AN EVALUATION OF THE MECHANICAL PROPERTIES OF M40 GRADE CONCRETE USING FLY ASH AND FOUNDRY SAND AS PARTIAL AGGREGATE REPLACEMENTS

[1]K.Madhu sudan reddy, [2]P.Sravanthi, [3]L.S. Sandeep kumar, [4]Lok Bahadur Bist
[1,2,3]Assistant Professor, [4]UG Student, [1,2,3,4]Department of Civil Engineering, Visvesvaraya College of Engineering & Technology, Hyderabad, India

ABSTRACT

Self-compacting concrete (SCC) is able to be shaped so that it can navigate obstacles with just its own weight and no need for vibration. Better uniformity is provided by SCC, particularly for those with increased blockage, decreased porousness, and increased cement flexibility. The main objective of this investigation is to determine if using SCC is feasible by analyzing its unique characteristics and strengths, such as water retention, shrinkage, and sulphate tolerance. In order to fulfill the requirements of the plastic state, this exploratory activity entails: (I) develop a successful mix for SCC; and (ii) projecting solid specimens and testing them for compressive force, shrinkage, water retention, and sulphate resilience. Local service providers supply neighborhood totals, concrete, mixes, and additional materials given by nearby providers have been utilized in this work. The significance of this work lies in its push to incorporate some SCC yield information to cause to notice the likely utilization of SCC.

Keywords: SSC, Dynamic strength, Equivalent lateral force, Response spectrum.

INTRODUCTION

The demand for construction materials generally rises as the infrastructure industry expands globally. We are experiencing a lack of construction materials as a result of this rapid expansion, which causes significant exports of natural resources at various points. The advancement of concrete technology makes it easier to decrease pollution and save energy and natural resources [1]. Construction is one of the least environmentally friendly businesses in the world, thus it has to make use of existing technology to lessen its effect. Some industrial waste products can replace cement in construction projects. These materials can be used in place of cement to improve concrete's environmental performance by lowering CO2 emissions. [2].

The self-compacting concrete is partly replaced with unprocessed calcareous fly ash to enhance the concretes workability. The fiber content addition after 50 %, results in worsening the concrete properties [3]. The cement is comparatively replaced with glass fiber and fly ash in fiber reinforced concrete in various fraction are tested. The glass fiber does not enhance the flexural strength and compression strength [4]. The fly ash and Cement Kiln Dust (CKD) are used in concrete to achieve significant effect on economic and environmental benefits [5]. The effect of Meta kaolin and fly ash in concrete are determined by partially replacing the cement. It is revealed that, 10 % Meta kaolin and fly ash in concrete attains favorable combinations for casting of concrete flexural members [6]. The by-product obtained from cement is CKD, which is used as a relative replacement of cement in lightweight construction material is analyzed to produce sustainable products [7]. The 20% of cement is partially replaced with GGBS and fine aggregate of 25 % is replaced with robo sand to validate the strength of gardened concrete [8]. The OPC (Ordinary Portland Cement) is moderately replaced with GGBS and crushed sand as fine aggregate and it is observed that, the addition 10 % GGBS and 0 % crushed sand gains, 50 % strength [9]. The 20 % and 30 % addition of GGBS and silica fume are suitable concrete mix for OPC, because it keeps the shrinkage within the acceptable level [10].

In this paper, The essential goal of this examination is to explore the feasibility of utilizing SCC by dissecting its particular properties and strength qualities, for example water retention, shrinkage and sulfate tolerance.

This exploration work comprises of: (I) plan a successful mix for SCC to meet the determinations of the plastic state; (ii) projecting solid examples and checking them for compressive force, shrinkage, water retention, sulfate resilience. Neighborhood totals, concrete, mixtures and added substances given by nearby providers have been utilized in this work. The significance of this work lies in its push to incorporate some SCC yield information to cause to notice the likely utilization of SCC.

MATERIALS AND METHODOLOGY

The experimental program structure, including the identification of different materials used, casting processes, following criteria and facilities are discussed.

Materials used a) Cement

Concrete is a cover, a structure medium that sets, solidifies and integrates different materials. As a part of the assembling of mortar in maceration and solid, which are a combination of concrete and total to frame a tough development material, the main types of concrete. Throughout the examination, Ordinary Portland Cement (53°C) affirmed by IS: 269-1976 was utilized.

Fine aggregate

It is more the IS sifter that passes 4.75 mm and just in corporate as a lot coarseras the determination requires. The contingent upon the scale, the thick sand, medium sand and slight sand can be recognized as coarse sand. The IS necessities characterize the fine classification as the fine total of the evaluating zone-1 to the reviewing zone-4 out of four sorts. From reviewing zone 1 to angle territory 4.90% to 100% of the fine gathering is progressively better, with 4.75mm IS 7 and 0 to 15% moving 150micron IS 7ve in consistence with its evaluating area.

Coarse aggregate

It is basically contained in the 4.75 mm IS sheet and contains the same amount of mores lender substance as characterized. Foundry sand is used as coarse aggregate. Foundry Sand will show high compressive strength in concrete because of its better holding properties. Fly debris is one of the consuming deposits of the fine particles that develop with the stream gas. Debris not rising is alluded to as the lower debris. Fly debris regularly alludes to debris created during coal burning in a modern setting.

Water

For projecting and readiness of the example, new and sterile water is utilized. The water is relatively clear, true to form by the Indian Standard, of natural matter, sediment, oil, sugar, chloride and acidic materials. Via hydration, the combination of water with a solidified substrate delivers concrete glue.

Admixture

Combinations are different materials that are applied to the blend either previously or subsequent to blending of cement other than Portland concrete, water and totals. Super plasticizer specialist conplast (SP423) of 2.8 lit/m3 for all solid blends was utilized to accomplish great usefulness.

Mix design for M40 grade concrete

i. Characteristic compressive strength— M 40
ii. Nominal maximum size of aggregate — 20 mm
iii. Degree of workability required at site — 50-75 mm (slump)
iv. Type of exposure— Mild
v. Type of cement: PSC
vi. Specific gravity of cement — 3.15
vii. Specific gravity of FA — 2.64
viii. Specific gravity of CA — 2.84
ix. Fine aggregates confirm to Zone II

Hims worth constant for 5% risk factor is 1.65. In this case standard deviation is taken from IS: 456

Target mean strength = Fck+1.65xS
=40+1.65x5
=48.25Mpa.

Where, S is the standard deviation in N/mm^2 for M40 grade concrete = 5 From Table 5 of IS 456, maximum water-cement ratio for Moderate exposure condition = 0.6 From Table 2 of IS 10262- 2009,

parameters	Values as per Standard reference condition	Values as per Present Problem	Departure	Correction in Water Content
Slump	25-50 mm	50-75	25	(+3/25) x 25 = +3
Shape of Aggregate	Angular	Angular	nil	-
			total	+3

Maximum water content=186Kg (for Nominal maximum sizeofaggregate—20mm)

Correction in water content:

Estimated water content = 186+ (3/100) x 186 = 191.6 kg /m^3

Water-cement ratio = 0.6

Water content = 191.6 kg /m^3

Cement content = water content / water cement ratio ewds/= 191.6/0.6 = 319.33 kg /m^3

From Table 5 of IS 456,

Minimum cement Content for mild exposure condition = 300 kg/m^3 319.33 kg/m^3> 300 kg/m^3,

Hence, OK. From Table 3 of IS 10262- 2009

For Nominal maximum size of aggregate = 20 mm,

Zone of fine aggregate = Zone II

For w/c = 0.6

Volume of coarse aggregate per unit volume of total aggregate = 0.62

Correction in estimation of coarse aggregate proportion

Parameter	Values as per Standard reference condition	Values as per present problem	Departure	Correction in Coarse Aggregate proportion	Remarks
W/C	0.5	0.6	nil	-	
Workability	-	Pumpable concret	-	-10%	See Note
			total	-10%	

Note: Forpumpableconcreteorcongestedreinforcementthecoarseaggregateproportionmay bereduced up to 10%.

Hence, Volume of coarse aggregate per unit volume of total aggregate = 0.62 x 90% = 0.558

Volume offine aggregate=1– 0.558 =0.442

Volume of concrete = 1 m^3

Volume of cement=(Mass of cement/Specific gravity of cement)x (1/100) =(320.00/3.15) x (1/1000) =0.101 m^3

Volumeofwater =(Massof water/Specificgravityofwater) x(1/1000) =(191.6/1) x (1/1000) =0.1916 m^3

Volume of total aggregates = Volume of concrete – (Volume of cement + Volume ofwater) =1 – (0.101+0.1916)= 0.7074 m^3

Mass of coarse aggregates= Volume of total aggregate X Volume of coarse aggregate X specific gravity of coarse aggregate X1000=0.7074 x 0.558 x 2.84 x1000=1121.03 kg/m^3

Mass of fine aggregates=Volume of total aggregate X Volume offine aggregate X specific gravity of coarse aggregateX1000=0.7074 x 0.442 x 2.64x 1000=825.45 kg/m^3

Per cubic meter requirement of ingredients

Cement– 319.33kgs

Sand-825.45kgs

Metal-1121.03kgs

Water-191.6liters

Finally mix proportion becomes 1:2.58:3.

3) Methodology

The methodology of project involves the following operations

Batching:

Thatisthetechniqueforgaugingorincorporatingsolidpartsbyvolumeormass.Normally, clustering happens in volume, however most include bunching by mass as opposed to accuracy rate for solid substance computation is as per the following:

Concrete:

In the event that concrete is to be stacked in abundance of 30% of the size, the estimation accuracy ought to be under 1% of the vital mass. On the off chance that the estimation amount isunder30%for example for tons less, the estimating accuracy ought to be under 4%.

Totals:

On the off chance that the estimation is over 30% of the scale power, the accuracy of the estimation ought to be inside 1%. In the event that amounts are underneath 30%, so the precision of estimation is beneath 3%.

Water:

Water is estimated in volumetric amount as 1 liter = 1kg. In the event of water, the estimating exactness ought to beinside1%.

Admixtures:

A similar accuracy as is needed for concrete for mineral admixes. Similar accuracy as is required for water in synthetic admixtures. The precision of mineral admixtures is equivalent with that of concrete, since it is utilized to substitute concrete mostly. Consequently, its exactness is like that of the water when substance compounds are fluid or applied to water.

b) Mixing:

The blending strategy requires pivoting or erosion for the expectation of covering the surface with concrete glue with every one of the totals and of blinding all materials of the solid to the uniform mass; the blender doesn't disturb this consistency.

c)Placing of cement:

To guarantee solidification is fruitful and complete, their quest, rate and thickness of layer should be observed. Most surface deformities are because of unnecessary situating and poker's inability to eliminate, and combine, air adequately. The vibrator of poker can't right the awful situating. Where cement is utilized to situate chutes, isolation doesn't exist. To limit isolation, confounds and spouts ought to be utilized.

d) Compaction of concrete:

Compaction is the technique for removing caught air from recently situated cement and bundling together the total particles so the solid thickness is improved. It enormously expands a definitive strength of the solid and builds up the bond. The scraped area opposition and generally speaking sturdiness of the solid likewise builds, the porousness lessens and its therapist and-creep properties can be limited. Appropriate compaction likewise ensures that the framed surfaces are altogether filled – for example no pockets of honey comb material – and that the right last surfaces are obtained. As placed first in the structure, normal cement contained somewhere in the range of 5% and 20% in the volume of gathered air, aside from exceptionally low or high droops. While covered with mortar, the total particles seem to curve and are halted by inner grinding from settling or combining.

e) Finishing:

The completion is to screw or buoy the concrete surface to densify the outside of the solid and further pack it to make it the view point you like. Prior tore storing solid, this progression ought to be considered.

f) Curing:

The system requires safeguarding a suitable dampness and temperature of the solid in early ages with the goal that the combination can make properties. The fix begins straight forwardly in the wake of situating and completing to improve the ideal strength and sturdiness of the solid. The established materials in the solid can't respond to a quality item without a fitting dampness supply. The drying strategy will extricate the water needed for this synthetic response known as hydration and concrete can't accomplish its likely properties. Temperature is a huge factor in right relieving as the pace of hydration and consequently strength development at higher temperatures is faster. In request for an appropriate pace of solidarity creation to be achieved, solid temperature ought to normally be kept above 50°F (10°C). What's more, a consistent temperature across the solid segment ought to be saved as it acquires power to oppose heart breaking. Relative stickiness and wind conditions are likewise basic for uncovered solid; they add to an absence of dampness in concrete, adding to breaking, low surface quality and life span. Counter action of plastic shrinkage breaking is significant to maintain a strategic distance from dampness dissipation from solid surfaces prior to settling.

g) Testing:

The assessment of the examples is completed to check with their separate treatment days the compressive force, break foothold power and twisting strength of the solid examples

III EXPERIMENTAL PROCEDURE

a) Specific gravity and Cement

Procedure:

Dry the carafe cautiously and load up with lamp fuel or naphtha to a point on the stem somewhere in the range of nothing and 1 ml. Record the level of the fluid in the cup as starting perusing. Put a weighted amount of concrete (around 60 gm) into the carafe so that degree of lamp oil ascend to around 22 ml mark, care being taken to abstain from sprinkling and to see that concrete doesn't stick to the sides of the over the fluid. After putting all the concrete to the flagon, roll the cup tenderly in a slanted situation to oust air until no further air bubble rise3s to the outside of the fluid. Note down the new fluid level as definite perusing.

Observation and Calculations:

Weight of cement use =W gm

Initial reading of flask =V1 ml

Final reading of flask =V2 ml

Volume of cement particle=V2-V1 ml

Weight of equal of water= (V2-V1) × specific weight of water.

Specific gravity of cement= (Weight of cement/ Weight of equal volume of water)= W/ (V2-V1)

b) Coarse aggregate

Procedure:

Take 2 kg of total Test bigger than 10mm. Wash the example altogether to eliminate better molecule and residue. Place the example in a wire bushel and inundate it in refined water at a temperature somewhere in the range of 22oC and 32oC with a front of in any event 5 cm of water over the highest point of the crate. Remove the ensnared air by lifting the bushel containing the example 25 mm over the base of the tank and permitting it to drop each second, care being taken to see that the example is totally drenched in water during the activity. With the example in water at a temper of 220C-32oC (W).Remove the container and total from water and permit depleting for a couple of moments. Empty the total from the container to a shallow plate. Immerse the vacant container in water shock multiple times and afterward the load in water ( ).Place the totals in broiler at a temperature of 100oC to 110oC for 24± 0.5 hours. Remove it from the broiler and cool it and discover the weight. ( )

Calculations:

Apparent Specific Gravity = (Weight of a substance/ weight offine aggregate and equal vol. of water)=$W_3/(W_3-(W_1-W_2))$

c) Fine aggregate

Procedure:

Take about 500g of test and spot it in the pycnometer. Pour refined water into it until it is full. Eliminate the entangled air by pivoting the pycnometer on its side, the opening in the zenith of the cone being covered with a finger. Wipe out the external surface of pycnometer and gauge it (W). Transfer the substance of the pycnometer into a plate, care being taken to guarantee that all the total is moved. Refill the pycnometer with refined water to a similar level. Find out the weight ( ). Drink water from the example through a channel paper. Place the example in broiler in a plate at a temperature of 100ºC to 110º C for24±0.5 hours, during which period, it is mixed at times to encourage drying. Cool the example and gauge it (W).

Calculation:

Apparent specific gravity =(weight of dry sample /weight of equal volume of water) =$W_2/(W_2-(W-W_2))$

d)Slump cone test:

Procedure:

Clean the interior surface of the shape and apply oil. Place the shape on a smooth even non-permeable base plate. Fill the shape with the readied solid blend in 4 around equivalent layers. Tamp each layer with 25 strokes of the adjusted finish of the packing bar in a uniform way over the cross segment of the form. For the ensuing layers, the packing ought to infiltrate into the hidden layer. Remove the abundance concrete and level the surface with a scoop. Clean away the mortar or +water spilled out between the form and the base plate. Raise the form from the solid promptly and gradually vertical way. Measure the droop as the distinction between the tallness of the shape and that of stature point of the example being tried.

C) Compaction factor test:

Apparatus

Compaction factor apparatus' trowels, hand scoop (15.2 cm long), a rod of steel or other suitable material (1.6 cm diameter, 61 cm long rounded at one end) and a balance.

Procedure

Place the solid example delicately in the upper container to its edge utilizing the hand scoop and level it. Cover the chamber. Open the hidden entrance at the lower part of the upper container so that solid falls in to the lower container .Push the solid staying on its sides tenderly with the street. Open the secret entryway of the lower container and permit the solid to fall in to the chamber beneath. Cut of the overabundance of cement over the high degree of chamber utilizing scoops and level it. Clean the outside of the chamber. Weight the chamber with cement to the closest 10 g. This weight is known as the heaviness of somewhat compacted solid ( ).Empty the chamber and afterward top off it with similar solid blend in layers roughly 5cm profound, each layer being intensely smashed to acquire full compaction. Level the top surface. Weigh the chamber with completely compacted. This weight is known as the heaviness of completely compacted concrete (W).Find the heaviness of void chamber ( )

Calculation

Compaction Factor= =$W_1/(W_2-(W_2-W))$

D) Fineness modulus and Cement

Weigh around 10g of concrete to the closest 0.01gand spot it on the sifter. Agitatethes trainer by twirling, planetary and direct developments, until notany more fine material

goes through it. Weigh the buildup and express its mass as a rate R1,of the amount previously positioned on the sifter to the closest 0.1 percent. Gently brush all the fine material off the base of the sifter. Repeat the entire method utilizing a new 10g example to acquire R2. At that point as certain R as the mean of R1 and R2 as a rate, communicated to the closest 0.1 percent. At the point when the outcomes vary by more than 1% outright, do a third sieving and compute the mean of the three qualities.

b) Fine aggregate Sample preparation:

Take an example of fine total in dish and put it in dry stove at a temperature of 100 – 110oC. After drying bring the example and note down its weight.

Methodology:

Take the sifters and orchestrate them in plummeting request with the biggest strainer on top. If mechanical shaker is utilizing then set the arranged strainers in place and pours the example in the top sifter and afterward closes it with strainer plate. Then switch on the machine and shaking of sifters ought to be done in any event 5 minutes. If shaking is finished by the hands at that point pour the example in the top strainer and close it at that point hold the main two sifters and shake it inwards and outwards, vertically and evenly. After some time shake the third and fourth sifters lastly last strainers. After sieving, record the example loads held on each sifter. At that point track down the combined weight held. Finally decide the aggregate rate held on each sifters. Add the all combined rate esteems and gap with 100 then we will get the estimation of fineness modulus.

E) Bulk density

a) Aggregate

Procedure:

Take the heaviness of void measure (W). Fill the action with totals test for around 33% stature and hat uniformly with 25 strokes of the adjusted finish of the packing pole. Add a comparative amount of total as second layer and pack it equitably with 25strokes.Fill the action with a third layer of total upto over after and pack itwith25strokes. Strike off the overflow total utilizing the packing pole as a straight edge. Take the weight (W_1). Empty the action and fill it again to over streaming by methods for a digging tool, the total being released from a stature not surpassing 5cm over the highest point of the action. Level the outside of the action and weight it (W_2).

F) Aggregate impact test

a) Coarse aggregates

The complete obstruction of the parts to misfortune by sway is by and large respected concerning concrete. The best thing about a normal molded total is 15 blows with a 14 Kgs weight metal rammer dropping from a stature of 38cm. The best one is that. The volume of material going through the IS sifter of 2,36mm shows the force of the total example. The extent of the heaviness of the general study as a rate communicated as the total impact esteem is characterized. IS 283-1970 expressed that, for the total utilized for concrete other than surface working, the total impact worth couldn't surpass 45% by mass and 30% by wearing for the wearing surface cement like walkways, streets and floors. The totals are classified by their impact significance for structure and individual in the accompanying.

Procedure:

Take the test comprising of standard total going through 12.5mm and held on 10mm. I.S. sifters. The total around 33% loaded with t shape and packed by 25 strokes by packing pole. Add further comparative amount of total and pack it and fill the action. Determine the net wt of total in shape and Place the entire example into a steel round and hollow cup fixed on the base of the machine. Raise the mallet wt about 14kgs to the tallness of 38cm over the surfaces of total. The test was exposed to an absolute 15 such blows each determine red at a time frame short of what one sec. Remove the squashed total from the cup and strainer through 2.36mm 1S sifter and weight the material went through 2.36mm.

G)Aggregate crushing test a) Coarse aggregate

Procedure

The heaviness of the examined test content (weight A) is resolved and a similar example weight is taken to the test imitates. The test device chamber will be mounted on the base plate and the preliminary example joined to the base plate in thirds, with every third subject to 25 packs from the cushion pole. The total surface will be altogether raised and the unclogged embedded so as not to stick into the edge, it might stay even on a superficial level. The unit is mounted between the estimating machine plates and filled at a rate as reliable as conceivable to such an extent that the total burden is accomplished quickly with the test and the unclogged in its area. The heap is 40 tons altogether. The heap is delivered and the whole Substance removed from the chambers is checked for the typical measure, onan IS sifter of2.36mm, oron the right strainer in Table

(Weight B). Altogether these systems the absence of fines should be halted. There will be two checks.

H) Concrete Test Procedures a) Compressive strength

Procedure

Remove the example from water after determined relieving time and crash abundance water from the surface. Take the component of the example to the closest 0.2m. Clean the bearing surface of the testing machine. Place the example in the machine in such a way that the heap will be applied to the contrary sides of the 3D square cast. Align the example halfway on the base plate of the machine. Rotate the versatile bit delicately by hand with the goal that it contacts the top surface of the example. Apply the heap bit by bit without stun and ceaselessly at the pace of 140kg/cm2/minute till the example fizzles. Record the greatest burden and note any uncommon highlights in the kind of disappointment.

Calculations:

Size of the cube =15cm×15cm× 15cm

Area of the specimen (calculated from the mean size of the specimen) = $225cm^2$

Characteristic compressive strength (f_{ck}) at 7,14,28,56 and 90 days =

Expected maximum load = f_{ck}× area × f.s Range to be selected is …………………..

Similar calculation should be done for 28 day compressive strength Maximum load applied =………tones =N

Compressive strength = (Load in N/ Area in mm2) =N/mm2

b) Split Tensile test

Procedure

Take the wet example from water following7days of restoring Wipeout water from the outside of example. Draw polar lines on the two finishes of the example to guarantee that they are ona similar pivotal spot. Note the weight and measurement of the example. Set the pressure testing machine for the necessary reach. Keep are compressed wood strip on the lower plate and spot the example. Align the examples o the lines seta part on the closures are vertical and focused over the base plate. Place the other compressed woods trip over the example. Bring down the upper plate to contact the pressed wood strip. Apply the heap persistently without s tunat a pace of roughly 14-21kg/cm2/minute (Which relates to an absolute heap of 9900kg/moment to 14850kg/minute). Note down the breaking load (P).

Calculations:

As per IS456, split tensile strength of concrete. = 0.7 f_{ck}

The splitting tensile strength is calculated using the formula T_{sp} = 2P/ pi DL

Where P = applied load

D = diameter of the specimen L = length of the specimen

Therefore P = T_{sp} x pi DL/2, Expected load = P x f.s

c) Flexural Test

Procedure

The pillar will be tried on its side comparative with the situation wherein it was projected. The length ought to be 457.2 mm (multiple times the profundity). The heap ought to be applied to the example at the third focuses as outlined in Figure 1 (152.4 mm from each help). The example ought not be eliminated from the relieving tank until not long prior to testing. Indeed, even a modest quantity of drying can antagonistically influence the outcomes. Two tests will be made on each pillar. Thusly, for the main test, position the pillar with one end around 30 mm from the help. The points of help and stacking ought to be set apart on the shaft. The test ought to be done at a pace of stacking demonstrated by the teacher. After the heap test, the normal profundity and width of the example at the disappointment segment should be estimated to the closest mm.

Calculations:

The modulus of rupture is calculated as follows:

CASEI where fracture occurs within the middle third of the span:

$$R = \frac{PL}{bd^2}$$

Where, R is the modulus of rupture in , P is the maximum load in KN, L is the span length I meters, d is the average depth in meters.

CASE II where fracture occurs outside the middle third of the span as measured along the beam bottom by no more than 5% of the span length (―grace zone‖)

$$R = \frac{PL}{bd^2}$$

Where a is the distance in m of the fracture from the nearest support measured along the bottom centre line of the beam if left support is closest, record as positive, if right support is closest, record as negative.

CASE III where fracture occurs more than 5% outside the middle third, the results of the test are discarded (i.e. the test is indeterminate).

The constant k, which is sometimes used in converting compressive strength to modulus of rupture is calculated as follows

$$k = \frac{\frac{R^2}{1000}}{f'_c}$$

Where f^1_c is the compressive strength in Mpa, R is the modulus of rupture in

IV. RESULT AND DISCUSSION

A) Compressive strength of cubes

A partial substitution of cement by fly ash was casted in cubes of sizes 150 mm x 150mm x 150 mm. In 7, 28 and 90 days, the strength variability was monitored using the compressive strength measuring unit. Cement has been substituted with fly ash with varying percentages to achieve the best fly ash performance, and the test specifics are given below. The variation of compressive strength on partial replacement of cement with fly ash at 7 days, 28 days and 90 days is represented in Table 1.

Table 1 Variation of compressive strength on partial replacement of cement with fly ash at 7 days, 28 days and 90 days.

S.No	% of Fly ash	% of Cement	7 days strength (MPa)	28 days strength (MPa)	90 days strength (MPa)
1	0	100	33.5	47.0	47.3
2	10	90	33.8	47.3	47.5
3	15	85	34.1	47.7	47.7
4	20	80	34.4	48.01	48.02

5	25	75	34.6	48.6	48.8
6	30	70	34.2	47.9	48.0

The optimum value of Fly ash was found to be 25%

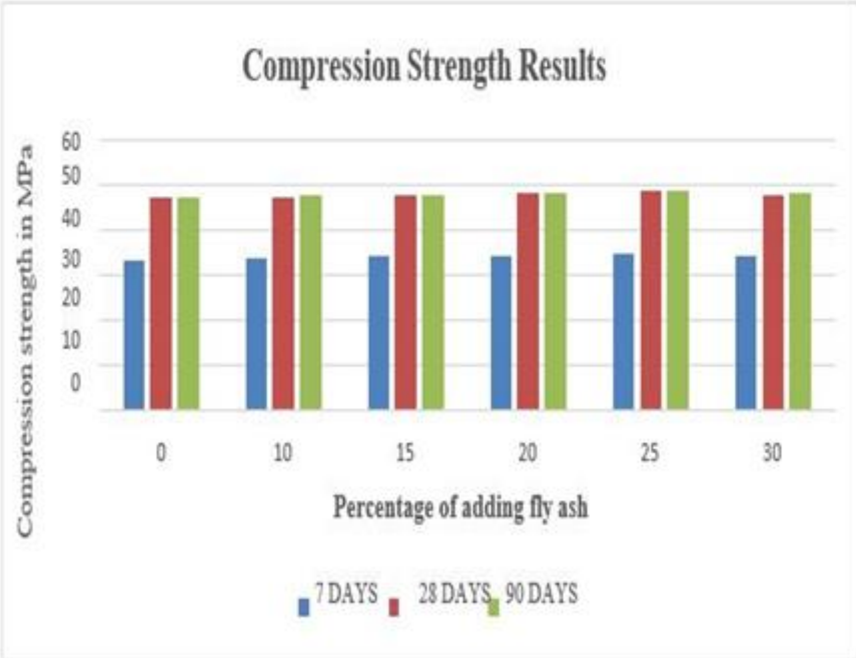
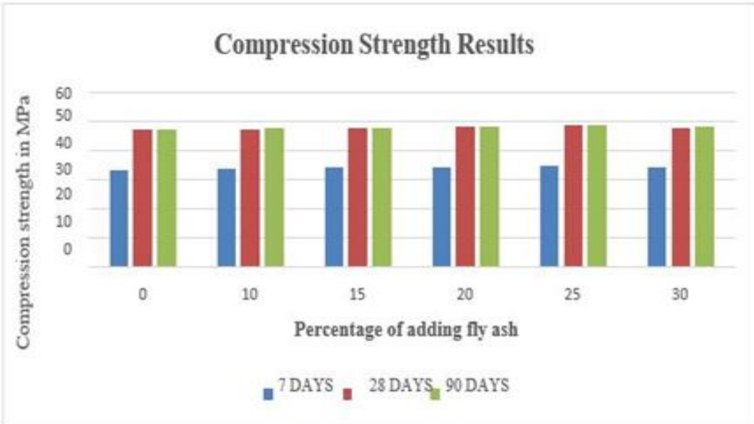


Figure 1 Variation of compressive strength on partial replacement of cement with fly ash at 7 days, 28 days and 90 days.



The graphical representation of variation of compressive strength on partial replacement of cement with fly ash at 7 days, 28 days and 90 days is represented in Figure 1.

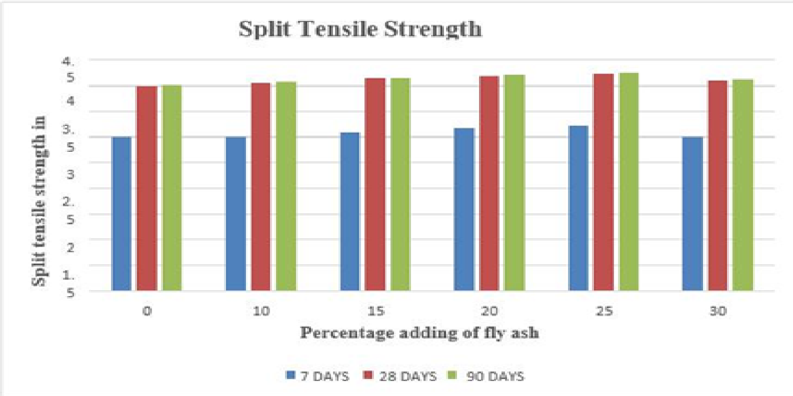
B) Split tensile strength

The variation of split tensile strength values on partial replacement of cement with fly ash at 7 days, 28 days and 90 days is represented in Table 2.

Sl.No	Flyash%	Cement %	7 days Split tensile strength (Mpa)	28 days split tensile strength (Mpa)	90 days split tensile strength (Mpa)
1	0	100	3.0	4.0	4.02
2	10	90	3.05	4.06	4.08
3	15	85	3.1	4.14	4.16
4	20	80	3.18	4.19	4.21
5	25	75	3.22	4.24	4.25

6	30	70	3.01	4.10	4.12

Figure 2 Variation of split tensile strength on partial replacement of cement with fly ash at 7 days, 28 days and 90 days.



The graphical representation of variation of split tensile strength on partial replacement of cement with fly ash at 7 days, 28 days and 90 days is represented in Figure 2.

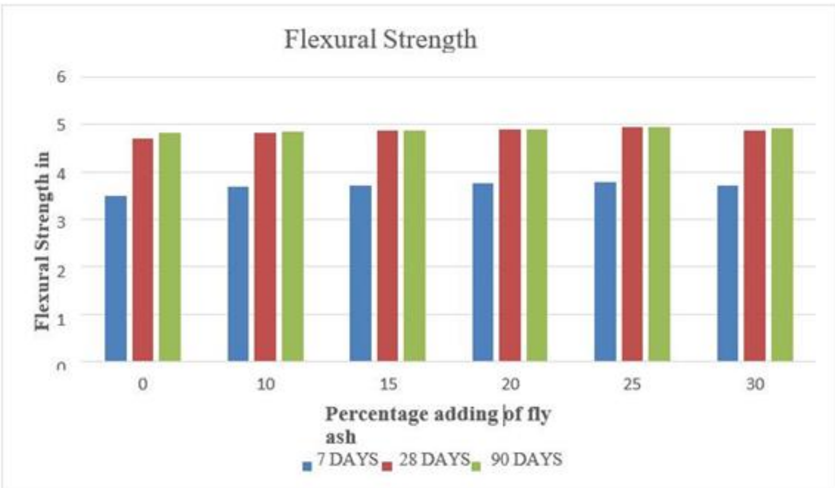
C) Flexural strength

The flexural strength of Conventional concrete values and the cement partially replaced with fly ash at 7, 28 and 90 days is represented in Table 2.

S.No	Flyash%	Cement%	7days flexural strength (Mpa)	28daysflexuralstrength (Mpa)	90 daysFlexural strength(Mpa)
1	0	100	3.5	4.7	4.82
2	10	90	3.68	4.82	4.84
3	15	85	3.72	4.87	4.88
4	20	80	3.76	4.90	4.91
5	25	75	3.79	4.94	4.96
6	30	70	3.72	4.88	4.92

The graphical representation of variation of flexural strength on partial replacement of cement with fly ash at 7 days, 28 days and 90 days is represented in Figure 3.

Figure 3 variation of flexural strength on partial replacement of cement with fly ash at 7 days, 28 days and 90 days



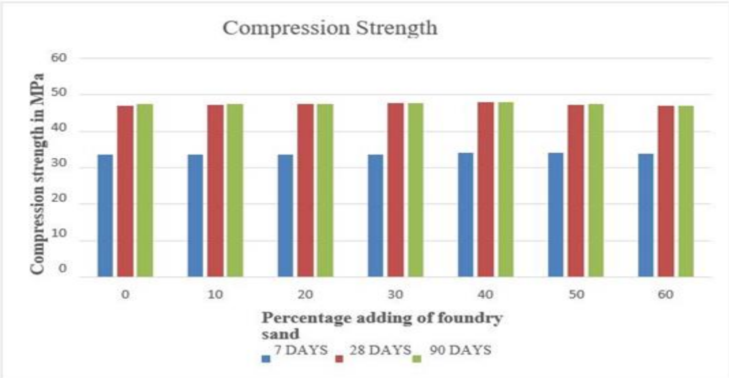
The fine aggregate was supplemented by varying amounts of the simple sand by the desired value of fly ash (i.e. 25 percent is derived from the test results). Various studies were again performed by the preparation of samples in labs, through continuous retention of 75% cement+ 25%Flyashand by substitution of the finely aggregated sand with many percentages of the bases and. The values of compressive strength of concrete with fly ash and the fine aggregate partially replaced with foundary sand cubes at 7, 28 and 90 days (Mpa) is represented in Table 4.

Table 4 Compressive strength of concrete with fly ash and the fine aggregate partially replaced with foundary sand cubes at 7, 28 and 90 days (Mpa)

S.No	Cement% +Flyash	Foundary sand%	7 days compressive strength(Mpa)	28 days compressive strength(Mpa)	90 days compressive strength(Mpa)
1	75+25	0	33.5	47.0	47.3
2	75+25	10	33.52	47.2	47.31
3	75+25	20	33.56	47.4	47.42
4	75+25	30	33.58	47.62	47.64
5	75+25	40	34.2	47.84	47.89
6	75+25	50	34.0	47.2	47.3
7	75+25	60	33.8	46.8	47

The graphical representation of variation of compressive strength of fly ash (25%) added concrete on partial replacement of fine aggregate with foundary sand at 7 days, 28 days and 90 days are depicted in Figure 4.

Figure 4 variation of compressive strength of fly ash (25%) added concrete on partial



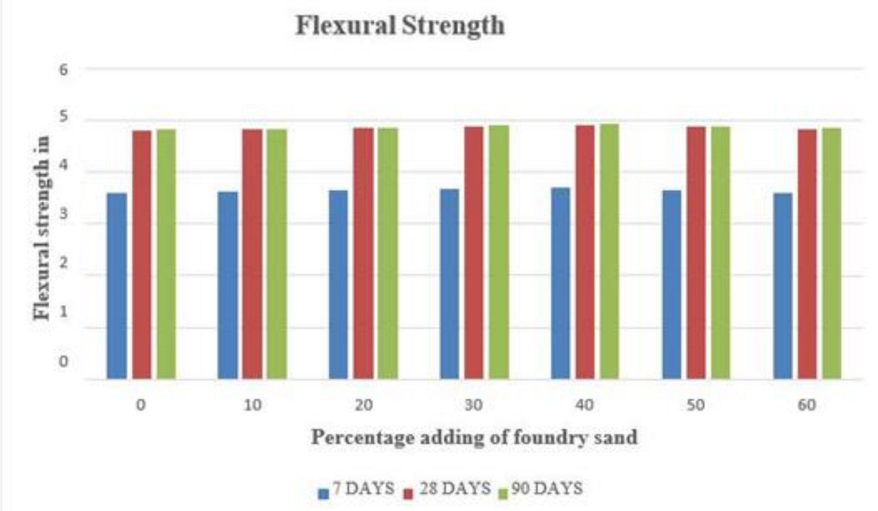
replacement of fine aggregate with foundary sand at 7 days, 28 days and 90 days

The Split tensile strength values of concrete with fly ash and the fine aggregate partially replaced with foundary sand at 7, 28 and 90 days (Mpa) is represented in Table 5.

The flexural strength values of concrete with fly ash and the fine aggregate partially replaced with foundary sand at 7, 28 and 90 days (Mpa) is represented in Table 6.

Sl.No	Cement % +Flyash %	Foundary sand%	7 days flexural strength (Mpa)	28 days flexural strength (Mpa)	90 days flexural strength (Mpa)
1	75+25	0	3.6	4.8	4.82
2	75+25	10	3.62	4.82	4.83
3	75+25	20	3.64	4.85	4.86
4	75+25	30	3.67	4.89	4.9
5	75+25	40	3.7	4.92	4.93
6	75+25	50	3.66	4.88	4.89
7	75+25	60	3.61	4.84	4.86

Figure 6 Variation of flexural strength of fly ash (25%) added concrete on partial replacement of fine aggregate with foundary sand at 7 days, 28 days and 90 days



CONCLUSION

By combining synthetic and mineral ingredients, it is possible to create self-compacting cement, which has more pronounced malleable and compressive limitations than regular vibrating concrete. Self-compacting concrete has demonstrated a more restrained interface with minor fractures than conventional cement with the use of synthetic and mineral mixes, resulting in a more solid holding between total and concrete adhesive and an increase in elastic and compressive capacities. Examined closely, self-compacting concrete offers two key benefits. One takes into account the structure time, which is typically not accurate when using conventional cement due to the manner that brief period is lost when compacted by vibration. The second benefit has to do with the situating. However long the SCC needn't bother with compaction, it very well may be considered naturally supportable, since no commotion is made if no contact is applied.

The rate improvement in compressive strength at 7, 28 and 90 days of concrete halfway subbed by 25% fly debris was seen to be 3%, 3.4% and 3.2%. The rate ascend in split elasticity at 7, 28 and 90 days of concrete somewhat supplanted by 25% fly debris was discovered to be 7%, 6% and 5%. The rate improvement in flexural strength at 7, 28 and 90 days of concrete part of the way subbed by 25% fly debris was seen to be 5%, 3% and 3%. More, the strength boundaries were imperceptibly expanded when the fine total was enhanced by different rates of foundry sand. The ideal measure of foundry sand to supplant the fine total was discovered to be 40%. The rate ascend in compressive strength at 7, 28 and 90 days of fine total mostly subbed with 40% of foundry sand was discovered to be 2%, 1.8 percent and 1.2 percent. The rate ascend in break rigidity at 7, 28 and 90 days of fine total incompletely subbed with 40% of foundry sand was discovered to be 6%, 3.5 percent and 3.4 percent. The rate improvement in flexural strength at 7, 28 and 90 days of fine total incompletely subbed by 40% of foundry sand was discovered to be 2.8 percent, 2.5 percent and 2.3 percent. The estimations of compressive strength, elasticity and flexural strength of both concrete and coarse total treated cement at 28 days were discovered to be 46.84Mpa, 4.14Mpa and 4.82Mpa individually. Percent expansion in compressive strength, split elasticity and flexural strength of both concrete and coarse total treated cement at 28 days was discovered to be 2%, 4% and 3% individually.

REFERENCE

1. M.V. Patil, Y. D. Patil, G. R. Vesmawala, ―A study on properties and effects of copper slag and marble dust in concrete‖, International Journal of Structural Engineering, vol. 9, no. 2, pp. 91-100, 2018.
2. Matea Flegar, Marijana Serdar, Diana Londono-Zuluaga, Karen Scrivener, "Regional Waste Streams as Potential Raw Materials for Immediate Implementation in Cement production‖, Materials, vol. 12,no. 23,pp. 5456, 2020.

3. Adnan mujkanovic,Dzenana becirhodzic, Ilhan busatlic, Marina jovanvovic,―Unprocessed calcareous fly ash as a partial cement replacement in self-compacting concrete" , Journal of Sustainable Construction Materials and Technologies, vol. 6, no. 2, pp. 44-55, 2021.
4. Sakshi Gupta, Aakash, Abhimanyu Ramola, Jatin Arora, Anand Saini, ―Partial Replacement of Cement by Flyash & Glass Fibre in Light Weight Fibre Reinforced Concrete." International Journal of Engineering Research and Technology, vol. 6, pp. 24-7, 2017.
a. A. Elbaz, A. M. Aboulfotoh, A. M. Dohdoh, A.M.Wahba, ―Review of beneficial uses of cement kiln dust (CKD), fly ash (FA) and their bmixture‖, Journal of Materials and Environmental Sciences, vol. 10, no.11, pp. 1062-1073, 2019.
5. M. Siva Parvathi , K.Yogesh , M. NikhilSuhas , Henloi L. Aventh, ―Evaluation of Strength of PCC with Partial Replacement of Cement by Meta Kaolin and Fly Ash‖, International Journal of Scientific Development and Research (IJSDR), vol. 4, no. 6, 2019.
6. Saleh HM, Faheim AA, Salman AA, E Sayed AM, ―A Review on Cement Kiln Dust (CKD), Improvement and Green Sustainable Applications‖, International journal of nuclear medicine and radioactive substances, vol. 4, no. 1, 2021.
7. Mallesh M, Sajidulla jamkhani, Nandeesh M, ―Experimental Study on Partial Replacement of Cement by GGBS and Fine Aggregate by Robo Sand for M25 Grade Concrete‖, International Research Journal of Engineering and Technology (IRJET), vol. 06 no. 08, 2019.
8. Shelke, Shalaka, Rm Jadhav, ―Partial Replacement of Cement by GGBS and Fine Aggregate by Crusher Dust‖, International Journal of Innovations in Engineering Research and Technology, vol. 7, no. 10, pp. 174-179, 2020.
9. Das, Kunal K., Eddie SS Lam, Ho H. Tang, ―Partial replacement of cement by ground granulated blast furnace slag and silica fume in two-stage concrete (preplaced aggregate concrete)‖, Structural Concrete, vol. 22, pp. E466-E473, 2021.