

EXPERIMENTAL STUDY OF PARTIALLY REPLACEMENT OF RECYCLE CRUMB RUBBER WITH AGGREGATE AND CONTAINING OF MICROSILICA

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Abstract-- This research investigates experimentally behavior of crumb rubber concrete crumb rubber are made from waste tire generated in world waste tire means used tire which cannot be used for any other use. In this study, the natural coarse aggregate and fine aggregate with replaced various percentage crumb rubber and cement replaced by micro silica in concrete and checked out various properties. The Coarse rubber replaced with 2% of interval up to 10% with Natural Coarse Aggregate. The Crumb rubber replaced with 3% of interval up to 15% with Natural Fine Aggregate. The micro silica is replaced up to 10% constant with cement. Different water cement ratio used with all replacement used in concrete. In this paper the water cement ratio of 0.45, 0.50 and 0.55 were used.

Keyword: protect environment, waste management, conserve natural aggregate, slump test, compaction factor test, compressive strength, flexural strength test, split tensile strength test.

I. INTRODUCTION

In India according to "Indian tire industry forecast to 2015" the tire production in India is around 191 million units of tire. So if new tire placed in market another one tire reaches at its end of service life and become waste. What is waste tire? Waste tire as a tire that is no longer mounted on vehicle and no longer suitable for use as a vehicle tire due to its wear, damage or deviation from its original specification. In India 10 lacks tone tire wastage per year. This number is about of only India but in world it reaches at over the 1 billion unit of tire from this number of waste tire. USA generate 4.5 million tone tire waste per year. European union 2.5 million tone tire waste per year. UK alone it is around 0.5 million tone generate per year. it was estimated number base on 2013 analysis and it will increase day by day.

From its total waste divide in to following system

3 to 12 % amount of waste tire recycled.

5 to 20 % amount of waste tire reused some way like retarding or new product.

20 to 50% amount of waste tire consumed for energy recovery.

25 to 40% amount of waste tire set to land fill and stock piled.

So it is serious problem to dispose of waste tire. Dispose it in land fill and stockpile it is harm full for environment and also if tire waste burned then it is problem of air pollution due to smoke from it. so it is serious problem for environment. So that is require to generating new application for this waste tire. In past two decade there is new studies have investigated to reuse of waste tire in concrete to replace with mineral aggregates. And determine fresh and hardened properties of concrete. Use of tire waste is help full to dispose that tire waste in concrete and also helpful to save natural minerals which is use in concrete.

II. SIGNIFICANCE OF WORK

In present work is using crumb rubber in various percentage of replacement with coarse and fine aggregate by volume and micro silica is replace with cement with constant percentage in various water cement ratio of 0.45, 0.50 and 0.55. Use of micro silica by the improve performance of concrete. So, maximum percentage replacement of crumb rubber is use in concrete as with respect to strength.

III. MATERIAL

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 as conforming to zone I of IS: 383, 1987. Natural fine aggregate size less than 4.75mm.

	NATURAL AGGREGATES	FINE
Specific gravity	2.68	
Water absorption	0.122%	
Surface moisture content	0.137%	

Natural coarse aggregate

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

	NATURAL AGGREGATES	COARSE
Specific gravity	2.62	
Water absorption	0.028%	
Surface moisture content	0.04%	

Water

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

Micro silica

Micro silica is cementitious material. MICRO SILICA was bought from the Stallion Energy Pvt. Ltd. Micro silica is ultra fine material which make concrete durable and low permeable with higher compressive strength.

	Micro silica
Density	1.88kg/m ³
Moisture	1.16%
SiO ₂	92.75%
Al ₂ O ₃	0.55%
Fe ₂ O ₃	0.032%
MgO	0.059%
SO ₃	<0.010%

Crumb rubber

Crumb rubber is grinded material of tire waste. It is in different size available 20 mesh 10mesh 30mesh. We use 20 mesh crumb rubber.

	CRUMB RUBBER
Density of fine	0.60gm/cm ³
Size of crumb rubber	30 mesh
Water absorption	Nil
Surface moisture for fine	0.011%
	COARSE RUBBER
Density of coarse	1.26gm/cm ³
Size of coarse rubber	10- 20 mm
Water absorption	Nil
Surface moisture for coarse	0.027%
Impact strength	99.99%
Flakiness value	13.12%
Elongation value	12.67%

IV. MIX PROPORTIONING

In this study conventional batch of water cement ratio 0.45, 0.50 and 0.55 was casted after compare with percentage replacement of crumb rubber and micro silica.

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

w/c ratio	Cement (kg)	Water (lit)	NCA (kg)	NFA (kg)
0.45	437.77	197	988.19	754.93
0.50	394.32	197	991.27	785.72
0.55	358	197	993.5	815.31

Details of various batches casted as the partial replacement

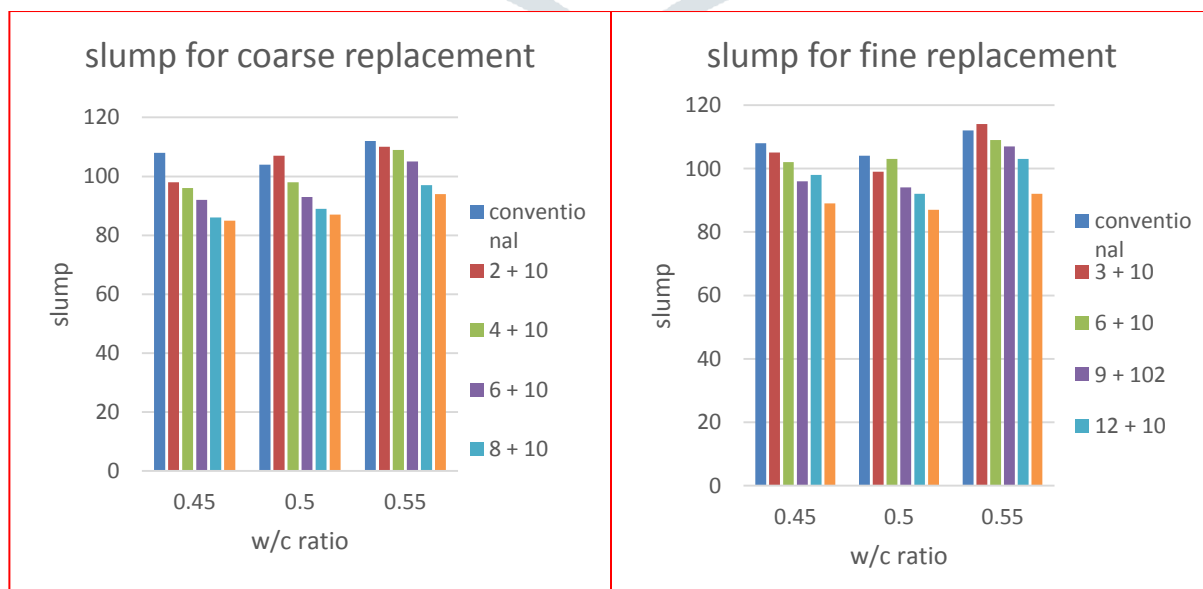
BATCH NO.	W/C RATIO	DESCRIPTION	NO. OF SPECIMENS			
			CUBE	BEAM	CYLINDER	
OA	0.45	100%C 100%NCA 100%NFA	9	3	3	
CA2		90%C 10%MS 2%CR 98%NCA	9	3	3	
CA4		90%C 10%MS 4%CR 96%NCA	9	3	3	
CA6		90%C 10%MS 6%CR 94%NCA	9	3	3	
CA8		90%C 10%MS 8%CR 92%NCA	9	3	3	
CA10		90%C 10%MS 10%CR 90%NCA	9	3	3	
FA3		90%C 10%MS 3%CR 97%NFA	9	3	3	
FA6		90%C 10%MS 6%CR 94%NFA	9	3	3	
FA9		90%C 10%MS 9%CR 91%NFA	9	3	3	
FA12		90%C 10%MS 12%CR 88%NFA	9	3	3	
FA15		90%C 10%MS 15%CR 85%NFA	9	3	3	
OB		0.5	100%C 100%NCA 100%NFA	9	3	3
CB2			90%C 10%MS 2%CR 98%NCA	9	3	3
CB4			90%C 10%MS 4%CR 96%NCA	9	3	3
CB6			90%C 10%MS 6%CR 94%NCA	9	3	3
CB8	90%C 10%MS 8%CR 92%NCA		9	3	3	
CB10	90%C 10%MS 10%CR 90%NCA		9	3	3	
FB3	90%C 10%MS 3%CR 97%NFA		9	3	3	
FB6	90%C 10%MS 6%CR 94%NFA		9	3	3	
FB9	90%C 10%MS 9%CR 91%NFA		9	3	3	
FB12	90%C 10%MS 12%CR 88%NFA		9	3	3	
FB15	90%C 10%MS 15%CR 85%NFA		9	3	3	
OC	0.55		100%C 100%NCA 100%NFA	9	3	3
CC2			90%C 10%MS 2%CR 98%NCA	9	3	3
CC4			90%C 10%MS 4%CR 96%NCA	9	3	3
CC6			90%C 10%MS 6%CR 94%NCA	9	3	3
CC8		90%C 10%MS 8%CR 92%NCA	9	3	3	
CC10		90%C 10%MS 10%CR 90%NCA	9	3	3	
FC3		90%C 10%MS 3%CR 97%NFA	9	3	3	
FC6		90%C 10%MS 6%CR 94%NFA	9	3	3	
FC9		90%C 10%MS 9%CR 91%NFA	9	3	3	
FC12		90%C 10%MS 12%CR 88%NFA	9	3	3	
FC15		90%C 10%MS 15%CR 85%NFA	9	3	3	

NFA=naturalfineaggregate C=cement NCA=naturalcoarseaggregat MS=microsilia CR=crumbrubbe

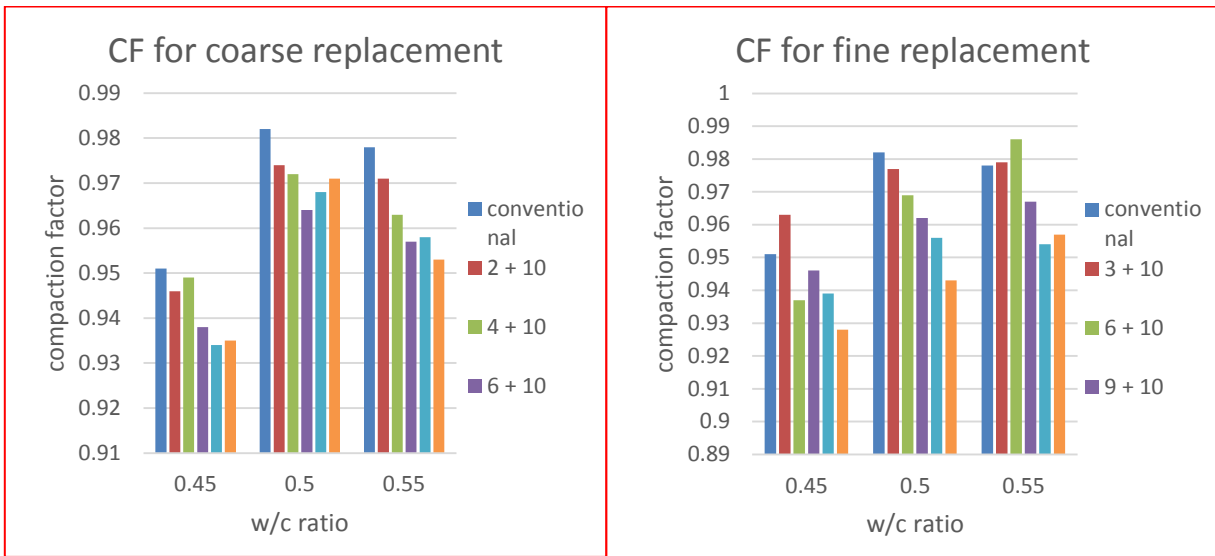
V. RESULTS

In this paper, mix design in use water cement ratio 0.45, 0.50 and 0.55 with various percentage replacement of crumb rubber with coarse and fine aggregate and micro silica replace with cement. This study was carried out slump test, compaction factor test, Compressive Strength, flexural strength, split tensile test.

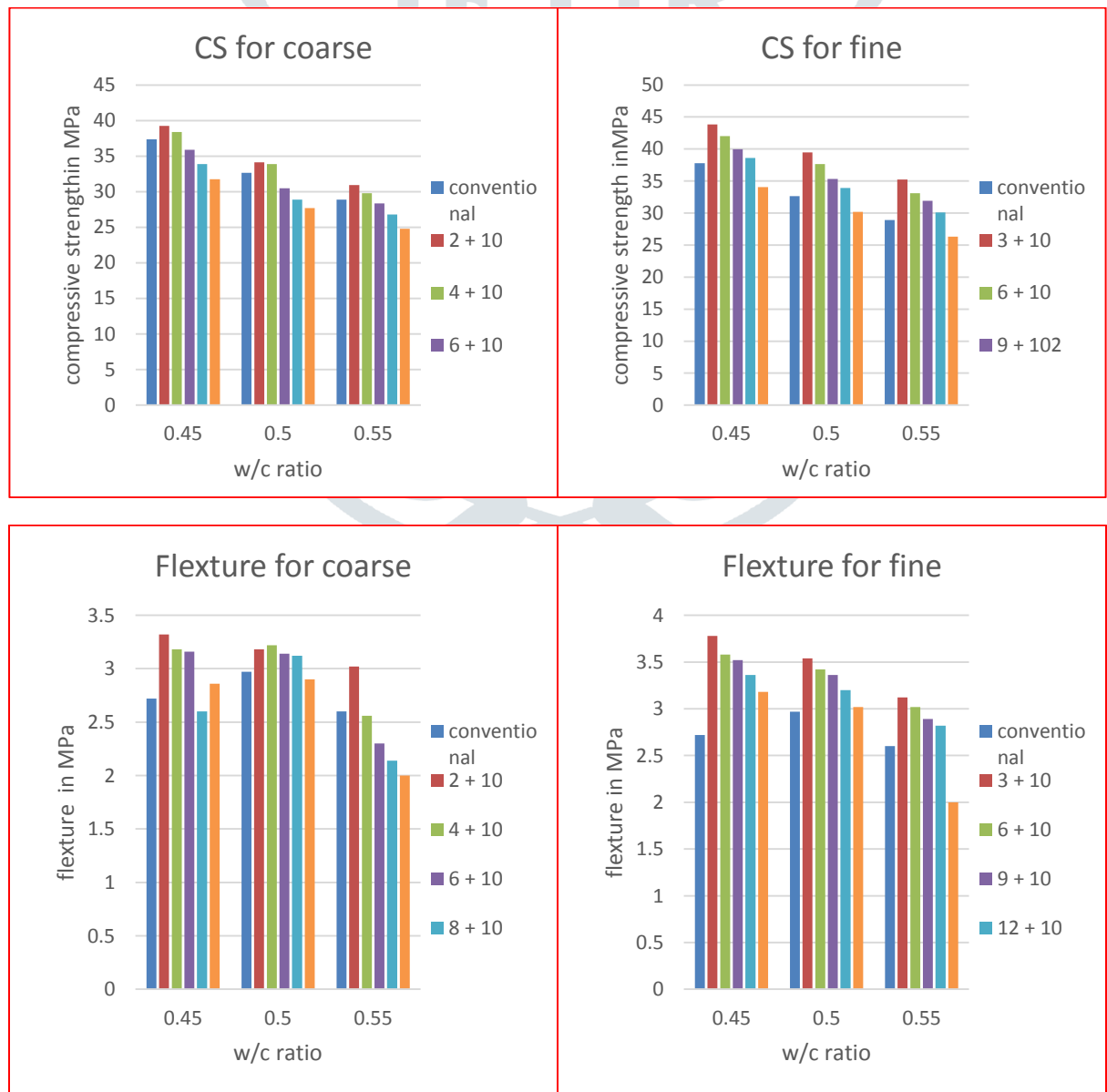
Tests on Fresh Concrete for slump

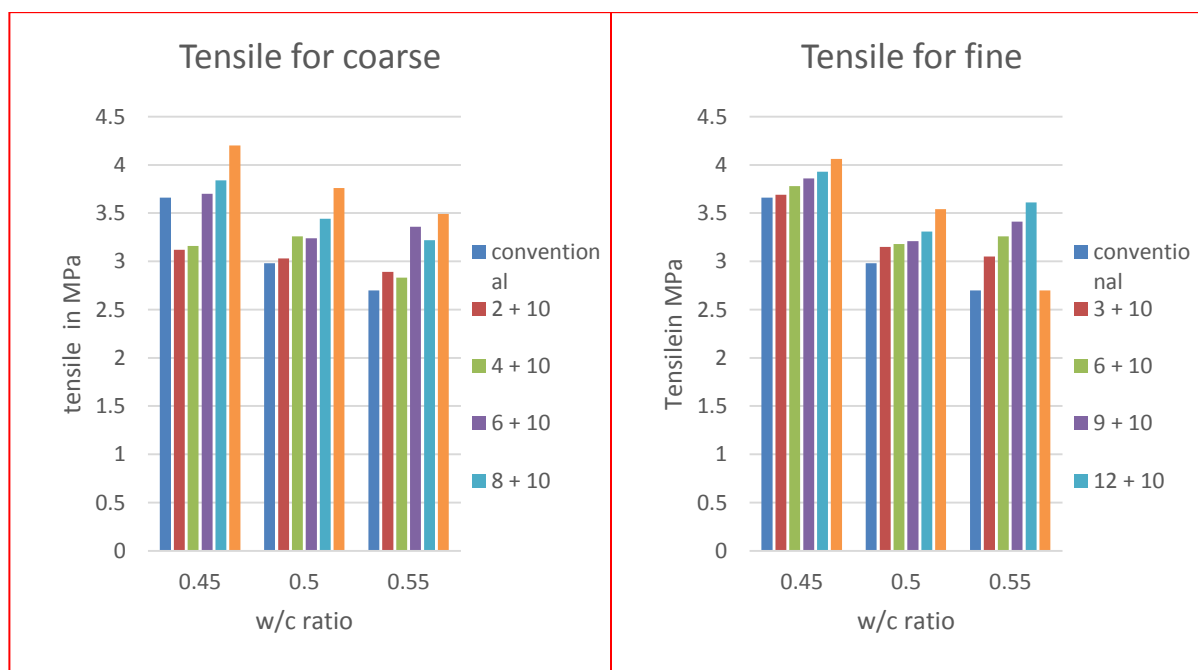


Tests on Fresh Concrete for compaction factor



Tests on Hardened Concrete for Coarse





VI. CONCLUSION

The various experiment done with replace of coarse and fine aggregate 0%, 2%, 4%, 6%, 8% and 10% and 0%, 3%, 6%, 9%, 12%, and 15% with crumb rubber and micro silica with replace of cement 10% constant with replacement..

Whole experiment was done for water cement ratio of 0.45, 0.50 & 0.55. From various experiments and results the following conclusion were made:

- Tire waste is reuse and protects natural resources and decrease the pollution.
- When replacement of aggregate increase with decrease in workability. So, workability is poor given by the percentage of crumb rubber increase.
- When coarse rubber aggregate increase resulted in decrease in strength then fine rubber aggregate replace ment.
- The results are also near the conventional concrete.
- This type of concrete helpful in small and medium type of construction light weight wall, blocks, buffers etc.
- With help of this dispose tire waste in well condition.

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