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MECHANICAL PROPERTIES OF CONCRETE CONTAINING WASTE TYRES AS REPLACEMENT OF COARSE AGGREGATES

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ABSTRACT: *Solid waste management has gained a lot of attention to the research community now-a- days. Out of the various solid waste, accumulated waste tyres, has become a problem of interest because of its non- biodegradable nature. Most of the waste tyre rubbers are used as a fuel in many of the industries such as thermal power plant, cement kilns and brick kilns etc. Unfortunately, this kind of usage is not environment friendly and requires high cost. Thus, the use of scrap tyre rubber in the preparation of concrete has been thought as an alternative disposal of such waste to protect the environment. In this study an attempt has been made to identify the various properties necessary for the design of concrete mix with the coarse tyre rubber chips as aggregate in a systematic manner. In the present experimental investigation, the M20 grade concrete has been chosen as the reference concrete specimen. Scrap tyre rubber chips, has been used as coarse aggregate with the replacement of conventional coarse aggregate. The objective of this project is to promote a practical use and acceptance of wastage tyres concrete block both environmental and economic construction. Solid waste is fast major important sources for aggregate replacement in concrete. Therefore there is increasing demand in finding possibility recycling and applying waste material for construction and our project is one of the examples of it.*

INTRODUCTION

In recent years, waste handling and management is the primary issue faced by the countries all over the world. The waste problem is considered as one of the most crucial problems facing the world as a source of the environmental pollution. One of the critical wastes to be managed in today's scenario is 'waste tyre' because; modern development in transportation has produced large number of vehicles, which creates enormous amount of waste tyres. The disposal of waste tyres is becoming a major waste management problem in the world at the moment. It is estimated that 1.2 billions of waste tyre rubber has produced globally in a year, among that 275 millions of waste rubbers are produced by the United States, 180 millions of waste tyres are produced by European Countries, 170,000 tonnes of waste tyres are produced in Australia and 3 crores of waste tyres are produced in India per year. At present, it is estimated that 11% of postconsumer tyres are exported, 62% are reused, recycled or sent for energy recovery, among that only 4% of waste tyres are used for Civil Engineering projects and 27% are sent to landfill, stockpiled or dumped in illegal tyre dumps (Farcasiu 1993 and Brown 2002). Attention was not paid to identify the Civil Engineering applications of waste tyres.

SCOPE OF THE STUDY

The objective of the present investigation is to identify the potential,use of tyre rubber in concrete. Henceforth an extensive research has been carried out to study the mechanical properties and durability. The replacement of rubber aggregates with fine aggregate, coarse aggregate, both fine and coarse aggregate varied between 2% and 10% of aggregates in steps of 2% by weight fraction. Cylindrical specimens of 6% rubber aggregate replacement are cast to derive the impact resistance and ductility index, hollow block specimens with the rubber replacement of 5%, 10% and 15% by volume are cast to derive the mechanical properties and beams are cast with optimal percentage of rubber aggregate replacement for studying the flexural strength.

Terminology:

a. Rubber aggregate:

It is the material made from scrap rubber tyre likewise aggregate.

b. Rubber aggregate concrete:

The concrete made from using these rubber aggregate added in a concrete is called rubber aggregate concrete.

c. Conventional normal concrete:

The concrete produced with natural sand as fine aggregate and gravel or cursed rock as coarse aggregate is called conventional normal concrete.

MIX DESIGN FOR CASTING

The present investigation has been considering grades of concrete M20.Quantity of various materials can be calculated by nominal mix (1:1.7:3.4).

Quantity of material for casting of one concrete cube.

Data for mix proportionig(as per IS 10262:2009)

Grade :-M20

Cement:-OPC53

Nominal size of aggregate :-20mm

Fck = 48.25 N/mm

Vol of concrete=0.00375 m3.

W/C Ratio=0.52

Water= 646.60ml

Cement=1243.42g

River sand=2119.60g

C.A. 10mm= 2094.90gm

C.A. 20mm= 2080.10gm

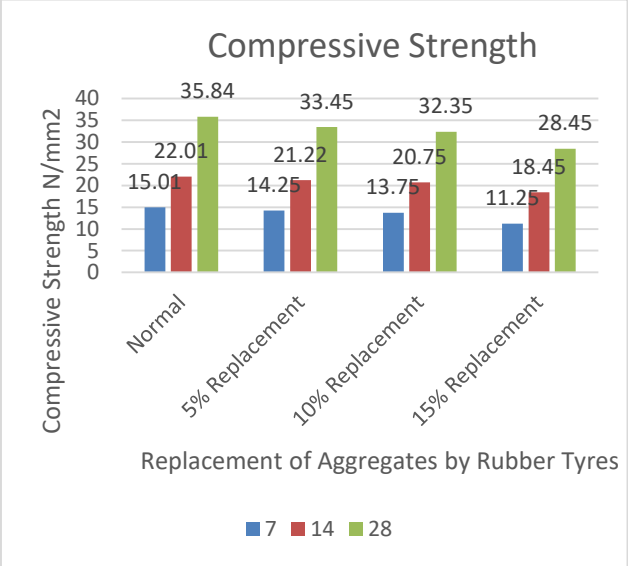
REASULTS AND COMPARISON:

COMPRESSIVE STRENGTH TABLE

The purpose of the test is to determine the crushing strength of hardened concrete and is conducted on test specimens of concrete either during mix design in laboratory or from concrete being used on construction. It serves as a good guide for quality control. The compressive strength is the maximum force per unit area, in compression, which a material can withstand before breaking. The compressive strength of a concrete is the most useful and important property of concrete many other properties of concrete such as durability, resistance to shrinkage, Young's modulus, imperviousness, etc. are dependent on compressive strength of concrete. Thus compressive strength reflects the overall quality of concrete.

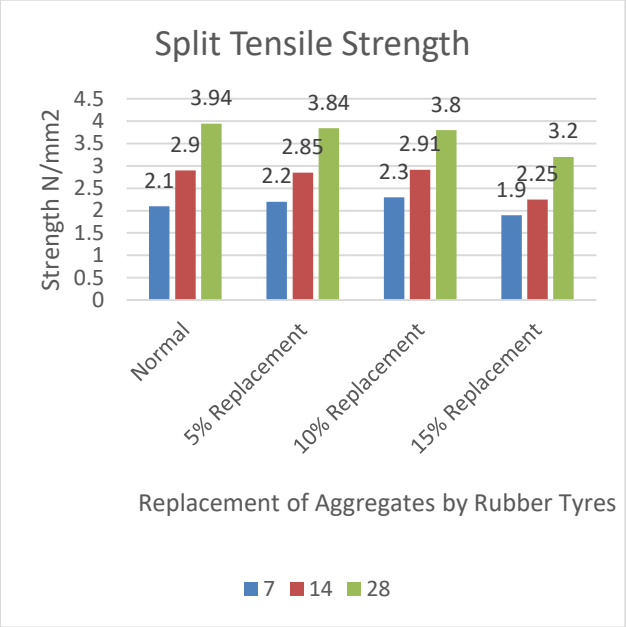
Sr. No.	TEST	APPROX. VALUE
1	AGGREGATE CRUSHING VALUE	Less than 45%
2	AGGREGATE IMPACT VALUE	Less than 45%
3	DETERMINATION OF WATER ABSORPTION	0%
4	SPECIFIC GRAVITY	1.127

SR.NO.	DIFF. TYPES OF REPLACEMENT	COMP. STRENGTH (7 Days in N/mm2)	COMP. STRENGTH (14 Days in N/mm2)	COMP. STRENGTH (28 Days in N/mm2
1	NORMAL	15.01	22.01	35.84
2	5% REPLACEMENT	14.25	21.22	33.45
3	10% REPLACEMENT	13.75	20.75	32.35
4	15% REPLACEMENT	11.25	18.45	28.45



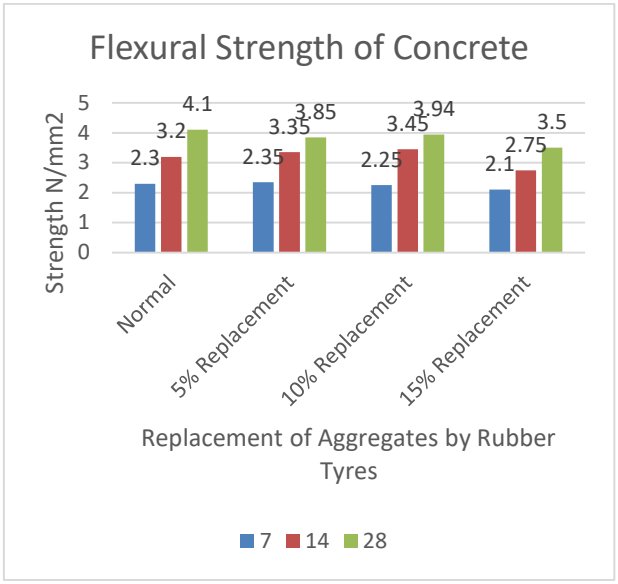
SPLIT TENSILE STRENGTH COMPARISON TABLE

SR.NO.	DIFF. TYPES OF REPLACEMENT	SPLIT TENSILE STRENGTH (7 Days in N/mm2)	SPLIT TENSILE STRENGTH (14 Days in N/mm2)	SPLIT TENSILE STRENGTH (28 Days in N/mm2
1	NORMAL	2.1	2.9	3.94
2	5% REPLACEMENT	2.2	2.85	3.84
3	10% REPLACEMENT	2.3	2.91	3.8
4	15% REPLACEMENT	1.9	2.25	3.2



FLEXURAL STRENGTH COMPARISON TABLE

SR.NO.	DIFF. TYPES OF REPLACEMENT	FLEXURAL STRENGTH (7 Days in N/mm2)	FLEXURAL STRENGTH (14 Days in N/mm2)	FLEXURAL STRENGTH (28 Days in N/mm2
1	NORMAL	2.3	3.2	4.1
2	5% REPLACEMENT	2.35	3.35	3.85
3	10% REPLACEMENT	2.25	3.45	3.94
4	15% REPLACEMENT	2.1	2.75	3.5



Conclusion

1. *By replacing natural aggregate by rubber aggregate we can solve the disposal problem of it.*
2. *It is observed that 10% replacement of aggregates has results similar to that of Normal concrete*
3. *It reduces the dead load of structure.*
4. *The cost of the concrete is reduced if we use with 10% replacement*

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