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Analysis Of M_{45} Grade Concrete With Substitution Of 30% Recycled Coarse Aggregate & Renewal Of Cement By Fly Ash With Inclusion Of 2% Hooked Steel Fibres

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ABSTRACT

One of the major challenges of the present situation is to protect the environment. Present natural sources are declining rapidly and on other hand handling the waste management of C&D (Construction & Demolition) waste has become a challenge for the construction industry and its adverse effect on the environment. The problem can be resolved by exploiting the utilization of waste from building demolition waste as a sustainable material.

In present research on M_{45} grade concrete, mix ratio of 1:1.73:2.93 with w/c ratio 0.35 was adopted , the experiment involved with 30% replacement of conventional aggregates by re-cycled coarse aggregates (RCA) and partial replacement of cement by Fly Ash (FA) with percentage variation ranging from 6%,12%,24% & 48%. Further 2% steel fibers (hooked) were introduced to prepare mix. From the results, Mix-4 shows appreciable improvement in Compressive, Split tensile & Flexural strength So Mix-4 is originated to be optimal

KEYWORDS: Recycled Aggregates (RCA), Fly ash (FA), Steel Fibers (SF)

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I. INTRODUCTION

Cement mortar and concrete are most widely used building material. It is difficult to point out another material of construction which is as versatile as concrete. It is the material of choice where strength, performance, durability, impermeability, fire resistance, and abrasion resistance are required. With the increase in the development of construction industry, the demand for concrete also increased.

With an increase in large quantities of construction and demolition waste due to the demolition of an old concrete structure, building rehabilitation, reconstruction of building etc. it's become a new aggregate source I,e recycled aggregate for concrete and received much more attention due to its environmental and economic benefit.

The construction industry is a sector which consumes natural aggregates rapidly and generates tons of waste. For evaluating the waste generated by building demolition and construction, building rehabilitation etc. it requires a waste management planning. Waste management is a method of management including reducing the waste in their source, separating according to their properties, collecting, temporary storing, recovering, carrying, disposing and controlling. In these study mechanical properties of concrete produced by using recycled aggregate is examined.

II. LITERATURE REVIEW

The partial & full substitution of conventional aggregates by re-cycled coarse aggregates in fly ash-based concrete, for substitution in RCA is mixed with a different percentage ranging from 0%, 30%, 50% and 100% by an outcome shows lower in the carbonation chloride diffusion by embedding high quantity of RCA.[1]. The outcome explains the use of RCA and high amount of fly ash, for this they have used (0%, 50% & 100%) of fine RCA, (0%, 30% & 60%) of fly ash without super plasticizer and each of fines RCA (0% & 100%) coarse RCA is used. They have repeated the more than half of the concrete Mix with adding up the SP to inspect the effect of admixture & w/b ratio. The outcome of the study shows that there is a decrement in the joint cause of both FA & RCA was bring into being lower than the effect of a personage of FA & RCA[3]. This proposal explains the study on mechanical assets of recycled aggregate concrete (RCA) comparing with conventional concrete. Compressive strength & indirect shear strength are tested on 1,3,7,14,28 & 56 days. Results show that 28days compressive, flexure & split tensile strength of RCA were on average 90% of those of conventional aggregate with same mix proportion. And 56days cube strength was 5% & 3% superior than 28days strength of RCA & conventional concrete.[9]. We all know that by using recycled aggregates in the concrete, compressive strength will be reduced and concrete will become less durable. So this study presents make use of fly-ash (class F) in concrete to diminish the inferior quality of RCA. The outcome of the study shows a high percentage of RCA can use by incorporating the 25 to 35% fly ash And the drawbacks which are activated by RCA will minimize. [10]. In this study concrete is prepared by using 0%, 50% & 100% of recycled concrete aggregate & renewal of cement by fly ash with percentage variation ranging from 25%,35% & 55% and this RCA were cured in water for 10years for finding out the durability and mechanical properties of concrete. The outcome shows mix arranged with 55% of FA shows the appreciable improvement in compressive strength & elastic modulus. Fly-Ash increases carbonation intensity & also improves refusal to chloride ion diffusion [11]. This study is on finding out the fresh properties I,e density, slump & air content of concrete. Here in this study conventional coarse aggregates are replaced by recycled coarse aggregates (RCA) with the percentage ranging 0% & 100 %, and for above mixes, 0 %, 50 %, 100% of RCA fine were used along with 0%, 30% & 60% of fly ash is used. The result shows RCA decrease the concrete slump, but water willing can diminish by fusion of fly ash. And by incorporation of the FA in RCA density & air content remains at acceptable levels [5]

III. MATERIALS AND METHODOLOGY

For this study for M_{45} grade mix design, recycled aggregate, fly ash and steel fibers with appropriate Proportions of the following materials were used to prepare concrete mix.

Table: 1 Various Materials used

Sl No	Materials Used
01	Binders: Cement
	: Fly ash
02	Fine aggregate
03	Natural coarse aggregate
04	Recycled coarse aggregate
05	Water
06	Steel fibers
07	Super plasticizer

2.1 BINDERS: Cementitious material OPC 53 grade ULTRATECH cement confirming to BIS specification on IS:12269-1987 obtained from local market sai agencies nearby Basaveshwar hospital is used and Class-F Fly ash collected from Raichur Thermal Power Station (RTPS) Raichur, Karnataka Confirming to specification IS 3812 (Part I & II -2003) is used in this analysis.

2.2 AGGREGATES: Natural & Recycled Aggregates (RCA) are used in this investigation. Fresh crushed coarse aggregate collected from the Lahoti crusher nearby Shetty Engineering College Kalaburagi are used in this study. Natural watercourse sand confirming to IS 383-1970 is used collected from the local market. Recycled coarse aggregate obtained from the RCC roof demolition at GPT Kalaburagi.

2.3 WATER: Potable water which Satisfies IS 450:2000 which is free from salt and which is clear for the mixing of concrete.

2.4 STEEL FIBERS: Hocked steel fibers with Aspect Ratio L/D 50. Length 50mm and diameter of 1mm.

2.5 SUPER PLASTICIZER: CONPLAST Super Plasticizer 430 confirms with BS 5075, BS: EN 934-2 with ASTM C494named super plasticizer is used in this study. It improves the workability and reduces the w/c ratio. Dosage is fixed as per the guidelines and requirements

Table 2: Mix proportion

Mix-Type	Utilization of RCA (%)	Steel-Fibres (%)	Utilization of Fly Ash (%)
Mix-1	0	0	0
Mix-2	30	2	6
Mix-3	30	2	12
Mix-4	30	2	24
Mix-5	30	2	48

IV. EXPERIMENTAL METHODOLOGY

For the present investigation total no of 45 cubes are cast for compressive strength, 30 no's of beams are cast for flexural strength test and 30 no's of cylinders are cast for the split tensile strength test.

These specimens are cured in fully immersed water for 3 days, 7 days & 28 days for Compressive Strength Test, 7 days and 28 days for Split Tensile Strength Test and Flexural Strength Test.

Table no 3 Shows the present investigation tests

Fresh Concrete	Hardened Concrete
Slump cone test	Compressive strength test
Compaction factor test	Split tensile strength test
	Flexural strength test

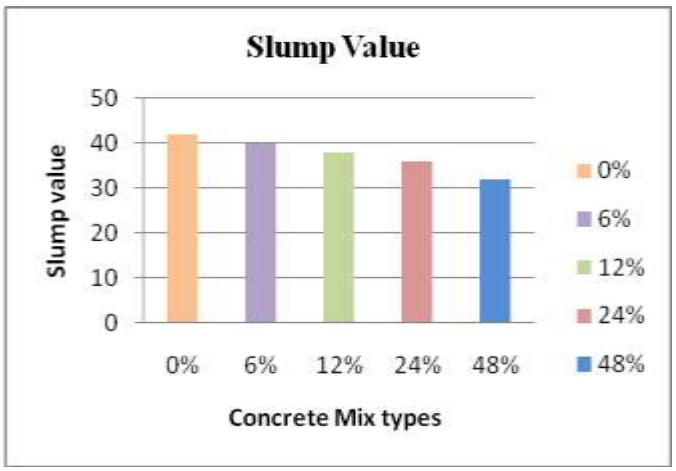
V. RESULTS AND DISCUSSION

5.1 Results of fresh state concrete.

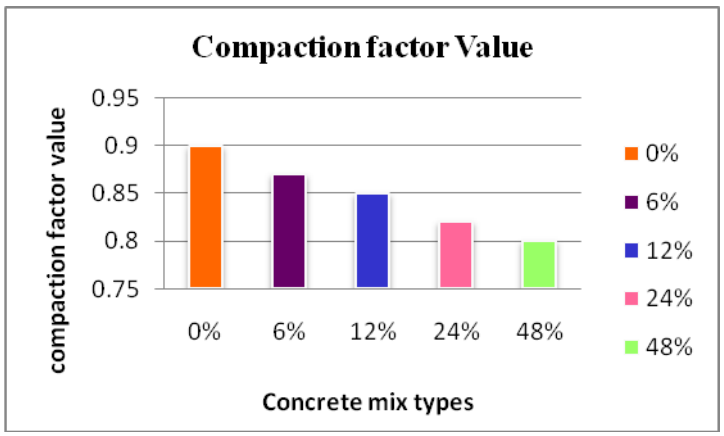
1. Slump and Compaction factor Test

Table 4 Shows The Result of Slump Cone & Compaction factor Value

SL No	Concrete Type	Slump value (mm)	Compaction factor
1	Mix-1	42	0.90
2	Mix-2	40	0.87
3	Mix-3	38	0.85
4	Mix-4	36	0.82
5	Mix-5	32	0.80



Graph 1 show: Calibration Slump Value



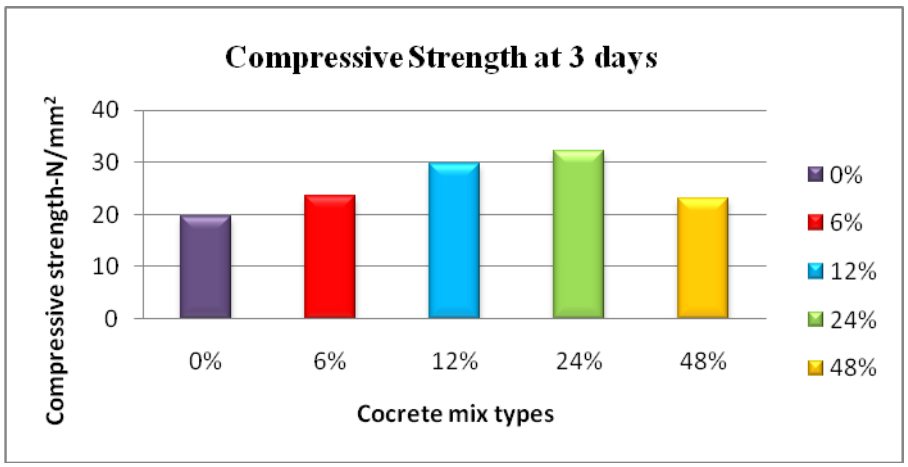
Graph 2 shows: Calibration Compaction Factor Value

5.2 Results of Hardened state of concrete

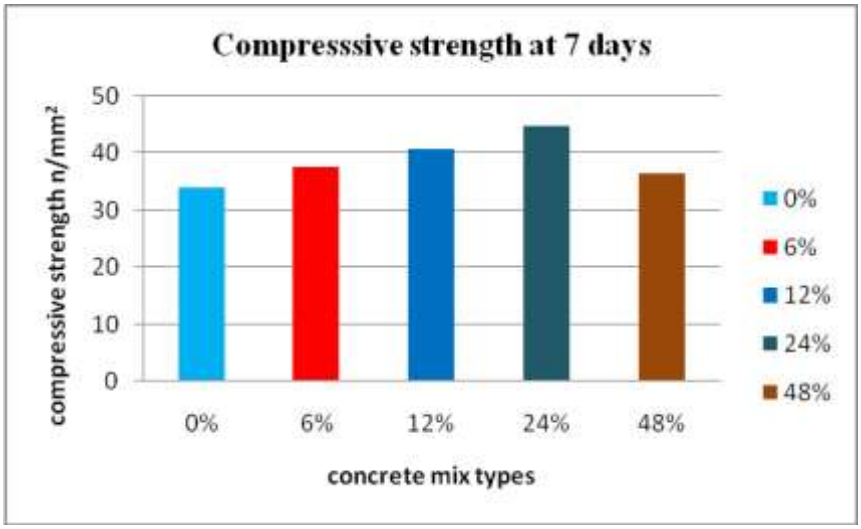
1. Compressive Strength Test

Table 5 Shows the Compressive-Strength of Specimen

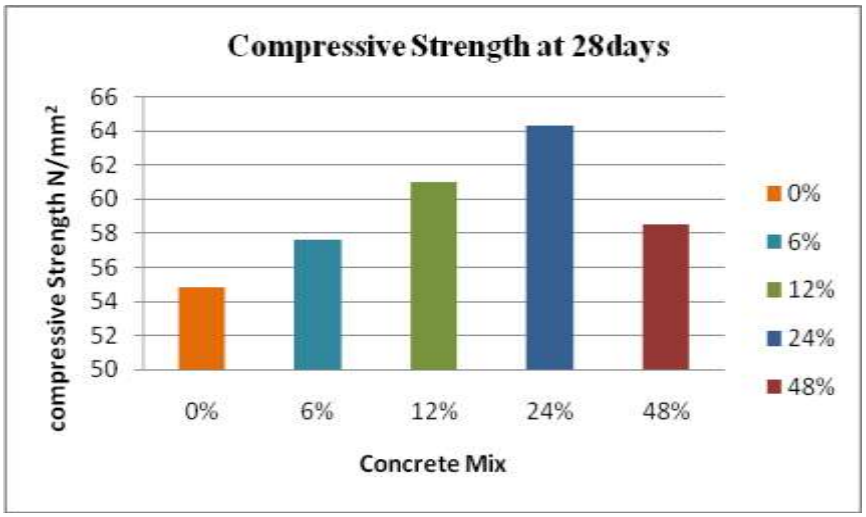
Sl No	Concrete Type	Average Compressive-Strength of Specimen in N/mm^2 at Curing in Days		
		3 Days	7 Days	28Days
1	Mix-1	19.55	33.90	54.81
2	Mix-2	23.55	37.47	57.62
3	Mix-3	29.62	40.73	61.03
4	Mix-4	32.29	44.73	64.29
5	Mix-5	23.11	36.58	58.51



Graph No 3.Compressive strength at 3days



Graph 4.Compressive strength @ 7days

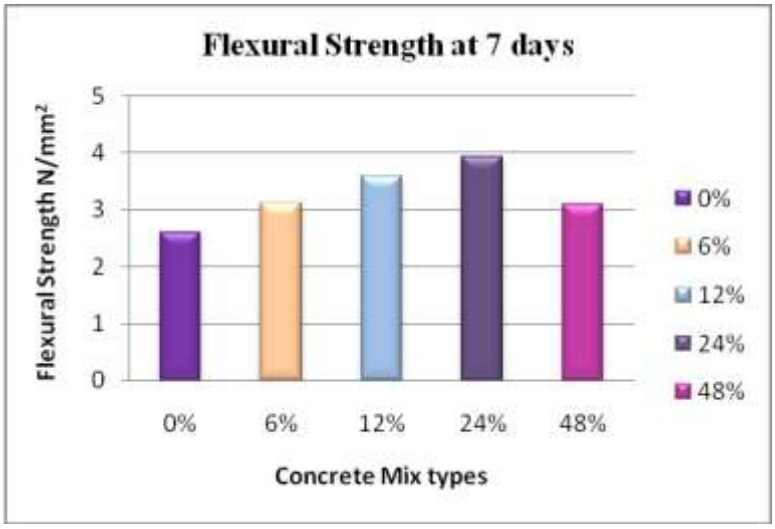


Graph 5.Compressive strength @ 28days

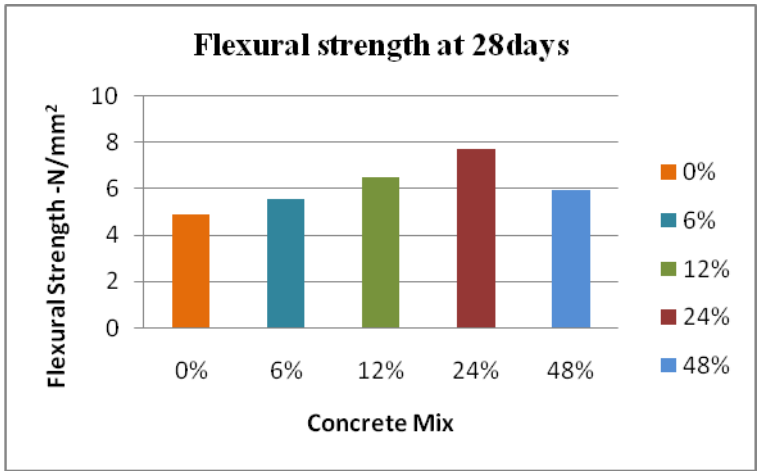
2. Flexural Strength Test

Table 6 Shows the Flexural Strength of Specimen

l No	Concrete Type	Average Flexural Strength of Specimen in N/mm^2 at Curing in Days	
		7 Days	28Days
1	Mix-1	2.60	4.90
2	Mix-2	3.11	5.56
3	Mix-3	3.60	6.48
4	Mix-4	3.93	7.72
5	Mix-5	3.10	5.97



Graph 6.Flexural strength @ 7days

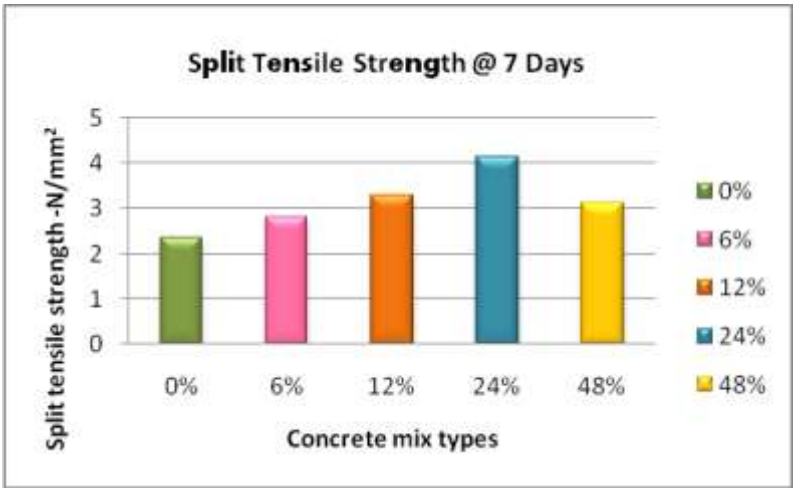


Graph 7.Flexural strength @ 28days

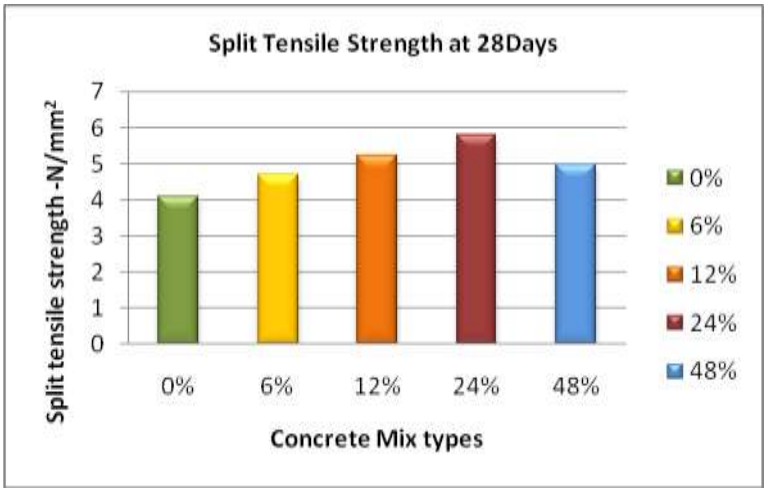
3. Split-Tensile Strength Test

Table 7 Shows the Split Tensile Strength of Specimen

Sl No	Concrete Type	Average Split Tensile Strength of Specimen in N/mm^2 at Curing in Days	
		7 Days	28Days
1	Mix-1	2.35	4.10
2	Mix-2	2.82	4.71
3	Mix-3	3.29	5.23
4	Mix-4	4.14	5.79
5	Mix-5	3.11	4.99



Graph 8 Split Tensile Strength @7Days



Graph 9 Split Tensile Strength @ 28Days

VI. CONCLUSIONS

1. All the strengths (Compression, Flexural and Split Tensile Strengths) are the upper side for 24% of fly
2. ash, 30% of RCA and 2% of steel fibers related to that created from 6%, 12%, and 48%.
3. Compressive strength of concrete of 24% fly ash,30% RCA And 2% steel fibers is almost 10mpa mores
4. than the traditional concrete @ 28days.
5. Split tensile strength of concrete of 24% fly ash,30% RCA and 2% steel fibers is almost 1Mpa more than
6. the traditional concrete @ 28 days.
7. This concrete has been produced by replacing the 30% of natural coarse aggregates by a natural coarse
8. aggregate and replacing the cement by fly ash with different variations I,e 6%,12% 24% and 48%.
9. In this study, we are able to conclude that progressive reduction altogether the strengths by
10. increasing share of the replacement of cement by fly ash.
11. The coarse recycled aggregates utilized in this study had a lower relative density and better water
12. absorption compared to the natural coarse aggregates.

VII. FUTURE SCOPE OF STUDY

1 Here in this study, we replaced the natural coarse combination (aggregates) with recycled coarse Combinations (aggregates) at 30% it's negligible. For future scope, we can increase the replacement Percentage up to 50% or 100%

2 For future scope, we can also replace the cement with GGBS, SCBA, Rice husk ash etc.

3 For further study, we can also change the variation of the fly ash.

4 One can replace the fine mixture and coarse mixture with M sand or natural alternative aggregates and investigate the recent and hardened properties of concrete.

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