ANALYTICAL STUDY ON POTENCY AND STABILITY CHARACTERISTICS OF ULTRA HIGH PERFORMANCE CONCRETE

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ABSTRACT
The most often used building material worldwide is concrete. As the concrete industry has developed, more mineral admixtures have been added to cement out of concern for economic efficiency, environmental safety, and resource preservation. Yet, pressure to minimise cement use through the use of supplemental materials has been brought on by environmental and energy-saving concerns, both in terms of harm from the extraction of raw materials and other carbon material emissions during cement manufacturing. In the twenty-first century, High Performance Concrete (HPC) is the most recent innovation. These days, it is more prevalent and utilised in several notable construction and infrastructure projects. The use of supplemental materials to potentially improve concrete mixes is widely acknowledged in recent years blast GGBFS ,SILICA FUME, FLY ASH when replaced with cement & other materials emerged as a major alternative to the conventional concrete and has rapidly used by the cement industry due to its cement saving, cost saving benefits. The main objectives of this to investigate the properties of high performance concrete (HPC) like strength, elasticity, plasticity using fly ash, silica fume as mineral admixtures. Mineral admixture like FA,SF, GGBFS are commonly used in the mixture of concrete. The uses of these admixtures increase and improve the properties of concrete like strength and durability.HPC also resist the attack of chemical attacks in hydration and plastic stage

INTRODUCTION
High-performance concrete principles
It must be acknowledged that rather than a fundamental and scientific approach, advancement in the field of high-performance concrete has up until now been the result of an empirical one. Advances in practice have frequently come before in-depth scientific research in concrete technology. Furthermore, although it is not yet able to describe every feature of high-performance concrete in great detail, it is currently possible to explain the higher performance of high-performance concrete on the basis of concepts that can be scientifically proven.

As a consequence, it will be seen in that the selection of concrete-making materials, and in that mix proportions, are no longer governed by pure empiricism, but that it is possible to follow practical guidelines in order to avoid starting over. However, in spite of this progress in the state of the art, we cannot expect that in the near future it will be possible to select 'on paper' the materials and their proportions to make economical and highperformanceconcrete in a given place. In fact, as long as highperformanceconcrete is made of about the same simple and low-cost materials that are used to make usual concrete, their actual composition will not necessarily be the best one for making high-performance concrete. As high-performance concrete still represents a small volume of the concrete market, cement producers are not interested in investing too much in modifying their production processes. Moreover, in a given place, the selection of the materials used to make high-performance concrete will always be limited by economic considerations because, in order to stay technically competitive with usual concrete, the production cost of high-performance concrete will have to be as low as possible

As will be seen, making high-performance concrete is more complicated than producing usual concrete. The reason for this is that, as the compressive strength increases, the concrete properties are no longer related only to the water/binder ratio, the fundamental parameter
Governing the properties of usual concrete by virtue of the porosity of the hydrated cement paste. In usual concrete, so much water is put into the mixture that both the bulk hydrated cement paste and the transition zone represent the weakest links in concrete microstructure, where mechanical collapse starts to develop when concrete is subjected to compressive load.
In spite of the fact that compressive strength is not the only concrete property making the use of high-performance concrete advantageous, itis nevertheless important because, as will be seen, it is closely related tothe same concrete micro structural features that also govern other

What is a High a performance concrete
High performance concrete is a concrete mix, That possess high durability and high strength when compared to conventional concrete. This concrete contains one or more of cementious materials such as fly ash, Silica fume or ground granulated blast furnace slag and usually a super plasticizer. The term 'high performance' is somewhat pretentious because the essential feature of this concrete is that it's ingredients and proportions are specifically chosen so as to have particularly appropriate properties for the expected use of the structure such as high strength and low permeability. Hence High performance concrete is not a special type of concrete. It comprises of the same materials as that of the conventional cement concrete. The use of some mineral and chemical admixtures like Silica fume and Super plasticizer enhance the strength, durability and workability qualities to a very high extent.

OBJECTIVES
The main objective of the study to know strength properties of the concrete by an incorporation of mineral admixtures and M-Sand with constant aggregate binder ratio i.e. 2.5. Following are the particular objectives are to be achieved
- To know the strength properties of different water binding ratio of plain HPC
- To measure the strength properties of HPC for different percentage of mineral admixtures
- To measure strength properties for different water binding ratio of HPC
- To reduce the water binding ratio by an addition of super plasticizer.

Comparison of strength properties for conventional and mineral admixture concrete.

LITERATURE REVIEW
Beam - column joints have been recognized as critical elements in the seismic design of reinforced concrete frames (ACI 1999, AIJ 1990, Euro Code 1994, SNZ 1995). Numerous studies were conducted in the past to study the behaviour of beam-column joints with normal concrete (Shamim and Kumar 1999, Gefken and Ramey 1989, Filiatrault et al 1994). ACI- ASCE committee 352 (2002) makes recommendation on the design aspects of different types of beam-column joints, calculation of shear strength, and on reinforcement details to be provided (ACI 2002). These recommendations are however not intended for fiber reinforced concrete.
Bakir (2003) conducted extensive research on parameters that influence the behaviour of cyclically loaded joints and has derived equations for calculating shear strength of the joints. A study conducted on fiber reinforced normal strength concrete by Filiatrault et al (1994) indicated that this material can be an alternative to the confining reinforcement in the joint region. The study conducted by Gefkon & Ramey (1989) illustrated that the joint hoop spacing specified by ACI-ASCE committee can be increased by a factor of 1.7 by the addition of fibers in the concrete mix. Jiuru et al (1992) studied effect of fibers on the beamcolumn joints and developed equation for predicting shear strength of joints for normal strength concrete.

Bayasi and Gevman (2002) also experimentally proved the confinement effects of fibers in the joints reason and reduction in the, lateral reinforcement by the use of fiber concrete. Besides these, there are several investigations on the effect of addition of fibers on the strength and durability of flexural members. Oh (1992) also indicated that the ductility and ultimate resistance of flexural members are increased remarkably due to the addition of steel fibers. ACI committee 544(1998) also reported considerable improvement in strength, ductility and energy absorption capacity with an addition of steel fibres. All these studies are, however, confined to normal strength concrete and the research in the area of High Performance Lightweight Fibrous Concrete joints is limited. Yung Chih Wang (2007) studied reinforced concrete beam column junctions strengthened with Ultra high steel Fiber reinforced Concrete (UFC). It was concluded that UFC displayed excellent performance in terms of mechanical and durability behaviour. The test results showed that UFC replaced joint frame behaves very well in seismic resistance. The performance was found to be much better than the frame strengthened with RC jacketing as normally seen in the traditional retrofit schemes.
Kiyoung-Kyuchoi (2007) conducted analytical studies to investigate punching shear strength of interior slab-column connections made of steel fiber reinforced concrete. A new strength model for the punching shear strength of SFRC slab column connections was developed

EXPERIMENTAL METHODOLGY ORDINARY PORTLAND CEMENT:
Ordinary Portland cement used in this investigation is Penna Cement (53 Grade) conforming to bureau of Indian Standards(IS 12269:1987). The cement is fresh and uniform colour, consistency and free from lumps and foreign matter. The cement was tested for various properties as per IS codes **.**

FINE AGGREGATE
The locally available Natural river sand conforming to grading zone II of table 4 of IS 383-1970 has been used as Fine aggregate.
The following tests have been carried out per the procedure given in IS 383-1970(2)

COARSE AGGREGATE
Machine Crushed granite confining to IS 383-1970 [23] consisting 20 mm maximum size of aggregates have been obtained from the local quarry. It has been tested for Physical and Mechanical Properties such as Specific Gravity, Sieve Analysis, Bulk Density, Cushing

SUPER PLASTICIZER
Super Plasticizers are new class of generic materials which when added to the concrete causes increase in the workability. They consist mainly of naphthalene or melamine sulphonates, usually condensed in the presence of formal dehyde.
Super plasticizer concrete is a conventional concrete containing a chemical admixture of super plasticizing agent. As with super plasticizer admixtures one can take advantage of the enhanced workability state to make reductions in water cement ratio of super plasticized concrete, while maintaining workability of concrete.

GROUND GRANULATED BLAST FURNACE SLAG (GGBS)
When the molten slag from melted iron ore is quenched rapidly and then ground into powder. This material has cementatious properties and has been used as a replacement for cement for over 100 years. Recently, Wisconsin has begun using it in some of its highway projects. Wisconsin has experienced several problems with GGBS, which include slow strength gain and decreased surface quality. Countering these problems, GGBS concrete has

higher late strength and lower permeability. This project investigates these GGBS characteristics and has several objectives.

CHEMICAL COMPOSITION:

Slag is primarily made up of silica, alumina, calcium oxide, and magnesia (95%).

Other elements like manganese, iron, sulphur, and trace amounts of other elements make upabout other 5% of slag. The exact concentrations of elements vary slightly depending on where and how the slag is produced. When cement reacts with water, it hydrates and produces calcium silicate hydrate (CSH), the main component to the cements strength, and calcium hydroxide (Ca (OH)2). When GGBFS is added to the mixture, it also reacts with water and produces CSH from its available supply of calcium oxide and silica.

TESTS ON MATERIALS

TESTS ON HARDENED CONCRETE

Testing of hardened concrete plays an important role in controlling and confirming the quality of self compacting concrete**.**

Compressive Strength

Compressive strength of a material is defined as the value of uniaxial compressive stress reached when the material fails completely. In this investigation, the cube specimens of size 150 mm x 150 mm x 150 mm are tested in accordance with IS: 516 – 1969 [Method of test for strength of concrete]. The testing was done on a compression testing machine of 300 KN capacity. The machine has the facility to control the rate of loading with a control valve. The machine has been calibrated to the required standards. The plates are cleaned; oil level was checked and kept ready in all respects for testing.

ULTRASONIC PULSE VELOCITY:

An ultrasonic pulse velocity test is an in-situ, non destructive test to check the quality of concrete and natural rocks. In this test, the strength and quality of concrete or rock is assessed by measuring the velocity of an ultrasonic pulse passing through a concrete structure or natural rock formation. This test is conducted by passing a pulse of ultrasonic wave through concrete to be tested and measuring the time taken by pulse to get through the structure. Higher velocities indicate good quality and continuity of the material, while slower velocities may indicate concrete with many cracks or voids

MIX DESIGN

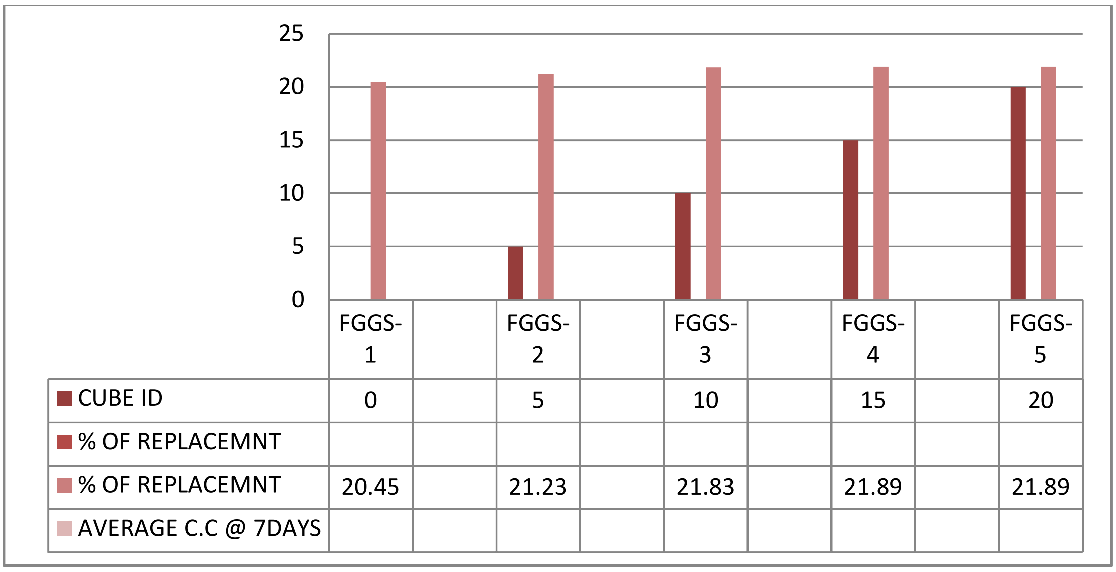
Mix Design for HPC

Since there are no specific methods for mix design found suitable for HPC, a simplified mix design procedure, is formulated by combining the BIS method, ACI methods for concrete mix design and the available literatures on HPC using SF.

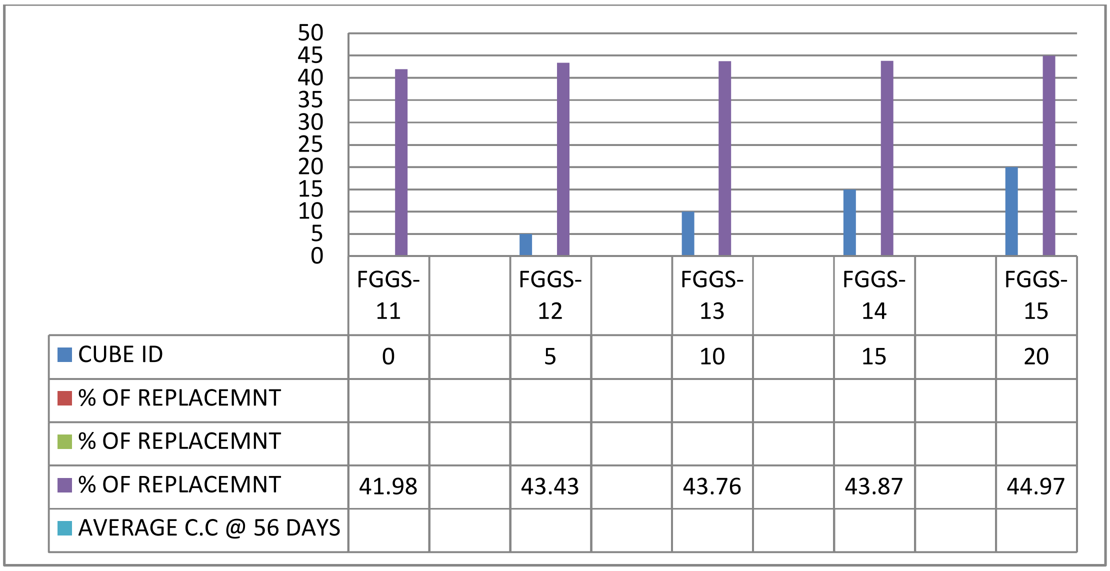
1) Calculation of binder contents The binder or cementitious contents per m2 of concrete is calculated from the w/b ratio and the quantity of water content per m3 of concrete. Assuming the percentage replacement of cement by SF(0-15%), the SF content is obtained from the total binder contents. The remaining binder content is composed of cement. The cement content so calculated is checked against the minimum cement content for the requirements of durabilility as per table 5and 6 of BIS: 456-2000 and the greater of the two values is adopted.

2) Moisture adjustments The actual quantities of CA, FA and water content are calculated after allowing necessary corrections for water absorption and free (surface) moisture content of aggregates. The volume of water included in the liquid plasticizer is calculated and subtracted from the initial mixing water

TEST RESULTS

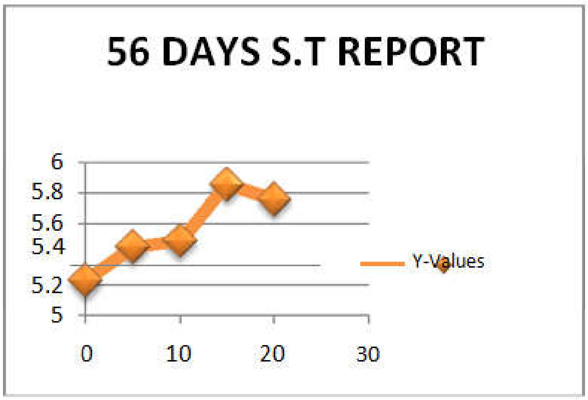


	FGGS-1	FGGS-2	FGGS-3	FGGS-4	FGGS-5
CUBE ID	0	5	10	15	20
% OF REPLACEMNT					
% OF REPLACEMNT	20.45	21.23	21.83	21.89	21.89
AVERAGE C.C @ 7DAYS					



	FGGS-11	FGGS-12	FGGS-13	FGGS-14	FGGS-15
CUBE ID	0	5	10	15	20
% OF REPLACEMNT					
% OF REPLACEMNT					
% OF REPLACEMNT	41.98	43.43	43.76	43.87	44.97
AVERAGE C.C @ 56 DAYS					

SPLIT TESNILE STRENGTH REPORTS



ULTRASONIC PULSE VELOCITY TEST REPORTS FOR CUBES:

Cube ID	% Replacement	Obtained average velocity (m/s)	Quality of concrete
FGGS-F	0	3567	Good
FGGS-G	5	4123	Good
FGGS-H	10	4298	Good
FGGS-I	15	4876	Excellent
FGGS-J	20	4878	Good

CONCLUSIONS

Based on the investigations carried out on HPC mixes the following conclusions are drawn.

The optimum percentage of cement replacement by SF is 10% for achieving maximum compressive strength

The 7 days to 28 days compressive strength ratio of HPC is 0.75 -0.8

The use of SF in concrete reduces the workability. Miscellaneous

a. The present replacement is a advanced one comparing to all the replacements in concrete
b. In the present thesis we replaced materials for the cement ,fine aggregate, coarse aggregate
c. After casting & curing the specimens the outcomes are positive compared to traditional concrete results

From the compressive strength results at 56 Days curing at zero percent it is 46.6 Mpa, it is not target mean strength value but it reached the target value with slight variations. Ten percent of replacement it gives 47.3 Mpa , at 30 percent value it gives the target value .

From the compressive strength results at 56 Days curing it gave a good result of M45 target mean strength value.

Overall replacement is very good but GGBFS,SF are having some alkali content and it is harmful to the iron in the concrete After the propagation of cracking the results very satisfactory and the flexure nature was increased compared to traditional specimens.

Split tensile strength of concrete was very low

Split tensile strength results randomly deviated from the reference values at some percentages

Ultrasonic pulse velocity of cubes are showing quality of hardened concrete is good at all tests.

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