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# Analysis the Characteristic Behaviour of Concrete by Partial Replacement of Cement by Rice Husk Ash and Fly Ash

**Sandeep Tak[1], Rajdeep Singh[2], Ashish Verma[2]**

[1]Student, [2]Assistant Professor

[1,2]BRCM College of Engineering and Technology, Bahal, Bhiwani, Haryana, India

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**ABSTRACT**

Rice Husk Ash (RHA) is actually a byproduct of the industry specially agricultural that contains higher quantity of silicon dioxide ($SiO_2$). With this analysis, for the very first time of the Middle East, in order to supply regular RHA, a specific furnace was designed as well as constructed. Afterwards, Efforts were made to figure out the optimum temperature as well as time period of burning up. Results indicate that temperature of $650^0$ centigrade as well as sixty minutes burning period are actually the very best combination. Subsequently different experiments had been carried away to establish attributes of concretes integrating the best possible RHA. These tests include compressive strength, splitting tensile strength, modules of elasticity, fast chloride as well as water permeability permeability check. Results indicate that concrete including RHA had greater compressive strength, splitting tensile strength as well as modulus of elasticity from different ages in contrast to that of the management concrete. Additionally, results indicate which RHA as an artificial pozzolanic content has improved the durability of RHA concretes as well as reduced the chloride diffusion.

***KEYWORDS:*** *Strength of concrete with RICE HUSK ASH*

## INTRODUCTION

The utilization of agricultural and industrial waste components are required by renewable development of concrete industry and the cement. With current, for a wide range of motives, the concrete structure industry isn't lasting. First of all, enormous numbers of virgin components which could stay for coming decades are consumed by it.

Second, the principal binder of concrete is actually Portland cement, the generation of that is actually a significant contributor to greenhouse gas emissions which are actually implicated in climatic change as well as climate change. Thirdly, a number of concrete structures suffer with lack of durability which might consume the natural resources. And so, obtaining an answer to substitute an useful recycled merchandise for part of the cement appears to be appealing for renewable Concrete it's essentially a blend of 2 components: Aggregates and Paste (or maybe binder). The paste comprises cement, additional cementing or perhaps additional cementitious substances &water. It binds the aggregates (sand and crushed stone) or maybe stones right into a rock like mass. The objective is actually filling up the voids and come with a strong and dense components. The good aggregates fill up the voids created by the coarse aggregates; and cement fills up the voids of the fine aggregates. Cheaper the voids more could be the strength of concrete. The chemical response of the cementitious substances &water, is actually known as hydration. It's the task by that paste hardens as well as binds the aggregates.

The excessive modulus of rigidity as well as elasticity of concrete compared to various other road making items offers a concrete pavement with a good amount of flexural or maybe beam strength. This particular property results to a broader distribution of externally used wheel loads. This in turn limits the pressures put on to the sub grade. The main component of the ton carrying capability of a concrete pavement is as a result supplied by the concrete coating on it's own. The thickness of its is largely based on the flexural strength of the concrete and by the magnitude of the wheel or maybe axle a lot. Sub-bases don't make a major structural contribution to Concrete.

**Cement Content**:

When Ordinary Portland Cement (OPC) is needed the amount of cement shan't be a bit less compared to 360 kg/cum. Just in case Fly ash grade I (as a IS:3812) is actually combined from site as partial replacing of cement, the amount of fly ash shall be as much as 20percentby mass of cement as well as also the quantity of OPC in such a mixture shan't be a bit less compared to 310 kg/cum. The bare minimum of OPC articles in case soil Granulated Portland blast furnace is actually utilized, shall additionally not be a bit less compared to 310 kg/m3

**Concrete Strength:**

The distinctive flexural strength of concrete shan't be a bit less compared to 4.5 MPa (M forty Grade). Goal imply flexural strength for blend layout shall be over 4.5 MPa 1.65*s, in which s is actually standard deviation of flexural strength derived by doing check on minimum thirty beams. While developing the blend in the lab, correlation between

compressive and flexural strengths of concrete shall be started on the foundation with a minimum of 30 assessments on samples. Nevertheless, quality control in the area shall be worked out on the foundation of flexural strength. The water content shall be the least required to offer the agreed workability for total compaction of the concrete to the necessary density as well as the optimum clear h2o cement ratio shall be 0.45 when simply OPC is actually utilized and 0.50 when combined cement (Portland Pozzolana Cement or maybe Portland Slag Cement or maybe OPC combined with fly ash or maybe Ground Granulated Blast Furnace Slag at site) is actually utilized.

**Table 1.1 Type of cement confirming to Indian standard code**

| S. No. | Type | Confirming to: |
|---|---|---|
| 1 | Ordinary Portland Cement 43 Grade | IS:8112 |
| 2 | Portland Blast Furnace Slag Cement | IS:455 |
| 3 | Portland Pozzolana Cement | IS:1489-Part I |
| 4 | Ordinary Portland Cement 53 Grade | IS:12269 |

Fly ash up to 20 percent by weight of cement may be used in Ordinary Portland Cement 53 Grade. No fly ash shall be used in any other grade of Cement other than 53 Grade.The fly ash shall conform to IS:3812 (PartI).

**Chemical Admixtures**

Admixtures conforming to IS:6925 and IS:9103 shall be allowed to enhance workability of the concrete or maybe extension of setting time, on satisfactory proof that they won't have any kind of negative impact on the attributes of concrete with value to strength, volume change, durability and also have absolutely no deleterious impact on steel bars. The specifics of the amount as well as the admixture to be consumed, have to be furnished to the Engineer in advance to get the endorsement of his prior to usage. Good enough performance of the admixtures must be proved both on the lab concrete trial mixes and in the trial length paving. When atmosphere entraining admixture is actually utilized, the entire amount of air flow in air entrained concrete as a fraction of the volume of the blend shall be 5±1.5percentfor 31.5 mm nominal measurement aggregate.

**Fibers:**

Fibers might be utilized subject to the provision in the design/approval by the Engineer to decrease the shrinkage cracking & post cracking. The fibers might be metal dietary fiber as a IRC:SP:46 or perhaps polymeric Synthetic Fibers in the next assortment of specifications:

| | |
|---|---|
| Effective Diameter | 10 micron – 1.0mm |
| Length | 6-48mm |
| Specific gravity | more than1.0 |
| Suggested dosage | 0.6-2.0kg/cum(0.2-0.6percent by weight of cement in mix). [Usage will be regulated as stipulated in IRC:44/IS:456 or any other specialist literature.] |
| Water absorption | less than 0.45percent |

**Aggregates**

Aggregates for pavement concrete shall be all-natural material complying with IS:

**Water**:

water used for blending just curing of concrete shall be free and clean from injurious quantity of fossil oil, acid, salt, additional materials or vegetable material bad for the completed concrete. It shall meet the

**Fly Ash**

The fly ash, also referred to as pulverized fuel ash, Coal Fly ash (FA) is actually a by product of the combustion of pulverized coal in thermal power plants. It's eliminated by the dust collection devices from the exhaust gases of fossil fuel power plants as extremely ok, predominantly spherical glassy contaminants coming from the combustion fumes just before they're discharged into ambiance. The dimensions of debris is mostly determined by the kind of dust compilation tools. Diameter of fly ash contaminants ranges from under one µm to 150 µm. It's commonly finer compared to Portland cement. The fly ash obtained from electrostatic precipitators could have a certain surface area of approximately 350000 to 500000 $mm^2/g$, i.e. it's finer compared to Portland cement. The fly ash received from cyclone separators is comparatively coarser and might include larger quantities of un burnt energy. The chemical composition of fly ash is actually driven by relative quantities as well as the kinds of incombustible content of the coal utilized. The main chemical constituents in fly ash are actually silica, oxides and alumina of iron and calcium. Due to its pozzolanic and fineness and at times self cementitious characteristics, fly ash is popular in concrete and cement.

Based on the collection process, varying by using physical to electric precipitators or maybe bag homes as well as cloth filter systems, approximately 85 99.9 percentof the ash coming from the flue fumes within retrieved in the type of fly ash. Fly ash accounts for 75 85percentof the entire coal ash, as well as the rest is actually collected as bottom ash or boiler slag. Fly ash due to the mineralogical structure of its, good particle size as well as amorphous character is usually pozzolanic and in many cases also person cementitious while bottom ash and boiler slag are actually a great deal of coarser and aren't pozzolanic in nature. Thus, It's vital that you be aware that all of the ash isn't fly ash as well as the fly ashes created by various energy plants aren't equally pozzolanic as well as, as a result, aren't often ideal for using as mineral admixture of concrete. The main ingredients of fly ash found in oxide type are actually silica (SiO2), alumina (Al2O3), and also oxides of iron and calcium (Fe2O3 and CaO). Fly ash structure can vary with the cause of coal.

***A. Utilizationof Fly Ash in Cementand Concrete*:**

It can be utilized in under given ways:

**High Volume Uses**

It includes:

- asstructura1fi11sinembankments,dams,dikesand1evees ,and
- as sub-baseas we11 asb as ecoursesin roadway construction.

**Medium Volume Uses**

This inc1udes the use of f1y ash

- as raw materia1 in cement production
- as an admixture in b1ended cement sand
- as rep1acement of cement or as a miner1dmixturein concrete

**Low Volume Uses**

This inc1udes the coa1 ash uti1ization

- in high va1ue added app1ications such as meta1extr actions.High va1ue meta1 recovery of A1uminum (A1),Go1d(Au),Si1ver(Ag),Vanadium(Va)and Strontium(Sr) fa11 in this category.
- F1y ash has potentia1 uses for producing 1ight weight refractory materia1 and exotic high temperature resistantti1es
- Cenospheres or f1oaters in f1y ash are used as specia1 refractory materia1 and a1so as additives in forging to produce high strength.

**LITERATURE REVIEW**

**Brown, J. H.(2012)"The strength and workability of concrete with Fly Ash substitution**" carried out a few scientific studies with fly ash replacing cement as well as facial aggregate at ph levels of 10 40percentby volume. He concluded that for every 10% of ash substituted for cement, the compacting element or maybe workability modified to exactly the same purchase as it'd by raising the water content of the blend by 3 4 %. When fly ash was substituted for sand or maybe complete aggregate, workability enhanced to attain an optimum worth at approximately8% ash by volume of aggregate. Fast reduction in workability was caused by additional substitution.

**Geblerand Klieger,(2015)** intheirpaper "**Effect of fly ash on the air void stability of concrete**" investigated the demands of Air Entraining Agent (AEA) for Class-F and Class-C fly ashes. They found that (1) concretes manufactured with Class C fly ash typically demand a lesser amount of AEA compared to individuals made with Class F fly ashes; (2) for six percent atmosphere articles in concrete, the AEA varied from 126 to 173percentfor fly ashes owning much more than ten percent CaO, while it had been in the assortment of 177 to 553percentfor fly ashes that contain under ten percent CaO; as well as (3) expansion in both overall alkalies as well as SO3 contents in fly ash have an effect on the atmosphere entrainment favorably. A concrete that contains a category F fly ash which has relative higher CaO content and much less organic material or maybe co2 tends to be much less weak to loss of atmosphere.

**Hardened Properties:**

**Lohtiaetal.(2016)**studied the creep as well as creep recovery of plain as well as fly ash concretes from stress strength proportions of twenty as well as 35 %. Fly ash content was varied between zero as well as 25 %. They concluded that (1) replacing of 15percentof cement with fly ash was most effective with value to strength, elasticity, creep and shrinkage of fly ash concrete; (2) creep-time curves for plain as well as fly ash concretes were very similar, and creep linearly associated with the logarithm of time; (3) with fly ash articles up to 15 %, increase in creep was negligible. Nevertheless, somewhat greater creep taken place with fly ash articles over 15 %; (4) creep coefficients had been very similar for the materials with fly ash articles of the assortment of 0-25 %; as well as (5) creep healing was discovered varying from 22-43percentof the corresponding 150 day creep. For replacing outside of 15 %, the creep recuperation was smaller. Absolutely no clear pattern of creep restoration as a characteristic of stress strength ratio was noticed.

**Saraswathy et al. (2014)** in their paper " **Influence of activated fly ash on corrosion–resistance and strength of concrete**" investigated the effect of activated fly ash on the compressive strength of concrete. Several activation strategies, like actual physical, thermal as well as substance had been followed. Concrete specimens had been ready with ten, twenty, thirty along with 40percentof triggered fly ash replacing amounts with cement. Compressive strength was driven at seven, fourteen, twenty eight as well as ninety times. They concluded that (1) activation of fly ash improved the strength of concrete. Nevertheless, the compressive strength of fly ash concrete was under that of regular portland cement (OPC) while after ninety days of curing; as well as (2) with the activation methods, chemically triggered coal fly ash (CFA) improved the compressive strength to a particular level, just with ten as well as 20 percent substitutes. Because the CFA area level is actually etched by a solid alkali to facilitate more cement contaminants to join also and together the inclusion of CaO that is even more encouraging the development of Ca(Oh)2 and csh gel that is a lot more beneficial to improve the power development.

**Atis et al. (2014)** in their paper " **Strength and shrinkage properties of mortar** " assessed the drying out shrinkage of mortar mixtures that contain huge calcium non regular fly ash up to the era of five weeks. 5 mortar mixtures such as management Portland cement as well as fly ash mortar mixtures have been ready. Fly ash supplanted cement on mass foundation at the replacing proportions of ten, twenty, and thirty along with 40 %. Water-cementitiousts ratio was 0.4. Mixtures had been relieved during 65 percent distant relative humidity as well as twenty 20 C. They found that shrinkage of Portland cement mortar from five weeks was 0.1228 %. Shrinkage of fly ash mortar reduced with the expansion in fly ash articles. Shrinkages of mortar that contains ten, twenty as well as 30 percent fly ash were twenty five, thirty seven as well as 43 %, smaller compared to the shrinkage of Portland cement mortar at the conclusion of five weeks. The decrease in shrinkage with the usage of fly ash in mortar might be clarified by the dilution impact of fly ash. The expansive property of fly ash possibly contributed to the decrease in drying out shrinkage.

**Demirboga et al. (2017)** "**Thermo-mechanical properties of concrete contaiing high-** the Thermal Conductivity (TC) of HVFA concrete at the era of twenty eight days or weeks. Cement was replaced with zero, fifty, sixty, along with seventy percentof Class C fly ash. They concluded that "TC of concrete decreased to thirty two, thirty three, along with thirty nine percentfor fifty, sixty as well as seventy percentfly ash replacement, respectively".

**Durability Properties:**

**Virtanen, J.(2016)** in his paper **"Freeze–tha wresist ance of concrete containing blast furnace slag,fly ash or condensed silica fume**" evaluated the freezing and thawing opposition concrete made with fly ash. They concluded that (one) atmosphere information has the best impact on the freeze-thaw opposition of concrete; (two) inclusion of fly ash had no main impact on the freeze-thaw resistance of concrete in case the power as well as atmosphere article are actually maintained regular.

**Naiketal., (2014)** in their research" Permeability of concrete containing large amounts of fly ash "evaluated the effect of inclusion of a lot (fifty as well as seventy percent cement replacement) of Class C fly ash on the chloride permeability

of concrete. Concrete mixtures had been specified as C 3 (zero percent fly ash), P4 7 (fifty percent fly ash P4-8 and) (seventy percent fly ash). Chloride permeability was driven in accordance with ASTM C1202, Chloride permeability decreased with age. At the era of two weeks, just about all concrete mixtures other than the seventy percent fly ash combination exhibited average (2,000-4,000 C) permeability in accordance with ASTM C1202 specs. The fifty percent fly ash concrete combination displayed reduced permeability distant relative to the no fly ash concrete at any age. The seventy percent fly ash combination also performed much better than that of the no fly ash concrete after three weeks.

**Mehta, P. K. (2015)**in his paper " **Sulfate Attack on concrete."** concluded that fly ashes are actually amongst the number of pozzolans which greatly up the life expectancy of concrete subjected to sulfate strike. Generally, Class F style fly ash conference the specification needs are going to improve the sulfate opposition of every concrete/mortar blend in that it's provided, though the amount of development could differ with possibly the cement utilized or maybe the fly ash. The circumstance with Class C fly ash is actually different

**Chaleeetal.(2017)** "**Effect of W/C ratioon covering depth of flyash concrete in marine environment**" studied the impact of W/C ratio on covering level needed against the oxidation of embedded metal of fly ash concrete in marine setting up to 4 year publicity. Fly ash was employed to partly swap Portland cement sort I at zero, fifteen, twenty five, thirty five, along with fifty percent by mass of cementitious content. Water-to-cementitious content proportions (w/c) of fly ash concretes had been diverse during 0.45, 0.55, as well as 0.65. Assessments had been done for oxidation of embedded metal bar after being subjected to tidal zone for two, three, and four yrs. According to the assessments, they concluded that (1) covering level necessary for the original oxidation of embedded metal bar in concrete might be diminished with fly ash; (2) drop in W/C ratio resulted in minimizing the equipment depth necessary for first oxidation, and typically impacted the cement concrete instead of the fly ash concrete; (3) fly ash concretes with thirty five as well as fifty percent substitutes as well as W/C ratio of 0.65, supplied the outcome of oxidation opposition at 4 year publicity as great as cement concrete with W/C ratio of 0.45; as well as (4) concrete with compressive strength of thirty MPa might lessen the covering level via fifty to thirty mm

## CONCLUSIONS

- The mixes with only fly ash replacement strength from 7days t o 28 days despite the fact hatthey have high initial strength, than the mixes with rice husk ash replacement only. The mixes with the inclusion of both rice husk ash and fly ash as replacement materials how the highest rate of increase of compressive strength for all water to cement ratios which indicates that pozzolanic activity initiates early for such mixes.
- Concrete mix with up to 30 percent replacement of cement with fly ash for all water-cement ratios have higher compressive strengths than minimum required as per MoRT&H specifications.
- Concrete mixes with 10 per cent replacement of rice husk ash in w/c=0.3 have higher compressive strengths tha MoRT&H specifications.
- Concrete mixes with combined replacement of 10% each of fly ash and rice husk ash inw/c=0.3 showed higher compressive strengths than minimum required as per MoRT&H specifications.

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