the rate of force rise is higher. However, after 28 days, the rise in intensity appears to be sluggish.

4.3.2.2 Consequence of Age on Split Tensile Strength of Control Concrete

Splitting tensile strength is investigated experimentally in UTM the laboratory testing setup is shown in Figure 4.8.

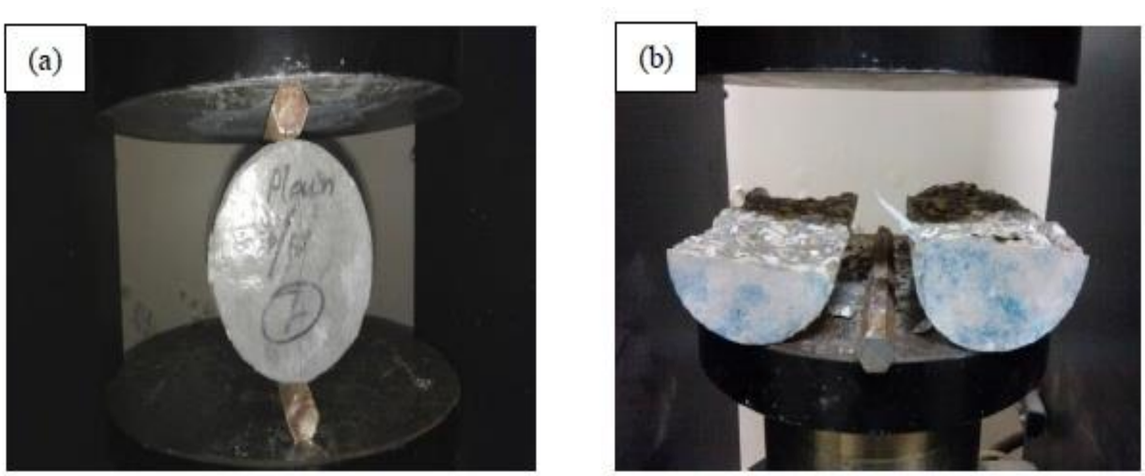


Figure 4. 9 Experimental setup for tensile strength; (a) Before testing, (b) After testing

For M25 grade control concrete the 28-day tensile strength is 2.81N / mm2.The results shown in table No 4.8 are shown as graphical differences, where the compression strength is compared with the percentage of cement replacement.

Table 4. 7Split Tensile Strength of Control concrete in N/mm^2

Grade of concrete	7 Days	14 days	28 Days
M25	1.98	2.51	2.81

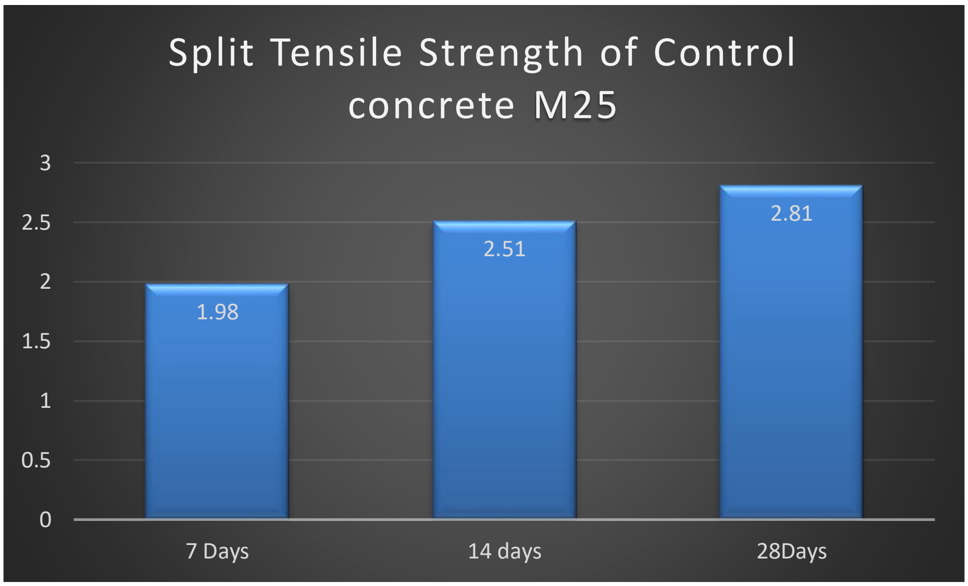


Figure 4. 10 Split Tensile Strength of Control concrete M25

4.3.2.3 Compressive **Tensile Strength of Control Concrete**

Table 4. 8 Compressive Tensile Strength of Control Concrete

Mix	Percentage of Cement Replacement	Cube Compressive Strength (N/mm^2)		
		7 days	14 days	28 Days
CONTROL	0	19.67	25.84	29.85
RHA	5%	20.41	26.32	30.26
	10%	22.14	27.33	33.93
	15%	19.63	23.76	27.74
	20%	17.66	23.22	26.48

Clearly, as age progresses, Control concrete's split tensile strength increases. The strength increase rate is higher in healing periods up to 28 days. However, the increase in intensity remains slower after 28 days.

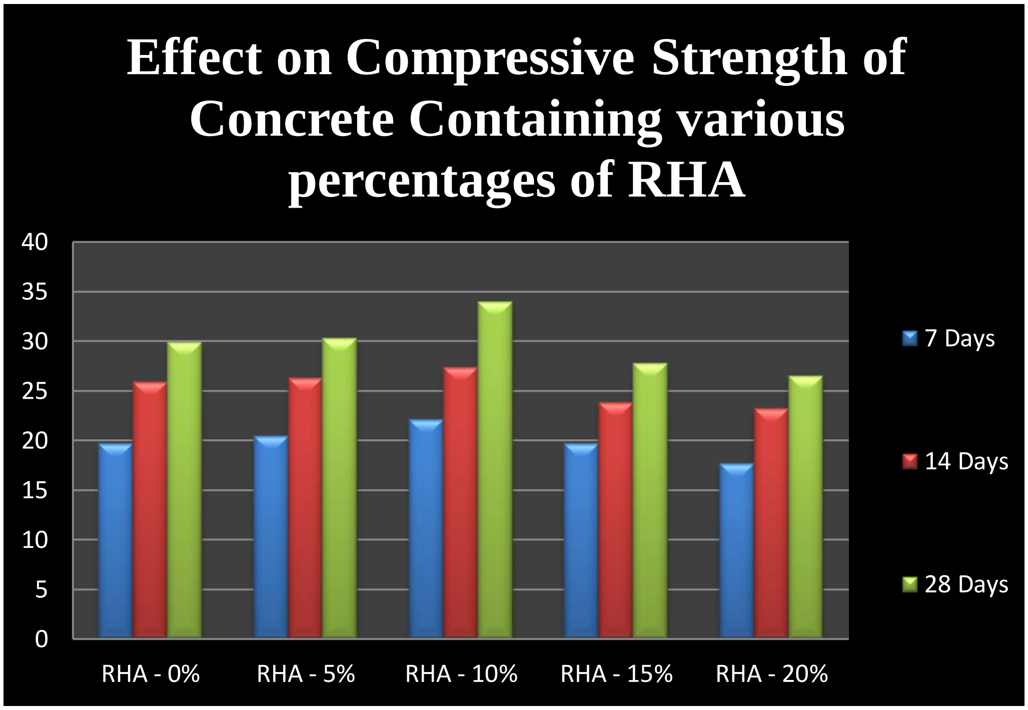


Figure 4.11 Effect on Compressive Strength of Concrete Containing various percentages of RHA

4.3.2.2 Compressive Strength of RHA Concrete

As demonstrated by experimental software and findings in table 4.9. We can substitute cement with RHA by 10%. Since up to 10 percent cement replacement compressive strength is comparatively equivalent to mix design power. If cement is substituted by RHA more than 10%, the compressive strength loss is comparatively greater than the 10% replacement.Effect on Split Tensile Strength of Concrete Containing various percentages of RHA.

Table 4. 9Split Tensile Strength of RHA Concrete

Mix	Percentage of Cement Replacement	Split Tensile Strength (N/mm²)		
		7 days	14 Days	28 Days
M25	0%	1.94	2.30	2.71
RHA	5%	2.03	2.34	2.94
	10%	1.99	2.30	2.72
	15%	1.89	2.10	2.34
	20%	1.34	1.43	1.97

4.3.2.3 Split Tensile Strength of RHA Concrete

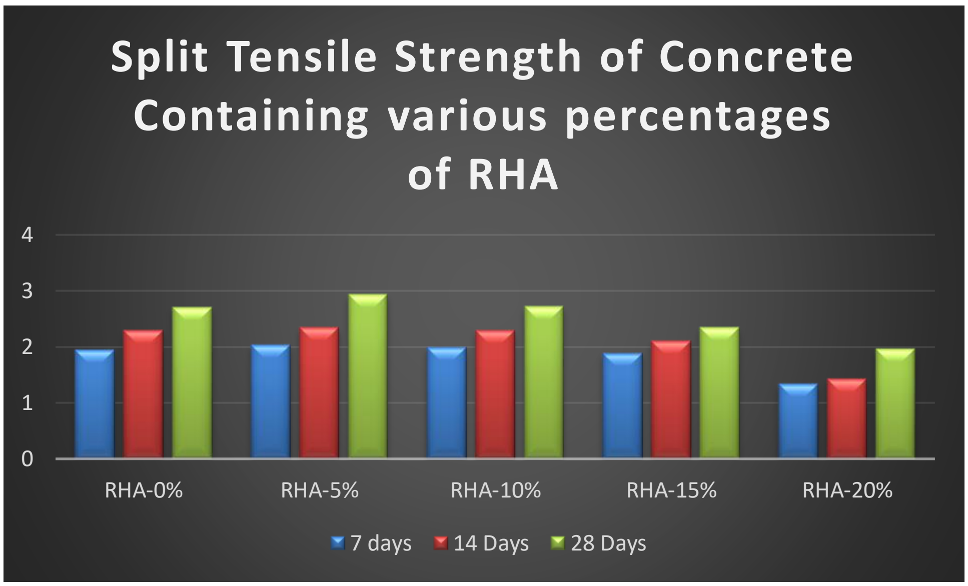


Figure 4. 12 Split Tensile Stremgth of Concrete containing various percentages of RHA

The split tensile stremgth for the replacement of 5% is higher than the control mix design in table No.4.10, but with an additional increase in RHA, but the split tensile stremgth still exceeds the split tensile strength in the control mix design, up to 10 percent of the substitution.

CHAPTER 5
CONCLUSSION

- The results above show that concrete M25 with RHA content of up to 10% can be designed.
- Based on Split tensile strength test results, it is convenient to say that the tensile strength due to addition of RHA is significantly increased.
- It is found that the compressive strength (7 day,14Days and 28 days) increased with the increase in the dosage of RHA up to certain limit of replacement of cement by RHA and when the dosage of was further increased after 10 %, it indicated plunge or dip in the compressive quality of RHA and Concrete.

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