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Strength Studies on Concrete with Recycled Aggregates and Cement with Metakaolin

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Abstract: *Concrete is one of the most widely used construction material in the world. Recent technology has greatly improved the recycling process for waste concrete. Due to the critical shortage of natural aggregate, the availability of demolished concrete for use a recycled concrete aggregate is increasing. The study presents on the natural aggregates and recycled aggregates and also the effect of mineral admixture (metakaolin) on the strength studies. The use of metakaolin in concrete to achieve high strength and durable of concrete. The experimental work on the recycled aggregate and natural aggregates are replaced of 0%,50,100%, replacement of natural aggregate of recycled aggregates were casting in respectively the concrete mixed designed using M30 grade. In the cement partial replacement of metakaolin in 15% used for all mixtures. In the cement partial replacement of metakaolin in 5%,10%, 15%,20% used for all mixtures. The compressive strength of concrete has been determined after 7&28 days are curing compared with the results of concrete. The result shows the 15% of metakaolin and 50% recycled aggregates is high strength in concrete. The compressive strength and split tensile strength of the concrete.*

Keywords: Fly Ash, GGBS, Sodium Hydroxide and Sodium Silicate

I. INTRODUCTION

The problem of waste disposal has become a major problem in the developed countries as well as developing countries like India. This is due to the enormous increase in the quantity of disposable materials, the continuing storage of dumping sites, increase in the cost of transportation and its disposal. The large-scale depletion of Natural Aggregate (NA) and the increased amounts of construction and demolition waste going to landfill sites are causing significant damage to the environment and developing serious problems denting the public and the environmentalist's aspirations for a waste-free society. Therefore, the concept of recycling the waste material and using It again in some form has gathered momentum. Also, recycling not only solves the problem of waste disposal but also reduces the cost and conserves the non-renewable natural sources Demolition waste generated in many countries is no exception to the above problem. And hence, recycling technology is making considerable headway in the recycling of demolished concrete. In India too, the same trend of depletion of the aggregate reserves.

II. OBJECTIVES

The main objective was to study suitability and effect of coarse recycled aggregate in new generation concretes.

1. Compressive, split strength parameters were considered.
2. The strengths are studied at 7 and 28 days of curing.

III. MATERIALS

Raw materials required for the concreting operations of the present work are cement, fine aggregate, coarse aggregate, dolomite powder, crushed sea shell powder and water.
The properties of cement are presented in Table 1.

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Table 1: Physical properties of cement

S.NO	DESCRIPTION	VALUES
1	Specific Gravity	3.16
2	Fineness of cement	9%

Table 2: Chemical Composition of Cement of 53 grade

S.NO	DESCRIPTION	COMPOSITION	PERCENATGES
1	Lime	Cao	60-67%
2	Silica	Sio_2	18-25%
3	Ironoxide	Fe_2o_3	0.5-6%
4	Alumina	Al_2o_3	5-9%
5	Gypsum	$Caso_4$	1-4%
6	Magnesiumoxide	Mgo	0.1-4%
7	Sulphur oxide	So_3	1-3%
8	Alkaliessuchas soda	$Naok_2o$	0.5-1.3%

IV. EXPERIMENTAL INVESTIGATIONS

4.1 Compressive Strength Test

The cube specimens of 150mm x 150mm x150mmwere cast and tested in compression testing machine for 7 and 28days of curing period for different proportions of concrete mix and presented.

Table 3: Compressive strength of concrete with recycled aggregates and cement with metakolin

MIX TYPE	Compressive strength, N/mm^2		
	28 days	56 days	90 days
NC	39.30	42.58	45.97
MK5	45.81	49.76	53.78
MK10	48.06	52.36	56.52
MK15	49.50	53.72	58.01
MK20	48.33	52.54	56.97
%RCA50	33.80	36.82	39.53
MK15RCA50	46.88	50.84	54.89
RCA100	29.69	32.35	34.75+
MK15RCA100	40.89	44.54	48.12

4.2 Split Tensile Strength Test

At the age of 7 and 28days, the cylindrical specimens (150mm diameter x 300mm height) were tested for evaluating the split tensile strength. The experiment is performed by putting a cylindrical sample horizontally between a compression testing machine loading surface and the load is applied until the cylinder fails along the vertical diameter.

Table 4: Split tensile strength of concrete with recycled aggregates and cement with metakolin.

MIX TYPE	Split tensile strength, N/mm^2		
	28 days	56 days	90 days
NC	3.81	4.13	4.44
MK5	4.53	4.91	5.25
MK10	4.66	5.06	5.54
MK15	4.82	5.24	5.59
MK20	4.77	5.20	5.56
%RCA50	3.30	3.61	3.92
MK15RCA50	4.56	4.94	5.29

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RCA100	2.93	3.18	3.45
MK15RCA100	3.99	4.33	4.64

V. CONCLUSION

In this study, the concrete ingredients like cement is partially replaced by metakaolin and coarse aggregates are partially replaced by recycled aggregates respectively. Metakaolin various different percentages of 5%, 10%, 15%, 20% and recycled aggregates is various from different percentages of 0%, 50%, 100%.

1. At 15% partial replacement of metakaolin with cement the compression strength of concrete at 7 and 28 days are 34.54 and 49.50 N/mm^2.
2. At 15% partial replacement of metakaolin with cement the split tensile strength of concrete at 7 and 28 days are 3.36 and 4.82N/mm^2.
3. At 50% partial replacement of recycled aggregates with coarse aggregate the compression strength of concrete at 7 and 28 days are 23.28and 33.80 N/mm^2.
4. At 50% partial replacement of recycled aggregates with coarse aggregate the split tensile strength of concrete at 7 and 28 days are 2.27 and 3.30 N/mm^2.
5. At 15% partial replacement of metakaolin with cement and 50% partial replacement of recycled aggregates with coarse aggregate the compression strength of concrete at 7 and 28 days are 31.78 and 46.88 N/mm^2.
6. At 15% partial replacement of metakaolin with cement and 50% partial replacement of recycled aggregates with coarse aggregate the split tensile strength of concrete at 7 and 28 days are 3.09 and 4.56 N/mm^2.

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