COMPARISION OF CONVENTIONAL CONCRETE AND SPECIAL CEMENT CONCRETE

Submitted In Partial Fulfillment Of The Project Requirements
Of The Under Graduate Degree
Civil Engineering

By

SYED SHAHABUDDIN AHMED (11CE58)

Under The Guidance Of

Prof. Shafi Mujawar

ANJUMAN-I-ISLAM'S
AKTC KALSEKAR TECHNICAL CAMPUS
INNOVATIVE TEACHING · EXUBERANT LEARNING

DEPARTMENT OF CIVIL ENGINEERING
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CERTIFICATE

Department of Civil Engineering,

School of Engineering and Technology

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New Panvel, Navi Mumbai. 41026

This is to certify that the project entitled **"COMPARISION BEHAVIOUR OF CONVENTIONAL CONCRETE WITH SPECIAL CEMENT CONCRETE"** is a bonafide work of**, SYED SHAHABUDDIN AHMED (11CE58)** submitted to the University of Mumbai in partial fulfilment of the requirement for the award of the degree of "Bachelor of Engineering" in Department of Civil Engineering.

Prof. Shafi Mujawar	Prof. Shafi Mujawar
Guide	Co-Guide
Dr. Rajendra B. Magar	Dr. Abdul Razzak Honnutagi
Head of Department	Director

Project Report Approval for B. E.

This project report entitled *"***Comparision Behaviour Of Conventional Concrete With Special Cement Concrete***"* **by**, **Syed Shahabuddin Ahmed** is approved for the degree of "***Bachelor of Engineering***" in "***Department of Civil Engineering***".

Examiners

1 ________________________

2 ________________________

Supervisors

1 ________________________

2 ________________________

Chairman (Director)

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Date:

Declaration

I declare that this written submission represents my ideas in my own words and where others ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Syed Shahabuddin Ahmed (11CE58)

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SYED SHAHABUDDIN AHMED

Chapter 1

Introduction

Concrete is widely used construction material in the world. nowdays the world witnessing the construction of more and more challenging and difficult engineering structures. so the concrete need to posses very high strength and sufficient workability. Researches all the world developing high performance concrete by adding various fibres, admixtures in different proportion . various fibres like glass ,carbon, polypropylene and provide improvement in concrete properties like tensile strength fatigue characteristic, durability, shrinkage, impact erosion resistence and serviceability of concrete

Special concrete is defined as concrete which meets special performance and uniformity requirements that cannot always be achieved routinely by using only conventional materials and normal mixing, placing and curing practices. The requirements may involve enhancements of characteristics such as placement and compaction without segregation, long-term mechanical properties, jearly-age strength, toughness, volume stability, or service life in severe environments.

Special cement concrete is a concrete that serve some specific function such as altering the setting or hardening behaviour of a concrete, producing different colours for architectural effects, imparting superior workability, imparting water retention and plasticity to mortars, resisting the penetration of water in walls or containment vessels or simply reducing the cost of the cementing agent.

In conventional concrete construction, a minimum quantity of free water is needed for a specified workability that reaches the strength and durability of the concrete. However, in RCC works, the free water content is determined by the field condition. The conditions on the field usually depend on parameters such as the ease of compaction, the process, and the ability of the concrete paste to support the vibrating roller without collapsing or bearing any imprint.

RCC for pavements is placed without form, finishing, or surface texturing. Large quantities of Special Cement Concrete can be placed with minimum cost, compared with conventional concrete. SCC for pavements is stronger and therefore is more durable than asphalt pavements. As for mixing, placing, and curing both types of concrete in either hot or cold climates, shares the same types of concerns.

Therefore, the techniques for handling them under extreme weather (hot or cold) are almost the same. However, for RCC, because of the less number of construction joints and therefore large surface area, the care needed and precision

procedures involved may be greater. The advantages of SCC techniques over

conventional concrete include the lower cost, increased durability with minimum maintenance, and speed of construction.

Conventional Concrete is prepared from a mixture of coarse and fine aggregates, Portland cement (PC), and water. Other additives such as fly ash and different types of admixtures such as air-entraining agents, accelerators, retarders, and plasticizers also may be used to improve the concrete's capabilities for workability and/or strength. Before concrete is produced, the components that make up concrete are tested for their qualitative performances. The aggregates for concrete are usually tested for gradation, hardness, specific gravity, absorption, and organic material impurities. PC usually is tested for consistency, initial and final set, soundness, and strength (with mortar). Water is tested at the source of supply for its purity and portability. Admixtures usually are considered acceptable on certification from the supplier . After mixing the components, fresh concrete is produced and transported to the field to be poured into its final place for hardening

1.1 Fibre :

Polypropylene is a synthetic hydrocarbon polymer material, first introduced in 19572,21. It is one of a group of synthetic, polymeric fibers (including but not limited to nylon, polyester, and polyethylene) adapted from the textile industry which have been added to PCC in an attempt to improve performance. Currently polypropylene is the most widely used of the synthetic fibers for paving applications .

The addition of various types of fibers to mechanically improve or modify the performance of portland cement concrete (PCC) results in what is called fiber reinforced concrete (FRC). The discrete reinforcing fibers are randomly dispersed within the PCC matrix. The performance improvements attributed to fiber reinforced concrete have been increased flexural, tensile, and dynamic strength, ductility, and toughnessl. 2 . The types of fibers commonly used include: steel, glass, polymeric, carbon, asbestos, and natural fibers. The polymeric type include: polypropylene, polyethylene, polyester, acrylic, and aramid fibers. Historically, the use of fibers as reinforcement in building materials dates back thousands of years and includes the use of asbestos fibers to construct clay pots, straw in making bricks, and hair in construction mortars 2 , 3 , 4 . The use of fibers as reinforcement in concrete precedes the use of conventionally reinforced concrete 2 . The- modern use of fibers for reinforcing concrete dates from the 1950's to the present

Recron 3s Fibres are engineered Micro Fibers with a unique “Trianguar” Cross-section, used in Secondary Reinforcement of Concrete. It complements Structural Steel in enhancing Concrete’s resistance to Shrinkage Cracking and improves mechanical properties such as Flexural / Split Tensile and Transverse Strengths of Concrete along with the desired improvement in Abrasion and Impact Strengths.

Recron 3s Fibres are manufactured by RIL in an ISO 9001:2000 facility for use Concrete as a “Secondary Reinforcement” at a rate of dosage varying from 0.1% to 0.4% by volume (0.9 KGs/Cu.M – 3.60Kgs/Cu.M). Fibers comply with ASTMC 1116, Type111 Fiber Reinforced Concrete

1.2 Role of Fibers :

Cracks play an important role as they change concrete structures into permeable elements and consequently with a high risk of corrosion. Cracks not only reduce the quality of concrete and make it aesthetically unacceptable but also make structures out of service. If these cracks do not exceed a certain width, they are neither harmful to a structure nor to its serviceability. Therefore, it is important to reduce the crack width and this can be achieved by adding polypropylene fibers to concrete

Thus addition of fibers in cement concrete matrix bridges these cracks and restrains them from further opening. In order to achieve more deflection in the beam, additional forces and energies are required to pull out or fracture the fibres. This process, apart from preserving the integrity of concrete, improves the load-carrying capacity of structural member beyond cracking . Reinforcing steel bars in concrete have the same beneficial effect because they act as long continuous fibres. Short discontinuous fibres have the advantage, however, of being uniformly mixed and dispersed throughout the concrete.

Fig 1.1

1.3 Superplasticizer :

The superplasticizers are broadly classified into four groups: sulfonated melamineformaldehyde condensate (SMF); sulfonated naphthalene-formaldehyde condensate (SNF); modified lignosulfonates (MLS), and others including sulfonic acid esters, such as polyacrylates, polystyrene sulfonates,etc. Blends of different superplasticizers have also been investigated. For example, lending of lignosulfonate with superplasticizers has economical and technological advantages. A blend of SNF and SMF-based superplasticizer may be used to realize certain benefits

1.4 Types of Admixtures :

Concrete admixtures are used to improve the behavior of concrete under a variety of conditions and are of two main types: Chemical and Mineral.

Fritz-Pak Corporation in Dallas, TX

Fig 1.2

Chemical admixtures reduce the cost of construction, modify properties of hardened concrete, ensure quality of concrete during mixing/transporting/placing/curing, and overcome certain emergencies during concrete operations.

Chemical admixtures are used to improve the quality of concrete during mixing, transporting, placement and curing. They fall into the following categories:

- air entrainers
- water reducers
- set retarders
- set accelerators
- superplasticizers
- specialty admixtures: which include corrosion inhibitors, shrinkage control, alkali-silica reactivity inhibitors, and coloring.

1.5 Fly Ash

Making Concrete Stronger, More Durable, and Easier to Work With

Derived from burning coal, fly ash is a valuable additive that makes concrete stronger, more durable and easier to work with.

Fly ash aids the formation of cementitious compounds to enhance the strength, impermeability and durability of concrete.

Two main classes of fly ash are used in concrete, Class F, and Class C.

Class F

Reduces bleeding and segregation in plastic concrete. In hardened concrete, increases ultimate strength, reduces drying shrinkage and permeability, lowers heat of hydration and reduces creep.

Class C

Provide unique self-hardening characteristics and improves permeability. Especially useful in pre-stressed concrete and other applications where high early strengths are required. Also useful in soil stabilization.

1.6 AIM and OBJECTIVE :

- Taking mix proportion of M10 grade concrete and enhancing its strength as per M30 grade concrete
  (fck =30Mpa)
- By lowering w/c ratio (0.35) and adding HRWRA and increasing workability.
- Design concrete mix for severe degree of exposure (specially Mumbai region for residential construction).
- To economise the construction cost.

1.7 SCOPE :

Polypropylene manufacturers and FRC producers were contacted for information. The laboratory study was conducted with a reference PCC mixture based on information provided by several major airports to represent a standard FAA mixture. Visits to locations involving polypropylene fibers were limited by the small number of ongoing paving projects.

Fibers can be mixed and tested with different chemicals with different proportion.

- Problem in Self Compacting Concrete is less shearing resistance, it can be solved by use of Fiber.
- Retrofitting of existing structure can be done with the help of Fibers.
- With the use of natural fiber, structure can be constructed with less cost
- Fiber can be used in making of Bricks.
- Construction of Rigid pavement may become economic.

CHAPTER NO : 2

REVIEW OF LITERATURE :

2.1 Historic review :

Rana A. Mtasher, Dr. Abdulnasser M. Abbas & Najaat H. Nema, In the Strength Prediction of Polypropylene Fiber Reinforced Concrete" test results showed that the increase of mechanical properties (compressive and flexural strength) resulting from added of polypropylene fiber was relatively high. D. L. Venkatesh Babu, In this Flexural Behavior of Hybrid (Polypropylene) Fibre Reinforced Concrete Beams" test results showed that use of Hybrid(polypropylene) Fibre reinforced concrete improves flexural performance of the beams during loading

The concrete with E- glass fibre showed an increase in compressive strength of about 11.45% at Vf = 2.0% and increase in split tensile strength of about 26.19% at Vf = 1.5%. The toughness indices of E - glass fibre concrete may be due to brittle character of the glass fibre [P.Baruah and S. Talukdar, 2007]. Glass fibre can restrain the expansion of specimens effectively. The expansion of composite decreases with increasing glass fibre volume fraction at each curing age for each set of concrete specimens. [Bing Chena, Juanyu Liub,2003].The addition of polypropylene fibres to plain concrete increases the compressive strength in the range of 4% to 17% and the reduction in maximum crack width is to an extent of 21% to 74% [K.Anbuvelan et al. 2007]. Cement matrix improves the flexural and tensile behavior of cement matrix. by the addition of glass fibres. The performance of these composites with aging depends on the matrix mix ingredients. The durability of Glass fibre reinforced cement composite improves with the addition of metakaolin to the concrete mix. [Shashidhara Marikunte et al 1997]. By replacing 35 - 50% of cement with fly ash , there was 5-7% reduction in the water requirement forobtaining the designated slump, and the rate and volume of the bleeding water was either higher or about the same cosplitred with the control mixture [Ravina and Mehta, 2000]. The addition of steel and polypropylene fibers provide better performance for the concrete. The addition of fly ash in the concrete mixture may adjust the workability and strength losses caused by fibres. [Topcu and Canbaz, 2007]. Incorporating of fibres into plain mortar results decreases in compression strength, however the addition of pozzolanas helped this loss of strength. The addition of SF in glass fibre mortar improved the performance over the plain mortar. [R.M. de Gutie´rrez, 2005].

Steel fibers are added to the concrete matrix to provide increased flexural and tensile strenth, toughness, and dynamic strength (impact resistance) 8 . Steel fiber reinforced concrete (S-RC) is generally more difficult to handle than conventional concrete and requires special considerations in planning and workmanship

The workability of concrete is measured by means of slump, flow table spread, compacting factor, or modified flow table method. Lessard [5] explained that ,these methods are not satisfactory for the concrete of flowing consistency. The slump test, although used extensively, reaches its practical limit at about220-250 mm. The ability of the superplasticizers to increase the slump of concrete depends on the type, dosage, and time of addition of the super plasticizer, w/c ratio, nature and amount of cement, aggregate, temperature, etc. Generally, the superplasticizers are used at higher dosages than are conventional water reducing admixtures.

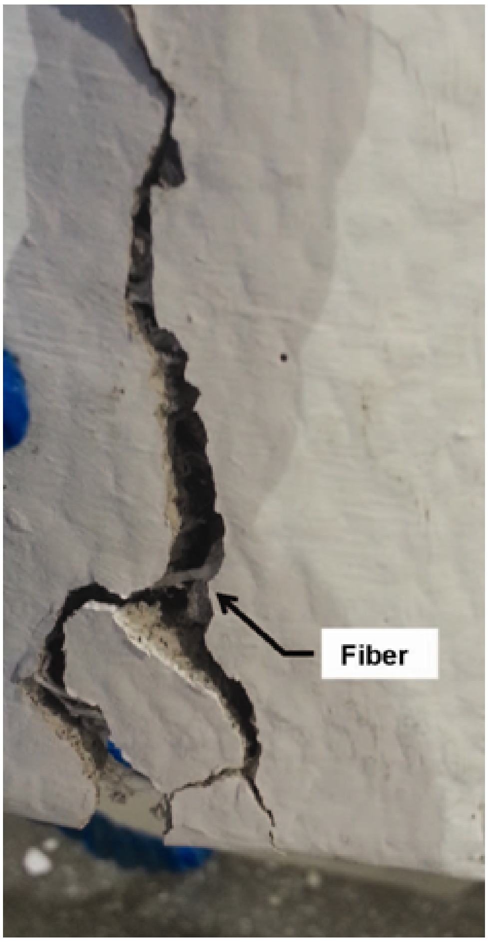
Ramachndran [6] stated that, the chemical nature of the superplasticizer determines its effectiveness in increasing the slump. For example, to obtain a slump of about 260mm from an initial value of 50 mm, it may be necessary to add 0.6% SMF or MLS-based superplasticizer, whereas this could be accomplished with only 0.4% SNF. Lessard [5] obtained data on the relative amounts of SMF and SNF needed to attain the same slump value, for example, to obtain slump of 185-190 mm (w/c = 0.3), the dosage required for SMF and SNF were 1.9 liter and 1.3 liter ,respectively .Also for obtaining slump of 230-240 mm at w/c of 0.22,the corresponding dosages were 2.3 liter and 1.6 liter. Some conclusions were state by Ramachndran [6] had show that, the calcium salt of polystyrene sulfonate at dosage of 0.1%,increase the slump from 8cm to 18 cm whereas 0.15% sodium salt of SNF would be needed to achieve the slump gain.

Kantro and Popescu [7] concluded that, the amount of water reduction (15-35%) achievable with a particular superplasticizer depends on the dosage and the initial slump. There is evidence that, beyond a particular dosage, further water reductions not possible. In all types of Portland cements, water reduction occurs, but to different extents. Generally, water reduction increases with the increasing the cement content. It has been reported that, for equal water reductions, more SMF than SNF type admixture is required. In addition Kantro and Popescu [7] investigated the water reduction capabilities of ammonium salt of SNF, sodium-based SMF, and admixtures of lgnosulfonate sulfonate. Compared to the w/c ratio of 0.25 for the reference, the values for the above admixtures were 0.21, 0.23, and 0.22 respectively

The most important property of a superplasticizer is its ability of dispersing the cement particles. Electron microscopic examination reveals that in water suspensions of cement, large irregular agglomerates of cement particles form. Malhotra [2] stated that, by the addition of a Anbar Journal for Engineering Sciences 54 superplasticizer, the material is dispersed into small particles, cement has a much higher percentage of fine particles than that treated with water 50°C Compared to cement suspension without the admixtures that with plasticizers shows better dispersion with the formation of finer particles. The ability of superplasticizers to reduce water and achieve very high strengths is of special importance for the precast concrete industry where high early strengths are needed for rapid turn over of formwork.

The slump and slump flow of the concrete were 250 mm and 580 mm, which are indicatives of very good workability. The air content was 2.3%, which was used to enhance the workability of the concrete. The fresh concrete flowed in a body and there was no segregation in the form of mortar separation or bleeding. However, the water demand of the concrete mixture was high due to greater specific surface area of fine materials. The increase in water demand as reduced in presence of adequate superplasticizer.

Due to workability problems with SFRC, the nominal maximum size of aggregate in the mixture has usually been either 3/8 or 3/4 inch. Fly ash and other pozzolans, along with air entrainment, and water reducing admixtures have been used in SFRC for pavements 11 ' 12 . SFRC mixtures are usually high in cementitious material content when compared with conventional PPC mixtures1 1 . Bulk handling techniques for introducing the fibers into the mixture during the batching operation are the largest adaptation required to the mixing plant. Manual procedures have often been used to introduce the fibers to the mixture1 1 . The fibers are usually combined with the aggregates on the charging belt leading to the mixer. In some instances, the mixer has been charged with the fibers first followed by the aggregate, the cement, and then the water.



2.2 POLYPROPYLENE FIBER REINFORCED CONCRETE (PFRC) :

Polypropylene fibers are hydrophobic, that is they do not absorb water. Therefore, when placed in a concrete matrix they need only be mixed long enough to insure dispersion in the concrete mixture1 . The mixing time of fibrillated or tape fibers should be kept to a minimum to avoid possible shredding of the fibers 2 . The type of polypropylene fiber recommended by manufacturers for paving applications is the collated fibrillated fiber. The length of fiber recommended is normally tied to the nominal maximum size of aggregate in the mixture. Manufacturers recommend that the length of the fiber be greater than twice the diameter of the aggregate. This would be consistent with past experiences with steel fibers and also with current theories on fiber dispersion and bonding"123 . The manufacturers of fibrillated fibers recommend their products for the following purposes in paving: to reduce plastic shrinkage and permeability, to increase impact resistance, abrasion resistance, fatigue, and cohesiveness (for use in slipforming and on steep inclines), and to provide a cost effective replacement for welded wire fabric (WWF). However, they do not recommend specifying fibers for the control of cracking from external stresses, increased structural strength, slab thickness reduction, joint spacing reduction, or replacement of structural steel reinforcement. Monofilament fibers, according to fiber manufacturers, only provide control of cracking caused by shrinkage and thermal stresses occurring at early ages. These fibers provide no post-crack benefit and are used only for shrinkage cracking and not to provide improvements to other engineering properties. The amount of polypropylene fibers recommended by most manufacturers for use in paving mixtures and most other mixtures is 0.1 percent by volume of concrete (1.5 to 1.6 pounds per cubic yard). Researchers have experimented with fiber volumes up to 7.0 percent2 4 . Fiber volumes greater than 2.0 percent normally involve the use of continuous fibers, which are not usually considered for paving applications due to constructability problems. Fiber volumes up to 0.5 percent can be used without major adjustments to the mixture proportions. As volume levels approach 0.5 percent, air-entraining and water-reducing admixtures are required .

2.3 Impact Resistance :

The impact resistance of PFRC is higher than conventional PCC and increases with increasing fiber volumes. This increase is noted even at low volumes of only 0.1 percent2 "' 2 .' 3 2 . The impact resistance and shatter resistance of PFRC is partly due to the energy absorbed by the fibers after the concrete matrix has cracked1 . The fibers improve the impact resistance by providing for a uniform distribution of stresses in three dimensions 31 . PFRC has shown to absorb as much energy as SFRC for the same fiber volume1 . Fibrillated polypropylene fibers when added to conventionally reinforced concrete beams have improved their cracking resistance under impact and also appeared to inhibit the debonding of the reinforcing steel from the concrete matrix.

2.4 FIBER INVESTIGATION :

A search was conducted to determine the different types and overall lengths of fibers being manufactured and distributed in the United States to not only FAA-related projects but generally to any large pavement (new construction or overlays) projects requiring polypropylene fiberreinforcement. Six different polypropylene fiber companies manufacture and distribute fibers throughout the United States. Most of the fiber companies have very similar types of fibers; monofilament (single strands of fibers, Figure 1) and collated-fibrillated (multi-strand forming a lattice or web (Figure 2); and one firm also manufactures small twisted bundles of fibers (Figure 3). The lengths of fibers ranged from 1/2-in, to 2-1/2-in., the most common being the 3/4-in and 1-1/2-in, fibers. One manufacturer produces a graded series of fibers (various percentages of lengths from 1/2- to 2-1/2-in. in a single bag).

Five portland cement concrete mixtures were proportioned with fibers. Mixture 1 contained the single-strand monofilament fibers. The 3/4-in. fiber length was the most common length distributed and selected for this investigation. Mixture 2 and mixture 3 contained the collated-fibrillated fibers. The 1-1/2-in, fiber length was used in mixture 2 and mixture 3 contained the 3/4-in. fiber lengths. Mixture 4 and mixture 5 contained the twisted bundles of collated-fibrillated fibers. The 1-1/2-in, lengths were in mixture 4 and the 3/4-in. fiber lengths we mixture 5. Mixture 6, the control mixture, contained no fibers.

2.5 THE USE OF FLY ASH IN CONCRETE :

One of the efforts to produce more environmentally friendly concrete is to reduce the use of OPC by partially replacing the amount of cement in concrete with by-products materials such as fly ash. As a cement replacement, fly ash plays the role of an artificial pozzolan, where its silicon dioxide content reacts with the calcium hydroxide from the cement hydration process to form the calcium silicate hydrate (CS-H) gel. The spherical shape of fly ash often helps to improve the workability of the fresh concrete, while its small particle size also plays as filler of voids in the concrete, hence to produce dense and durable concrete. Generally, the effective amount of cement that can be replaced by fly ash is not more than 30% (Neville 2000). An important achievement in the use of fly ash in concrete is the development of high volume fly ash (HVFA) concrete that successfully replaces the use of OPC in concrete up to 60% and yet possesses excellent mechanical properties with enhanced 9 durability performance. HVFA concrete has been proved to be more durable and resource-efficient than the OPC concrete (Malhotra 2002). The HVFA technology has been put into practice, for example the construction of roads in India, which implemented 50% OPC replacement by the fly ash (Desai 2004).

Activation of fly ash with alkaline solutions enables this by-product material to be a cement-like construction material. In this case, concrete binder can be produced without using any OPC; in other words, the role of OPC can be totally replaced by the activated fly ash. Palomo et al (1999) described two different models of the activation of fly ash or other by-product materials. For the first model, the silicon and the calcium in the material is activated by a low to mild concentration of alkaline solution. The main product of the reaction is believed to be a calcium silicate hydrate (C-S-H) that results from the hydration process. On the contrary, the material used in the second model contains mostly silicon and aluminium, and is activated by a highly alkaline solution. The chemical process in this case is polymerisation.

CHAPTER NO : 3

METHODOLOGY :

3.1 MATERIALS & TEST METHOD :

Material used in developing cement slurry is having following properties: Cement: pozzolana portland cement (Birla shakti) with Specific Gravity 2.49 , available in local market. Water: Potable water was used for mixing. Superplasticizers (SP): polycarboxylates ether condensate (PCE) based Superplasticizer namely Sunanda was used . Different dosages of Superplasticizers were used for finding the flow values of the mixes. The properties of SPs are listed in tables

Fine aggregate (Natural river sand)

River sand having density of 1460 kg/m^3 and fineness Modulus (FM) of 2.51 was used. The specific gravity was found to be 2.6.

Coarse aggregate

Natural granite aggregate having density of 2700kg/m^3 and fineness modules (FM) of 6.80 was used. The specific gravity was found to be 2.60 and water absorption as 0.31%.

Admixture

Commercially available Super-plasticiser has been used to enhance the workability of fresh concrete for selected proportions of ingredients.

Testing :

In this study, mix proportions yielding 10 MPa characteristic strengths, and 0.5% percentages of Polypropylene fibres by weight of cement were considered. For each proportion of concrete, fibre content was kept constant of 0.5% . For each of these mix proportions, three standard cubes of size 150mm x150mm x150mm were cast and tested as per IS: 450-2000 [10] to determine the compressive strength of concrete.

While the mixing operation is in progress, 80% of water is added first and mixed for about 5 min then the remaining water is added and mixed thoroughly. For each mix, a total of 3 cubes of 150 x 150 x 150 mm and , After 24 hrs the specimens are demoulded, immersed in water all mixes are tested for workability in terms of slump , vee-bee, compacting factor (CF) and flow table test as per Indian Standard IS:456-2000. The main purpose of these tests is to check the consistency and the uniformity of concrete from batch to batch. Slump values are not so consistent indicating the fact, that this is not a good measure of workability for FRC. It is in general noticed that conventionally popular tests like slump and compacting factor tests are not as appropriate and accurate in determination of workability of fibre reinforced concrete as they are for plain concrete this is essentially because of interlocking of fibres there by affecting normal workability due to concrete ingredients. Still upon vibration the fibre reinforced concretes exhibited the needed workability for placement.

3.2 Compressive strength test :

The compressive strength of mixes is determined by cubes of size 150mm x 150mm x 150mm as per IS 456-1000 [10] at the rate of 9 specimens for each mix. The cubes are casted with designed mix proportions to yield characteristic strengths of 10 MPa with fibre contents of 0.5% keeping the replacement of cement by fly ash at 10% . All the cube specimens are compacted on a table vibrator for 2 Minutes. After 24 hours the cubes are removed from moulds and immersed in fresh water for 28 days of curing before testing. The specimens are tested under a digital compression testing machine of 50.0 tons capacity.

3.3 DESIGN OF M10 :

MIX CALCULATIONS :

The mix calculations per unit volume of concrete shall be as follows

a) Volume of concrete = 1 m3

b) Volume of cement = [Quantity of cement/specific gravity] x [1/1000]

c) Volume of water = [Quantity of water/1] x [1/1000]

d) Volume of chemical admixture = [Quantity of admixture/specific gravity] x [1/1000] (SP 2%by mass of cement)

e) Volume of all in aggregates (e) =a – (b + c + d)

f) Quantity of coarse aggregates = e x Volume of Coarse Aggregate x specific gravity of Coarse Aggregate

g) Quantity of fine aggregates = e x Volume of Fine Aggregate x specific gravity of Fine Aggregate.

MIX DESIGN : M10 Grade

- Target mean strength

  Fm=fck+ks

  =10+(1.65*3.5)

  =15.775

- W/c ratio=0.6

  % of entrapped air= 2% of volume

- Water content

  WC=186+(0.02*186)

  =190 kg

- Cement content

  CC =320 kg

- Total volume of aggregate (v1)

  V1 =1-(190/1000)-(320/3150)-(2/100)

  =0.6884

- Fine aggregate content

  FA=p1 *v1*gs1*1000

  =0.4*0.6884*2.6*1000

  =715.96kg

- Coarse aggregate content

  CA=0.6*0.6884*2.67*1000

  =1102.26

MIX PROPORTION BY WEIGHT (kg/cum)

WATER	CEMENT	FA	CA (60% of 20mm)	CA (40% of 10mm)
190	320	715.96	661.356	440.904

MIX PROPORTION BY RATIO

WATER	CEMENT	FA	CA (60% of 20mm)	CA (40% of 10mm)
0.6	1	2.261	2.066	1.377

MIX DESIGN : M30 Grade

- Target mean strength

  Fm=fck+ks

  =30+(1.65*5)

  =38.25

- W/c ratio=0.45

  % of entrapped air= 1.5% of volume

- Water content

  WC=186+(0.015*186)

  =188.8 kg

- Cement content

  CC =420kg

- Total volume of aggregate (v1)

  V1 =1-(188.8/1000)-(420/3150)-(1.5/100)

  =0.6628

- Fine aggregate content

  FA=p1 *v1*gs1*1000

  =0.4*0.6628*2.6*1000

  =689.312 kg

- Coarse aggregate content

  CA=0.6*0.6628*2.67*1000

  =1061.8

MIX PROPORTION BY WEIGHT (kg/cum)

WATER	CEMENT	FA	CA (60% of 20mm)	CA (40% of 10mm)
188.8	420	689.312	637.08	424.72

MIX PROPORTION BY RATIO :

WATER	CEMENT	FA	CA (60% of 20mm)	CA (40% of 10mm)
0.45	1	1.641		

CHAPTER NO : 4

EXPERIMENTAL INVESTIGATION :

4.1 Marsh Cone Test :

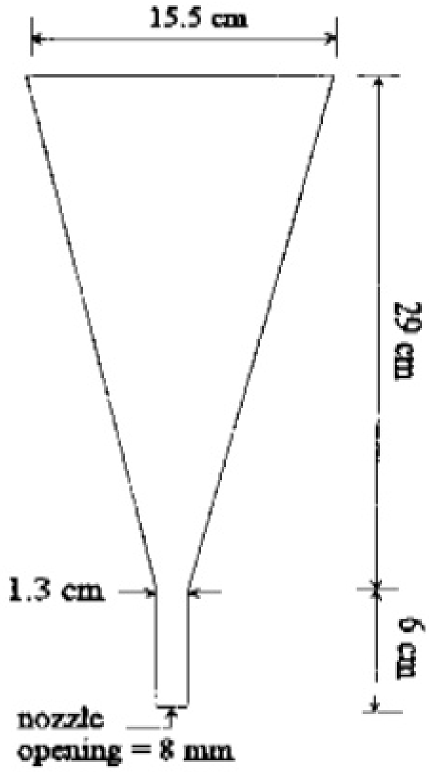
Apparatus:

Marsh cone is a conical brass vessel, (Funnel shaped) with a smooth aperture diameter of 8 mm at the bottom. It hold son a stand with container below it. The apparatus is shown in Fig. 1, Stop Watch is needed to record the flow time (T) to empty the con

Procedure :

Take @ 2 kg cement, proposed to be used for the project. Take 640 ml of water (W/C 0.35%) and 0.9% Super plasticizer by weight of cement to make slurry of @ 1 liter. Mix them thoroughly in a mechanical mixer (Hobart mixer is preferable) for two minutes. Hand mixing may not give consistent results because of unavoidable lump formation which blocks the aperture. Fig. 1 Marsh Cone Test In Process If hand mixing is done, the slurry should be sieved through 1.18 sieves to exclude lumps. Take one liter slurry and pour it into marsh cone duly closing the aperture. Start stop watch and simultaneously open the aperture. Find out the time taken in seconds, for complete flow out of the slurry. The time in seconds is called the "Marsh Cone Time". The procedure is repeated gradually increasing the percentages of Super plasticizers in the steps of 0.1% .

W/C ratio	Admixture(%)	Cement(kg)	Duration
0.35	0.8	2	1 min 55 sec
0.35	0.9	2	57 sec
0.35	1	2	52 sec
0.35	1.1	2	1 min sec
0.35	1.2	2	58 sec



4.2 WATER ABSORPTION TEST :

W1= 2.5kg

W2=2.58kg

Where

W1= weight of aggregate before water absorption

W2= weight of aggregate after water absorption

WA=((W2 - W1) / W2) *100

=((2.58 – 2.5) / 2.58)*100

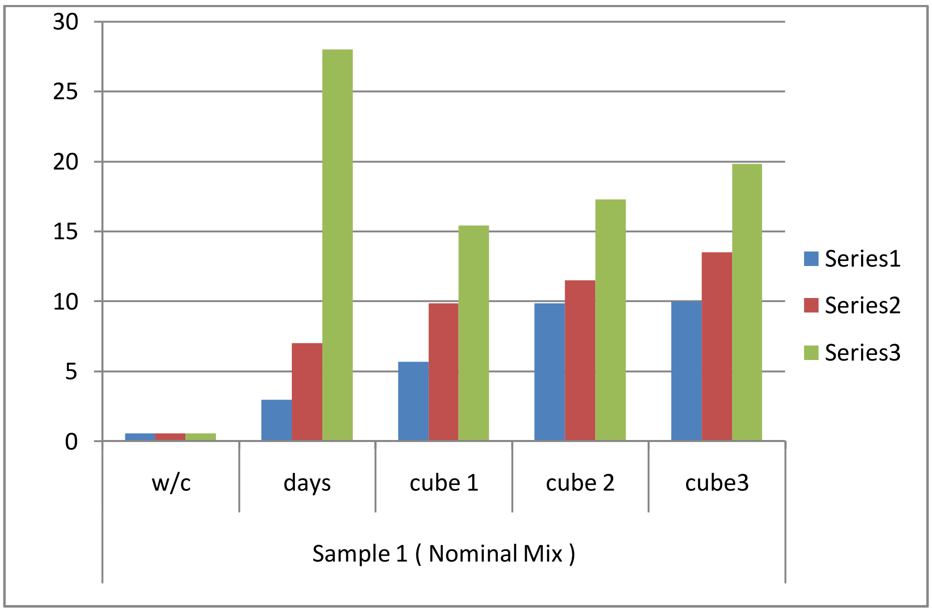
= 3.1%

CHAPTER NO : 5

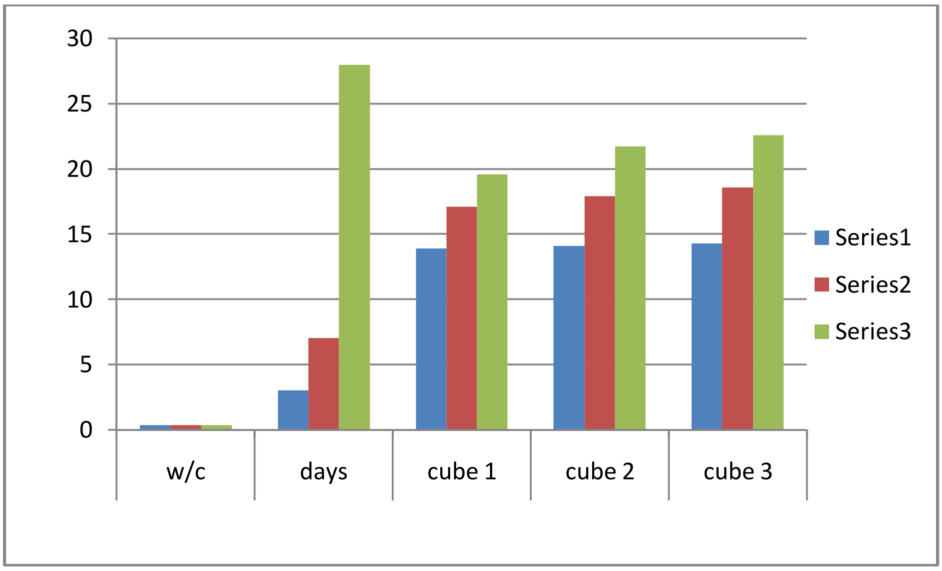
RESULTS AND DISCUSSIONS :

5.1 Sample Results :

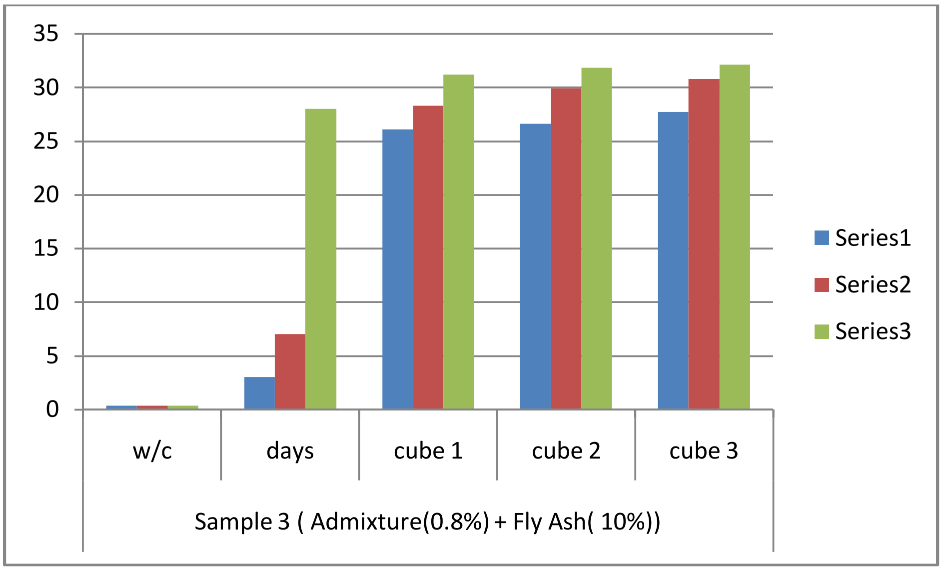
Sample 1 (Nominal Mix)				
w/c	days	cube 1	cube 2	cube3
0.6	3	5.68	9.85	9.99
0.6	7	9.85	11.5	13.5
0.6	28	15.4	17.3	19.8



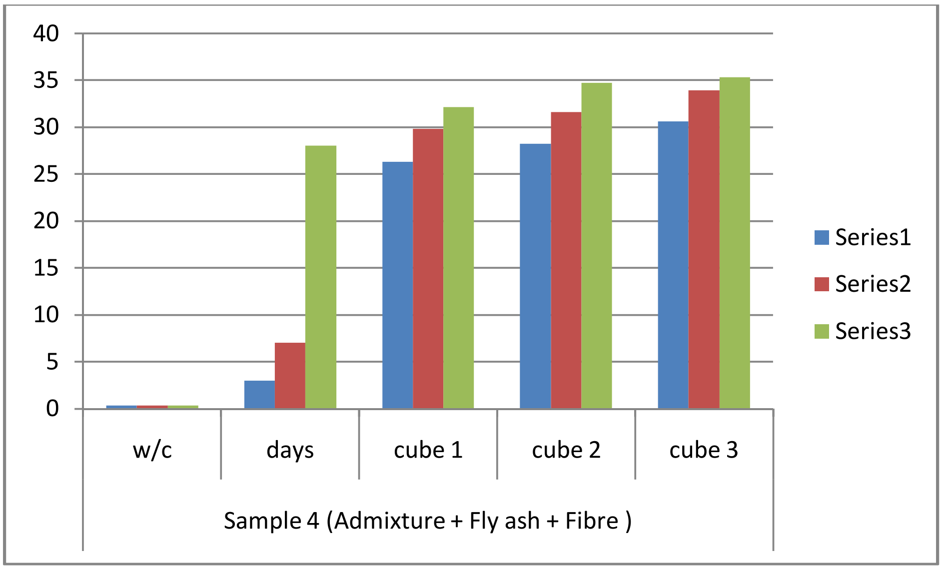
Sample 2(Admixture(0.9%))				
w/c	days	cube 1	cube 2	cube 3
0.35	3	13.9	14.1	14.3
0.35	7	17.1	17.9	18.6
0.35	28	19.6	21.75	22.6



Sample 3 (Admixture(0.8%) + Fly Ash(10%))				
w/c	days	cube 1	cube 2	cube 3
0.35	3	26.1	26.6	27.7
0.35	7	28.3	29.9	30.78
0.35	28	31.2	31.8	32.1



Sample 4 (Admixture + Fly ash + Fibre)					
w/c	days	cube 1	cube 2	cube 3	
0.35	3	26.3	28.2	30.6	
0.35	7	29.8	31.6	33.9	
0.35	28	32.1	34.7	35.3	



5.2 Rate analysis :

	M10	M30
Cement	320 kg/$_{m3}$ Rs 2240	420
Coarse Aggregate	1102.26 Rs 785	
Fine Aggregate	715.96 Rs2321.4	

SAMPLE	DAYS	STRENGTH (MPa)
Sample no 1	28	
Sample no 2	28	
Sample no 3	28	
Sample no 4	28	

CHAPTER NO :

CONCLUSION :

- Adding additives to the concrete mix enhances the properties of the mix.
- Fly Ash plays an important role as a binding material and proves to be very economical
- By keeping the same mix proportion of M10 grade mix , the concrete's strength can be considerably increased to a certain extent with the help of admixtures and fibres.
- Keeping the same mix proportion of low grade concrete (M10) and increasing its strength equal to M30 grade proves to be very economical.
- Adding admixture to the concrete increases its workability.
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