LITERATURE REVIEW ON PARTIALLY REPLACED OF CRUMB RUBBER BY FINE AGGREGATE IN CONCRETE

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ABSTRACT

The main aim of the study is to identify the usage of recycled material in the concrete as it enhances the mechanical properties of concrete. As "Crumb Rubber" is also one of the solid waste which can be used in concrete by partially replacing fine aggregate. In this study "Crumb Rubber" was replaced by volume of fine aggregate as 5% to 30% volume of "Crumb Rubber" replaced fine aggregate explained by different authors in their research papers. Many tests were done by these different authors for fresh concrete (i.e. Slump test, Flow test, Compaction factor etc.) and for hard concrete (i.e. Compressive strength, Flexural strength and Splitting Tensile strength test) for M20, M25, M30 Grade of concrete.

KEYWORDS: -Crumb Rubber, Fine aggregate and Alternative Construction materials.

INTRODUCION

Crum rubber which mean small piece or the powdered form of tire (used in vehicle) which is being made after removing thin steel wire from the tire. As the use and production of rubber is increasing day by day with the increase of population. With the coming generation there is rapid increase in the production of vehicle so there is chance of increase in crumb rubber. But still there is very less use of vehicle tyre. In most of the parts of the world the use of vehicle tyre as crumb rubber is very less, so very often they are normally burn or just buried in landfills. Due to this i.e., landfill and burning there are many issue rising which are harmful to environment and causes Global Warming too. So now days many techniques have been came into work. There are also a many recycling methods for the tyre according to our needs. So it is not easy to decompose tire under environment conditions and thus leads to serious issue. Based on the above investigation tyre as a crumb rubber are used in concrete. This results in improvement of various properties like dynamics and mechanical, ductility and gives resistance to cracking. So the partial replacement of crumb rubber as a fine aggregate in concrete mainly deals with the strength and weight parameter.

LITERATURE REVIEW

1) Tushar R More, Pradip D Jadhao and SM Dumme:

In their study the aim was to study of waste tyre as partial replacement of fine aggregate to produce rubberizes concrete in M25 grade of mix. Different partial replacement of crumb rubber i.e., 0%, 3%, 6%, 9% and 12% by volume of fine aggregate are casted and tested for flexural strength and split tensile strength. The result shows that there is a reduction in all type of strength for crumb rubber mixture, but crumb rubber content concrete become more lean due to increase in partial replacement of crumb rubber as fine aggregate ie.,3%, 6%, 9% and 12%. Flexural strength of concrete decreases with 3% replacement of sand and further decrease in strength with the increase in percentage of crumb rubber. For split tensile strength decreases with 3% replacement of sand and further decrease in strength with the

increase in percentage of crumb rubber. This is mainly due to lower bond strength between cement paste and rubber tyre aggregate.

2) Prof. M. R. Wakchaura and Mr. Prashant. A. Charan :

In this study they did partial replacement of fine aggregate as crumb rubber as 0.5%, 1%, 1.5% and 2% in M25 grade of concrete and its effects on concrete properties like compressive strength, flexural strength were investigated. Addition to this combination of glass fibre at ratio 0.4% and 0.5% addition to the weight of cement are used to regain the reduced strength due to use of waste tyre crumb rubber particle. Results indicate that replacement of waste tyre crumb rubber particle to the fine aggregate in concrete at ratio 0.5% and 1% there is no effect on the concrete properties would occur, but there was a considerable change for 1.5% and 2% replacement ratio.

3) Dr. B. Krishna Rao:

In this investigation he did casting and testing of cubes, cylinders, and prisms for M20 grade of concrete and added 5% and 10% of rubber fibre by volume of concrete. There the specimens are tested for compression, split tensile and flexural strength. The test results were done and noted that due to addition of rubber fibre, strength of concrete decreases, but as observing ductility is improving. Hence it is used for medium grade of concrete. The various rubberised concrete mixes were designed in accordance with standard mix design procedure for normal concrete with grade of M20. As expected the target strength were not achieved for the mixes incorporating rubber fibre.

4) Er. YogenderAntil:

The primary objective of their investigation is to study the strength behaviour i.e., compressive strength and flexural strength of rubberised concrete with different volume of crumb rubber. Parameter to be varied in Investigation is volume variation of crumb rubber. The proposed work is aimed to study the effect of volume variation of crumb rubber on the compressive strength, flexural strength and slump test. So they founded that strength of modified concrete is reduced with an increase in rubber content. The Flexural strength of the concrete decreases about 69% when 20% of sand is replaced by crumb rubber. The compressive strength of the concrete decreases about 37% when 20% of sand is replaced by crumb rubber. So overall large percentage of crumb rubber the lower the compressive strength and flexural strength as compared to conventional concrete.

4) Sulagno Banerjee, Aritra Mandal, Dr.Jessy Robby

The aim of their investigation was studies on mechanical properties of tyre rubber concrete. In their study they made a concrete of M25 grade by replacing 5%, 10%, 15%, 20% and 25% of tyre concrete with coarse aggregate and compared with regular M25 grade concrete. The properties of fresh concrete and flexural strength of hardened concrete were identified. So they concluded that flexural strength decreases in concrete. In 7 days' flexure strength, there is not much variation seen between conventional and rubberized concrete. So there was not much difference in strength of rubberized and conventional concrete.

5) Nithiya P and Portchejian G:

It this research paper the mix design was done as per IS:10262-2009 to achieve the target strength. The concrete mixes were made by replacing fine aggregate with 5%, 10%, 15% and 20% for M20 grade concrete. So they founded that compressive strength decreases with the replacementof crumb rubber increased and 5% replacement of crumb rubber proves exceptionally well in compressive strength and tensile strength. It also gives more strength at 28^{th} days for 5% replacement for M20 grade of cement and split tensile strength decreases at the maximum at the maximum of 25% when crumb rubber is replaced up to 10% of fine aggregate. Thus by replacing fine aggregate by crumb rubber safeguard the environment.

6) Jaylina Rana and Reshma Rughooputh:

The broad aim of this work was to investigate the effects of partially substituted fine aggregate by rubber on the properties of fresh and hardened concrete. Different tests were performed to determine slump, compressive strength, tensile splitting strength, flexural and initial surface absorption of the concrete mixes. The compressive, tensile splitting strength, flexural decreases with increasing rubber content. Rubber fails the initial surface absorption test that is the surfaces of their concrete mixes are almost impermeable. However, partial replacement of fine aggregate with 5% of rubber can potentially be used in low strength concrete applications.

7) S. Selvakumar and R. Venkatakrishnaiah:

They did concrete mix as per IS:10262-2009 for M30 grade of concrete for their investigation. The specimen was casted and used to determine the compressive strength, split tensile strength and flexural strength of concrete. They were tested for 7 and 28 days with replacement of fine aggregate with 5%, 10%, 15%, 20% of crumb rubber. Finally, they concluded that compressive strength of crumb rubber concrete with 5% replacement is 38.66 N/mm^2, it is higher than the strength of normal concrete ie.,36.73 N/mm^2 on the 28 days. The compressive strength of crumb rubber concrete with 10% replacement it gives acceptable strength of 33.47 N/mm^2. In flexural strength of crumb rubber is lower than the strength of normal concrete and it was seen the same lowering of strength as compared to normal concrete in splitting tensile strength. So crumb rubber possess less bonding ability which effected on the strength of the concrete.

8) A Mansoor Ali and A. Sarvanan:

This paper is the experimental study on waste rubber tire concrete. The mechanical and durability properties of concrete withcomposition of crumb rubber replacing part of the fine aggregate and cement with silica fumes were investigated for M25 grade as per IS:10262-2009. Compressive strength, flexural strength and split tensile strength was conducted for each sample by these authors. Finally they concluded that there was a reduction in compressive strength and split tensile strength and increase in flexural strength when the rubber content is increased. But the target strength was achieved by addition of silica fume and rubber in the concrete as compared to the addition of rubber without silica fumes. Therefore, this study has been focused on strength and durability requirement which shows that the concrete is sustainable and use for non-structural element where the low strength is required.

9) Kotresh K.M and Mesfin Getahun Belachew:

In this present generation the disposal of waste tyres normally used in vehicle is becoming a serious issue for waste management problem in the world. It is estimated that 1.2 billion of waste tyre rubber produced globally per year. It is estimated that 11% of post-consumer tyres are exported and 27% are sent to landfill, stockpiled or dumped illegally when they have no use and only 4% is used for civil engineering projects. Hence major steps have been taken to find the potential application of waste tyre in civil engineering projects. In this investigation, our present study aims to investigate the optimal use of waste tyre rubber as coarse aggregate in concrete composite. A total of 24 cubes and 12 prisms are casted of M25 grade by replacing 10%, 20% and 30% of tyre aggregate as a coarse aggregate and compared with regular M25 grade concrete. Fresh and hardened concrete strength were identified. Finally, it was found that the strength was not achieved as targeted. But still it can be used for low strength structure as using crumb rubber can help in maintaining the environment.

OVERALL CONCLUSION:

1. The 7- day and 28- day compressive strength of the specimens increased by addition of silica fume to concrete containing crumb rubber. This happens because of filling capability of silica fume fine particles as well as good adhesion between the rubber and the cement paste.

2. The addition of 5% crumb rubber gives more strength as compared to conventional concrete for M30 grade of concrete.
3. The addition of 10% crumb rubber gives less strength as compared to conventional concrete for M30 grade of concrete.
4. For M30 grade of concrete with 5% and 10% addition of crumb rubber as fine aggregate the strength is lowered for flexural and splitting tensile strength.
5. It was also found that addition of 5% crumb rubber as a fine aggregate by volume give a little better strength as compared to 10%, 15% and 20%. So concrete with 5% addition of crumb rubber as a fine aggregate can be use for low concrete strength application.
6. Use of 0.5% and 1% of crumb rubber as a fine aggregate in concrete for M25 grade does not show any changes.
7. Use of 1.5% and 2% of crumb rubber as a fine aggregate in concrete for M25 grade shows a lower in strength.
8. With 3% replacement of fine aggregate with crumb rubber for M25 grade of concrete there was a decrease in flexural and split tensile strength.
9. Addition of 6%, 9% and 12% of crumb rubber further decreases the strength.
10. Decrease in strength was mainly due to lower bond strength between cement paste and rubber tyre aggregate.
11. The high CRC rubber content mix had a flexural strength almost 50% less than the control mix. However, CRC mix had a more ductility and comparable toughness values to the control mix.
12. Rubber fails the initial surface absorption test that is the surface of their concrete mixes are almost impermeable.

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