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An Experimental Study on Strength Parameters of A Concrete By Using Fly Ash and Demolished Concrete in Cement and Coarse Aggregate With Addition of Fibers

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ABSTRACT

Next to water Concrete is the world's most significant and reliable material for the construction. Most of construction is done with concrete. Concrete is a mixture of cement, aggregates and water. Now days we are constructing many new structures in which large amount of cement is used and due to increase in population and luxury in our life we should rebuild our old structures so lot of waste material is also produced. Due to the usage of large amount of cement in global wide, it produces carbon dioxide which is harm full for the atmosphere. Demolished waste material can be used as used as replacement of aggregates. Aim of this project is to reduce the cement content in concrete and use the demolished waste as the replacement of course aggregate. To reduce the cement content cement is partially placement with fly ash in 5%, 10%, 15% and 20% by cement weight to reduce the pollution and to use the waste from the demolished structures coarse aggregate as fully replaced by demolished waste. To increase the durability, flexural strength reduce the plastic shrinkage, dry shrinkage, to enhance life of overall structure and cracks control fibers are used after obtaing of optimal mix in 0% 0.5% 1%, 1.5%, 2%, 2.5% by cement weight.

Mechanical Properties of concrete are studied by conducting Compressive, Split Tensile and Flexural tests for 7, 14&28days.

Keywords: Demolished waste, fly ash, steel fibers, glass fibers

I.INTRODUCTION

In olden days lime is used as binding material but due to present conditions for constructing heavy structures like apartments, bridges, dams, reservoirs lime cannot used as the binding material.so we need a binding material where we can construct heavy structures so we are using cement as binding material. Now a day in our modern world almost all the structures are constructed with concrete. Concrete is a mixture of cement, fine aggregate, coarse aggregate, water. Chemical composition of cement is lime, silica, alumina, iron oxide, magnesium oxide, alkalies. Coarse aggregate can be obtained by blasting in stone quarries or by breaking them by hand or machine crushing. Fine aggregate consists of natural sand or any crushed stone particles

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The materials which are using in concrete like fine aggregate and coarse aggregate can easily available in the local market with low cost.

When concrete is mixed with sufficient water then it forms slurry which can be moulded to any required shape. Due to its strength, durability and fire resistance concrete can be used for construction.
Mostly all construction are built by using concrete due to the following reasons

1. Concrete is economical
2. Concrete hardens at ambient temperature
3. Ability to be cast into shape
4. High temperature resistance
5. Ability to consume and recycle waste etc.

The advantage of using concrete is we can replace the industrial waste as partial replacement of cement. There are many industries which produces industrial waste like ground granulated blast furnace slag, waste glass, fly ash etc. even the ground vehicle tires can be used as the replacement of concrete.

In concrete mostly consists of aggregates, due to increase in the population, standards, or luxury in our life or due to the reaching limit of our old buildings don't serve their purpose so we need to re-built our old structures into new buildings so there will be lot of waste due to renovation of the buildings so that total waste should be dumped. The waste produced due to renovation of structures like bricks, concrete or timber etc. Due to availability of land on the earth is low when compare to the water so we need to reuse the materials which are obtained from the construction and renovation of the buildings.

If we don't use the construction waste there will be harmful to the atmosphere.so we need to use the construction waste as recyclable material in concrete thus replacement will make reduce in the construction and demolished waste and it will reduce the cost of the project and help full for the atmosphere. To reduce the construction waste using demolished waste as the fully replacement of coarse aggregate.

Cement is used as binding material in the concrete due to the usage of cement there will be emission of co_2 due this there will be harmful for the atmosphere. There are many industries which produce lot of waste like fly ash, GGBS etc. so to reduce the cement content fly ash as the partial replacement of cement.

Steel fibers and glass fibers are additionally added to the concrete mix due to this adding of fibers there will be some advantages to the concrete when we use steel fibers like increasing the load bearing capacity of concrete, reduction of concrete slab thickness, increase durability, improve the flexural properties, and reduce project cost.

When glass fibers are added in the concrete mix then advantages of concrete are economical, require very low maintenance, weather resistance, fire resistance, light in weight, high flexural strength

To get the better strength and performance from the replaced aggregate mix here adding steel fibers & sisal fibers to the optimum mix obtained, with 0.5%,1%,1.5%,2%,2.5%.

THE MAIN OBJECTIVES OF THIS PROJECT ARE

- To reduce the cement consumption in concrete for economic reasons.

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- Partial replacement of cement with fly ash powder by various proportions.
- Demolished material in replacement of concrete materials.
- To increase the strength properties of replaced concrete mix adding steel fibers and glass fibers by varying percentage of volume.
- Study on mechanical properties of concrete.
- Comparison of test results.

II. SCOPE OF THE STUDY

- The main aim of this study is wholly concentrated on performance of the demolished concrete waste as full replacement of coarse aggregate, the demolished waste materials are collected from the local sources and grinded into 10-20mm.
- To determine the different properties of the coarse aggregate by replacing with 100% demolished concrete waste.
- To study the influence of fly ash dust if replaced with cement, in different proportions of 5%, 10%,15% and 20% by weight of cement.
- Addition of steel fibers and glass fibers to the final obtained mix in categories of 0.5%, 1%, 1.5% and 2%.

III. LITURATURE REVIEW

HATIM HUSAIN (Mar - Apr. 2015) "Effect of Recycled Aggregate and Fly Ash in Concrete" The mix designing is done for water cement ratio 0.5. Cubes are casted by replacing virgin aggregate and cement with 10%, 20%, 30%, 40% RCA and FA and compressive strength is checked. Results shows that RCA and FA up to 30% can be used for making concrete. The specimens up to 30% replacement of FA get the strength more than ordinary strength. The optimum strength of concrete was achieved at 20% replacement of cement by FA. Up to 30% of NCA replaced by RCA gave strength closer to the strength of plain concrete cubes and strength retention is in the range of 88.29-93.61% as compared to conventional concrete. Optimum compressive strength is obtained at percentage replacement of FA (30%) and RCA (20%) .The FA and RCA are used as 30% or below 30% replacement of cement and natural aggregate get the strength more than targeted strength.

MOHD MONISH: "Demolished waste as coarse aggregate in concrete". This experiment study is a part of comprehensive program wherein experimental investigations have been carried out to assess the effect of replacement of coarse aggregate by demolished waste on workability and compressive strength of recycled concrete.

SHIVA KUMAR: "Use of building demolished waste as coarse aggregate in concrete"

D.V.PRASADA RAO: "Experimental investigations of coarse aggregate recycled aggregate", the present work is directed towards the evaluation of concrete using full replacement of natural coarse aggregate.

B. GOVINDA RAJULU "Strength of concrete by replacement of coarse aggregate with waste rubber and demolished waste materials.

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SAI DINAKAR SWAROOP M, Prince Arul Raj G,"Experimental program on concrete with activated carbon (charcoal), in this study charcoal properties by 7, 14 and 28 days curing.

PREETI SAINI, DEEPAKAR KR. ASHISH: "A Review on recycled aggregate , analysis of this paper get the information the compressive and tensile strength of admixed recycled aggregate has been found to be lower than strength of normal concrete.

CONSTRUCTION DIVE,(MARCH 2018): According to report from the transparent market research posted in construction dive website, volume of waste from construction could double to 2.2 billion tons by the year 2025.

HAMID PESARAN BEHBAHANI: realizing the improved properties of the fiber reinforced concrete products, further research and development on fiber reinforced concrete (frc) has been initiated since the last three decades. this paper presents an overview of the mechanical properties of steel fiber reinforced concrete (sfrc), its advantages, and its applications.

SEMSI YAZICI AND HASAN ¸SAHAN AREL: "Effects of fly ash fineness on the mechanical properties of concrete". It was found that compressive and tensile strength of the concretes increased as fly ash fineness increased. It was concluded that Blaine fineness value should be above 3849 cm2/g fineness of fly ash to have positive impact on mechanical properties of concrete. The effects of fly ash fineness on the compressive and splitting tensile strength of the concretes were remarkably seen in the fly ash with FAC code with fineness of 5235 cm2/g.

DR. M.N.BAJAD,NANDAN MUTHA, HATIM HUSAIN, NIKHIL KSHIRSAGAR
"effect of recycled aggregate and fly ash in concrete" The objective of present study is to determine the sustainability of RCA as an alternate material to NCA and to compare the workability, density and compressive strength result using FA. The mix designing is done for water cement ratio 0.5. Cubes are casted by replacing virgin aggregate and cement with 10%, 20%, 30%, 40% RCA and FA and compressive strength is checked. Obtained results are then used to establish an empirical relationship between the strength of concrete by using percentage of RCA and percentage of FA. Results shows that RCA and FA up to 30% can be used for making concrete.

DR. SITESH KUMAR SINGH (JUNE 2020) "Partial Replacement of Coarse Aggregates with Demolition Waste In Construction" . As we observed that the demolished concrete found to lower bulk density, higher workability, crushing strength, impact value and water absorption value as compared to normal concrete. Use of recycled coarse aggregate up to 20% did not affect the functional requirement of structure as per calculated test result. The 10%, 15% and 20% recycled coarse aggregate replaced with normal concrete. It resulted that the strength of demolished concrete decreased as compared to normal concrete.

IV. METHODOLOGY

Plain cement concrete is collected from local dealers and grade of cement used for this project is 53. The coarse aggregate and fine aggregate is used sieved according to Indian standards. The demolished aggregate is collected from the local area. The obtained demolished aggregate is crushed into 20 mm according to Indian standards. Now for the plan and demolished concrete fly ash is partially replacement. For the obtained mix steel and glass fibers are added and found the results. The results are shown below

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INGRIDENTS

The following ingredients used in this project are

1. Cement
2. Fine aggregate
3. Coarse aggregate
4. Fly ash
5. Demolished aggregate
6. Steel fibers
7. Glass fibers
8. Water

Cement an ordinary Portland cement of 53 grade cement is used.
Fine aggregate is sieved though 4.75 mm to remove any dust and particles higher than 4.75 mm.
Coarse aggregate of nominal size 20 mm is used. These aggregates are washed with water to remove dust and after cleaning aggregate are dried
The demolished aggregate is collected from the local site and crushed in to 20 mm and used as fully replacement of natural coarse aggregate
Fly ash of class F is used as partial replacement of cement
Hooked end steel fibers are used at 0%, 0.5%, 1%, 1.5%, 2%
Glass fibers of diameter 12 microns is used at 0%, 0.5%, 1%, 1.5%, 2%

Table 1 : Shows The chemical composition of cement

S.NO	INGREDIENTS	PROPORTION RANGE
1	Lime (Cao)	60-67
2	Silica (Sio2)	17-25
3	Alumina(Al2o3)	3-8
4	Iron Oxide (Fe_2O_3)	0.5-6
5	Magnesium Oxide(Mgo)	0.1-4.0
6	Sulphur trioxide ($S0_3$)	1.3-3.0
7	Alkalies	0.4-1.3

Table 2 : Shows The chemical composition of fly ash

S.NO	INGRIDENTS	PROPORTION RANGE
1	Silicon Dioxide(Sio2)	61.85
2	Aluminium Oxide(	27.36
3	Ferric Oxide	5.18
4	Calcium Oxide	1.47
5	Magnesium Oxide	1.0
6.	Sodium Oxide	0.08
7.	Sulphur Trioxide	0.05
8.	Loss Of Ignition	6.02

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Table 3 : Shows the Mechanical Properties of M25 Concrete Grade

Tests On Hardened Specimens	7 Days	14 Days	28 Days
Compression strength (N/mm^2)	19.85	25.68	30.39
Split tensile strength (N/mm^2)	2.38	3.05	3.23
Flexural strength (N/mm^2)	2.55	3.18	3.68

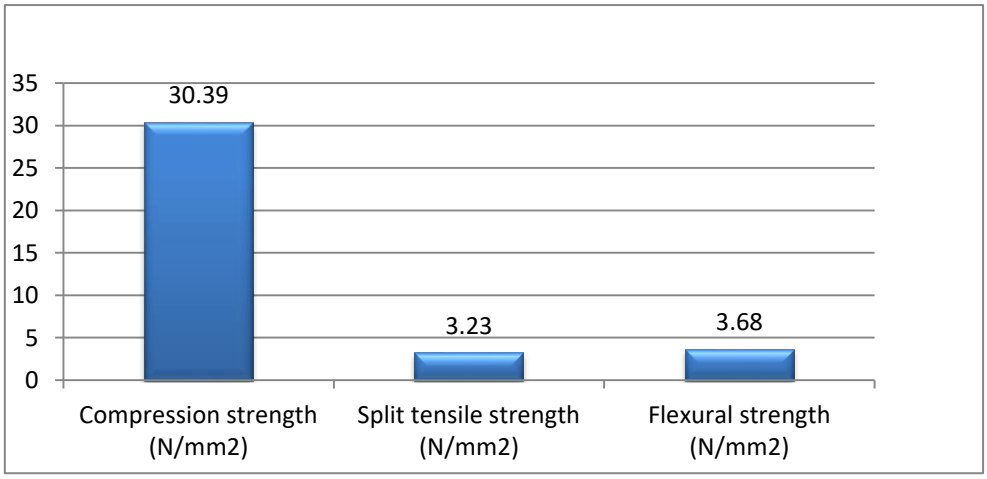

Figure 1 : Shows :Graph showing strength of nominal concrete after 28 days
The above graph represents the compressive, split tensile and flexural strength of the nominal concrete when it is done curing for 28 days.

The following graphs will show the results when the cement is partially replace with fly ash foe demolished and coarse aggregate.

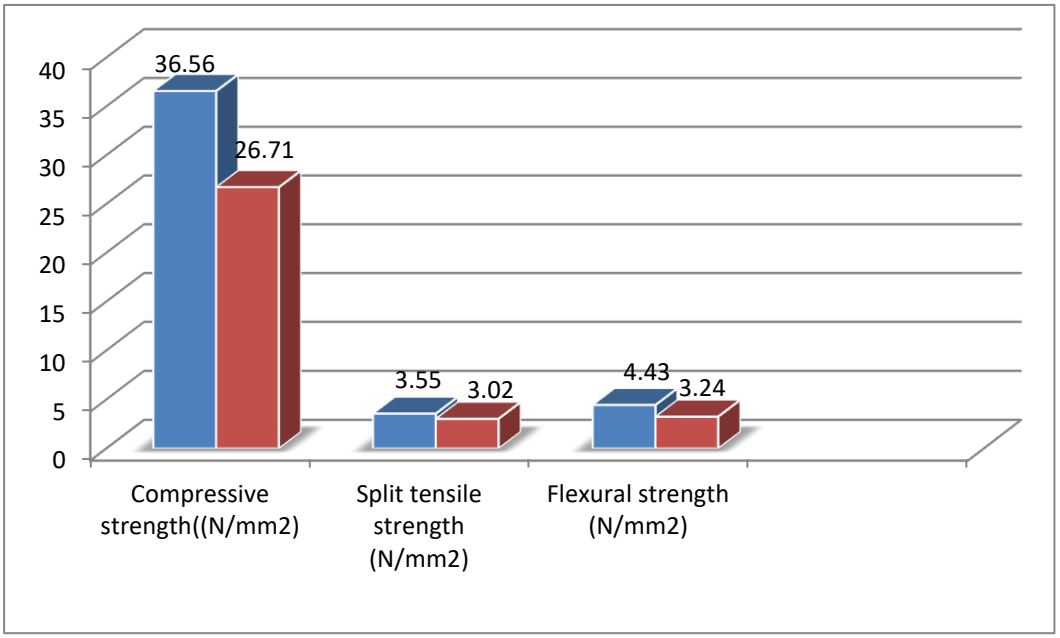

Figure 2: Shows Graph showing comparison of optimum results of cement replacement with fly ash at 15% in demolished aggregate and normal aggregate

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OPTIMUM VALUES OF THE MIX OBTAINED FOR NORMAL AND DEMOLISHED AGGREGATE WITH 15% OF FLY ASH AT 1.5 % STEEL FIBERS

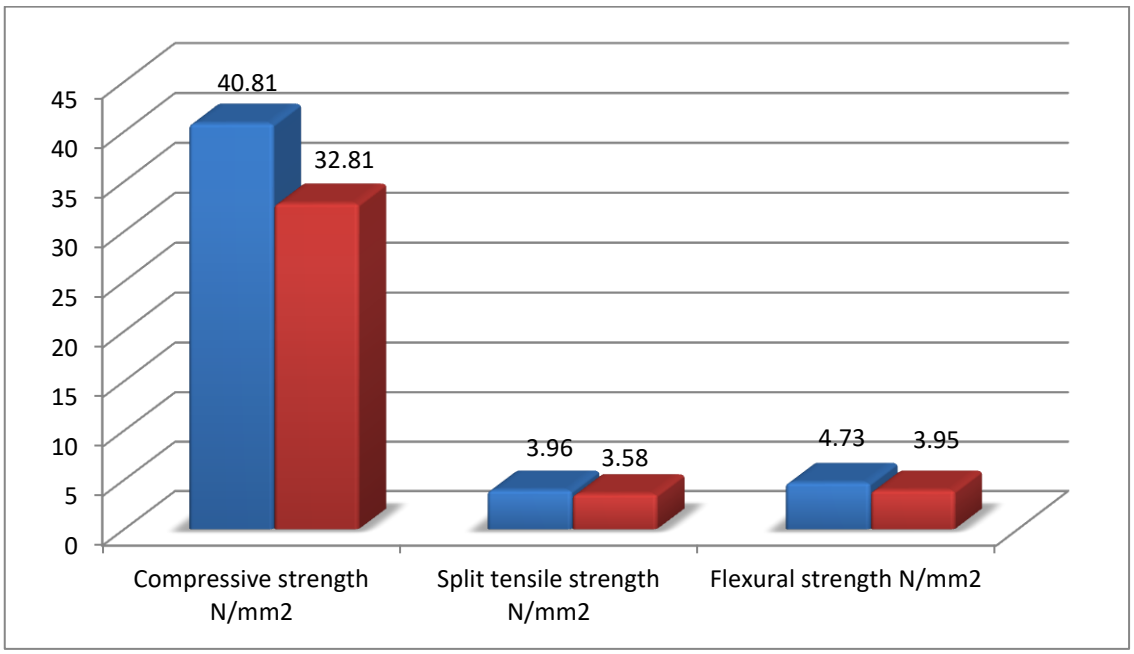
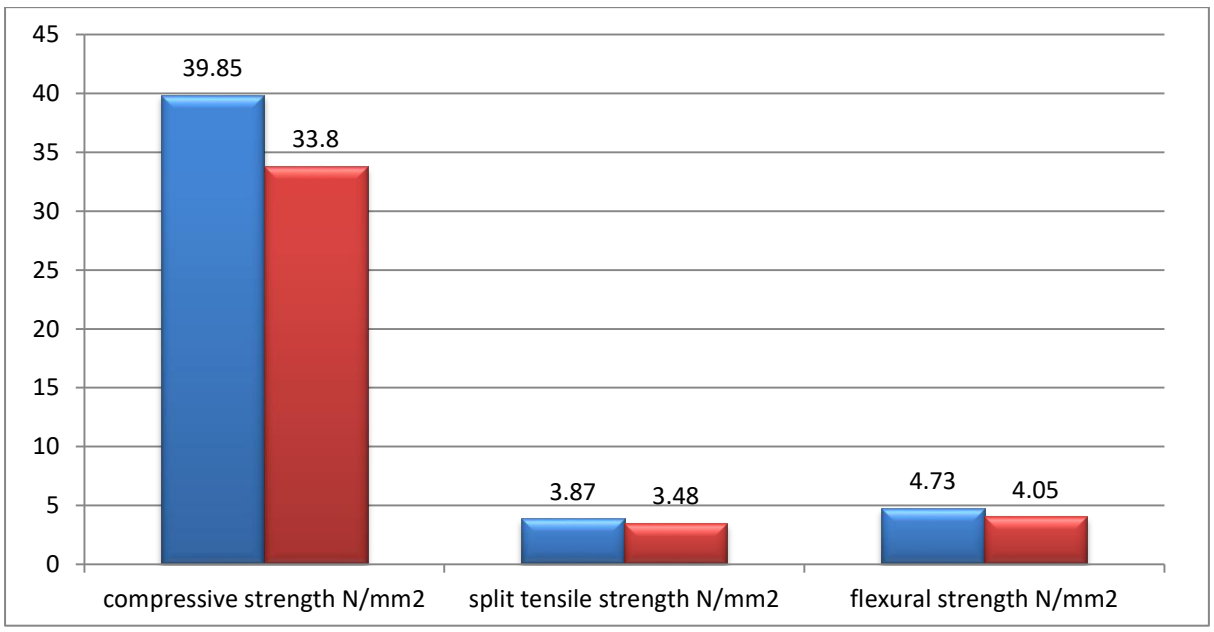


Figure 3 : Shows Graph shows comparisons of optimum results for steel fiber mix at 1.5%

OPTIMUM VALUES OF THE MIX OBTAINED FOR NORMAL AND DEMOLISHED AGGREGATE WITH 15% OF FLY ASH AT 1.5 % GLASS FIBERS



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V. CONCLUSION

- 15 % Fly ash is replaced in the Cement, increased Compressive strength 20.30 %, Split tensile strength by 10%, and flexural strength from 20.380% Compared to the Nominal Mix.
- Adding 15 % Fly ash to the demolished aggregate (100%) mix, increased Compressive strength by 7.61 %, Split tensile strength by 14.49 %, flexural strength by 16.12% compare to demolished concrete mix.
- At 1.5 % steel fibers increased Nominal mix with fly ash, increased compressive strength by 11.624%, Split tensile strength by 11.549%, Flexural strength by 6.77%.
- At 1.5% glass fibers increased Nominal Mix with fly ash compressive strength by 9%, Split tensile strength by 9.01%, Flexural strength by 6.772%.
- At 1.5 % steel fibers in demolished mix increased compressive strength by 22.83%, split tensile strength by 18.54%, flexural strength by 21.91 %.
- At 1.5% of glass fibers increased compressive strength by 26.544 % only, Split tensile strength by 15.23%, Flexural strength by 25%.
- Glass fibers gave good results when added to the demolished aggregate+ fly ash 15% than the steel fibers.

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