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Experimental study on Strength and setting time of Concrete by using Fly ash and Recycled Aggregate

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Abstract - These days, ecologically inviting building is getting to be a pivotal issue in development industry. The course towards economical concrete includes minimizing the natural affect of concrete generation and as well as diminishing the worldwide CO2 emanations. Universally, the concrete industry expends expansive amounts of characteristic assets, which are getting to be deficiently to meet the expanding requests. At the same time, expansive number of ancient buildings and other structures have come to the conclusion of their benefit life and are being pulverized, coming about in era of pulverized concrete. A few of this concrete squander is utilized as backfill fabric and much being sent to landfills. Reusing concrete by utilizing it as substitution to unused total in concrete may diminish concrete squander and preserve characteristic assets of total. Within the final two decades, assortments of reusing strategies for development and devastation squanders have been investigated and are in well-developed stages. Fly ash is known to be a good pozzolanic material and has been used to increase the ultimate compressive strength and workability of fresh concrete. The approach adopted here includes a 30% substitution of natural aggregates by recycled concrete aggregates as well as the use of (0%,15%,20%,30%) by mass of fly ash as a partial substitute of Portland cement. This paper discusses the strength characteristics of natural and recycled aggregate concrete using fly ash. The most important benefit is reduced permeability to water and aggressive chemicals. This increases strength and reduces permeability

Keywords - Concrete, Flyash, Aggregate, Strength, Permeability

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INTRODUCTION

Concrete is a construction material composed of cement, fine aggregates (sand) and coarse aggregates mixed with water which hardens with time. Portland cement is the commonly used type of cement for production of concrete. Concrete technology deals with study of properties of concrete and its practical applications. In a building construction, concrete is used for the construction of foundations, columns, beams, slabs and other load bearing elements. There are different types of binding material is used other than cement such as lime for lime concrete and bitumen for asphalt concrete which is used for road construction. Water cement ratio plays an important role which influences various properties such as workability, strength and durability. Adequate water cement ratio is required for production of workable concrete. When water is mixed with materials, cement reacts with water and hydration reaction starts. This reaction helps ingredients to form a hard matrix that binds the materials together into a durable stone-like material. Concrete can be casted in any shape. Since it is a plastic material in fresh state, various shapes and sizes of forms or formworks are used to provide different shapes such as rectangular, circular etc. Various structural members such as beams, slabs, footings, columns, lintels etc. are constructed with concrete. ACI 318 Building code requirements for structural concrete and ACI 301 Specifications for Structural Concrete are used in United States as standard code of practice for concrete construction

METHODOLOGY

Experiments were guided on concrete prepared by partial replacement of natural aggregate with 0%, 15%, 20%, 30%, recycled aggregate and cement with 0%, 15%, 20%, 30%, of fly ash,

MATERIALS USED

Cement:

Ordinary Portland cement of grade53 conforming to Indian Standards IS 12269-1987 was used

throughout the experimental program. In general similar types of cements have quite different rheological and strength characteristics

FLYASH: Most fly ash is a pozzolanic material, which means it is a siliceous or siliceous and aluminous material that reacts with calcium hydroxide to form cement. When Portland cement reacts with water, it produces a calcium silicate hydrate and lime. This reaction of fly ash is lime in concrete improves strength. Typically, fly ash is added to the structural concrete 15-35 percent to weight of the cement.

Fine Aggregate: Locally Available sand used for experimental analysis In this project two types of aggregates were using, they are

- Natural aggregates
- Recycled aggregates

Natural aggregates: Coarse Aggregate occupies upto35 to 70% of the volume of the concrete. .Coarse aggregate is crushed granite of 20 mm size has been used as coarse aggregate. Specific gravity of coarse aggregate is 2.75

Recycled aggregate: The recycled aggregate collected from Wagholi Plant of PMC for Recycle ion of construction material ,and Following test will be carried out

MIX DESIGN: Mix design for M40 grade of concrete was prepared by using the guidelines of IS 10262:2009

RESULTS AND DISCUSSION

1 Compressive Strength Results :

Compressive Strength of Concrete (Conventional Concrete) W/C (0.5)

Days	Specimen	C/S Area (mm^2)	Average Strength (N/mm^2)
7	Cube	22500	25
	Cube	22500	
	Cube	22500	
14	Cube	22500	31.46
	Cube	22500	
	Cube	22500	
28	Cube	22500	37
	Cube	22500	
	Cube	22500	

Compressive Strength of Concrete (15 % Fly Ash + 15 % RCA) W/C (0.5)

Days	Specimen	C/S Area (mm^2)	Average Strength (N/mm^2)
7	Cube	22500	26.07
	Cube	22500	
	Cube	22500	
14	Cube	22500	36
	Cube	22500	
	Cube	22500	
28	Cube	22500	37.92
	Cube	22500	
	Cube	22500	

Compressive Strength of Concrete (20% Fly Ash + 20 % RCA) W/C (0.5)

Days	Specimen	C/S Area (mm^2)	Average Strength (N/mm^2)
7	Cube	22500	27.64
	Cube	22500	
	Cube	22500	
14	Cube	22500	32.32
	Cube	22500	
	Cube	22500	
28	Cube	22500	40.79
	Cube	22500	
	Cube	22500	

Compressive Strength of Concrete (30% Fly Ash + 30 % RCA) W/C (0.5)

Days	Specimen	C/S Area (mm^2)	Average Strength

			(N/mm^2)
7	Cube	22500	31.05
	Cube	22500	
	Cube	22500	
14	Cube	22500	36.80
	Cube	22500	
	Cube	22500	
28	Cube	22500	44.2
	Cube	22500	
	Cube	22500	

Split Tensile Strength of Concrete

Tensile Strength Results

Tensile Strength of Concrete (Conventional Concrete) W/C 0.50 Ratio

Days	Sample	Strength (N/mm^2)	Average Strength (N/mm^2)
7	Cylinder	4.10	4.15
	Cylinder	4.13	
	Cylinder	4.19	
14	Cylinder	4.45	4.50
	Cylinder	4.56	
	Cylinder	4.50	
28	Cylinder	4.90	**4.98**
	Cylinder	4.92	
	Cylinder	5.4	

Split Tensile Strength of Concrete (15 % Fly Ash + 15 % RCA) W/C (0.5

Days	Sample	Strength (N/mm^2)	Average Strength (N/mm^2)
7	Cylinder	4.1	4.2
	Cylinder	4.3	
	Cylinder	4.2	
14	Cylinder	4.7	4.8
	Cylinder	4.9	
	Cylinder	4.8	
28	Cylinder	5.10	**5.15**
	Cylinder	5.20	
	Cylinder	5.25	

Split Tensile Strength of Concrete (20% Fly Ash + 20 % RCA) W/C (0.5)

Days	Sample	Strength (N/mm^2)	Average Strength (N/mm^2)
7	Cylinder	4.59	4.58
	Cylinder	4.57	
	Cylinder	4.58	
14	Cylinder	5.25	5.3
	Cylinder	5.40	
	Cylinder	5.28	
28	Cylinder	5.77	**5.79**
	Cylinder	5..79	
	Cylinder	5.90	

Split Tensile Strength of Concrete (30% Fly Ash + 30 % RCA) W/C (0.5)

Days	Sample	Strength (N/mm^2)	Average Strength (N/mm^2)
7	Cylinder	5.20	5.15
	Cylinder	5.25	
	Cylinder	5.15	
14	Cylinder	5.7	5.8
	Cylinder	5.9	

	Cylinder	5.9	
28	Cylinder	6.010	**6.12**
	Cylinder	6.12	
	Cylinder	6.30	

Flexural Strength of Concrete Test:

Flexural Strength Test of Concrete (Conventional Concrete) W/C 0.50

Days	Specimen	$F_b=\frac{M}{I}xy$ (N/mm^2)	Average Strength (N/mm^2)
7	Beam	4.00	4.15
		4.10	
		4.20	
14	Beam	4.20	4.50
		4.80	
		4.60	
28	Beam	5.10	4.90
		4.80	
		4.90	

Flexural Strength Test of Concrete (15 % Fly Ash + 15 % RCA) W/C (0.5)

Days	Specimen	$F_b=\frac{M}{I}xy$ (N/mm^2)	Average Strength (N/mm^2)
7	Beam	4.30	4.25
		4.20	
		4.60	
14	Beam	4.90	5.10
		5.20	
		5.30	
28	Beam	5.10	5.20
		5.30	
		5.21	

Flexural Strength Test of Concrete (20% Fly Ash + 20 % RCA) W/C (0.5)

Days	Specimen	$F_b=\frac{M}{I}xy$ (N/mm^2)	Average Strength (N/mm^2)
7	Beam	4.60	4.50
		4.65	
		4.70	
14	Beam	5.70	5.70
		5.80	
		5.90	
28	Beam	5.80	5.79
		6.05	
		5.88	

Flexural Strength Test of Concrete (30% Fly Ash + 30 % RCA) W/C (0.5)

Days	Specimen	$F_b=\frac{M}{I}xy$ (N/mm^2)	Average Strength (N/mm^2)
7	Beam	5.10	5.20
		5.25	
		5.30	
14	Beam	5.21	5.25
		5.30	
		5.40	
28	Beam	6.120	6.20
		6.20	
		6.30	

CONCLUSION

The effects of fly ash on these properties are studied. The following are the conclusions that can be drawn from the experimental investigation. The following conclusions are drawn from the results: The workability of the concrete has increased by 15% when 50% RAC is used while compared to normal concrete. While increasing the percentage of RAC the workability got decreased. The average 28 days compressive strength of M40 grade concrete has increased by 14% when replacement of RAC was up to 50%, further on increasing the RAC the compressive strength decreases gradually

- As shown from the values obtained the slump value increased for partial replacement cement with fly ash and RCA. up to 30% and then it decreased.
- Compressive strength of the mortar design mix was check by casting and testing of cubes after the curing period of 7 ,14 days & 28days and the optimium value is obtained at 30%.
- The optimum value for flexural strength is obtained from the replacement of 30%.
- The optimum value for split tensile testis obtained from the replacement of 30%

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