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EXPERIMENTAL STUDY ON ENGINEERIED CEMENTITIOUS COMPOSITE (ECC) BY REPLACING CEMENT WITH RICE HUSK ASH AND SILICA FUME

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ABSTRACT

In this study that effect the RHA and SF when replacement on cement with some of ratio of sand aggregates with polypropylene fiber (PPF). Is used RHA to improve the mechanical properties for engineered cementituos composite (ECC) with rate of silica fume. ECC is new type of cement it improves the ductility and tensile strength also can repair. This experimental confers on high tenacity, shrinkage, compressive strength, and cracking load. In addition to add polypropylene fiber (PPF). Important things in this study to found best replacement of RHA with SF to get good condition of mechanical properties. And superplastizer is added to the concrete mixture to make it smooth and easy to form. Mix proportion that replacement with Sf and RHA can showing as SF05%, RHA05% + SF 10, RHA10 + SF15, RHA15 + SF20%, RHA10% + SF25%, RHA05% + SF30%, RHA0%. Using silica fume to resistance of chloride, sulfate attack, corrosion currents and acids that can make concrete high crack resistance and high-grade concrete also can change of strength to make it high strength early.

Keywords: ECC, Rice Husk, Silica Fume, Polypropylene Fibers, Concrete.

INTRODUCTION

Engineering Cementitious Compound (ECC), also known as a stress hardening cementitious compound, like hardenable concrete that is easily Reinforced with specially selected random short fibers, usually polymer fibers. Unlike regular concrete, ECC has 3 to 7% tensile strength, compared to 0.01% for regular concrete (OPC). Therefore, ECC acts like a ductile metal-like material rather than brittle glass that resembles a material (such as OPC). Development ECC is same ordinary Portland cement concrete, with the difference that it can deform (or bend) under stress. ECC science is developed by various research groups Including the universities of Michigan, University of California, Irvine, Delft University of Technology, University of California, Tokyo, Czech Technical University, University of British Columbia, and Stanford University. The lack of durability and stress failure of conventional concrete, both of which leads to brittle behavior, was a critical factor in the development of the ECC. Properties of ECC have a variety of unique properties, including higher tensile properties than other fiber-reinforced composites, ease of processing like that of conventional cement, use of a small fiber fraction (2%), low crack width and a lack of anisotropy ally weak planes. These properties are due in large part to the interaction between the fibers and the adhesive matrix, which can be customized through precise mechanical design. Type of ECC has several kinds following that:

i. Light ECC (low density) is developed by adding air blanks, glass bubbles and light aggregates. Compared to other lightweight concrete, the light weight ECC is characterized by bigger flexibility. Applications contain floating homes, sandals, and canoe.
ii. "Self-compacting concrete" Refers to concrete that can sink under its own weight. For example, a self-compacting material can fill a reinforcing steel mold with vibrations or without vibrations to warrant even transfer. The self-compressed ECC is It was developed using chemicals additives to reduce viscosity and by Control of particle interactions with the consistency of the mixture.
iii. Spray ECC which can be sprayed with compressed air from hose, has been developed by many superplastic and additives to reduce viscosity. Compared to other spray-reinforced composites, the spray-efficient ECC system has improved pump ability and unique mechanical properties. Spray able ECC was used for modification / repair work and tunnel / sewer coverings.

Field applications of ECC has been used in several country as Japan, Korea, Switzerland, Australia, and the United States and include:

i. I am. The Mitaka Dam near Hiroshima was repaired using ECC in 2003. The surface of the 60-year-old dam was severely damaged, indicating cracks, dispersal, and some dams. A layer of ECC 20 mm thick was applied by spraying over an area of 600 square meters.
ii. Secondly. The earth retaining wall in Gifu, Japan, was repaired with ECC also in 2003. Ordinary Portland cement cannot be used due to the severity of the cracks in the original structure, which would have caused a reflection crack. The ECC aimed to reduce this risk: only one year after the discovery of microcracks an acceptable supply.
iii. The Glorio Roppongi building in Tokyo, at a height of 95 meters (312 feet), has 54 ECC beams (two per floor) designed to less the damage caused by the earthquake. Compared to ordinary Portland cement, the characteristics of ECC (high damage resistance, High energy absorption (and under-shear stress capacity) gives it superior performance in seismic applications.
iv. Similarly, the 225mm ECC deck surface was completed on Interstate 94 in Michigan in 2005. A quantity of 30 cubic meters of material was used and delivered onsite in truckloads. Standard mix. Because the unique mechanical properties of ECC, the material used on this surface is also less than the recommended Portland cement surface. The University of Michigan and the Michigan Department of Transportation are monitoring the bridge to verify the theoretical maximum sustainability of the ECC after four years of monitoring, and the performance has not decreased.

An importance process to conserve the natural funds and decrease the influences and effects on the ecological issues by following ECC process, into the which the quantity of OPC is reduced and provide the opportunity to translate basic material property, by validation of the usage of those waste materials like (RHA and SF, etc…) properties of ECC could contribute to world development by improving properties of concrete. ECC is alike fiber reinforce concrete which include cement, water, sand, pozzolanic, and a few chemical admixtures, that can give durability and high strength in reasonable. But ECC validation cannot be achieved with conventional concrete without using an appropriated technology that could contributed to reduce earth warming and greenhouse gas manufacture because ECC is blending cement with wastes material, as RHA, SF, following the requirement of Indians standard.

SUPPLEMETARY OF CEMENTITIOUS MATERIALS:

(SCM) contributes to the performance of hardened concrete through its hydraulic or pozzolanic activity (such as rice hull ash, cement slag (crushed, granular blast furnace slag), silica fumes and fly ash). It can used alone with Portland cement, mixed or in different admixture. Usually, additional cement materials added to the concrete to make it more economical, decrease permeability and rise strength.

BINARY BLENDING OF RHA:

Rice considers important product on life. It is developed in 75 countries on world also using for cultivable approximately 11% on world. 80 million tons produced between (1994-1995) in India. The ratio for husk by rice approximately from (16 to 25) from weight of cereal. RHA has coarse surface. It is affectation risk environmentally friendly. It starts to dispose it so the way to use is making a new manufacture, so cement is first manufacture to use RHA in good condition. RHA has good influence when used as replacement of cement. RHA is a perfect pozzolan it increases the hardness, durability, and strength. To exchange of rice husk to RHA take away the organic material and put the silica remainder. RHA can replacement until 40% with no main modification at compressive strength when put RHA inside of concrete it reduces the absorbency and good blended of cement with non-negative influence of strength in concrete.

BINARY BLENDING OF SF:

SF can call also condensed SF, micro silica, micropoz (trademark), silica dust. Silica powder, also known as condensed silicon powder or micro silicon powder, is a finely divided residue derived from the iron-silicon alloy produced by the exhaust gas, which is produced by the furnace. Silica fume, with or without fly ash or slag, is often used to the manufacture of high strength concrete. Silica fume can be used as an additive cement, but usually used as (5 to 10) % replaced by mass for cement. Silica fume is more expensive than cement. SF is product silicon metallic. It is the most pozzolan in concrete due to has good chemical and physical property. Concrete which contains SF have a great strength and durable those are most things for ECC so SF can affect too much. SF has small atoms 0.01 by the volume in cement particle. SF is resistant for breakthrough chloride ions. SF makes concrete become gooey and decrease also workability has perfect access for kind of resin, perfect intake, and normal mix. Can make it more in the thermal accessibility and alteration the viscosity. Blended cement is like fiber reinforcement concrete content: cement, sand, water, fiber, and some of chemical addition. Come to replace OPC in world, and it is increasing the durability with more economy. Even reducing the pollution.

SIGNIFICANCE OF THE STUDY:

In this study, the purpose of the research is the mechanical properties in rapports of pressure, Tensile strength, flexural strength at 28 days for different ECC samples Mixtures. The water-binding ratio is kept constant at (0.32). Replacement levels. There are two section of replacement of SF and RHA. First section is replacement SF and RHA are (05,05+10,10+15,15) respectively with 2% of polypropylene fiber. Second section is replacement SF and RHA are (20,10+25,05+30,0) respectively with 2% of polypropylene fiber.

SCOPE OF THE STUDY:

The main characteristics are compressive, flexural, and tensile strength in concrete which are the basic focuses in this investigation to study mixing SF and RHA for the showing and goodness in concrete. Goal from study also is defining the best right mix ratio can make concrete wanted on the goodness, strength, and performance. The results from this study it will reduce from use concrete and influence the environmental.

LITERATURE REVIEW:

Xinchun guan et al. {1} investigate act of ultra-high ductile (ECC) with huge particle and high-volume ordinary river sand. that ultra-fine silica sand in old style ECC consequences demonstration that altogether river silica (ECC) current strain hardening, and various crack phenomena is reduced by more than10%and tests were directed to show its mechanical resources and to basically clarify these ductile certain by robust linking capacity delivered by fiber.

Mustafa Şahmaran et al. {2} The robustness of an ECC containing high fractional (FA) ash was studied. Aging and post-analyzes of transmission origins used to study the effect of functional analysis on robustness on the ECC After improving the elderly, tensile tests are performed to assess the effect of damage on tensile strength. The result shows both pre-loaded mechanical mixtures and without preloading ECC mixes with large amounts of FA maintain their stability in mechanical performance after a fast-aging time. Moreover, increased FA content has a negative effect especially on transport origins in the ECC test.

F.B.P. da Costa et al. {3} Environmental variation (ECC) was examined with untreated rice husk ash (RHA) with 30% concrete replacing concrete and high strength polypropylene fibers were evaluated for their durability origins. Likewise, use conventional concretes as the main material for comparison of ECC blends. The combination of RHA and ECC showed improved durability. Additionally, incorporation of RHA reduced the free and regulated shrinkage of ECC.

Ali S. Shanour et al. {4} They have been examined by the (ECC) as a type of super-ductile fiber with reinforcing fibers that they are using for financial purpose in construction and to investigate the demonstration of ECC concrete girders with usual reinforcing bars. They added twelve Rc-beams to study flexion behavior under the point loading test and used two strengths of variable volume ratios (PVA) and (PP). Verify showed us the maximum capacitance with (PVA) more important than (PP)

Shwan H. Said et al. {5} Discuss the effects of polyvinyl alcohol (PVA) on the durability, compressive, and external strength of ECCs and panels that are an index of stiffening. To assess the stress stiffness behavior on an ECC with PVA-ber contents, the tests were performed in straight tension. Stiffening of stress and implementation of different cracks were monitored for plates with reinforcement records above 316 although conditioning behavior was monitored for lower qualities. In this way, the increase in PCS60 values shows higher outdoor implement ability, and better ductile and energy absorption capacity for panels.

Mustafa S,ahmaran et al. {6} } Investigate the fluorescence of maximum volume (FA), and BERS (PVA) phi in periodic freeze-thaw-to-resistivity and microscopy (ECC). The airspace properties of the mixtures were studied using the liner cross method. The test result test that mixes both ECCs with a high volume of FA continues permanently, displaying a stress capacity of more than 2% even after 300 freezing and thawing cycles plus the remaining physical and mechanical assets decrease as the number of freezing processes increases - thaw cycles are relatively to ECC With an FA / C ratio of 2.2 and then for an ECC with an FA / C ratio of 1.2.

Yan Yao et al. {7} Study of concerns to give technique to improve tensile and external resources, drying shrinkage, and bound shrinkage by incorporating SAP particles as a previous example. The experimental result shows that all ECC mixtures show excellent ductility, more than 1.5%. Compared with control examples, the tensile and reversal capacity of ECC can increase with SAP particles by 92% and 77%, in addition, increasing the FA content can also increase the tensile capacity and reduce the drying shrinkage and restricted shrinkage of ECC.

Hocine Siad et al. {8} The investigation focuses on the effect of substituting LP content with a cementitious material on the performance of the large volume ECC (FA). The experimental result displays all self-healing combinations with slight differences. The microstructure was assessed using a SEM-EDS and XRD probe that confirmed a potential response between FA and LP. Due to mechanical self-healing and durability to increase the sustainability of civilian infrastructure.

Yu Zhu et al. {9} It was examined for improvement of ECC type with large tensile ductile and sufficient matrix strength, especially in initial age. To determine the resources for mechanically evaluation and dry shrinkage in ECC with 70% alloyed mineral admixtures of FA and granular furnace slag (SL). The results of the experiment also showed that ECC with alloyed metal alloys could achieve the stress hardening performance, tensile ability. Compared to ECC only with FA, SL and FA can efficiently develop compressive strength over ECC, especially in initial lifetime.

Ali N. AL-Gemeel et al. {10} It presented a potential research for a newly established reinforcing system, basalt fiber reinforced fabric (ECC). Three types of basalt fiber fabric were used, in conjunction with ECC to confine the square concrete pillars. The trial results system enhanced the load capacity and ductility of square concrete columns sandwiched with Textile Reinforced Mortar (TRM). Similarly shown results, the ECC itself can be used as a new retrofit in column confinement.

Fang Yuan et al. {11} A total of eight steel-reinforced poles with different longitudinal stiffness ratios and different loads of different loads were examined under eccentric tension. Current results the steel reinforced ECC (R / ECC) shows the superior performance of RC shafts in terms of load capacity, ductility, crack control ability and damage tolerance. A unique proposal for predicting the instantaneous bending response of an R / ECC column is presented and presented to show the effects of matrix types, longitudinal strengthening ratio, ECC compressive strength and tensile strength. ECC in momentary column load interaction curves.

Jokai Zhou et al. {12} The studied GFRP rods were tested with various fiber contents under pure torsional loading. The PP fiber identification test can effectively stop the crack propagation, and the spacing and width of the cracks have been reduced using experimental formulas for both the crushing and final torsion moments of the beams which were provided with good agreement in the pilot test.

Christopher K.Y. Leung et al. {13} did experimental investigation of layers ECC concrete beam subject to still and exhaustion flexural load in were still test result its flexural quality and thickness on ECC applied and improved ductility of beam on letdown style changed from brittle to ductile in comparison exhaustion loading at bend without letdown by utilize ECC strategic in dangerous locations for control of exhaustion crack.

Wen-Jie Ge et al. {14} presented diagnostic method and simplified equations for calculate of crack, yield and last moments of dissimilar cases on a par with deflections on ECC concrete combined beam reinforced with steel bar, founded on easy models of materials, strain similarity, necessarily aptitude of materials and balance of inside forces and moment from experimental test of many moment values and deflections. It provides approach by expanding tensile resistance and decrease compressive letdown.

Ali S. Shanour et al. {15} Performance was tested experimentally on conventional ECC reinforced steel reinforcing rod. Advanced Fibers (PVA-ECC) were studying the primary flexural crushing load, final load, ductility, and load-to-deflection relationship at different stages of loading, it was evaluated that large capacity is more important in the case of using PVA instead of PP and using the limited thickness of PVA concrete layer. When considering the nonlinear finite component analysis (NLFEA) of the tested beams and the load deflection response.

Li-li Kan et al. {16} Experimental research was performed on the crack properties of pre-loaded M45-ECC and HFA-ECC samples with stress levels of 0.3%, 0.5%, 1.0% and 2.0% considering the life cycle and mechanical action of the re-processed ECC material after reloading and analysis. Chemist where the tensile stress capacity of the restored ECC is approximately 2.0% for M45-ECC and 3.0% for HFA-ECC.

Zuanfeng Pan et al. {17} Approached to find out multiple NE phi cracking, meeting high requirements for safety and durable in sustainable infrastructure development by analyzing the construction of a fine mechanics model, and the feasibility of using unsaturated oil BERS PVA Phi and hybrid BERS PVA Fi in the ECC studied M7, M17 and M21. Relatively high tensile ductility and enhanced by the hybrid PVA bers, the determination of the mixture depends on the requirements of the structural act.

OBJECTIVE:

This research focus:

Investigate the properties of components Engineered Cement Composite (ECC). Find the exactly mix concrete percentage of RHA and SF in ECC to give highest strength in compression, flexure, and tension. Discussing the results that will appear through the tests, clarifying the best rates and the best results, and clarifying lower results and the reason for that.

EXPERIMENTAL METHODS

MATERIAL PROPERTIES:

CEMENT:

In this study ordinary Portland cement 43 grades has been used as per IS 8112 with specific gravity 3.13 showing in table IV.2 and following standard water required is 43% showing in table IV.3. The initial and final setting time have been getting 140 min and 420 min respectively and percentage of cement particle passing was taken with IS 90-micron sieve analysis with 96.4 %. And physical properties defined in the table IV.1

Table Error! No text of specified style in document.**.1 Physical Properties of Ordinary Portland Cement**

Physical Properties	**Value**
Standard Consistency	43.00%
Initial Setting Time of Cement	140 min
Final Setting Time of Cement	420 min
Specific gravity	3.13

Table Error! No text of specified style in document.**.2 Specific Gravity of Cement**

Compound	**Value**
Weight of empty bottle W1	117
Weight of Bottle + Cement W2	167
Weight of Bottle + Cement + Diesel W3	380
Weight of Bottle + Diesel W4	343
Specific gravity of Diesel	0.92
Specific gravity of Cement	3.3
Weight of cement	300

Table Error! No text of specified style in document.**.3 Standard Consistency of Cement**

Test	**Percentage** (%)	**Quantity** (g)
First trial	28	84
Second trial	35	105
Third trial	39	117
Fourth trial	43	129

AGGREGATES:

The aggregates fine was 4.75mm and less sieve respectively, fine aggregates falling under zone III following specified IS 383-1978. Water availability were from explain in IS 456-2000 used for concreting. Mix design were for M30 methods from standards IS code and giving in the table IV.4.

Table Error! No text of specified style in document.**.4 Sieve Analysis Fine Aggregate**

IS sieve	Passing%	Permissible% Passenger per IS
4.75	98.3	90-100
2.35mm	88.8	85-100
1.18mm	74.8	75-100
600mic	61.7	60-79
300mic	34.2	12-40
150mic	5.5	0-10
Pan	0.0	

Figure **Error! No text of specified style in document.**.1 Fine Aggregate

WATER:

The minimum water requirement of Indian standard for ECC, this water calculation has been setting from water/cement ratio where the quantity of cement is 384 as shown in the mix proportion tableIV.6.

SILICA FUME:

Silica fume, white color is obtained from India. It is very economic, and better useful of sprayed concrete. SF is superior product use for stabilization, rehabilitation of deterioration of construction industry element as (marine columns, piles, tunnel etc.….). IT Strength bonding is assured with high performance of wet and dry process with low rebound and application. But in this research silica fume is considered replacement of cement for investigated this experimental work, and also conductor for each design mix at the application.

Figure **Error! No text of specified style in document.**.2 Silica Fume Powder

RICE HUSK ASH:

Rice husk ash is pozzolanic from Rice husk after manufacturing process with temperature between 550°C and 900°C, content the fine particle like cement with black color. More decades ago, rice husk Ash has been recognized a good pozzolanic admixture that as full the requirement to use it in concrete.

Figure **Error! No text of specified style in document.**.3 Rice Husk Ash

POLYMER FIBER:

There are different types of polymer fibers, but the cheapest and most affordable polymer is polypropylene fibers that have some key important properties, for example, that are resistant to most chemical attacks. Its melting point is high, about 165 ° C. So that it can withstand working temperature for example 100 degrees without changing the properties of the fibers. The length of the fibers is mostly between 1 to 2 inches (25 to 500 mm). Because natural fibers are naturally available materials, they are not uniform in diameter and length. Typical values for the diameter of untreated natural fibers vary from 0.004 to 0.03 in (0.1 to 0.75 mm). There are physical properties of polypropylene fibers in Table IV.5

Figure **Error! No text of specified style in document.**.4 Polypropylene Fiber

Table Error! No text of specified style in document.**.5 Physical Properties of Polypropylene Fiber**

Specific Heat	0.46 cal/gxc
Refractive Index	1.49
Moisture Regain	0.1%
Specific Gravity	0.90 to 0.96

CHEMICAL ADMIXTURES:

Engineered Cementitious Composite (ECC) has a low rate of water freezing and contains very fine particles of mineral mixture, for example silica fume, rice husk ash. Thus, the efficient dispersion of cement, SF and RHA is necessary to obtain the appropriate microstructure of hardened concrete as well as the operability of the concrete, without modifying the water content and the cement content of the mixture. superplasticizers delay the hardening of concrete. In the present research work, Poly Carboxylic Ether superplasticizer is used to obtain an applicable concrete with a low water ratio. The super plasticizer it can reduces the water content by 30% or more. Poly Carboxylic conforms as per IS 9103 as High rang water reducing admixtures (HRWRA) are additives used in the manufacture of high strength concrete. The properties of the PCEs are shown in table IV.6.

Table Error! No text of specified style in document.**.6 Properties of Superplasticizer**

Characteristics	Specifications (As per IS9103)	Test Results
Physical state	Amber Colour Liquid	Amber Colour Liquid
Chemical Name of Active Ingredient	Poly Carboxylic Ether	Poly Carboxylic Ether
Density @ 25^0 C	1.040 - 1.080	1.065
Dry Material Content	(16.15 – 17.85) %	16.98 %
Workability	Produce high workable concrete	Produce high workable concrete
PH	6 Min	7.28 Min

MIX PROPORTIONING:

M30 grade concrete mixes are designed to consider pressure resistance in a constant w / c ratio. w / c ratio of 0.32 was approved and the cement was replaced with silica fume (SF), rice husk ash (RHA). Cement replacing at (0,30) %, (5, 25) %, (10,20) %, (15,15) %, (10,10) %, (5,5) % In weight of cement. The concrete mixer is used to mix dry and wet concrete for long enough to achieve a uniform mix following on table IV.7

Table Error! No text of specified style in document.**.7 Mix Proportion M30**

Mix ranges			W/C 32%	PPF 2 %	water	PC	SF	RHA	SP 2.5%	F AGG
PC%	SF%	RHA%								
100	0	0	0.32	18.2	384	1200	0	0	30	406.534
90	5	5	0.32	18.2	384	1134.824	42.173	23.03	30	406.534
80	10	10	0.32	18.2	384	1069.649	84.345	46.006	30	406.534
70	15	15	0.32	18.2	384	1004.473	126.518	69.01	30	406.534
70	20	10	0.32	18.2	384	985.134	168.69	46.006	30	406.534
70	25	5	0.32	18.2	384	966.134	210.863	23.003	30	406.534
70	30	0	0.32	18.2	384	946.965	253.035	0	30	406.534

TESTING METHODS:

Details of Test Specimen:

The casting of ECC simple of strength and tensile and flexural it has come in Table IV.8

Table Error! No text of specified style in document.**.8 Details of Test Specimen**

Test Details	Specimen Type	Curing Period	Specimen Size
Compressive strength	Cube	14, 28 days	150 mm
	Cylinder	14,28 days	300*150 mm
Splitting tensile strength	Cylinder	14,28 days	300*150 mm
Flexural strength	Beam	14,28 days	500*100*100 mm

FRESH PROPERTIES:

Slump Test:

The slump test of a conical rock consists of a bottom diameter of 20 cm and a diameter of 10 cm on the top and a height of 30 cm. The concrete is inserted three times and each time the concrete is compressed 25 times with a steel rod with a diameter of 16 mm, then the upper surface is attempted and then the mold is pulled up vertically at a speed that makes the concrete combined and shows correct results. It has to the highest peak of the mold as it exists according to IS 7320-1972.

Vee-Bee Test:

Place slump cone inside the mold, then place the concrete on four layers, each layer a quarter of the mold and damper the surface 25 times a layer, then move additional concrete from the surface then rotate the glass plate to the upper surface for concrete and noted graduated rod and measure the initial reading. After this, put the glass plate the original position and slowly lift the slump cone in vertical direction in that time noted concrete change from its shape again put the glass plate and measure the final reading then start the electric vibrator and at the same time start the stopwatch until the concrete becomes in a horizontal, flat shape, stop the stopwatch and an electric vibrator.

MECHANICAL STRENGTH PROPERTIES OF CONCRETE:

Preparation of Specimen:

The basic components of ECC concrete mixture are cement, fine aggregate, water. In addition, mineral admixture, and chemical admixture. At first the basic components are mixed with mineral admixture without water until the mixture becomes coherent, 50% water is added in the mixture and then add other percentage gradually after the mixture becomes a single mass then put chemical admixture to make the mixture more flexible and easier to shape. The molds are prepared, which are: a cylindrical mold of volume 300x150$_{mm}$ and a cube mold of volume 150x150x150$_{mm}$ and a beam mold volume 500x100x100$_{mm}$. Clean the molds and grease the mold by oil from inside well, and then put the concrete mixture in the molds and put it in the electric vibrator to expel the air and get avoid of the voids that appear during casting of the mixture, and then put it in a safe place. After that, when the mixture becomes harder, put it directly in the water.

Figure **Error! No text of specified style in document.**.5 Materials of ECC

Figure **Error! No text of specified style in document.**.6 Concrete Mixture of ECC

Figure **Error! No text of specified style in document.**.7 Flexibility of ECC

Figure **Error! No text of specified style in document.**.8 Casting of ECC

Figure **Error! No text of specified style in document.**.9 Casting of ECC Specimens

Figure **Error! No text of specified style in document.**.10 Curing of ECC Specimens

RESULT AND DISCUSSION

WORKABILITY OF CONCRETE:

Slump, Vee Bee:

Workability of traditional concrete mainly considering the maximum volume of aggregate used. Workability for concrete It is mainly selected according to the water requirements at the time of mixing. Water The requirements and workability of the concrete mixture are affected in an unusual way. Its physical properties. Generally, it is a joint to combine Concrete increases rice husk ash and silica fume increases the need for water Unlike mix control. Slump test results and Vee-Bee values are shown in Table V.1. Degrees of workability of concrete mixtures are indicated from slump, and Vee-Bee scores. The percentage of Increased silica fume (SF), rice husk ash (RHA) due to A large area of SF and RHA. From the results RHA that has decrease value of slump also, with a Vee Bee test it takes a lot of time due to the higher awareness and higher surface area of RHA. Silica fume and rice husk ash generally require the addition of a superplasticizer to make concrete with RHA, SF more workability. RHA reducing workability and to find the required slump, high water range reduction additives (HRWRA) are essential. Using HRWRA to separate RHA and SF particles. Therefore, it is assumed that HRWRA use is extremely important in concrete that contains fine particles such as RHA to achieve good results.

Table Error! No text of specified style in document.**.9 Workability Results of ECC Mixes**

Mix ratio	SF %	RHA %	Workability of Concrete Test	
			Slump mm	Vee Bee sec
Mc	0	0	115	7
M1	5	5	90	8
M2	10	10	75	10
M3	15	15	15	27
M4	20	10	70	11
M5	25	5	85	9
M6	30	0	94	8

MECHANICAL STRENGTH:

Compressive Strength:

The compressive strength of M30-grade additive mixes Test blends for age 28 days in Table V.2. The compressive strength of the ECC trial mixture provides an M_{30} grade Containing 0,0 + 05, 05 + 10, 10 + 15, 15 + 20, 10 + 25, 05 and 30, 0 percent cement replacement levels for silica fume powder (SF) and Rice Husk Ash (RHA). In the graph shown in Figures V.1 and V.2. It can show the pressure value at 28 days for ECC test mixtures M_C to M_6 containing 0,0 +05, 05 + 10, 10 + 15, 15 + 20, 10 + 25, 05 and 30, 0 percent replacements are, 30.05, 29.85, 30.16, 20.79, 34.45, 33.20, 31.10 MPa, Respectively.

The lifetime of compressive strength at 28 days. Upgrade from 31.10 MPa to 34.45 MPa for cement replacement level Values of 30% SF + 0% RHA to 20% SF to 10% RHA (M6 to M4) and A reduction from 30.16 MPa to 29.85 MPa for 10% SF + 10% RHA at 05% SF + 05% RHA cement replacement level values. From Table V.2, it is noted That at 28 ages.

The cube compressive strength increases for M_6 mixture to M_4, and it is reduced for mixtures M_2 to M_1. As a result, it is assumed that maximum compressive strength is obtained for mixed additives 20% SF and 10% RHA with partial substitution by weight of cement. and gradually exceeds this level down. Noted, the best percentages that give good results is 30% SF+RHA replacing with cement. When increase RHA more than 10% it gives lower result such as M_3 because of RHA absorbs a large amount of water.

Table Error! No text of specified style in document.**.10 Compressive Strength of ECC Results**

Mix Ratio	SF %	RHA %	Compressive strength 28 days
M_c	0	0	30.50
M_1	05	05	29.85
M_2	10	10	30.15
M_3	15	15	20.79
M_4	20	10	34.45
M_5	25	05	33.20
M_6	30	0	31.10

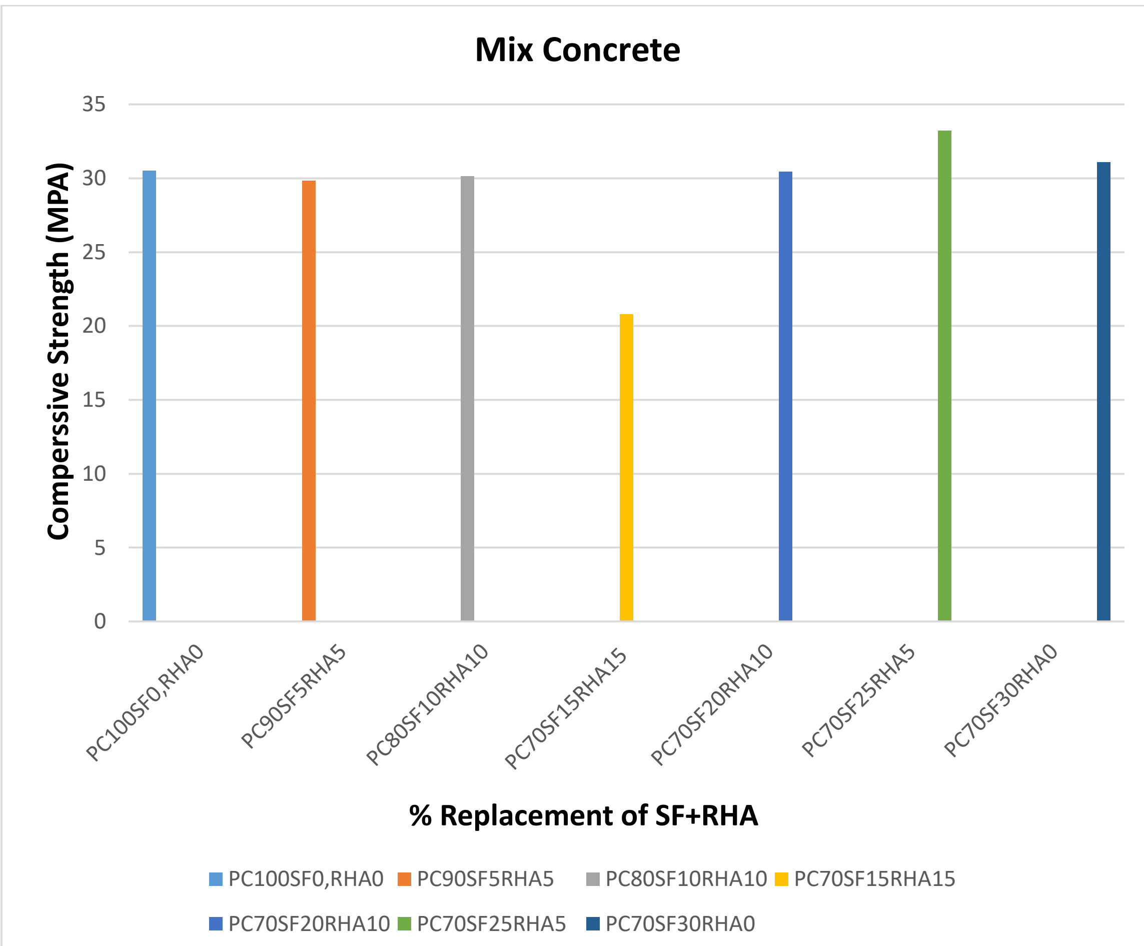

Figure **Error! No text of specified style in document.**.11 Compressive of Strength of ECC Mixes with effect SF and RHA at 28 days

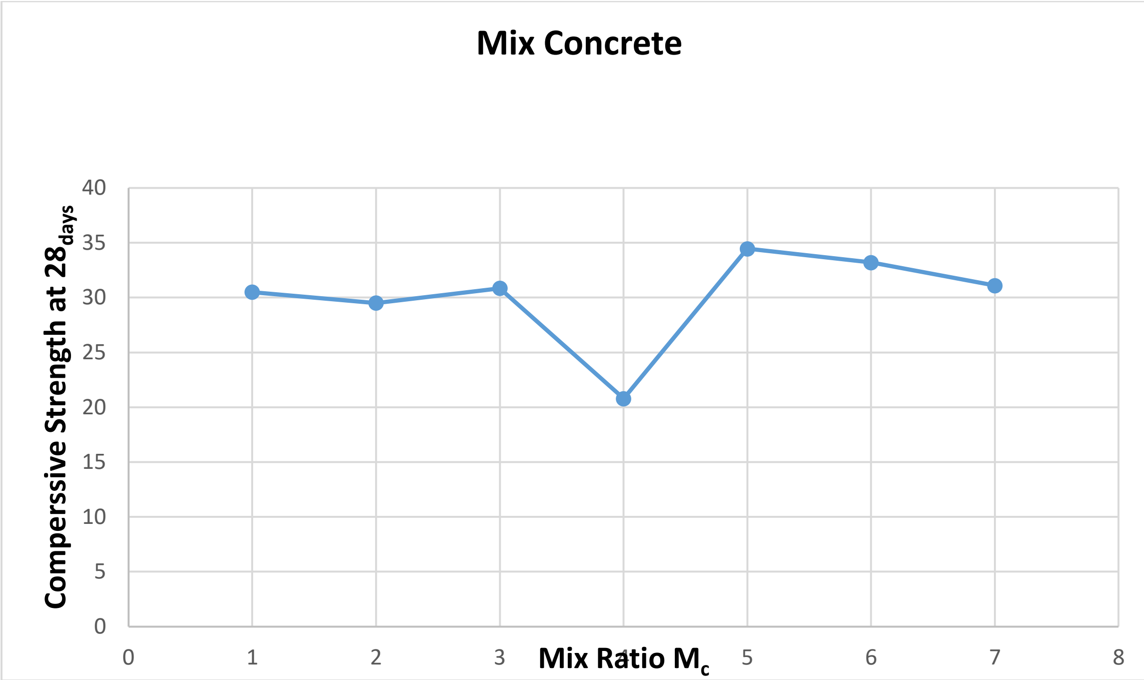

Figure **Error! No text of specified style in document.**.12 Variation of Compressive Strength of ECC with Replacement SF and RHA

Split Tensile Strength:

Splitting tensile strength of SF + RHA mixed concrete at28 days are shown in Table V.3. Notice that tensile strength values increase from 2.46 MPa to 2.66 MPa (M_6 to M_4) then decrease from 2.40 MPa to 2.39 MPa (M_2 to M_1). From the test results, noted that the best splitting tensile is obtained by 20% SF + 10% RHA. It is also noted that the strength of the concrete is present. Compressive and tensile are closely related and the relationship between the two Strengths depend on the general level of strength of concrete.

Table Error! No text of specified style in document.**.11 Split Tensile Strength of ECC Results**

Mix Ratio	SF %	RHA %	Split Tensile Strength 28 days
M_c	0	0	2.43
M_1	05	05	2.39
M_2	10	10	2.40
M_3	15	15	1.90
M_4	20	10	2.85
M_5	25	05	2.61
M_6	30	0	2.46

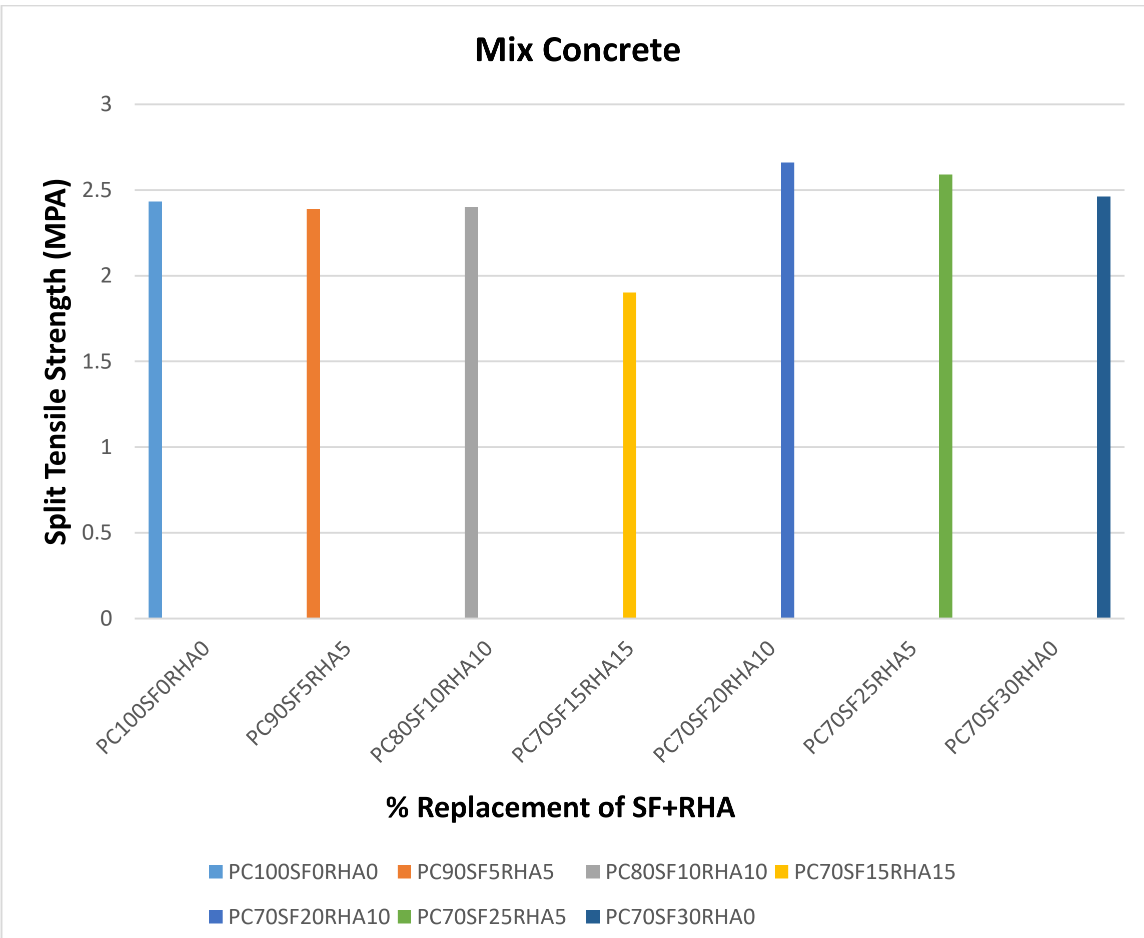

Figure **Error! No text of specified style in document.**.13 Split tensile of Strength of ECC Mixes with effect SF and RHA at 28 days

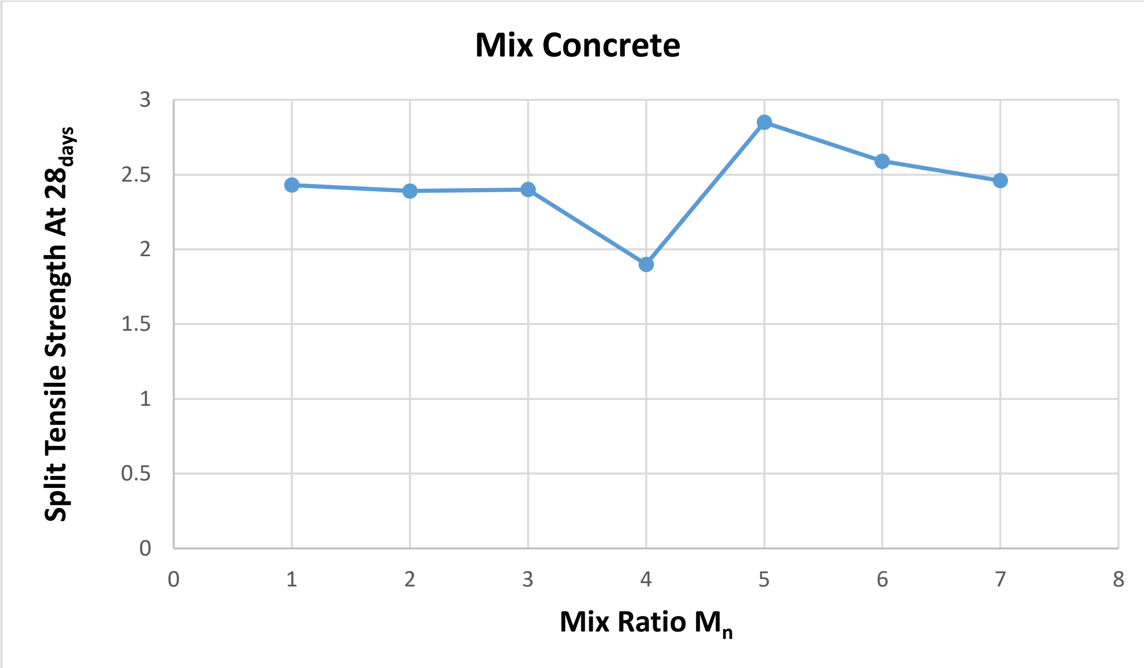

Figure **Error! No text of specified style in document.**.14 Variation of Split Tensile Strength of ECC with Replacement SF and RHA

Flexural Strength:

Flexural strength outcomes for the combined SF + RHA ECC experiment Grade M30 mixes at 28 days of age are shown in Table V.4. the Effect of SF + RHA and variation in flexural strength at 28 days of age with different percentages of SF and RHA shown in the graphs given in Figures V.5 and V.6.

Flexural strength is 28 days after mixing. The ECC experiment mixes Mc to M6 and contains 0, 0 + 05, 05 + 10, 10 + 15, 15 + 20, 10 + 25, 05 and 30, 0 percent cement replacement SF + RHA are 4.5, 4.8, 4.01, 3.89, 5.5, 5.1 and 4.15 N / mm^2, Respectively. From Table V.4, there are two section first is 10, 20, 30% of SF + RHA divided each one. It is observed that the flexural strength Gradually increases from 3.89 N / mm^2 up to 4.8 N / mm^2 for cement Replacement values from M3 to M1 (15% SF + 15% RHA to 05% SF + 05% RHA). Second section is proportion into 30 % additional of cement. It is observed that the flexural strength gradually increases from 4.15 N / mm^2 to 5.5 N /mm^2 for cement replacement values from M6 to M4 (30% SF + 0% RHA to 20% SF + 10 RHA) second section has good values gradually. First section Flexural strength decrease with increasing SF + RHA. Second section flexural strength increase when separate the proportion. Therefore, from the test result, it is observed that the optimal flexural strength is 20% SF + 10% RHA with cement replacement for an experimental mix of ECC. The strength of concrete in compressive and flexural is closely related.

Table Error! No text of specified style in document.**.12 Flexural Strength of ECC Results**

Mix Ratio	SF %	RHA %	Flexural Strength 28_{days}
M_C	0	0	4.50
M_1	05	05	4.80
M_2	10	10	4.01
M_3	15	15	3.89
M_4	20	10	5.50
M_5	25	05	5.10
M_6	30	0	4.15

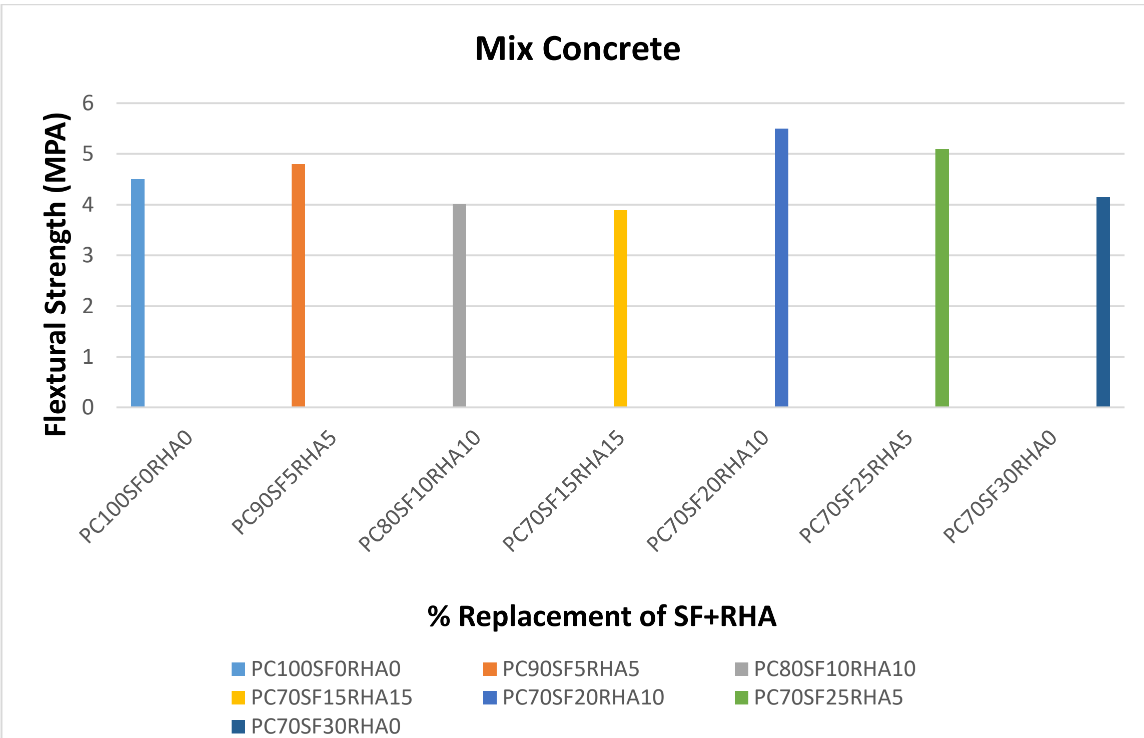

Figure **Error! No text of specified style in document.**.15 Flexural Strength of ECC Mixes with effect SF and RHA at 28 days

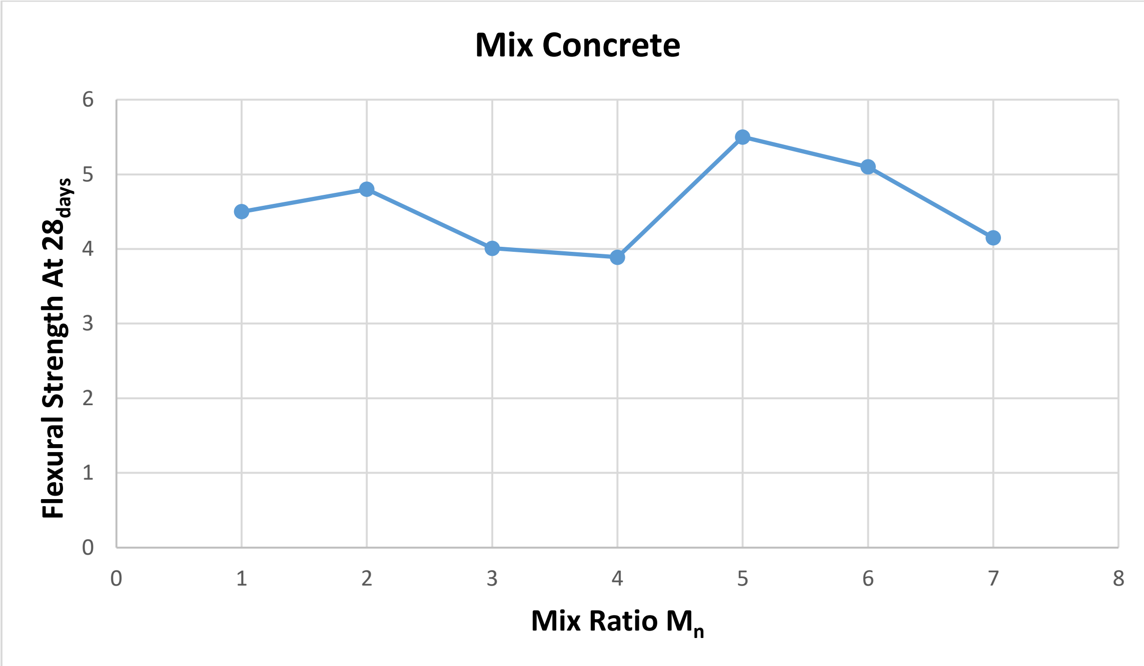

Figure **Error! No text of specified style in document.**.16 Variation of Flexural Strength of ECC with Replacement SF and RHA

CONCLUSION:

This investigation is focused on experimental and mechanical test for engineering cementitious composite. This is new research of application of RHA with SF in ECC. To looking for these admixture material effect on ECC. Also compare the strengths with ordinary normal concrete. And get less economy used in ECC. In this content of paper talking about who effect when replace good percentage of RHA on cement to get high compressive strength, flexural strength, tensile. In addition, search for best result of cracking load and in workability for concrete by add silica fume. Silica Fume and Rice husk Ash are making together to improve all properties of concrete. During the tests, I noticed that RHA absorbs the water and makes the concrete mixture drier, so I tried to reduce the RHA percentage to make it more functional and more usable. RHA gives more strength to concrete when replace less than 10%. Silica fume powder and rice husk ash gives good related with compound of concrete.

TABLE TIMELINE

Activity	Month and Year									
	2019					2020				
	March	April	October	November	December	January	February	March	April	May
Research Topic	■									
Preliminary literature Rivew		■								
Research Gap, Objective and Scope of Work		■								
Research Methodology			■							
Collection of Material			■							
Cube Casting for Mix Design of M30 Grade of Concrete				■						
Compressive Strength Test for 28 days					■					
Beam Casting for Flexural Strength Testing					■					
Flexural Strength After 28 days					■					
Report Preparation					■					
Cylinder Casting for Split Tensile Strength Testing						■				
Split Tensile Strength Testing For 28 days							■			
Report Preparation and Research Paper Preparation								■	■	
Viva of Research Work										■

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