EVALUATION OF STRENGTH OF RECYCLED COARSE AGGREGATE USING TERNARY BLENDED CONCRETE WITH FLY ASH AND GGBFS

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ABSTRACT: **The needs of the use of construction and demolition wastes have increased due to the rapid evolution. The demolition wastes are not properly disposed resulted in very harmful for the environment. Today the use of demolition wastes is in landfill, but this paper represents the demolition wastes in aggregates recycling after use in concrete.**
In this study, the natural coarse aggregate with replaced various percentage recycled coarse aggregate and cement replaced by the industry waste of fly ash andground granulated blast furnace slag(GGBFS), after concrete in checked out various properties. The Recycled Coarse Aggregate replaced with 20% of interval upto 60% with Natural Coarse Aggregate. The byproduct GGBFS is used up to 20% and fly ash is used up to 20%.
Different water cement ratio used with all replacement used in concrete. In this paper the water cement ratio of 0.50 and 0.55 were used.

INTRODUCTION

Day to day new construction is demeaned with raise in population. Cement, coarse aggregate, fine aggregate and water by the making concrete. Concrete is making by the various water cement ratio and also various grade of concrete. Cement is the important role for making concrete and also it is costlier than other. There was estimate that production of cement was about 3 billion tons in 2009 and the extended production of cement is about 5.9 billion tons by 2020. Cement industry in about 7% of co_2 emitted on atmosphere. So, cement is harmful material for environment.

Ground granulated blast furnace slag (GGBFS) is the byproduct of steel plant and fly ash is also byproduct of thermal plant. Both material has some property and also resistance to alkali aggregate reaction. Both material have some property similar to near about as a cement property. So, fly ash and ggbfs is use as supplementary cementitious material in concrete and use maximum amount without change cement properties. Recycled coarse aggregate is obtained by the demolition of structure and rigid pavement. So, Recycled coarse aggregate replaced with natural coarse aggregate. Increasing recycled coarse aggregate replace with natural coarse aggregate resulted in decrease strength. So, recycled coarse aggregate replace with natural coarse aggregate is positive as environment aspect and economical. Recycled coarse aggregate partial replace with natural coarse aggregate.

SIGNIFICANCE OF THE WORK

In present work is using recycled coarse aggregate with fly ash and GGBFS with various water cement ratio of 0.50 and 0.55. Use of fly ash and GGBFS by the improve performance of concrete. So, maximum percentage replacement of fly ash and GGBFS and recycled coarse aggregate is use in concrete as with respect to strength.

MATERIALS

CEMENT

IS 12269, 1987 conforming of Ordinary Portland Cement (OPC) of Ultra Tech 53 grade cement was used.

NATURAL FINE AGGREGATE

Natural Fine Aggregate used for study asconforming to zone I of IS: 383, 1987. Natural fine aggregate size less than 4.75mm.

	NATURAL FINE AGGREGATES
Specific gravity	2.74
Water absorption	1.0%
Moisture content	Nil

NATURAL COARSE AGGREGATE

Natural coarse aggregate size is maximum 20mm used for study as conforming to IS: 383, 1970.

	NATURAL COARSE AGGREGATES
Specific gravity	2.75
Water absorption	1.40%
Moisture content	Nil

WATER

Casting and curing in potable water available in the college was used.

GROUND GRANULATED BLAST FURNACE SLAG (GGBFS)

GGBFS is cementitious material. It is obtained from Kutch Iron plant. GGBFS was bought from the Stallion Energy Pvt. Ltd. The specific gravity of GGBFS is 2.85.

Sr No.	Test	Result Obtained	Requirement as per IS- 12089-1987
1	Insoluble Residue (%)	0.51	5(Max)
2	Magnesia Content (%)	8.21	17(Max)
3	SulphideSulphur (%)	0.59	2(Max)
4	Sulfate Content (%) So3	0.22	-
5	Loss on ignition (%)	0.75	3.00(Max)
6	Maganese Content (%)	0.3	5.5(Max)
7	Chloride Content (%)	0.009	-
8	Moisture Content (%)	0.005	-
9	Glass Content (%)	96	85(Min)

FLY ASH

Fly ash is cementitious material. It is obtained from Gandhinagar thermal power plant. Fly ash was bought from the Stallion Energy Pvt. Ltd. The specific gravity of fly ash is 2.1.

Sr. No.	TEST	UNIT	OBTAINED RESULT	IS specification
1	Loss on ignition	%	<1	5% Max by Mass
2	Silica as SiO2	%	62.57	35% Min by mass
3	Alumina as Al2O3	%	12.11	-
4	Magnesium as MgO	%	0.85	5 % Max by mass
5	Sulphur Trioxide SO3	%	N/A	3% Max by mass
6	Calcium as Cao	%	8.16	-
7	Iron Oxide as Fe2O3	%	N/A	
8	Alkalies	%	0.007	
9	Reactive Silica	%	>20	

RECYCLED COARSE AGGREGATE

The residential building demolition waste collected. The Residential building age is about 30 years. Demolition waste in separated aggregate and this study in use aggregate size 20mm and 4.75mm. Recycled aggregate properly wash after use in concrete mix.

	RECYCLED COARSE AGGREGATES
Specific gravity	2.52
Water absorption	4.40%
Moisture content	1.08%

MIX PROPORTIONING

In this study conventional batch of water cement ratio 0.55 and 0.50 was casted after compare with percentage replacement of recycled coarse aggregate and fly ash and ggbfs batch.

As per code IS: 10262,2009, Conventional mix design of concreteis given below.

w/c ratio	Cement (kg)	Water (lit)	NCA (kg)	NFA (kg)
0.55	358.18	213	1137.67	783.63
0.50	394	213	1110.5	751.22

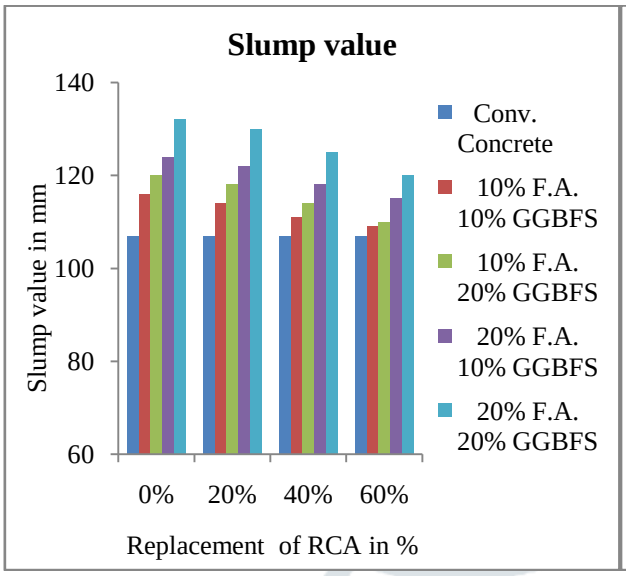
Details of various batches casted as the partial replacement

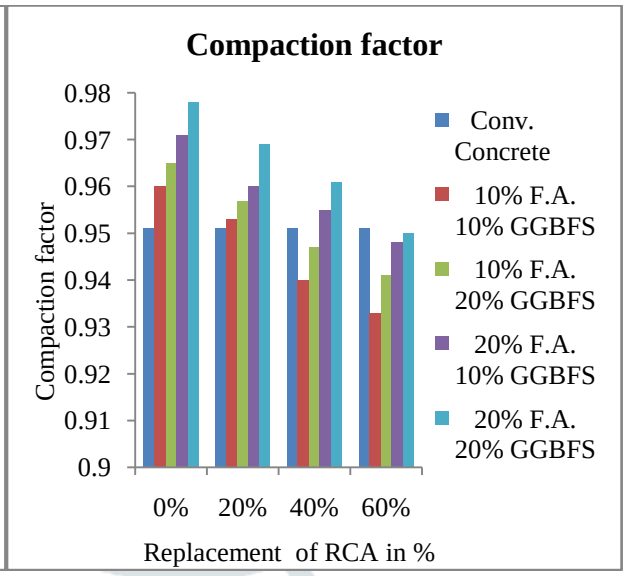
BATCH NO.	W/C RATIO	DESCRIPTION	NO. OF SPECIMENS		
			CUBE	BEAM	CYLINDER
A1	0.55	100%C 100%NCA	9	3	3
A2	0.55	80%C 10%FA 10%GGBFS 100%NCA	9	3	3
A3	0.55	70%C 10%FA 20%GGBFS 100%NCA	9	3	3
A4	0.55	70%C 20%FA 10%GGBFS 100%NCA	9	3	3
A5	0.55	60%C 20%FA 20%GGBFS 100%NCA	9	3	3
A6	0.55	80%C 10%FA 10%GGBFS 80%NCA 20% RCA	9	3	3
A7	0.55	70%C 10%FA 20%GGBFS 80%NCA 20% RCA	9	3	3
A8	0.55	70%C 20%FA 10%GGBFS 80%NCA 20% RCA	9	3	3
A9	0.55	60%C 20%FA 20%GGBFS 80%NCA 20% RCA	9	3	3
A10	0.55	80%C 10%FA 10%GGBFS 60%NCA 40% RCA	9	3	3
A11	0.55	70%C 10%FA 20%GGBFS 60%NCA 40% RCA	9	3	3
A12	0.55	70%C 20%FA 10%GGBFS 60%NCA 40% RCA	9	3	3
A13	0.55	60%C 20%FA 20%GGBFS 60%NCA 40% RCA	9	3	3
A14	0.55	80%C 10%FA 10%GGBFS 40%NCA 60% RCA	9	3	3
A15	0.55	70%C 10%FA 20%GGBFS 40%NCA 60% RCA	9	3	3
A16	0.55	70%C 20%FA 10%GGBFS 40%NCA 60% RCA	9	3	3
A17	0.55	60%C 20%FA 20%GGBFS 40%NCA 60% RCA	9	3	3
B1	0.5	100%C 100%NCA	9	3	3
B2	0.5	80%C 10%FA 10%GGBFS 100%NCA	9	3	3
B3	0.5	70%C 10%FA 20%GGBFS 100%NCA	9	3	3
B4	0.5	70%C 20%FA 10%GGBFS 100%NCA	9	3	3
B5	0.5	80%C 10%FA 10%GGBFS 80%NCA 20% RCA	9	3	3
B6	0.5	70%C 10%FA 20%GGBFS 80%NCA 20% RCA	9	3	3
B7	0.5	70%C 20%FA 10%GGBFS 80%NCA 20% RCA	9	3	3
B8	0.5	60%C 20%FA 20%GGBFS 80%NCA 20% RCA	9	3	3
B9	0.5	80%C 10%FA 10%GGBFS 60%NCA 40% RCA	9	3	3
B10	0.5	70%C 10%FA 20%GGBFS 60%NCA 40% RCA	9	3	3
B11	0.5	70%C 20%FA 10%GGBFS 60%NCA 40% RCA	9	3	3
B12	0.5	60%C 20%FA 20%GGBFS 60%NCA 40% RCA	9	3	3
B13	0.5	80%C 10%FA 10%GGBFS 40%NCA 60% RCA	9	3	3
B14	0.5	70%C 10%FA 20%GGBFS 40%NCA 60% RCA	9	3	3
B15	0.5	70%C 20%FA 10%GGBFS 40%NCA 60% RCA	9	3	3
B16	0.5	60%C 20%FA 20%GGBFS 40%NCA 60% RCA	9	3	3
B17	0.5	60%C 30%FA 10%MS 40%NCA 60%RCA NFA	9	3	3

Results

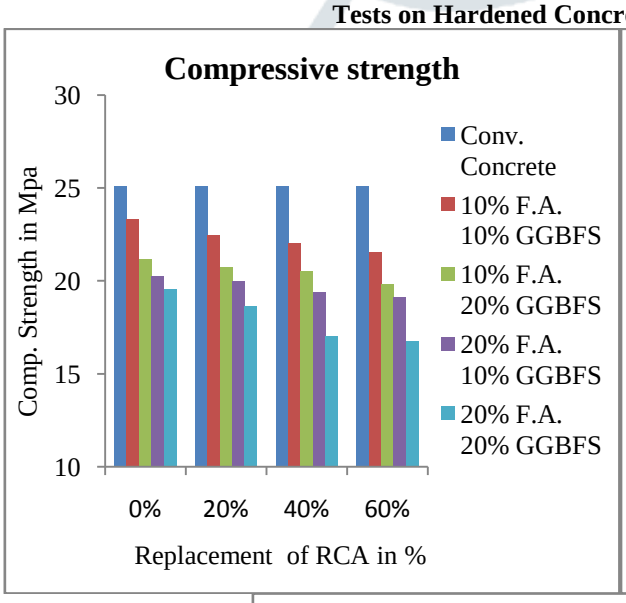
In this paper, mix design in use water cement ratio 0.50 and 0.55 with various percentage replacement of recycled coarse aggregate and fly ash and ggbfs also use. This study was carried out slump test, compaction factor test, Compressive Strength, flexural strength, split tensile test.

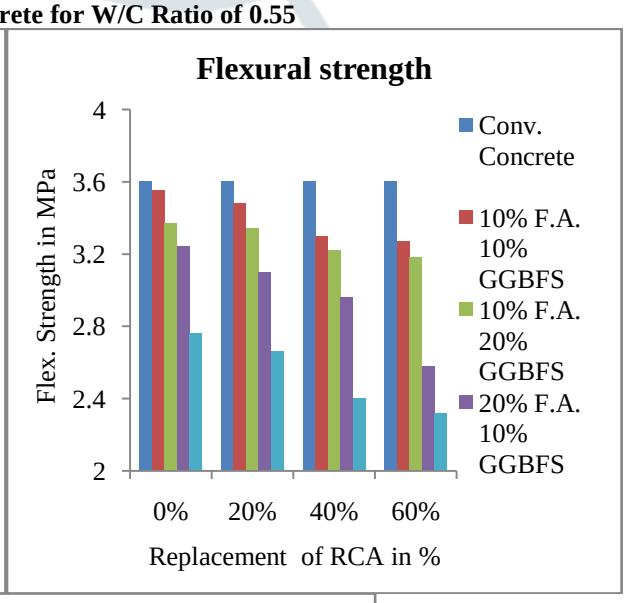
Tests on Fresh Concrete for W/C Ratio of 0.55

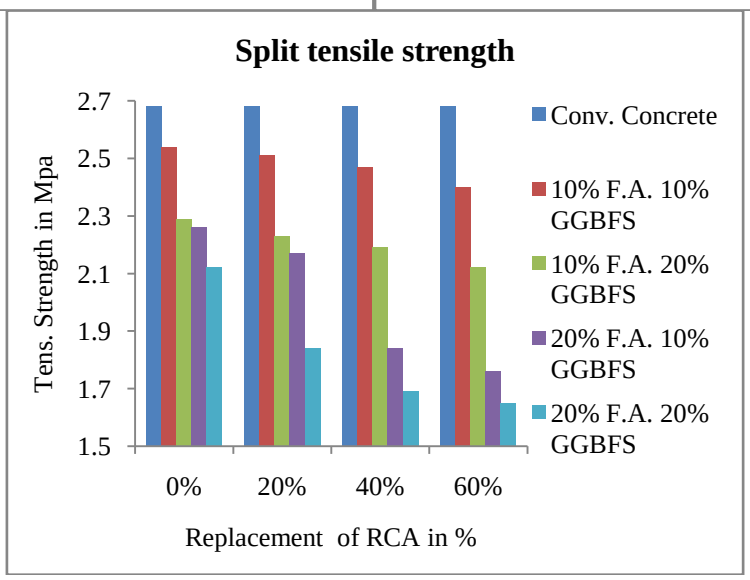




Tests on Hardened Concrete for W/C Ratio of 0.55

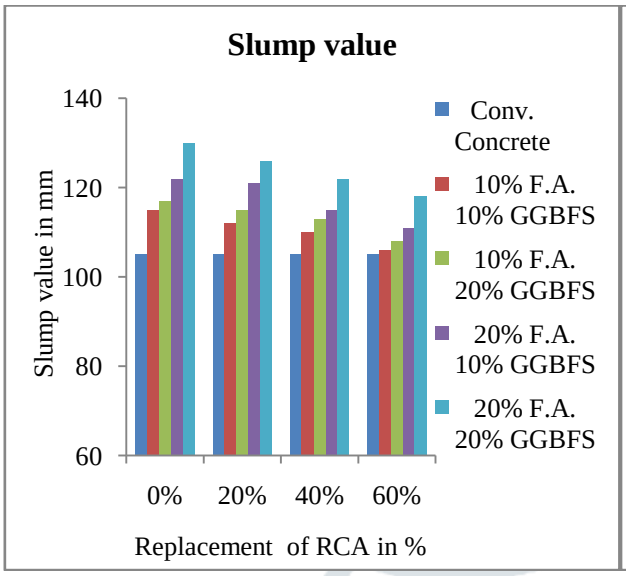


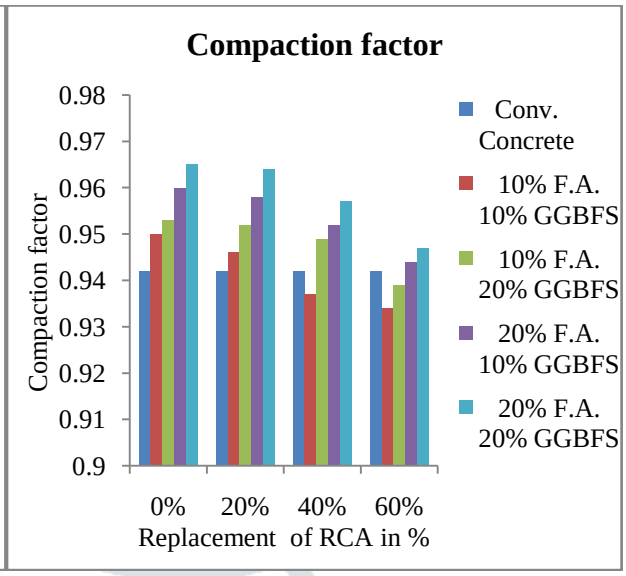




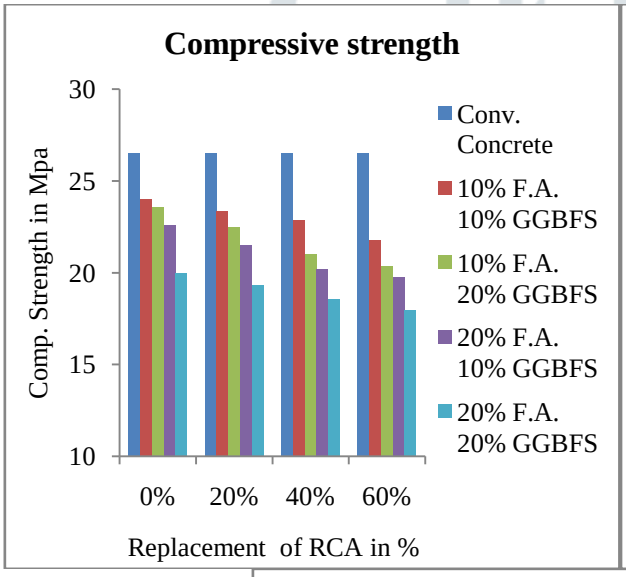
Results of each tests for water cement ratio 0.50 are given below

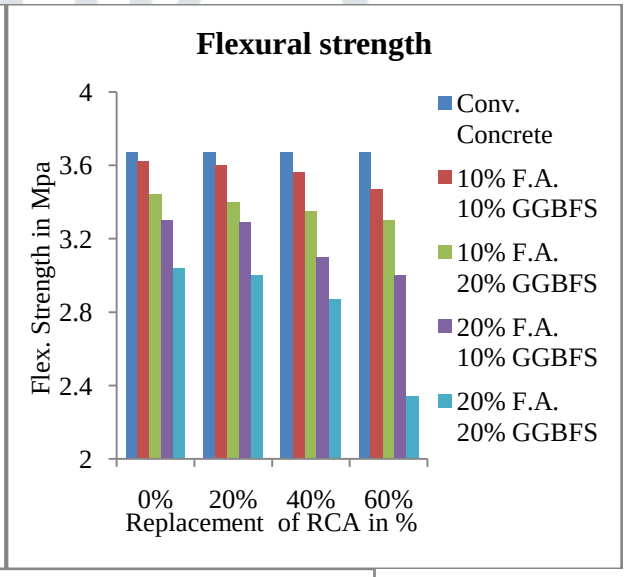
Tests on Fresh Concrete for W/C Ratio of 0.50

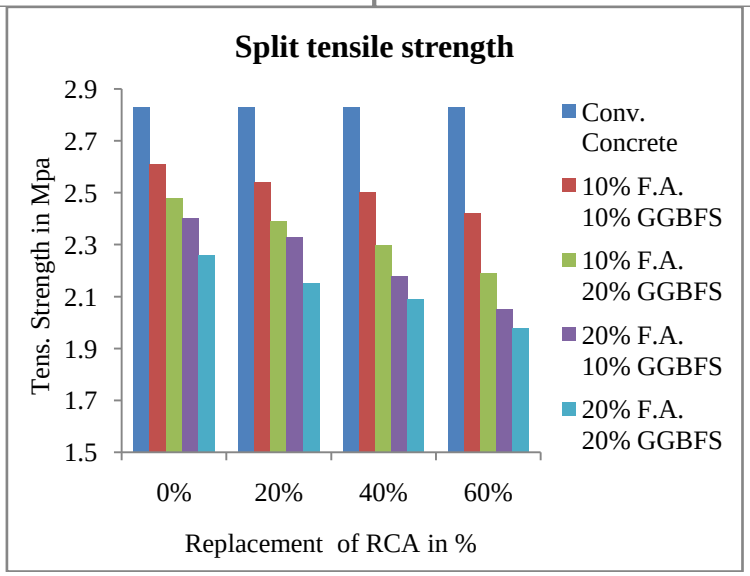




Tests on Hardened Concrete for W/C Ratio of 0.50







CONCLUSION

The various experiment done with replace of recycled aggregate 0%, 20%, 40%, 60% with natural aggregate and fly ash with replace of cement 10% and 20% and also GGBFS replace with cement 10% and 20%. Fly ash and GGBFS was replace with every replacement of recycled coarse aggregate.

Whole experiment was done for water cement ratio of 0.55 & 0.50. From various experiments and results the following conclusion were made:

I. Demolition waste is reuse and protects natural resources and decrease the pollution.
II. When replacement of fly ash and GGBFS increase with increase in workability. So, workability is good given by the percentage of fly ash and GGBFS increase.
III. When recycled coarse aggregate increase resulted in decrease in strength.
IV. The results are also near the conventional concrete.
V. This type of concrete helpful in small and medium type of construction.
VI. Fly ash and GGBFS use by the overall cost can decrease.
VII. While increasing in percentage of recycled coarse concrete and fly ash and GGBFS values of compressive strength, tensile strength and flexural strength are decreases.

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