Partial Replacement of Cement with Rice Husk Ash in Rigid Pavement

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Abstract – *In this paper conduct of concrete for rigid pavement by replacing of rice husk ash by cement in concrete is analyzed. The study of compressive strength in concrete is greater than the compressive strength of normal concrete. The replacement of cement with different percentage of rice husk ash is preferred in concrete. Using of rice husk ash in concrete is found more economical than normal concrete. The cost of concrete reduces some content in comparison to normal concrete. The paper indicates that rice husk ash reduced the emission of Carbon Dioxide from concrete slab of rigid pavement. In general the concrete impact the environment condition in which it prevents the global warming because it reduces the Carbon Dioxide emission. So the paper determines that partial use of rice husk ash in rigid pavement is sustainable material for efficient transportation.*

Key Words: Rice Husk Ash, Cement, Concrete, Compressive Strength, Global Warming, Flexural Strength

1. INTRODUCTION

Concrete is mostly used material for various types of structures for its strength parameter. Partial replacement of cement is the best method for increasing demand of cement and concrete, for which the reason is energy and cost saving. Such this by product is environmental friendly for disposal. Otherwise it is pollute land, water and air. The paper is described for the use of RHA as a replacement with cement. The cost of concrete is reduced by replacing cement with RHA.

The present investigation is used to study the effect of RHA on the performance of various property of concrete. This replacement gives a better result for flexural strength of concrete pavement. Supplementary cementious material such RHA improved the durability of hardened concrete and service life of structure.

This project investigate that the use of RHA in rigid pavement to reduce the cement to achieve better highway specification. Global warming is major cause of while using fully cement in concrete. But due to partial replacement of cement reduces the global warming. The use of RHA is an environmental friendly method for disposal of quantities of material because it started to pollute the land, water as well as air.

Generally it is found that emission of Carbon dioxide is depends upon the cement content of concrete. For development basis to match increasing population, it should also be sustainable. The sustainability consists in proper balance of economic, social and environmental impact. The investigation performing for minimum processing of RHA is required to achieve the acceptable strength properties.

2. Rice Husk Ash

Rice husk ash is used by burning rice husk without causing environmental pollution. When the RHA is burnt it has high SiO_2 content and also it is used as a concrete admixture.

Table- 1: Physical Properties of Rice Husk Ash

S.No.	Particulars	Properties
1	Colour	Gray
2	Appearance	Very Fine Powder
3	Specific Gravity	2.37
4	Particle Size	Less than 45 microns
5	Mineralogy	Non Crystalline
6	Odour	Odourless

3. MATERIAL USED

3.1 Cement

Portland Pozzolana Cement is used for making concrete which is confirmed for the standard code. Test of the cement is done in lab and requirement of test of cement using for standard code.

Table- 2: Physical properties of cement

S.No.	Characteristics	Experimental Value
1	Fineness	5%
2	Consistency	30%
3	Initial Setting Time	35 min
4	Final Setting Time	570 min
5	Soundness	2.5 mm

3.2 Aggregate

Aggregate contributes 60 to 80% of concrete mix. The process of Sieve Analysis is used for gradation of aggregate for use in concrete and for other applications.

3.2.1Coarse Aggregate - Coarse grained aggregates will not pass through a sieve with 4.75 mm openings. The size of coarse aggregate used as 20 mm.

Table- 3: Physical Properties of coarse Aggregate

S.No	Particular	Properties
1	Specific Gravity	2.67
2	Fineness Modulus	6.57
3	Aggregate Crushing Value	17.14%
4	Abrasion Value	17.2%
5	Impact Value	11.95%

3.2.2Fine Aggregate - Fine aggregate is the essential ingredient in concrete that consists of natural sand or crushed stone. Quality and density of fine aggregate strongly affect the hardened properties of concrete mix.

Specific Gravity = 2.7
Fineness Modulus = 2.3

3.3 Water

The water which is used for drinking should be used for making concrete. Potable, fresh, colorless and clean municipal tap water, which is used for organic matter, is used in this project work. PH of water should be 6 to 8 as much as possible.

4. METHODS USED

There are following methods used for making concrete for rigid pavement:

- The rice husk ash is selected from rice mill plant which is used for making concrete.
- Various tests were applied on the cement.
- Different tests were used on aggregate like as aggregate crushing value test, Impact value and Abrasion value test.
- Drinking water is used for making concrete which has pH 7 to 8.
- The ingredient of concrete is weighted with proper proportion.
- Ingredient of concrete is mixed properly.
- Curing of concrete is done properly.
- Then there is perform various test on concrete given as compressive strength test, flexural strength, slump cone test and compaction factor test.

5. RESULT AND TEST

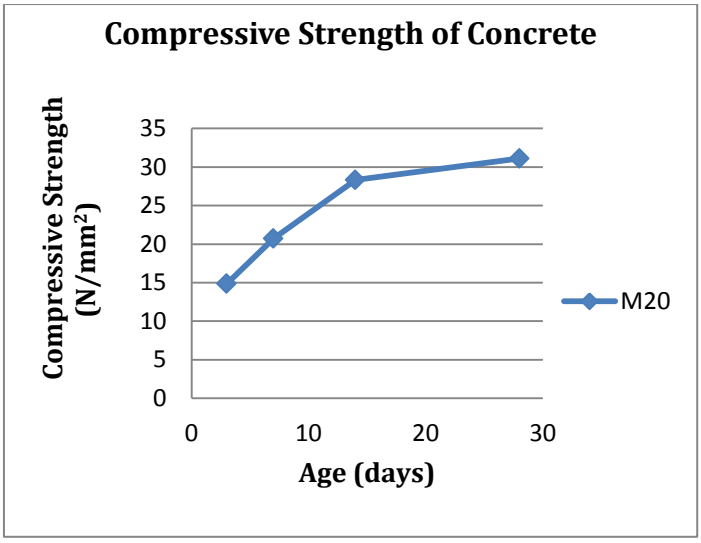
Compressive Strength and Flexural Strength of Concrete at different ages are listed below which can be given as:

5.1 Compressive Strength Test

- The result of compressive strength for M20 grade concrete is given as following table:

Table- 4: Compressive Strength of Concrete

Age in days	Compressive Strength of Concrete (N/mm²)
3	14.83
7	20.72
14	28.32
28	31.1



Graph- 1: Compressive strength of Concrete

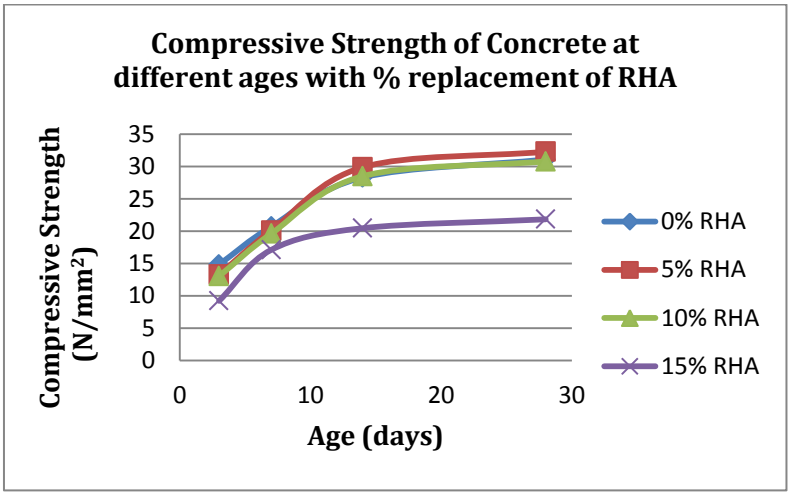
From the graph 1 which shows the compressive strength of concrete at different ages increases.

- Compressive Strength (N/mm²) of concrete at different ages by partial replacement of cement with 0%, 5%, 10%, 15% rice husk ash is described following table:

Table- 5: Compressive Strength of Concrete at different age with % replacement of RHA

Age in days	0% RHA	5% RHA	10% RHA	15% RHA
3	14.83	13.27	13.03	9.21
7	20.72	20.1	19.63	17.12
14	28.32	29.9	28.52	20.47
28	31.1	32.3	30.8	21.84

From the above graph 2 compressive strength of concrete at different ages with different % replacement of RHA increases.



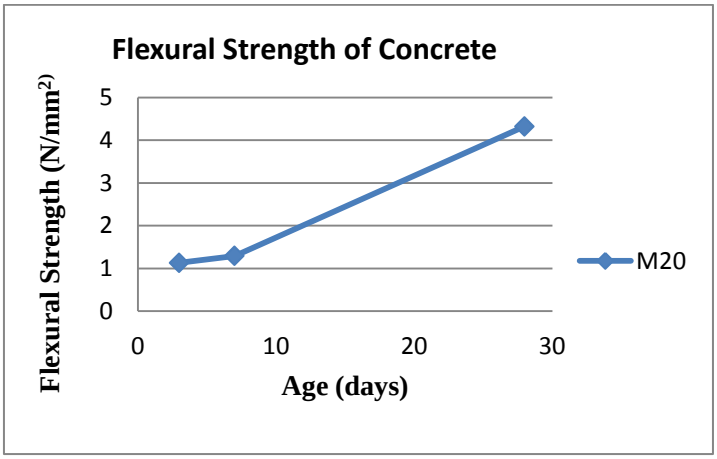
Graph- 2: Compressive Strength of Concrete with % replacement of RHA

5.2 Flexural Strength

- The result of Flexural Strength of M20 grade concrete is given as following table:

Table- 6: Flexural Strength of Concrete

Age (Days)	Flexural Strength (N/mm²)
3	1.13
7	1.29
28	4.32



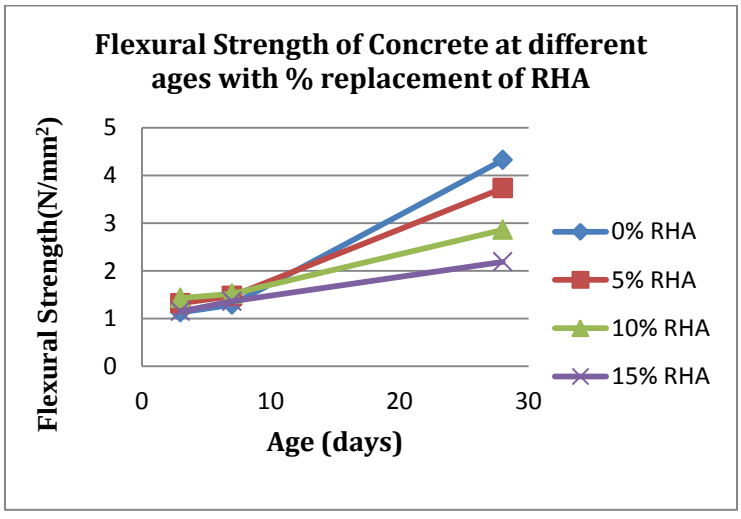
Graph- 3: Flexural Strength of Concrete

From the graph 3 flexural strength of concrete increases slowly and then followed rapidly.

- Flexural Strength (N/mm²) of Concrete at different ages by partial replacement of cement with 0%, 5%, 10%, 15% rice husk ash is described following table:

Table- 7: Flexural Strength of Concrete at different age with %replacement of RHA

%RHA	3 day	7 day	28 day
0%	1.13	1.29	4.32
5%	1.32	1.47	3.73
10%	1.43	1.52	2.86
15%	1.15	1.36	2.19



Graph- 4: Flexural Strength of concrete with % replacement of RHA

From the graph 4 Flexural Strength concrete gradually increases for 3 to 7 days and increases rapidly for 7 to 28 days.

6. CONCLUSIONS

On the basis of the strength criteria of Rice Husk Ash there are described following conclusions:

1. At all percentage of partial replacement of cement with Rice Husk Ash the compressive strength of concrete gradually increases from 3 to 7 days and increases rapidly from 7 to 28 days.
2. At all percentage of partial replacement of cement with Rice Husk Ash the Flexural strength gradually increases for 3 to 7 days and fast increases from 7 to 28 days.
3. Reduction of cement with some extant results decreasing the emission of Carbon Dioxide.
4. As replacement of cement with Rice Husk Ash results decreasing the emission of greenhouse gases at greater extent.
5. Result for test of concrete impact the environmental condition which prevents the global warming.

7. FUTURE STUDY

1. There is different level of replacement of RHA for making more strengthening concrete pavement.
2. The characteristics of pavement enhances for that type of concrete for future study which is used for providing more accurate characteristics for pavement.
3. Design of rigid pavement is used for enhancement in future which gets better result in comparison to normal pavement.
4. For use of Rice Husk Ash for concrete pavement it is used to investigate the behavior of reinforce rice husk ash concrete under flexure, shear, compression and torsion.
5. There are various tests which used for the need of investigation for rice husk ash in such a way that tests like as water permeability, corrosion of steel reinforcement, resistance to sulphate attack durability in marine environment etc.

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