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Reduction in Temperature of Rigid Pavements by Waste of Tyre Rubber and Waste Glass Materials

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Abstract - *In the developing countries like India the rate of constructions of pavement increased very rapidly and continuously in past few decades. As per recent surveys it is found that India have second largest infrastructure of road construction infrastructure. The construction of concrete pavement has also been rapidly increased in greater extent in the past decades. Some recent researches have shown that rigid pavements are responsible to increase the surrounding temperature at some extent. So the aim of our project is to minimize the surface temperature of the pavement by making use of the waste materials. These waste materials had effectively decreased the surface temperature of pavements. In the project we used crushed waste glass material and waste of tire rubber as an aggregate which had replaced partially in different amount, for enhancing the various properties as surface temperature and Flexural strength of the pavement.*

Key Words: Rigid pavements, Infrastructure, Surface temperature, Flexural strength.

1. INTRODUCTION

In these research we use waste materials which is available in very large amount in India as an aggregate in concrete road construction for to reduce the surface temperature at some extent. In recent studies it is found that in our country only 45% of waste glass have been recycled and reused ,remaining amount of amount of glass remained waste and we don't make any use of it. In the United Kingdom 100% of waste glass have been reuse and recycled and use in various fields, They make use of crushed glass as an aggregate in concrete used for the various construction. Also the very large amount of tire rubber waste has been illegally dispose in land which create unnecessary health hazards and pollution. So important intention of the study to convert this waste into the aggregate for to use partially as an aggregate in the construction rigid pavement and minimize its temperature.

1.1 Literature reviews

[1] **Erhan Burak Pancar and Muhammet Vefa Akpınar (2016**) Has been found that 19% of glass beads replaced partially as of fine aggregate used in concrete help reduced the road temperature they used C30/37 grade concrete for the design . The difference in temperature after partial replacement of this waste is 3.5 degree Celsius.

[2] **Chun and Kim (2015**) determine the temperature gradients in the test slab by using thermocouples instrument for many slab depths. For the under cured concrete slab the maximum increment in temperature was shown about 7.8 _ C between 3 to 4 pm ,and the maximum decrease in temperature in the slab depth was -6.7 _C at11–12pm

[3] **Armaghani and Richardson (1990) and Fahmy and Shoukry (2002)**, have determine that difference in temperature was 10 degree Celsius after partial replacement of waste glass samples in concrete slab thickness of 225 mm.

1.2 Objectives of the research

- "To convert waste into wealth" means using waste materials for aggregates production help to reduce waste and produce aggregates.
- To reduce and recycled waste by replacing this aggregates as conventional aggregates
- Prevention of Portland Cement Concrete Pavement from thermal cracking.
- To increase the service life of the pavement.
- Minimizing heat migration by reducing temperature, beneficial for human survival.
- To reduce pavement heat effect cause to increase in environmental temperature.
- To improve vehicular characteristics.
- To minimize the effect of temperature for human life.

2. METHODOLOGY

- **Study of literature**
  In the literature survey we have studied the various literature which already worked on this topic.
- **Collection of required raw material**
  After studying the various literatures we collect the required raw materials such as cement, sand and aggregate and waste samples of glass and rubber.

- **Mix design of M 30 grade as per IS-10262-2009**
  After collecting the required raw materials we prepare M 30 grade of concrete by calculating various quantities of concrete ingredients and waste aggregates samples.

- **Batching, mixing and placing of concrete with partial replacements of waste samples**
  After preparing the M30 concrete grade , we prepare another M30 concrete grade with partial replacements of 15% waste glass samples as fine aggregates and 5 % waste tire rubber as a coarse aggregate.

- **Casting and curing of all cube samples**
  After preparation of concrete grade we cast cubes in two moulds for surface temperature test we cast concrete cubes in mould of size (150x150x150)mm cubes for measuring surface temperature test and another cube sample size of(100x100x700)mm width, height and length respectively and casting we remove moulds after 24 hrs of setting and put them in a water tub for 28 days of curing.

- **Testing of samples for surface temperature test and flexural strength**
  After completion of curing for 28 days we test the samples for determining the surface temperature on 6 march at 3 pm when cubes placed in surrounding temperature and flexural strength after of cubes after curing of 28 days.

- **Result and comparison with samples without partial replacements of aggregates and samples with partial replacements of aggregate**

- **Discussion and Conclusion to be done on the basis of result obtain.**

2.1. Figures of sample used for partial replacement

[1] Waste glass materials as a partial replacement of fine aggregate

Fig 2.1.1-Waste glass materials

[2] Waste tire rubber materials as a partial replacement of fine aggregate

Fig 2.1.2-waste tire rubber materials

2.3 Quantities of materials of concrete as per mix design of M30 (IS 10262-2009)

Materials	Quantities
cement	438 kg
Coarse aggregate	695 kg
Fine aggregate	1107kg
Water cement ratio	0.45

3. RESULTS

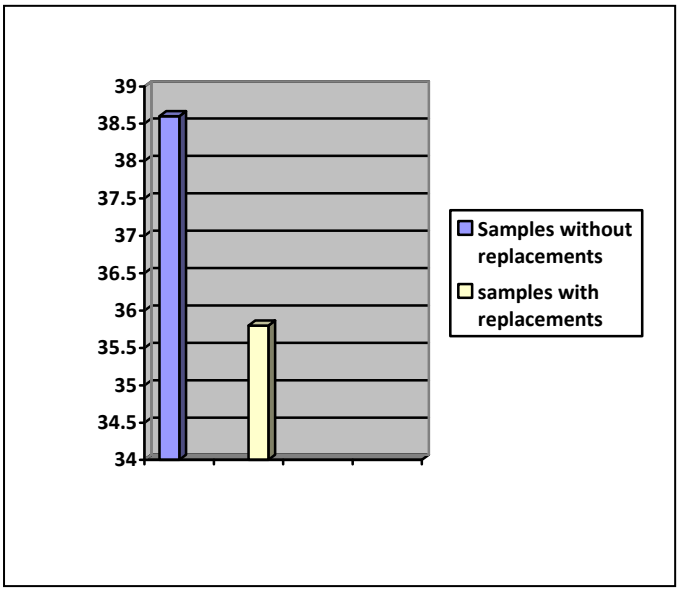
3.1.1 Surface temperature test without partial replacement of aggregate and with partial replacements of 15% glass waste as a fine aggregate and 5% of rubber as coarse aggregate

Cement (Kg)	Coarse aggregate (kg)	Fine aggregate (kg)	w/c ratio	Glass waste (kg)	Tire waste (kg)	Surface temperature (degree Celsius)
1.47	2.34	3.73	0.45	0	0	38.6
1.47	2.23	3.17	0.45	0.56	0.12	35.8

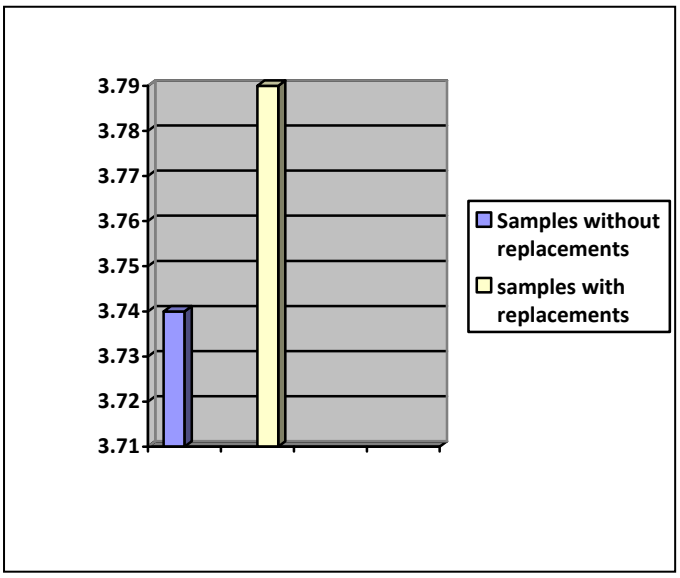
3.1.2 Flexural strength test without partial replacement of aggregate and with partial replacements of 15% glass waste as a fine aggregate and 5% of rubber as coarse aggregate

Cement (Kg)	Coarse aggregate (kg)	Fine aggregate (kg)	w/c ratio	Glass waste (kg)	Tire waste (kg)	Flexural strength (N/mm2)
3	4.865	7.749	0.45	0	0	3.74
3	4.625	6.56	0.45	1.16	0.24	3.79

3.2.1 Graphical representation of results of surface temperature in degree Celsius



3.2.1 Graphical representation of Flexural strength in N/mm2



3. CONCLUSIONS

From the result we conclude that for to reduce the surface temperature of the rigid pavements partial replacements of the aggregates as a waste material will be preferable. For to check the surface temperature of the pavements after the partial replacements of 15% of glass waste as a fine aggregate and 5 % of tire rubber as coarse aggregate ,we found that the surface temperature has been reduced up to 2.8 degree Celsius hence this waste can be used as a partial replacements for to reduce the surface temperature of rigid pavements.

When we check for the flexural strength of the concrete cube we find that flexural strength of the sample also gets increases in very small extent of 0.05 N/mm2 hence it also does not effect on the strength of the samples, hence this waste samples of aggregates can be used as in concrete of the rigid pavements.

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