INTERNATIONAL JOURNAL OF PROGRESSIVE RESEARCH IN ENGINEERING MANAGEMENT AND SCIENCE (IJPREMS)

www.ijprems.com
editor@ijprems.com

Vol. 04, Issue 03, March 2024, pp: 482-491

e-ISSN : 2583-1062

Impact Factor: 5.725

A COMPARATIVE STUDY OF DIFFERENT STRENGTH FOR DIFFERENT MIXER BY USING FLY ASH, QUARRY DUST AND 10MM COARSE AGGREGATE

S. Kasilingam[1], Dr. A. Arivumangai[2]

[1]M.Tech Structural Engineering, Dr. M.G.R. Educational & Research Institute, Chennai, India.

[2]Professor,Department of Civil Engg, Dr. M.G.R. Educational & Research Institute, Chennai, India.

DOI: https://www.doi.org/10.58257/IJPREMS32938

ABSTRACT

Structural failures are one of the important phenomena which should be very important to deal with. Structural failures occur then and causing heavy damage to both property and human lives. Structural elements include beam, column, slab etc. The failure of the horizontal load bearing member beam is considered. Building failure can be defined as the collapse of structure, while building disaster gives evidence of a structural member being unsafe before the actual collapse. Building failure in a construction sector is an indispensable factor that must be considered with great care and skills. In this Research, various reasons for structural failures like Faulty Design, Inferior quality of materials, Poor Workmanship, Weathering conditions, Natural calamities etc. It will discuss about the various methods of doing the repair woks that is remedial measures. To know better about the nature of concrete elements, the most effective and also most economical.

Keywords: Structural failures; reasons; retrofitting materials; causes

1. INTRODUCTION

Every year 87 to 100 million tonne of fly ash is generated from coal based thermal power stations in India and power is the key to the prosperity and development pf a nation and the power generation in India consumes 70% of country’s coal production and generates 100 million tones ash per tear. The ash generation is projected to increase at least to 175 million tonne per year by 2012. Now, having seen that fly ash is such a wonderful and useful material that it can be used for large number of gainful applications like in building components, cement, construction of embankments, raising, dykes, agriculture and mine fill material, it is successfully accepted for large scale utilization in stead of disposing at high handling costs. This article deals with the management of fly ash in utilization based on its quality and value, dry ash collection, handling, densification and managing ash dykes and ponds in an economical.

Cementations materials have in existence for a long time and that their use in construction activity dates back to Babylonians, Romans and Egyptian is a well-known fact. These materials have undergone several changes over ages and during the past four decades, the changes in both process and prediction have established cement and concrete composites to be the most economical and high performance of the construction materials today. The different forms of reinforcing these materials to compensate for their inadequate tensile strength and other properties made it an effective and viable alternative material to structural steel in the construction industry.

The rapid deterioration of concrete structures, which are forced to perform in the most severe natural environment like the oceans and the other more severe environmental condition brought about by the industrialization, necessitated the construction industry to look for effective methods of achieving a better performance.

As a first step, it as been established that lower water cement ratio, results in high concrete strength that can resist the environmental forces better. But the requirement of workability inhibited the initial. Attempts in this direction till super plasticizers or High. Range Water Reducers (HRWR) was invented. These materials facilitated the production of reasonably high strength concrete of very low water cement ratios, though mostly with higher cement contents, making the concrete much more reactive to the environment.

Also it was realized that the high strength alone will not be an effective method of achieving high performance and that the durability of these materials in various environments needs a better understanding to achieve an appropriate solution. The utilization of large quanties of industrial wastes presently available as pozzolanas in concrete showed the possibilities of obtaining very high strength concrete having much lower reactivity.

The most noteworthy of these works is probably the introduction of mineral admixtures like fly ash, blast furnace slag, silica fume etc. With the use of both mineral admixture and super plasticizers, it is now possible to develop both high strength and high performance in concrete composition.they must be both stiff and tough. A very stiff material may resist bending, but unless it is sufficiently tough, it may have to be very large to support a load without breaking. On the other hand, a highly elastic material will bend under a load even if its high toughness prevents fracture.

1.2 Fly ash in concrete :

Fly ashes are finely divided residue resulting from the combustion of ground or powdered coal. They are generally finer than cement and consist mainly of glassy- spherical particles as well as residues of hematite and magnetite, char, and some crystalline phases formed during cooling. Use of fly ash in concrete started in the United States in the early 1930's. The first comprehensive study was that described in 1937, by R. E. Davis at the University of California (Kobubu, 1968; Davis et al., 1937). The major break through m using fly ash in concrete was the construction of Hungry Horse Dam in .1948, utilizing 120,000 metric tons of fly ash. This decision by the U.S. Bureau of Reclamation paved the way for using fly ash in concrete constructions.

In addition to economic and ecological benefits, the use of fly ash in concrete improves its workability, reduces segregation, bleeding, heat evolution and permeability, inhibits alkali-aggregate reaction, and enhances sulfate resistance. Even though the use of fly ash in concrete has increased in the last 20 years, less than 20% of the fly ash collected was used in the cement and concrete industries (Helmuth 1987).One of the most important fields of application for fly ash is PCC pavement, where a large quantity of concrete is used and economy is an important factor in concrete pavement construction. FHWA has been encouraging the use of fly ash in concrete. When-the price of fly ash concrete is equal to, or less than, the price of mixes and cement, fly ash concretes are given preference if technically appropriate funder FHW A guidelines (Adams 1988). Fortunately, a portion of the Portland cement could be replaced in concrete by supplementary cementing materials (SCMs) such as fly ash, a byproduct from coal- burning in thermal power stations. The replacement can be done either directly at the concrete batch plant or during, the production of blended cements. Given this scenario, it is imperative that every effort is made in the extensive use of fly ash, which is abundant in India, to meet the current construction demands and to decrease the environmental damage.In terms of public good, the greater use of fly ash in concrete contributes to reduced greenhouse gas (GHGs) permission, without negative impacts on the economy. The overall quantity of CO_2 mitted will be reduced in one important sector of the economy without affecting it Such changes in the construction sector should provide certain flexibility to the governments to meet emission targets with reduced pressure on other sectors bound to be more affected by measures of CO_2 reduction. In addition to CO_2 emission reductions, there are other potential benefits of using larger amounts of fly ash in concrete including reduced landfills, lower-cost concrete, increased durability, and reduced fly ash disposal costs.

Approximately l00 million tonnes of fly ash are produced in India annually from the combustion of coal, and this is increasing rapidly due to the growth in demand for energy. It is predicted that the amount of fly ash produced in India will double in the next ten to fifteen years. While this ensures that there will be more than sufficient supply of fly ash in India to meet its use, as a supplementary cementing material for years to come, currently, it is creating a waste disposal problem. Most of the fly ash produced is currently disposed of in landfills, requiring large tracts of land and water. Therefore it is essential that the utilization of fly ash in useful applications increase dramatically to reduce the use of land for waste disposal, and that then becomes potentially available for other uses such as housing, agriculture or industry. Since it is a by product, the initial cost of-fly ash is minimal compared to that of Portland cement. There are some costs associated with the handling of the fly ash and possibly-with any special operations required to ensure proper quality control of the material. However, for the cement or concrete producer, the cost of fly ash will depend mainly on the cost of its transportation from the thermal power plant. Consequently, in areas close to power stations producing good quality fly ash, there should be cost benefits associated with the use of fly ash in concrete or in the production of blended cement. Thus, by making use of appropriate technologies, fly ash concrete of equivalent quality to that of conventional concrete could be produced at a lower cost. Therefore, there is some immediate economical benefit potential in using fly ash in concrete. For the power generation industry, the disposal of fly ash in landfills is costly. In the event that large amounts of fly ash are used by the concrete industry, the disposal costs would be reduced by a corresponding amount. Also, it is well established that the proper use of fly ash in concrete improves the durability of concrete, translating into increased service life of concrete structures, resulting in considerable savings in repair and replacement costs. Consequently, there are potential indirect economical benefits of using fly ash in concrete.

1.3 Quarry dust in fly ash concrete:

Currently India has taken a major initiative on developing the infrastructures such as express highways, power projects and industrial structures etc., to meet the requirements of globalization, in the construction of buildings and other structures concrete plays the rightful role and a large quantum of concrete is being utilized. River sand, which is one of the constituents used in the production of conventional concrete, has become highly expensive and also scarce. In the backdrop of such a bleak atmosphere, there is large demand for alternative materials from industrial waste.

The consumption of cement content, workability, compressive strength and cost of concrete made with Quarry Rock Dust. The possibilities of ensuring the workability by wise combination of rock dust and sand, use of super plasticizer

INTERNATIONAL JOURNAL OF PROGRESSIVE RESEARCH IN ENGINEERING MANAGEMENT AND SCIENCE (IJPREMS)
www.ijprems.com
editor@ijprems.com
Vol. 04, Issue 03, March 2024, pp: 482-491
e-ISSN : 2583-1062
Impact Factor: 5.725

and optimum water content using generalized reported significant increase in compressive strength, modulus of rupture and split tensile strength when 40 percent of sand is replaced by Quarry Rock Dust in concrete. Natural Sand with Quarry Dust as full replacement in concrete as possible with proper treatment of Quarry Dust before utilization.

The utilization of Quarry rock dust which can be called as manufactured sand has been accepted as a building material in the industrially advanced countries west for As a result of sustained research and developmental works under-taken with respect to increasing application of this industrial waste. The level of utilization of Quarry Rock Dust in the industrialized nations like Australia, France, Germany and UK has been reached more than 60% of its total production. The use of (2) manufactured sand in India has not been much, when compared to some advanced countries. This paper presents the feasibility of the usage of Quarry Rock Dust as hundred percent substitutes for Conventional Concrete. Tests were conducted on cubes and beams to study the compressive, flexural strengths of concrete made of Quarry Rock Dust for three different proportions and five different methods. Durability Studies were done for concrete with Quarry Rock Dust and compared with the Conventional Concrete. In this project we are going to study and compare the mechanical properties of conventional concrete with different mixers by using fly ash, quarry dust and 6mm stone chips as coarse aggregate. Common fly ash, quarry dust and 6mm coarse aggregate are waste material from structural point of view. In this project we prove all structural waste material could be converted into use full building material and certainly cost of concrete will be reduced further leads to national economic growth.

2. LITERATURE REVIEW

2.1-. orgin of fly ash:

The fly ash produced from the burning of pulverized coal in a coal-fired boiler is a fine-grained, powdery particulate material that is carried off in the flue gas and usually collected from the flue gas by means of electrostatic precipitators, bag houses, or mechanical collection devices such as cyclones. In general, there are three types of coal-fired boiler furnaces used in the electric utility industry. They are referred to as dry-bottom boilers, wet-bottom boilers, and cyclone furnaces. The most common type of coal burning furnace is the dry-bottom furnace. When pulverized coal is combusted in a dry-ash, dry-bottom boiler, about 80 percent of all the ash leaves the furnace as fly ash, entrained in the flue gas. When pulverized coal is combusted in a wet-bottom (or slag-tap) furnace, as much as 50 percent of the ash is retained in the furnace, with the other 50 percent being entrained in the flue gas. In a cyclone furnace, where crushed coal is used as a fuel, 70 to 80 percent of the ash is retained as boiler slag and only 20 to 30 percent leaves the furnace as dry ash in the flue gas

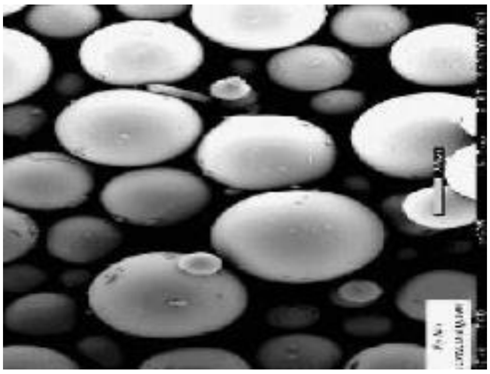

Fig -1 Flyash

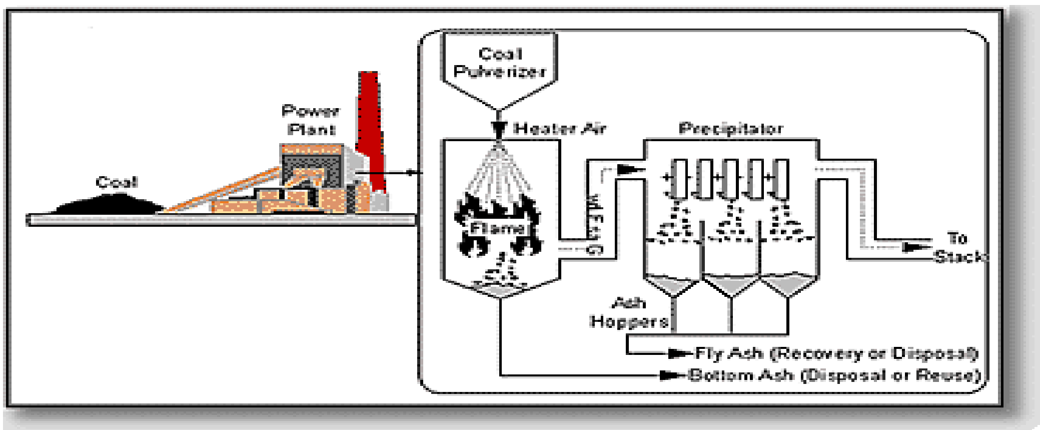

Fig -2 Fly ash production in a dry-bottom coal-fired utility boiler operation

2.2-. Engineering properties of fly ash:

Some of the engineering properties of fly ash that are of particular interest when fly ash is used as an admixture or a cement addition to PCC mixes include fineness, LOI, chemical composition, moisture content, and pozzolanic activity. Most specifying agencies refer to ASTM C618.

Fineness: Fineness is the primary physical characteristic of fly ash that relates to pozzolanic activity. As the fineness increases, the pozzolanic activity can be expected to increase.

Pozzolanic Activity (Chemical Composition and Mineralogy):

Pozzolanic activity refers to the ability of the silica and alumina components of fly ash to react with available calcium and/or magnesium from the hydration products of Portland cement. ASTM C618 requires that the pozzolanic activity index with Portland cement, as determined in accordance with ASTM C311, be a minimum of 75 percent of the average 28-day compressive strength of control mixes made with Portland cement.

Loss on Ignition: LOI value should not exceed 3 or 4 percent, even though the ASTM criteria is a maximum LOI content of 6 percent. This is because carbon contents (reflected by LOI) higher than 3 to 4 percent have an adverse effect on air Entrainment. Fly ashes must have a low enough LOI (usually less than 3.0 percent) to satisfy ready-mix concrete producers, who are concerned about product quality and the control of air-entraining admixtures. Furthermore, consistent LOI values are almost as important as low LOI values to ready-mix producers, who are most concerned with consistent and predictable quality.

Moisture Content: ASTM C618 specifies a maximum allowable moisture content of 3.0 percent. Some of the properties of fly ash concrete mixes that are of particular interest include mix workability, time of setting, bleeding, pump ability, strength development,

Heat of hydration, permeability, resistance to freeze-thaw, sulfate resistance, and alkali-silica reactivity.

Workability: At a given water-cement ratio, the spherical shape of most fly ash particles permits greater workability than with conventional concrete mixes. When fly ash is used, the absolute volume of cement plus fly ash usually exceeds that of cement in conventional concrete mixes. The increased ratio of solids volume to water volume produces a paste with improved plasticity and more cohesiveness.

Time of Setting: When replacing up to 25 percent of the Portland cement in concrete, all Class F fly ashes and most Class C fly ashes increase the time of setting. However, some Class C fly ashes may have little effect on, or possibly even decrease, the time of setting. Delays in setting time will probably be more pronounced, compared with conventional concrete mixes, during the cooler or colder months.

Bleeding: Bleeding in concrete is usually lower because of the greater volume of fines and lower required water content for a given degree of workability.

Pumpability: Pumpability is increased by the same characteristics affecting workability, specifically, the lubricating effect of the spherical fly ash particles and the increased ratio of solids to liquid that makes the concrete less prone to segregation.

Strength Development: Previous studies of fly ash concrete mixes have generally confirmed that most mixes that contain Class F fly ash that replaces Portland cement at a 1:1 (equal weight) ratio gain compressive strength, as well as tensile strength, more slowly than conventional concrete mixes for up to as long as 60 to 90 days. Beyond 60 to 90 days, Class F fly ash concrete mixes will ultimately exceed the strength of conventional PCC mixes. For mixes with replacement ratios from 1.1 to 1.5:1 by weight of Class F fly ash to the Portland cement that is being replaced, 28-day strength development is approximately equal to that of conventional concrete. Class C fly ashes often exhibit a higher rate of reaction at early ages than Class F fly ashes

Heat of Hydration: The initial impetus for using fly ash in concrete is stemmed from the fact that the more slowly reacting fly ash generates less heat per unit of time than the hydration of the faster reacting Portland cement.

Thus, the temperature rise in large Masses of concrete (such as dams) can be significantly reduced if fly ash is substituted for cement, since more of the heat can be dissipated as it develops. Not only is the risk of thermal cracking reduced, but greater ultimate strength is attained in concrete with fly ash because of the pozzolanic reaction. Class F fly ashes are generally more effective than Class C fly ashes in reducing the heat of hydration.

Permeability: Fly ash reacting with available lime and alkalies generates additional cementitious compounds that act to block bleed channels, filling pore space and reducing the permeability of the hardened concrete.

The pozzolanic reaction consumes Calcium hydroxide ($Ca(OH)2$), which is leach able, replacing it with insoluble calcium silicate hydrates (CSH). The increased volume of fines and reduced water content also play a role.

Vol. 04, Issue 03, March 2024, pp: 482-491
e-ISSN : 2583-1062
Impact Factor: 5.725

2.3-Materi al properti es

Physical Properties

Fly ash consists of fine, powdery particles that are predominantly spherical in shape, either solid or hollow, and mostly glassy (amorphous) in nature. The carbonaceous material in fly ash is composed of angular particles. The particle size distribution of most bituminous coal fly ashes is generally similar to that of a silt (less than a 0.075 mm or No. 200 sieve). Although subbituminous coal fly ashes are also silt-sized, they are generally slightly coarser than bituminous coal fly ashes.

The specific gravity of fly ash usually ranges from 2.1 to 3.0, while its specific surface area (measured by the Blaine air permeability method)) may range from 170 to 1000 m2/kg.The color of fly ash can vary from tan to gray to black, depending on the amount of unburned carbon in the ash. The lighter the color, the lower the carbon content. Lignite or subbituminous fly ashes are usually light tan to buff in color, indicating relatively low amounts of carbon as well as the presence of some lime or calcium. Bituminous fly ashes are usually some shade of gray, with the lighter shades of gray generally indicating a higher quality of ash.

Chemical Properties

The chemical properties of fly ash are influenced to a great extent by those of the coal burned and the techniques used for handling and storage. There are basically four types, or ranks, of coal, each of which varies in terms of its heating value, its chemical composition, ash content, and geological origin. The four types, or ranks, of coal are anthracite, bituminous, subbituminous, and lignite. In addition to being handled in a dry, conditioned, or wet form, fly ash is also sometimes classified according to the type of coal from which the ash was derived. The principal components of bituminous coal fly ash are silica, alumina, iron oxide, and calcium, with varying amounts of carbon, as measured by the loss on ignition (LOI). Lignite and sub bituminous coal fly ashes are characterized by higher concentrations of calcium and magnesium oxide and reduced percentages of silica and iron oxide, as well as a lower carbon content, compared with bituminous coal fly ash.

Very little anthracite coal is burned in utility boilers, so there are only small amounts of anthracite coal fly Ash. Table below compares the normal range of the chemical constituents of bituminous coal fly ash with those of lignite coal fly ash and sub bituminous coal fly ash. From the table, it is evident that lignite and sub bituminous coal fly ashes have a higher calcium Oxide content and lower loss on ignition than fly ashes from bituminous coals. Lignite and sub bituminous coal fly ashes may have a higher concentration of sulfate compounds than bituminous coal fly ashes.The chief difference between Class F and Class C fly ash is in the amount of calcium and the silica, alumina, and iron content in the ash. In Class F fly ash, total calcium typically ranges from 1 to 12 percent, mostly in the form of calcium hydroxide, calcium sulfate, and glassy components in combination with silica and alumina. In contrast, Class C fly ash may have reported calcium oxide contents as high as 30 to 40 percent. Another difference between Class F and Class C is that the amount of alkalis (combined sodium and potassium) and sulfates (SO4) are generally higher in the Class C fly ashes than in the Class F fly ashes.

Table 1. Normal range of chemical composition for fly ash produced from different coal types(expressed as percent by weight).

Component	Bituminous	Subbituminous	Lignite
SiO_2	20-60	40-60	15-45
Al_2O_3	5-35	20-30	10-25
Fe_2O_3	10-40	4-10	4-15
CaO	1-12	5-30	15-40
MgO	0-5	1-6	3-10
SO_3	0-4	0-2	0-10
Na_2O	0-4	0-2	0-6
K_2O	0-3	0-4	0-4
LOI	0-15	0-3	0-5

2.3. Quality of fly ash used in Portland cement:

Fly ash to be used in Portland cement concrete (PCC) must meet the requirements of ASTM C618.[5] Two classes of fly ash are defined in ASTM C618: 1) Class F fly ash, and 2) Class C fly ash. Fly ash that is produced from the burning of anthracite or bituminous coal is typically pozzolanic and is referred to as a Class F fly ash if it meets the chemical composition and physical requirements specified in ASTM C618. Materials with pozzolanic properties contain glassy silica and alumina that will, in the presence of water and free lime, react with the calcium in the lime to produce calcium silicate hydrates (cementitious compounds).Fly ash that is produced from the burning of lignite or sub bituminous coal, in addition to having pozzolanic properties, also has some self-cementing properties (ability to harden and gain strength in the presence of water alone). When this fly ash meets the chemical composition and physical requirements outlined in ASTM C618, it is referred to as a Class C fly ash. Most Class C fly ashes have self-cementing properties.Fly ash is typically stored dry in silos, from which it can be used or disposed of in a dry or wet form. Water can be added to the fly ash to allow for stockpiling or landfilling in a conditioned form (approximately 15 to 30 percent moisture), or for disposal by sluicing into settling ponds or lagoons in a wet form. Approximately 75 percent of the fly ash produced is handled in a dry or moisture-conditioned form, making it much easier to recover and use. The main advantage to the conditioning of fly ash is the reduction of blowing or dusting during truck transport and outdoor storage.

2.4 Advantages On Addition Of Fly Ash In Concrete

- Increased (later) Compressive Strength
- Increased Workability
- Reduced heat of hydration (CANMET, Canada found that 10 ft cubes had a temperature rise of only 35 deg Celsius vs. 65 deg using Portland cement)
- No leaching of Calcium Hydroxide crystals on to the surface (those white patches)
- Increased Durability - (low Chloride Ion penetration, i.e. very low coulomb rating that further decreases with time).
- Decreased Permeability
- Reduced Sulfate Attack
- Decreased Bleeding & Segregation
- Reduced Drying Shrinkage

2.5 FEATURES OF FLY ASH?

Spherical shape : Fly ash particles are almost totally spherical in shape, allowing them to flow and blend freely in mixtures.

Ball bearing effect :The "ball-bearing" effect of fly ash particles creates a lubricating action when concrete is in its plastic state.

Higher Strength : Fly ash continues to combine with free lime, increasing structural strength over time.

Decreased Permeability : Increased density and long term pozzolanic action of fly ash, which ties up free lime, results in fewer bleed channels and decreases permeability Increased Durability. Dense fly ash concrete helps keep aggressive compounds on the surface, where destructive action is lessened. Fly ash concrete is also more resistant to attack by sulfate, mild acid, soft (lime hungry) water, and seawater.

Reduced Sulfate Attack : Fly ash ties up free lime that can combine with sulfate to create destructive expansion.

Reduced Efflorescence: Fly ash chemically binds free lime and salts that can create efflorescence and dense concrete holds efflorescence producing compounds on the inside.

Reduced Shrinkage : The largest contributor to drying shrinkage is water content. The lubricating action of fly ash reduces water content and drying shrinkage.

Reduced Heat of Hydration :The pozzolanic reaction between fly ash and lime generates less heat, resulting in reduced thermal cracking when fly ash is used to replace portland cement.

Reduced Alkali Silica Reactivity : Fly ash combines with alkalis from cement that might otherwise combine with silica from aggregates, causing destructive expansion.

Workability : Concrete is easier to place with less effort, responding better to vibration to fill forms more completely. Ease of Pumping. Pumping requires less energy and longer pumping distances are possible.

Improved Finishing : Sharp, clear architectural definition is easier to achieve, with less worry about in-place integrity.

Reduced Bleeding : Fewer bleed channels decreases porosity and chemical attack. Bleed streaking is reduced for architectural finishes. Improved paste to aggregate contact results in enhanced bond strengths.

Reduced Segregation : Improved cohesiveness of fly ash concrete reduces segregation that can lead to rock pockets and blemishes. **Reduced Slump Loss** : More dependable concrete allows for greater working time, especially in hot weather.

3. SCHEME OF WORK

In order to establish empirical relationship between compressive strength of HPC with its other properties like tensile strength, modulus of rupture study is carried out. The properties investigated are

- Compressive strength at 21 and 28 days.
- Tensile strength by split cylinder test at 21 and 28 days.
- Modulus of rupture test at 21 and 28 days.
- Totally seven different mixer of concrete we are used in this project. No.of samples = 70.

Table 2. Scheme of work

S.No	Properties investigated	No. Of specimens
		M25 grade
1	Compressive strength (cube size 150mm x 150mm x 150mm)	6
2.	Tensile strength (spilt cylinder test) (cylinder size 150mm dia and 300mm height	2
3.	Modulus of rupture test(beam 100mm x 100mm x 500mm)	2
	Total →	10

4. CONSTRUCTI ON PROCEDURES

4.1 Material Handling and Storage

When fly ash is used as a mineral admixture, the ready-mix producer typically handles fly ash in the same manner as Portland cement, except that fly ash must be stored in a separate silo from the Portland cement.

4.2 Mixing, Placing, and Compacting

Placement and handling of fly ash concrete is in most respects similar to that of normal concrete. Fly ash concrete using Class F fly ash has a slower setting time than normal concrete hours, depending on the temperature. Placement and finishing, although properly proportioned concrete mixes containing fly ash should benefit workability and finishing. The concrete mix is placed in layers in standard steel moulds (cube, cylinder and beam) for casting the concrete specimens. The concrete placed was compacted using table vibrator. Before casting a thin coat of oil was applied on the interior faces of the mould to prevent damages to concrete on extraction.Normal procedures for screeding, finishing, edging, and jointing of conventional PCC are also applicable to fly ash concrete

4.3 Curing

The proper application of a curing compound should retain moisture in the concrete for a sufficient period of time to permit strength development. After 24 hours of casting, the specimens are removed from the mould with great care. The surface of the specimens is cleaned gently to remove loose particles and are lowered in a curing tank containing clean freshwater. The water in the curing tank was removed after every 10 days and filled with freshwater for curing.

5. TEST PROCEDURES

5.1 Preparation of Test Specimens

The ingredients for the various concrete mixtures were weighed and casting was carried out using a pan mixer. Precautions were taken to ensure uniform mixing of ingredients. The specimens were cast in steel moulds and compacted on a table vibrator by placing the concrete in the moulds in three equal layers and compacting with the table vibrator after placing each layer. The specimens were cured in water on demoulding after 24 hours.

3.6. 2 Mechanical Properties

Compressive strength tests were done on 150 mm cube concrete specimens at different ages as per the procedure specified in IS:516-1959 **[28].** Cylindrical concrete specimens were tested at 21,28 days. The flexural tests were carried out on beam specimens of size 500 x 100 x100 mm under standard two-point loading, while the split tensile strength was determined by subjecting 150 mm diameter x 300 mm long cylinders to diametric compression.

5.3 Compressive test

The compressive strength of concrete cubes of the different mixer are found out at the end of 21 and 28 56 days. The concrete cubes are tested for their compressive strength in the compression testing machine as per IS 516-1959 specifications. The rate of loading is applied 140 kg/sq.cm/min until the failure takes places. The ultimate loads of the concrete cubes are recorded.

5.4 Splitting tensile strength

The splitting tensile strength of concrete cylinders (150 mm dia & 300 mm ht) are tested as per IS 5816-1970 specification. The rate of loading shall be applied without shock increased continuously at rate to produce approximately a splitting tensile stress of approximately 14 to 21 kg/cm2/min until specimen failure be recorded. The spltting tensile strength **τ** of the specimen shall be calculated from the following formula.

$$\tau = \frac{2P}{\pi dl} ; \quad kg/cm^2$$

P = maximum load in kg applied to the specimen.

D = measured diameter in cm of the specimen.

L = measured length in cm of the specimen.

5.5 Modulus of rapture

The modulus of rapture of the beam (100mm x 100mm x 500mm) is tested in UTM as per IS : 516-1959 specifications. The rate of loading applied 180 kg/sq.cm/min. the shall be increased until the specimens fails, and the maximum laod applied (P) to the specimen during the test shall be recorded.

Modulus of rapture $\sigma = \frac{M}{I} = \frac{\sigma}{Y}$; $I = bd^3/12$; Y= D/2

Where,

M = Moment

D = measured depth in cm of the specimen at the point of failure.

I = Moment Of Inertia.

P = maximum load in kg applied to the specimen.

6. RESULTS

6.1 Compressive strength

The compressive strength of concrete using 6.standard cubes and obtained as per IS 516(1959)(5) .

Table 3 The compressive strength values at 21 and 28 days are presented in table for different mixers.

S.No	Grade	Sample	Detail of specimen	Compressive strength N/mm^2	
				21 days	28 days
1.	M25	Plain cement concrete	1	24.00	27.57
			2	23.11	26.22
			3	23.78	25.78
			Average	**23.63**	**26.52**
2.	M25	OPC + fly ash 20%	1	22.67	25.78
			2	22.22	23.78
			3	21.78	22.67
			Average	**22.22**	**24.08**
3.	M25	OPC + fly ash 20%+quarry dust 20%	1	21.78	21.33
			2	20.89	22.67
			3	21.33	23.58
			Average	**21.33**	**23.53**
4.	M25	OPC + fly ash 20%+quarry dust 20%+6mm C.A 20%	1	21.33	24.89
			2	22.67	25.78
			3	22.22	23.78
			Average	**22.67**	**24.81**

5.	M25	OPC + fly ash 30%	1	20.44	24.89
			2	21.33	25.78
			3	20.00	25.78
			Average	**20.59**	**25.48**
6.	M25	OPC + fly ash 30%+quarry dust 30%	1	20.00	21.33
			2	19.11	22.67
			3	21.33	23.58
			Average	**20.15**	**23.53**
7.	M25	OPC + fly ash 30%+quarry dust 30%+6mm C.A 30%	1	19.55	24.00
			2	19.55	23.11
			3	20.89	23.78
			Average	**20.00**	**23.63**

6.2 Split Tensile Strength

Table 4 The tensile strength of concrete using standard cylinders and obtained as per IS5816-1970 and presented in table for different mixer.

S.No	**Grade**	**Sample**	**Detail of specimen**	**Tensile strength(split) N/mm^2**	
				21 days	**28 days**
1.	M25	Plain cement concrete	1	3.26	3.75
2.	M25	OPC + fly ash 20%	2	3.00	3.40
3.	M25	OPC + fly ash 20%+quarry dust 20%	3	3.11	3.60
4.	M25	OPC + fly ash 20%+quarry dust 20%+6mm C.A 20%	4	3.40	3.96
5.	M25	OPC + fly ash 30%	5	2.83	3.11
6.	M25	OPC + fly ash 30%+quarry dust 30%	6	3.26	3.53
7.	M25	OPC + fly ash 30%+quarry dust 30%+6mm C.A 30%	7	3.40	3.68

6.3 Modulus of rupture

Table 5 Test as per IS: 516-1959. The results of modulus of rupture for different mixer.

S.No	**Grade**	**Sample**	**Detail of specimen**	**Tensile strength(split) N/mm^2**	
				21 days	**28 days**
1.	M25	Plain cement concrete	1	3.6	6.6
2.	M25	OPC + fly ash 20%	2	4.2	7.2
3.	M25	OPC + fly ash 20%+quarry dust 20%	3	3.0	5.4
4.	M25	OPC + fly ash 20%+quarry dust 20%+6mm C.A 20%	4	4.8	6.9
5.	M25	OPC + fly ash 30%	5	4.2	7.2
6.	M25	OPC + fly ash 30%+quarry dust 30%	6	3.9	6.9
7.	M25	OPC + fly ash 30%+quarry dust 30%+6mm C.A 30%	7	4.8	7.8

7. CONCLUSION

Fly ash concrete mixer contains 20% fly ash, 20% quarry dust and 20% 6mm coarse aggregate or stone chips with OPC concrete having cube compressive strength is 4% less with OPC at the age of 21 days At the same time 7% more with OPC @age of 28 days.Fly ash concrete mixer contains 30% fly ash, 30% quarry dust and 30% 6mm coarse aggregate or stone chips with OPC concrete having cube compressive strength is 15% less with OPC at the age of 21 days. At the same time 5% more than OPC @age of 28 days.Cost of fly ash concrete mixer (20:20:20) is 12% less with OPC concrete.Cost of fly ash concrete mixer (30:30:30) is 19% less with OPC concrete.From the above results it is well known by using fly ash concrete mixer(30:30:30) will bring down 19% cost reduction with OPC concrete and cube compressive strength is also increased by 5%. And also it is good environment protector and reduces the impact of global warming.Hence the Government should implement the above project to all the cement industries, Ready mix concrete (RMC) manufacturers and local construction industries and the growth of the National economic will be increased.Environmental protection and global warming which were threatening the very existence of society. By using fly ash in the manufacture of concrete industry is a best mechanism to arrest environmental pollution and there by reduce the impact of global warming.

8. REFERANCES

[1] Weerachart Tangchirapat1; Chaiyanunt Rattanashotinunt2; Rak Buranasing3; and Chai Jaturapitakkul Influence of Fly Ash on Slump Loss and

[2] Strength of Concrete Fully Incorporating Recycled Concrete Aggregates Journal of Materials in civil Engineering © Asce / February 2013

[3] ACI Committee 211 (1993), Guide for Selecting Proportions for High Strength Concrete with Portland Cement and Fly ash, ACI Materials Journal, Vol.90, No.3, pp. 272-283.

[4] Bharat Kumar, B. H., Narayanan, R., Raghu Prasad, B. K., Ramachandra murthy, D. S. (2001), Mix proportioning of high performance concrete‖, Cement & Concrete Composites, Vol.23, pp. 71 – 80.

[5] Gopalan, M. K., Haque, M. N. (1986), ―Strength development of fly ash concretes‖, Engineering Materials and Structures, Vol.19, No.1, pp. 33-37.

[6] Mehta, P. K. (1985), ―Influence of Fly Ash Characteristics on the Strengthof Portland FlyAsh Mixtures‖, Vol.15, pp.669 – 674.

[7] Xu, A., Sarkar, S.L. (1993), ―Hydration and Properties of Fly ash Concrete‖, in S.N.Ghosh edited Mineral Admixtures in Cement and Concrete, Progress in Cement and Concrete series, Akademia Books International,New Delhi, India, pp. 174 – 225.

[8] Slanicka, S. (1991), ―The Influence of Fly Ash Fineness on the Strength of Concrete‖, Cement and Concrete Research, Vol.21, pp. 285 – 296.