IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Experimental Investigation On Partial Replacement Of Fly Ash -Pond Ash GGBS Dust As Alternatives To Pozzolanic And Filler Media.

[1]U GOPAL, [2]B SHANMUKHA RAO,

[1]M TECH Structural engineer, [2]asst professor,

[1]aditya institute of technology and management tekkali, Andhra Pradesh, India

[2]aditya institute of technology and management tekkali, Andhra Pradesh, India

Abstract: The present scenario, rapid development of construction and material technology in India utilization of cement as ingredient of concrete production. It is more expensive and also scare.Now- a- days utilization of fine aggregate is more and less availability. In this situation, to useindustrial waste as alternative ingredient in the concrete production. Mix design was developed for M30 grade of concrete by an approach Indian standard for both conventional and non- conventional concrete. The mix design was done for varying proportion of (fly ash+ pond ash) and (GGBS +quarry dust) as 15%, 20%, 25%, 30% to the replacement of cementand fine aggregate. The specimens were casted and tested for mechanical properties. Resultswere analyzed, the maximum strength attained at 15% replacement of cement and fine aggregate compared with the control mix.

Index Terms - Fly ash, Pond ash, Ground-granulate blast-furnace slag (GGBS), Quarry dust

I. INTRODUCTION

India has taken a major initiative on developing the infrastructures such as express highways, power projects and industrial structures etc. for the construction of these projects like, bridges, buildings, heavy civil projects etc. used only conventional concrete it is more expansive and scare. In this situation, the replacement of cement and fine aggregate with industrialized waste materials up to some percentages. The most commonly used fine aggregateis sand derived from river banks. In today's global warming is greatly affected adversely by the environment. Which are increases day by day due to the emission of carbon oxide and other greenhouse gases in large amounts to open atmosphere by many industries and by manmade things. These are directly harmful to living things. Among all greenhouse gases, CO_2 contributes 65%of total global warming.

To mitigate these environmental problems, our civil engineers were strived to produce many alternatives and eco-friendlier concrete by doing many experiments and test on replacing of different percentage of ingredients with industrial by–products such as Fly-ash, silica fume, granulated blast furnace slag, Rick husk Ash and Me-taka Olin. Which possess excellent mechanical properties. For every year million tons of industrial waste is generated which causesenvironmental pollution if not disposal well.

Objectives:

To evaluate the mechanical properties of conventional concrete and designed mixproportion with partial replacement of cement and fine aggregate.

To determine the optimum replacement of cement and fine aggregate by using the wastematerials of fly ash, pond ash and quarry dust, GGBS.

Scope:

Further investigations can be carried on several industrial waste suitability in concrete making individually or compositely. Fly ash and pond ash usage with combination of other industrial wastes in concrete making can be analyzed.

They also can be tested with GGBS and quarry dust combination to achieve desired properties of fine aggregate replacement in the concrete mix.

Studies should be encouraged towards innovative materials usage in concrete making which is beneficial in both constructional and environmental aspects.

LITERATURE REVIEWS

Farzad Moghaddam, et al. (2018) (1) proposed that the experimental study on the effect of flyash fineness on the heat of hydration, micro structure, flow and compressive strength of blendedcement paste was carried out and evaluated against control cement paste. Partially replacing cement with fly ash with different fineness, decrease the cumulative heat evolution. the reduction in heat evolved increased with an increased in fly ash content. The blended cement paste containing finger grade fly ash demonstrated higher compressive strength then the coarsergrade fly ash at both replacement levels of cement at 20% and 40%

Sabarish, et al. (2017) (2) this paper proposed that presently large amount of fly ash is generated in thermal power plants as a waste material with an improper impact on environmentand humans. The experimental studies depend on fly ash used as cement in concrete production.Accordingly, in range of 10%,20%,30%,40% and evaluate the mechanical properties. For the test results for compressive strength and flexural strength up to 28 days. The research concludesthe fly ash can be innovative supplementary cementitious material up to 20% after increasing the percentages of replacement starts decreasing strengths.

Shaik thali, et al. (2019) (3) studied about the experiment conduct on the workability and compressive strength properties of normal weight concrete using high dosage of fly ash as cement replacement. Based on the results acquired from the experimental investigation on theslump – loss and non – destructive strength properties of using fly ash percentage fixed. The strength measured using non – destructive strength test is low when compare to compressive strength. it shows about 40% of differences between the strength measured using NDT and compressive strength test.

Vinod goud, et al. (2016) (4) fly ash is residual material of energy production using coal, whichhave been found to have numerous advantages for use in concrete. Some of the advantage include improved workability, reduced permeability, increased ultimate strength, reduced bleeding, better surface and reduced heat of hydration. The 10% and 20% replacement of cement with fly ash shows good compressive strength for 28 days. The 30% replacement of cement with fly ash ultimate compressive strength of concrete decreases.

MATERIALS AND METHODOLOGY

Fly ash:

Fly ash is finely divided residue that results from the combustion of pulverized coal and it is transported from the combustion chamber by exhaust gases. Fly ash used in the engineering applications include: Portland cement concrete (PCC), stabilization of soil and road, grouts.

Fly ash utilization, especially in concrete, has significant environmental benefits includes: (1)Increasing life of concrete roads and structures by improving the concrete durability, (2) net reduction in energy use and greenhouse gas and other adverse air emissions when the fly ash isused to replace or displace manufactured cement, (3) Reduction in amount of coal combustionproducts that must be disposed in the landfills.

Pond ash:

Pond ash is waste products from most of the thermal power plants in India. The fly ash gets mixed with bottom ash and disposed of in large pond dykes as slurry. Pond ash contains relatively coarse particles. The huge amount of pond ash accumulate around the thermal powerstations is still thread to environment. The utilization of pond ash in the building material is one of possible way of its sustainable management. In the present study, an attempt made to ascertain the possibility of pond ash used as replacement of cement.

GGBS:

GGBS means ground granular blast furnace slag is a by-product of manufacture of steel makingindustry, to produce a blast furnace in water or steam, to produce glassy, granular product thatis then dried and ground into granular forms. GGBS is highly cementitious and calcium silicatehydrates which is increase the strength, durability and appearance of the concrete. It consists of siliceous and aluminous residues, is rapidly water-quenched. Resulting formation of glassygranulates. This glassy granulate is dried and ground to required size which known as ‘groundgranulated blast furnace slag.

Quarry dust:

Quarry dust is a by-product of the crushing process which is a concentrated material to use aggregate for concreting purpose, especially as fine aggregate. In quarrying activities, the rockhas been crushed into various sizes; during the process the dust will be generated is known ‘quarry dust’. It is formed as waste. So it becomes a useless material and also result in air pollution. Therefore, quarry dust should be used in construction works, which will reduce the construction cost and construction material would be saved and the natural resources can be used properly. The present study is planned to study the effect of quarry dust addition in normal concrete and to assess the rate of compressive strength development.

Chemical admixture:

To minimize permeability and increase the water proofing properties of concrete and cement sand mortars for critical applications like roof slabs and screeds, water tanks etc. It increases workability. The minimum dosage is 125ml and maximum dosage 200ml for 50kgs cement bag. Chloride content as per IS:2645-2003.Conplast wl has a minimum self-life of 12 months,it is kept in a dry store in an opened container.

Table 3.1 Properties of Chemical Admixture

Property	Value
Colour	Dark brown
Density	1150 kg/m^3
Ph	7
Specific gravity	1.15
Chloride content	Nill
Air entrainment	< 1.5%

Methodology:

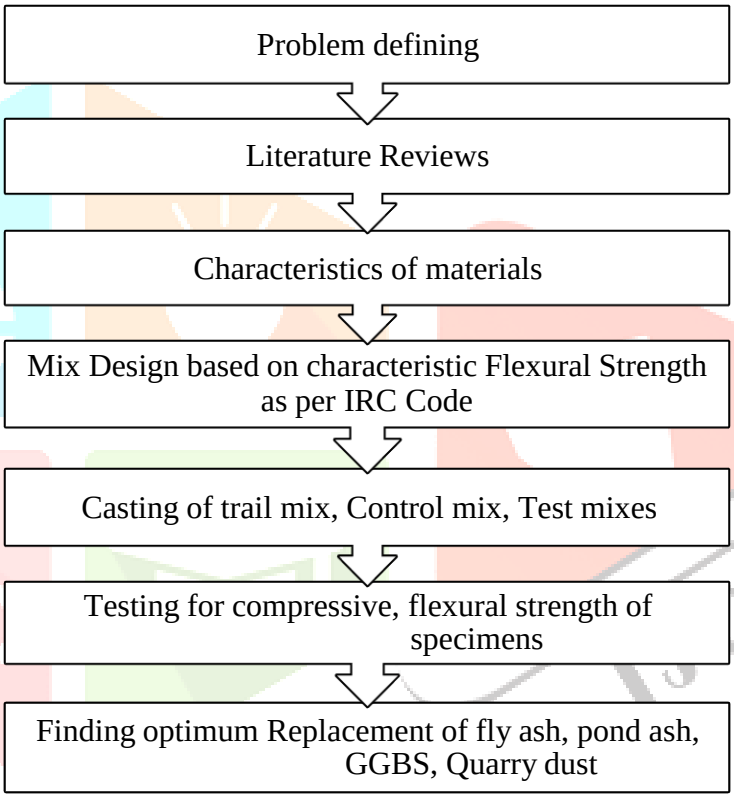


Fig.3.8: Flow chart of Methodology

RESULTS AND DISCUSSIONS

The study was done on the effect of fly ash and pond ash on and Fly ash and pond ash-based concrete. The following are the results obtained from the experiments i.e., from Compression strength test and flexural strength test. These tests are done on the normal concrete and 15%, 20%, 25%, 30% replacement of cement and fine aggregate
Evaluating the optimum Proportion of (Fly ash Pond ash) and(GGBS+Quarry dust)

Testing Methods:

According to the codal specification of IS: 516-1959, the experimental investigation onfresh concrete mix was done by using a slump cone test. The tests on hardened concrete like compressive, flexural strength and split tensile strength tests for 7 and 28 days were also doneby conforming to IS: 516-1959 codal specification.

Tests on Fresh Concrete:

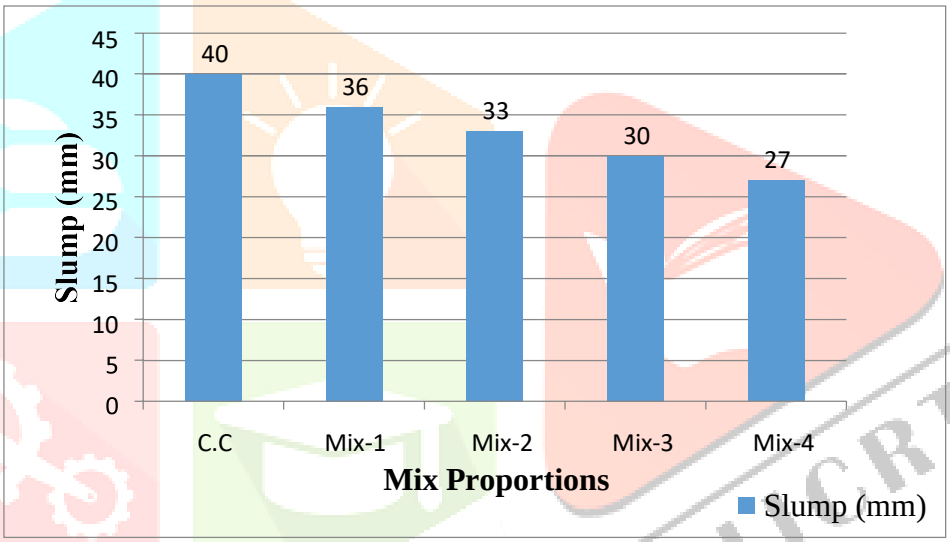
Fresh concrete is a freshly mixed material which can be molded into any shape. To analyze the workability of the concrete mix, tests are conducted on fresh concrete. In this investigation slump cone test was conducted to determine the workability of fresh concrete mix.

Slump cone test

The slump values are attained at the varying mix proportions of (Fly ash pond ash) and (GGBS + Quarry dust) to the cement and fine aggregate replacement of 15%, 20%, 25%, 30% as shownin the below Table. Which showed a reduction in slump with increase in the replacement of (Fly ash + pond ash) and (GGBS + Quarry dust) in the cement and fine aggregate mass.

Table 5.1: Slump values for Cement and fine aggregate replacement

Mix Proportion	Slump (mm)
C.C	40
Mix-1	36
Mix-2	33
Mix-3	30
Mix-4	27



Graph 5.1: Workability of various mix proportions

Compressive strength test:

The compressive strength test is to determine the crushing strength of hardened concrete, for this test evaluated the cubes of dimensions (150mm×150mm×150mm) are prepared with different proportion of (Fly ash pond ash) and (GGBS + Quarry dust) to the cement and fine aggregate replacement of 15%, 20%, 25%, 30%. The prepared samples were tested, after the completion of curing period of 7 days and 28 days, before testing the cubes were air dried.

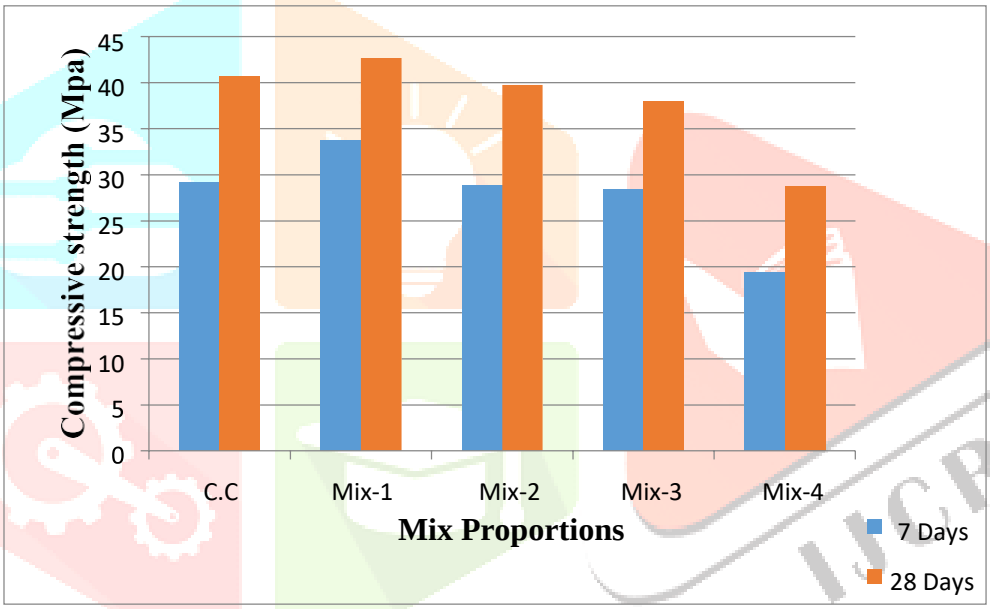
Failure load (P)

Compressive Strength (C_S) =_____

Area of Specimens (A)

Table 5.2: Results of compressive strength

S.No.	Mix Proportions	Compressive Strength (Mpa)	
		7 Days	28 Days
1	C.C	29.22	40.683
2	Mix-1	33.78	42.68
3	Mix-2	28.80	39.74
4	Mix-3	28.42	37.96
5	Mix-4	19.44	28.767



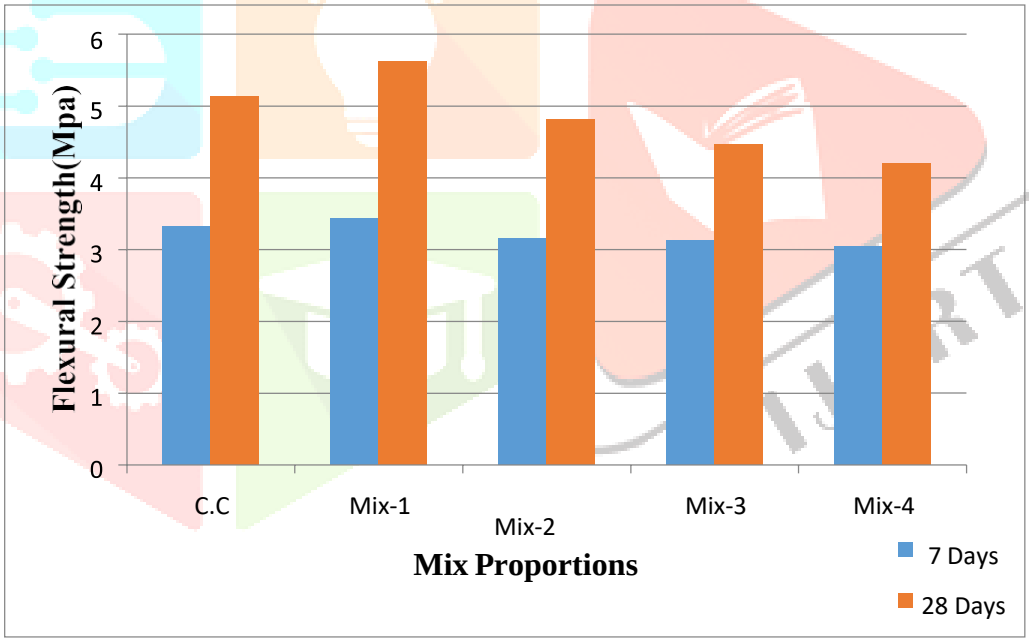
Graph 5.2: The graphical representation of compressive strength results

Flexural Strength test:

The flexural Strength test is to evaluate the value of the modulus of rupture (extreme fibre stress in bending) depending on the dimension of the beam and manner of loading. To determining the flexural tension of the beam, the application of loading is used as central pointand third point loading. In this investigation the application of loading is used as third point loading on the prism dimensions of (500mmx100mmx100 mm), considered the following procedure, the prism samples were casted and cured for 7 days and 28 days in the water then they are dried and tested in Universal Testing Machine (U.T.M) of 2000 KN capacity the testingmethod considered by conforming to IS: 516-1959.

Table 5.3: Results of flexural strength of beams

S.No	Mix Proportions	Flexural strength (Map)	
		7 Days	28 Days
1	C.C	3.33	5.14
2	Mix-1	3.43	5.62
3	Mix-2	3.15	4.81
4	Mix-3	3.13	4.47
5	Mix-4	3.04	4.20



Graph 5.3: Results of flexural strengths of varying mix proportions

CONCLUSIONS

General

In the present study, the effect of addition of fly ash and pond ash on the conventional concrete. In the fly ash-based cement concrete, proportion of the element of the binding materialwas 30% fly ash and pond ash. Various proportions of quarry dust and GGBS as fine aggregatesuch 0%, 15%, 20%, 25%, and 30% of binding material by weight. Various mechanical properties such as Compressive strength and flexural strength were studied in this work.

conclusions:

Based on experimental work reported in this study, the following results were developed:

The mixes were casted to 15% fly ash and pond ash varying proportion of 15%, 20%, 25%,30% in OPC and the workability of concrete gradually decreased for mix proportion of C.Cand (fly ash + pond ash).

The results were obtained by test of compressive and flexural of specimens at 7days and 28 days at optimum replacement of fly ash and pond ash found at mix proportion of 15%.8% of fly ash + 7% pond ash as cement replacement and 7.5% of quarry dust + 7.5% ofGGBS as fine aggregate replacement.

The maximum compressive strength and flexural strength achieved at the mix proportionof 15% of replacement of cement and fine aggregate.

For the replacement of cement and fine aggregate, the compressive strength results were attained at 7 days and 28 days with incremental percentage 14.46, 4.79 to proportion of 15% replacement and decreased at the proportion of 30% of cement and fine aggregate replacement when compared to control mix.

The maximum flexural strength results were achieved at 7days and 28 days with incremental percentage of 3.04, 9.0 to the proportion of 15% replacement of cement and fine aggregate.

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