Experimental Study On Partial Replacement Of Cement With Fly Ash And Complete Replacement Of Sand With M sand

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ABSTRACT

Due to rapid growth in construction activity, the available sources of natural sand are getting exhausted & also, good quality sand may have to be transported from long distance, which adds to the cost of construction. In some cases, natural sand may not be of good quality. Therefore, it is necessary to replace natural sand in concrete by an alternate material partially, without compromising the quality of concrete. Quarry sand is one such material which can be used to replace sand as fine aggregate. The present study is aimed at utilizing Quarry sand as fine aggregate replacing natural sand and also the compressive strength of the water cured specimens is measured on the 7,14,28 Days. Split Tensile strength, Flexural Strength, Here we have conducting a test on concrete by using fly ash and m sand. By using these materials we have find out strength on a concrete by adding partial replacement on cement with fly ash and complete replacement of sand with m sand.

Key words:: Experimental Study, Partial Replacement, Cement, Fly Ash, Sand, M sand.

1.INTRODUCTION

Concrete is the most widely used construction material in civil engineering industry because of its high structural strength, stability, and malleability. Recent technological developments have shown that these materials can be used as valuable inorganic and organic resources to produce various useful value-added products. The concrete industry is constantly looking for supplementary cementitious material with the objective of reducing the solid waste disposal problems i.e Fly Ash (FA) are among the solid wastes generated by industry. Substantial energy and cost savings can result when industrial by-products are used as partial replacements for the energy intensive Portland cement. High quality sand is in short supply in India thus; an increased demand for cement and concrete can be met by partially replacing cement with fly ash (FA) and natural sand with quarry sand. This investigation attempts to study the feasibility of using locally available fly ash (FA) and Quarry sand (QS)as partial replacements for cement and natural sand in concrete. The detailed experimental investigation is came to study the effect of partial replacement of cement by Fly Ash (FA) and fine aggregate by quarry sand with using admixture in concrete.The huge quantity of concrete is consumed by construction industry all over the world. In India, the conventional concrete is produced using natural sand from river beds as fine aggregate. Decreasing natural resources poses the environmental problem and hence government restriction on sand quarrying resulted in scarcity and significant increase in its cost. Normally particles are not present in river sand up to required quantity. Digging sand, from river bed in excess quantity is hazardous to environment. The deep pits dug in the river bed, affects the ground water level. In order to fulfill the requirement of fine aggregate, some alternative material must be found. The cheapest and the easiest way of getting substitute for natural sand is obtained from limestone quarries, lateritic sand and crushing natural stone quarries is known as manufactured sand. Concrete made with limestone filler as replacement of natural sand in concrete can attain more or less same compressive strength, tensile strength, permeability, modulus of rupture and lower degree of shrinkage as the control concrete.Coal-based electricity generation results in the production of significant quantities of coal combustion products (CCP). Fly ash is a CCP possessing unique characteristics that allow it to be used ton-for-ton as a substitute for portland cement in making concrete. Through the reuse of fly ash, the GHG emissions associated with the production of portland cement are avoided.

The streamlined life-cycle GHG analysis in WARM focuses on the waste generation point, or the moment a material is discarded, as the reference point and only considers upstream GHG emissions when the production of new materials is affected by materials management decisions.1 As Exhibit 3 illustrates, most of the GHG sources relevant to fly ash in this analysis are contained in the raw materials acquisition and manufacturing nd materials management sections of the life cycle. WARM does not consider source reduction, composting or combustion as life-cycle pathways for fly ash. The recycling emission factor represents the GHG impacts of manufacturing concrete with recycled fly ash in place of portland cement. The land filling emission factor reflects the GHG impacts of disposing fly ash in a landfill. Because fly ash does not generate methane in a landfill, the emission factor reflects the emissions associated with transporting the fly ash to the landfill and operating the landfill equipment Portland cement, a material with GHG-intensive production, is the most common binding ingredient in concrete. As a pozzolana siliceous material that in a finely divided form reacts with lime and water to form compounds with cementitious properties - fly ash may be used to replace a portion of the portland cement in concrete. When used in concrete applications, fly ash typically composes 15–35 percent by weight of all cementitious material in the concrete mix. In high-performance applications, fly ash may account for up to 70 percent.

2 . MATERIALS COLLECTION

2.1 Cement

The cement used was ordinary Portland cement 53 (OPC 53).All properties of cement were determined by referring IS 12269 - 1987. The specific gravity of cement is 3.15. The initial and final setting times were found as 55 minutes and 258 minutes respectively. Standard consistency of cement was 30%.

Advantages :

» Gives more flexibility to architects and engineers to design sleeker and economical sections.

» Develops high early strength so that form work of slabs and beams can be removed much earlier resulting in faster speed of construction and saving in centering cost.

» Produces highly durable and sound concrete due to very low percentage of alkalis, chlorides, magnesia and free lime in its composition.

» Almost a negligible chloride content results in restraining corrosion of concrete structure in hostile environment.

» Significant saving in cement consumption while making concrete of grades M15, M20 & M25 and pre-cast segments due to high early strength.

Physical Properties

Portland cements are commonly characterized by their physical properties for quality control purposes. Their physical properties can be used to classify and compare Portland cements. The challenge in physical property characterization is to develop physical tests that can satisfactorily characterize key parameters.

- Setting Time
- Soundness
- Fineness
- Compressive Strength

Coarse Aggregate

20mm size aggregates-The coarse aggregates with size of 20mm were tested and the specific gravity value of 2.78 and fineness modulus of 7 was found out. Aggregates were available from local sources.

Fine Aggregate

The sand which was locally available and passing through 4.75mm IS sieve is used. The specific gravity of fine aggregate was 2.60.

Water

The water used for experiments was potable water.

Fly Ash

Fly Ash is a by-product of the combustion of pulverized coal in electric power generation plants. When the pulverized coal is ignited in the combustion chamber, the carbon and volatile materials are burned off. However, some of the mineral impurities of clay, shale, feldspars, etc., are fused in suspension and carried out of the combustion chamber in the exhaust gases. As the exhaust gases cool, the fused materials solidify into spherical glassy particles called Fly Ash. Due to the fusion-in-suspension these Fly Ash particles are mostly minute solid spheres and hollow ecospheres with some particles even being plerospheres, which are spheres containing smaller spheres. Th e size of the Fly Ash particles varies but tends to be similar to slightly larger than Type I Portland cement. The Fly Ash is collected from the exhaust gases by electrostatic precipitators or bag filters.

Chemical makeup of Fly Ash is primarily silicate glass containing silica, alumina, iron and calcium. Color generally ranges from dark grey to yellowish tan for Fly Ash used for concrete. ASTM C 618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as Mineral Admixture in Concrete has two designations for Fly Ash used in concrete - Class F and Class C.(Figure.2.1)

Class F Fly Ash is normally produced from burning anthracite or bituminous coal that meets the applicable requirements. This class of Fly Ash has pozzolanic properties and will have a minimum silica dioxide plus aluminum oxide plus iron oxide of 70%.

Class C Fly Ash is normally produced from subbituminous coal that meets the applicable requirements. This class of Fly Ash, in addition to having pozzolanic properties, also has some cementitious properties and will have a minimum silica dioxide plus aluminum oxide plus iron oxide content of 50%.

Most state and federal specifications allow, and even encourage, the use of Fly Ash; especially, when specific durability requirements are needed. Fly Ash has a long history of use in concrete. Fly Ash is used in about 50% of ready mixed concrete (PCA 2000). Class C Fly Ash is used at dosages of 15 to 40% by mass of the cementitious materials in the concrete. Class F is generally used at dosages of 15 to 30%.

Advantages of Fly Ash in Concrete

Fly Ash is a pozzolan. A pozzolan is a siliceous or aluminosiliceous material that, in finely divided form and in the presence of moisture, chemically reacts with the calcium hydroxide released by the hydration of Portland Cement to form additional calcium silicate hydrate and other cementitious compounds. The hydration reactions are similar to the reactions occurring during the hydration of Portland cement. Thus, concrete containing Fly Ash pozzolan becomes denser, stronger and generally more durable long term as compared to straight Portland cement concrete mixtures.

Fly Ash improves concrete workability and lowers water demand. Fly Ash particles are mostly spherical tiny glass beads. Ground materials such as Portland cement are solid angular particles. Fly Ash particles provide a greater workability of the powder portion of the concrete mixture which results in greater workability of the concrete and a lowering of water requirement for the same concrete consistency. Pump ability is greatly enhanced.

Fly Ash generally exhibit less bleeding and segregation than plain concretes. This makes the use of Fly Ash particularity valuable in concrete mixtures made with aggregates deficient in fines.

Sulfate and Alkali Aggregate Resistance. Class F and a few Class C Fly Ashes impart significant sulfate resistance and alkali aggregate reaction (ASR) resistance to the concrete mixture.

Fly Ash has a lower heat of hydration. Portland cement produces considerable heat upon hydration. In mass concrete placements the excess internal heat may contribute to cracking. The use of Fly Ash may greatly reduce this heat buildup and reduce external cracking.

Fly Ash generally reduces the permeability and adsorption of concrete. By reducing the permeability of chloride ion egress, corrosion of embedded steel is greatly decreased. Also, chemical resistance is improved by the reduction of permeability and adsorption.

Fly Ash is economical. The cost of Fly Ash is generally less than Portland cement depending on transportation. Significant quantities may be substituted for Portland cement in concrete mixtures and yet increase the long term strength and durability. Thus, the use of Fly Ash may impart considerable benefits to the concrete mixture over a plain concrete for less cost.

Figure.2.1 Flyash

Figure.2.2 M Sand

M Sand

Natural or River sand are weathered and worn out particles of rocks and are of various grades or sizes depending upon the amount of wearing. Now-a-days good sand is not readily available, it is transported from a long distance. Those resources are also exhausting very rapidly. So it is a need of the time to find some substitute to natural river sand. The artificial sand produced by proper machines can be a better substitute to river sand. The sand must be of proper gradation (it should

have particles from 150 microns to 4.75 mm in proper proportion). When fine particles are in proper proportion, the sand will have fewer voids. The cement quantity required will be less. Such sand will be more economical. Demand for manufactured fine aggregates for making concrete is increasing day by day as river sand cannot meet the rising demand of construction sector. Because of its limited supply, the cost of Natural River sand has sky rocketed and its consistent supply cannot be guaranteed. River sand in many parts of the country is not graded properly and has excessive silt and organic impurities and these can be detrimental to durability of steel in concrete whereas manufactured sand has no silt or organic impurities(Figure.2.2)

Requirements Of Manufactured Sand

- All the sand particles should have higher crushing strength.
- The surface texture of the particles should be smooth.
- The edges of the particles should be grounded.
- The ratio of fines below 600 microns in sand should not be less than 30%.
- There should not be any organic impurities
- Silt in sand should not be more than 2%, for crushed sand.
- In manufactured sand the permissible limit of fines below 75 microns shall not exceed 15%

Sieve Analysis

Table. 2.1 shows Sieve Analysis Of River & Manufactured Sand

Table.2.1:Sieve Analysis Of River & Manufactured Sand

Typical Sieve analysis: Comparison of River & Manufactured Sand			
IS Sieve	% of passing(River Sand)	% of passing (Manufactured Sand)	Zone II (As per IS:383)
4.75mm	100	100	90-100
2.36mm	99.7	90.7	75-100
1.18mm	89	66.2	55-90
600micron	60.9	39.8	35-59
300micron	17.7	25.5	8-30
150micron	3.1	9.9	0-20
75micron	Max 3	Max 15	Max 15
	Zone II	Zone II	

Comparison Between Manufactured And River Sand

Table 2.2: Comparison Between Manufactured And River Sand

Technical specification – comparison between Manufactured and River sand				
Sl No	**Property**	**River sand**	**Manufactured sand**	**Remarks**
1	Shape	Spherical particle	Cubical particle	Good
2	Gradation	Cannot be controlled	Can be controlled	
3	Particle passing 75micron	Presence of silt shall be less than 3%(IS:383-1970)reaffirmed 2007	Presence of dust particle shall be less than 15%	Limit 3% for uncrushed & limit 15% for crushed sand
4	Silt and Organic impurities	Present (Retard the setting & Compressive Strength)	Absent	Limit of 5% for Uncrushed & 2% for Crushed sand
5	Specific gravity	2.3 – 2.7	2.5 – 2.9	May vary
6	Water absorption	1.5 - 3%	2 – 4%	Limit 2%
7	Ability to hold surface moisture	Up-to 7%	Up-to 10%	
8	Grading zone(FM)	Zone II and III FM 2.2 -2.8	Zone II FM 2.6 – 3.0	Recommends Zone II for Mass Concrete

Table 2. 3: Properties Of Concrete

Sl No	Property	River sand	Manufactured sand	Remedies
1	Workability & its retention	Good & Good retention	Less & Less retention	Control of fines & apply water absorption correction, use of plasticisers
2	Setting	Normal	Comparatively faster	Apply water absorption correction, use retarders
3	Compressive strength	Normal	Marginally higher	As shown above
4	Permeability	Poor	Very poor	
5	Cracks	Nil	Tend to surface crack	Early curing & protection of fresh concrete

3. MATERIALS PROPERTIES

3.1 Fresh Concrete Properties

- Setting of Concrete
- Water content or Water Cement Ratio
- Amount and type of Aggregate

Workability

The property of fresh concrete which is indicated by the amount of useful internal work required to fully compact the concrete without bleeding or segregation in the finished product.\

Segregation And Bleeding

"Segregation in concrete is commonly thought as separation of some size groups of aggregates from cement mortar in isolated locations with corresponding deficiencies of these materials in other locations. Segregation results in proportions of the laid concrete being in variation to those as designed. Segregation could result from internal factors such as concrete that is not proportioned properly and not mixed adequately, or too workable a mix. It also could result from external factors such as too much vibration, improper transportation, placement, or adverse weather conditions. The corresponding increase in proportion of cement paste in upper areas would tend to make them susceptible to increased shrinkage and formation of cracks. These cracks could be 10 µm to 500 µm wide, formed perpendicular to the surface, and be in the form of map patterns.

Bleeding is a form of segregation where some of the water in the concrete tends to rise to the surface of the freshly placed material. This arises due to the inability of the solid components of the concrete to hold all of the mixing water when they settle downwards (water being the lightest of all the mix constituents). Bleeding of the water continues until the cement paste has stiffened enough to end the sedimentation process.

Slump Test

Fresh concrete when unsupported will flow to the sides and sinking in height will take place. This vertical settlement is known as slump. The workability (ease of mixing, transporting, placing and compaction) of concrete depends on wetness of concrete (consistency) i.e., water content as well as proportions of fine aggregate to coarse aggregate and aggregate to cement ratio.

The slump test which is a field test is only an approximate measure of consistency defining ranges of consistency for most practical works. This test is performed by filling fresh concrete in the mould and measure the settlement i.e., slump.(Figure.3.1)

Figure.3.1 Slump Test

Hardened Concrete Properties

Compression Test On Concrete Cubes

The determination of the compressive strength of concrete is very important because the compressive strength is the criterion of its quality. Other strength is generally prescribed in terms of compressive strength. The strength is expressed in N/mm^2. This method is applicable to the making of preliminary compression tests to ascertain the suitability of the available materials or to determine suitable mix proportions.

The concrete to be tested should not have the nominal maximum size of aggregate more than 20mm test specimens are either 15cm cubes or 15cm diameter used. At least three specimens should be made available for testing. Where every cylinder is used for compressive strength results the cube strength can be calculated as under.

Minimum cylinder compressive strength = 0.8 x compressive strength cube (15cm x 15 cm x 15cm) The concrete specimens are generally tested at ages 7 days,14days,28days.

Split Tensile Test On Cylinder

Concrete is strong in compression but weak in tension. Tension stresses are likely to develop in concrete due to drying shrinkage, rusting of reinforcement, temperature gradient etc.

In concrete road slab this tensile stresses are developed due to wheel loaded and volume changes in concrete are available to determine this. Split test is one of the indirect methods available to find out the tensile strength.

Flexural Test On Beams

It is the ability of a beam or slab to resist failure in bending. It is measured by loading un-reinforced 6x6 inch concrete beams with a span three times the depth (usually 18 in.). The flexural strength is expressed as "Modulus of Rupture" (MR) in psi. Flexural MR is about 12 to 20 percent of compressive strength.

4. MIX DESIGN

Definition

Mix design is the process of selecting suitable ingredient if concrete and determines their relative proportions with the object of certain minimum strength and durability as economically as possible.

Objective Of Mix Design

The objective of concrete mix design as follows.

- The first objective is to achieve the stipulated minimum strength.
- The second objective is to make the concrete in the most economical Manner. Cost wise all concrete's depends primarily on two factors, namely cost of material and cost of labour. Labor cost, by way of formwork, batching, mixing, transporting and curing is namely same for good concrete.

Factors To Be Considered In Mix Design

1. Grade of concrete
2. Type of cement
3. Type & size of aggregate
4. Type of mixing & curing
5. Water /cement ratio
6. Degree of workability
7. Density of concrete
8. Air content

5. TESTING PROCEDURE

General Procedure

Within the experimental research program concerning the development of mechanical properties of a partially replacement of cement by flyash, partially replacement of sand by bottom ash and glass is used reference concrete of grade M25 (REF) was considered with the following composition, accordingly. The w/c-ratio is 0.43. Coarse aggregates were chosen, having a particle size mainly varying between 2 mm and 20 mm.An intensive experimental program is performed to study the effect of internal curing on different types of concrete properties: (i) fresh properties (slump and density); (ii) mechanical properties (compressive strength, flexural strength, splitting tensile strength).

Compressive Strength Test

Out of many test applied to the concrete, this is the utmost important which gives an idea about all the characteristics of concrete. By this single test one judge that whether Concreting has been done properly or not. For cube test two types of specimens either cubes of 15 cm X 15 cm X 15 cm or 10cm X 10 cm x 10 cm depending upon the size of aggregate are used. For most of the works cubical moulds of size 15 cm x 15cm x 15 cm are commonly used.(Figure.3.2) This concrete is poured in the mould and tempered properly so as not to have any voids. After 24 hours these moulds are removed and test specimens are put in water for curing. The top surface of these specimen should be made even and smooth..These specimens are tested by compression testing machine after 7 days curing or 28 days curing.

Figure.3.2 Compression Test

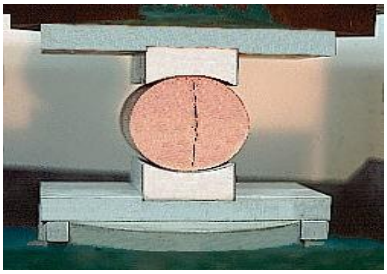

Figure.3.3 Split Tensile Test

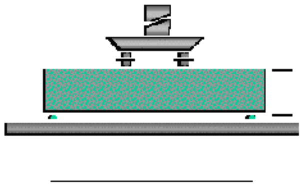

Figure.3.4 Flexural Strength Test

Split Tensile Test

The tensile strength is one of the basic and important properties of the concrete. The concrete is not usually expected to resist the direct tension because of its low tensile strength and brittle nature. However, the determination of tensile strength of concrete is necessary to determine the load at which the concrete members may crack. The cracking is a form of tension failure. Apart from the flexure test the other methods to determine the tensile strength of concrete can be broadly classified as (a) direct methods, and (b) indirect methods. The direct method suffers from a number of difficulties related to holding the specimen properly in the testing machine without introducing stress concentration, and to the application of uniaxial tensile load which is free from eccentricity to the specimen. As the concrete is weak in tension even a small eccentricity of load will induce combined bending and axial force condition and the concrete fails at the apparent tensile stress other than the tensile strength. As there are many difficulties associated with thedirect tension test, a number of indirect methods have been developed to determine the tensile strength. In these tests in general a compressive force is applied to a concrete specimen in such a way that the specimen fails due to tensile stresses developed in the specimen. The tensile stress at which the failure occurs is termed the tensile strength of concrete. The splitting tests are well known indirect tests used for determining the tensile strength of concrete sometimes referred to as split tensile strength of concrete. (Figure.3.3)

The test consists of applying a compressive line load along the opposite generators of a concrete cylinder placed with its axis horizontal between the compressive platens. Due to the compression loading a fairly uniform tensile stress is developed over nearly 2/3of the loaded diameter as obtained from an elastic analysis.

Flexural Strength Test

Flexural testing is used to determine the flex or bending properties of a material. Sometimes referred to as a transverse beam test, it involves placing a sample between two points or supports and initiating a load using a third point or with two points which are respectively call 3 Point Bend and 4 Point Bend testing. Maximum stress and strain are calculated on the incremental load applied. Results are shown in a graphical format with tabular results including the flexural strength (for fractured samples) and the yield strength (samples that did not fracture). Typical materials tested are plastics, composites, metals, ceramics, and wood.(Figure.3.4)

6.TEST RESULT

Ratios For Special Concrete (Extra Ingredients)
Various Percentange Of Flyash And M Sand
RATIO –I
Fly ash – 25 % by replacement of cement
M sand – 100 % by replacement of sand
RATIO - II
Fly ash – 30 % by replacement of cement
M sand – 100 % by replacement of sand
RATIO - III
Fly ash – 35 % by replacement of cement
M sand – 100 % by replacement of sand

- Table.6.1 shows Compressive Strength Of Cube At 7 Days**,** Table.6.2 shows Compressive Strength Of Cube At 14 Days and Table.6.3 Compressive Strength Of Cube At 28 Days
- Table.6.4 shows Split Tensile Test For Cylinder At 7 Days, Table.6.5 Split Tensile Test For Cylinder At 14 Days and Table.6.6 shows Split Tensile Test For Cylinder At 28 Days
- Table.6.7 shows Flexural Strength Of Beam At 7 Days, Table.6.8 shows Flexural Strength Of Beam At 14 Days Table.6.9 shows Flexural Strength Of Beam At 28 Days

Table.6.1: Compressive Strength Of Cube At 7 Days

Control Mix	Best Compressive Strength In N/Mm² 7 Days			
	Cc	25 % Of Flyash	30 % Of Flyash	35 % Of Flyash
		Ratio I	Ratio II	Ratio III
M30	17.8	20.80	21.65	22.80

Table.6.2: Compressive Strength Of Cube At 14 Days

Control Mix	Best Compressive Strength In N/Mm² 14 Days			
	Cc	25 % Of Flyash	30 % Of Flyash	35 % Of Flyash
		Ratio I	Ratio II	Ratio III
M30	17.95	21.03	21.95	23.41

Table.6.3 :Compressive Strength Of Cube At 28 Days

Control Mix	Best Compressive Strength In N/Mm² 28 Days			
	Cc	25 % Of Flyash	30 % Of Flyash	35 % Of Flyash
		Ratio I	Ratio II	Ratio III
M30	18.33	21.56	22.34	21.77

Table 6.4: Split Tensile Test For Cylinder At 7 Days

Control Mix	Best Split Tensile In N/Mm² 7 Days			
	Cc	25 % Of Flyash	30 %Of Flyash	35 % Of Flyash
		Ratio I	Ratio II	Ratio III
M30	1.28	1.3	1.42	1.54

Table.6.5 :Split Tensile Test For Cylinder At 14 Days

Control Mix	Best Split Tensile In N/Mm² 14 Days			
	Cc	25 % Of Flyash	30 %Of Flyash	35 % Of Flyash
		Ratio I	Ratio II	Ratio III
M30	1.31	1.49	1.58	1.67

Table.6.6: Split Tensile Test For Cylinder At 28 Days

Control Mix	Best Split Tensile In N/Mm² 28 Days			
	Cc	25 % Of Flyash	30 %Of Flyash	35 % Of Flyash
		Ratio I	Ratio II	Ratio III
M30	1.39	1.55	1.65	1.60

Table.6.7: Flexural Strength Of Beam At 7 Days

Control Mix	Best Flexural Strength In N/Mm² 7 Days			
	Cc	25 % Of Flyash	30 %Of Flyash	35 % Of Flyash
		Ratio I	Ratio II	Ratio III
M30	2.30	3.05	4.24	4.86

Table.6.8: Flexural Strength Of Beam At 14 Days

Control Mix	Best Flexural Strength In N/Mm² 14 Days			
	Cc	25 % Of Flyash	30 %Of Flyash	35 % Of Flyash
		Ratio I	Ratio II	Ratio III
M30	2.39	3.11	4.33	4.66

Table.6.9: Flexural Strength Of Beam At 28 Days

Control Mix	Best Flexural Strength In N/Mm^2 28 Days			
	Cc	25 % Of Flyash	30 %Of Flyash	35 % Of Flyash
		Ratio I	Ratio II	Ratio III
M30	2.42	3.23	4.57	4.17

7.CONCLUSION

Based on limited experimental investigation concerning the compressive & split strength of concrete, the following conclusions are drawn:

- Compressive strength reduces when cement replaced fly ash. As fly ash percentage increases compressive strength and split strength decreases.
- Use of fly ash in concrete can save the coal & thermal industry disposal costs and
- produce a 'greener' concrete for construction.
- The cost analysis indicates that percent cement reduction decreases cost of concrete, but at the same time strength also decreases.
- This research concludes that fly ash can be innovative supplementary cementitious Construction Material but judicious decisions are to be taken by engineers.

All the experimental data shows that the addition of the industrial wastes improves the physical and mechanical properties. These results are of great importance because this kind of innovative concrete requires large amount of fine particles (Aitcin, 1990). Due to its high fines of quarry dust it provided to be very effective in assuring very good cohesiveness of concrete. From the above study it is concluded that the quarry dust may be used as a replacement material for fine aggregate. Quarry dust has been used for different activities in the construction industry such as for road construction and manufacture of building materials such as light weight aggregates, bricks, tiles and auto clave blocks. However its use as rigid payment is very much limited. Thorough reaction with the concrete admixture, quarry dust, improved pozzolanic reaction, micro aggregate filling and concrete durability. As the properties are good as sand, the quarry dust is used as fine aggregate in replacement with sand in the cement concrete.

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II.REFERENCES

[1]. Ali Ergun (2011), "Effects of the usage of diatomite and waste marble powder as partial replacement of cement on the mechanical properties of concrete", Construction and Building Materials, 25(2), pp 806812.

[2]. A. Oner , S. Akyuzb, R. Yildiza,(2004)"An experimental study on strength development of concrete containing fly ash and optimum usage of fly ash inconcrete" Cement and Concrete Research , Vol.35, Issue 6, pp 11651171

[3]. Bhatty, JI., J Gajda, PE., Botha, F. and MM Bryant, PG. 2006. Utilization of Discarded Fly Ash as a Raw Material in the Production of Portland cement. Journal of ASTM International, Vol. 3, No. 10.

[4]. D.L.Venkatesh Babu, S.C. Natesan, "Studies on Strength and Durability Characteristics of High Performance Silica Fume Concrete",Proceedings of the INCONTEST 2003, pp.262 – 267, September 2003.

[5]. Gopalakrishna, S., Rajamane, N.P., Neelamegam, M., Peter, J.A. and Dattatreya, J.K. 2001. Effect of partial replacement of cement with fly ash on the strength and durability of HPC. The Indian Concrete Journal, pp. 335-341.

[6]. Subramani, T. "Experimental Investigations on Coir Fibre Reinforced Bituminous Mixes" International Journal of Engineering Research and Applications, Vol.2, Issue.3, pp 1794-1804, 2012.

[7]. Subramani,T, Krishnan.S. And Kumaresan.P.K., Study on Exixting Traffic condition in Salem City and Identify the transport facility improvement projects, International Journal of Applied Engineering Research IJAER, Vol.7,No.7, Pp 717 – 726, 2012.

[8]. Subramani.T, Sharmila.S, "Prediction of Deflection and Stresses of Laminated Composite Plate with Artificial

Neural Network Aid", International Journal of Modern Engineering Research, Volume 4, Issue 6 (Version 1), pp 51 -58, 2014.

[9]. Subramani.T, Senthilkumar.T, Jayalakshmi.J, "Analysis Of Admixtures And Their Effects Of Silica Fumes, Metakaolin And Pfa On The Air Content",International Journal of Modern Engineering Research, Volume 4, Issue 6 (Version 4), pp 28-36, 2014.

[10].Subramani.T, Sakthi Kumar.D, Badrinarayanan.S "Fem Modelling And Analysis Of Reinforced Concrete Section With Light Weight Blocks Infill " International Journal of Engineering Research and Applications, Volume. 4, Issue. 6 (Version 6), pp 142 - 149, 2014.