© April 2024 | IJIRT | Volume 10 Issue 11 | ISSN: 2349-6002

A Self-Compaction Concrete Analysis Incorporating Nano Silica

CH.SRIKANTH[1], ADUSUMALLI MANIKANTA[2], B.VIKAS MYTHREYA[3], S.HARIKA[4], M.VENKATESH[5], K.ASHOK[6]

[1, 2] Assistant Professor, Department of Civil Engineering, PACE Institute of Technology And Sciences,Ongole, India

[3, 4, 5, 6] B.Tech Student, Department of Civil Engineering, PACE Institute of Technology And Sciences,Ongole, India

Abstract- To create more flexible and strong concrete, the mechanical characteristics of concrete composites incorporating nano silica were examined in this work. Concrete was mixed with varying amounts of Nano-silica powder for this reason. Investigations were conducted on the sample's morphology and mechanical characteristics. By adding the Nano-silica, the mechanical qualities like flexural, tensile, and compressive strength were greatly enhanced. The ideal composition, with 2.5 weight percent to 3.5 weight percent of nano silica, was attained; in comparison to the next concrete, an increase in tensile strength, compressive strength, and flexural strength was anticipated for 0.25% to 1.28%, respectively. Images captured by a scanning electron microscope demonstrated that the interfacial transition zone between the cement particles was improved by adding nano-silica to concrete.

I. INTRODUCTION

Cement, sand, water, and occasionally admixtures are the ingredients of concrete, a composite material. In order to create long-lasting concrete constructions, self-compacting concrete was initially developed in 1988. Since then, a number of studies have been conducted, and significant construction companies in Japan have primarily employed this kind of concrete in functional constructions. Research aimed at creating a logical mix-design Methodology and self-compatibility testing techniques have been conducted with the goal of standardizing self-compacting concrete. In the building business, self-compacting concrete is becoming more and more popular. This is because it has a substantially higher compressive strength than regular concrete and is thought to be an optimal solution when taking into account the strength, durability, and cost requirements of specific constructions. The most active ingredient is cement.II.

II. PROBLEM STATEMENT

Compaction was necessary for most concrete casts in order to guarantee the development of sufficient strength and durability. The goal of concrete compaction is typically to increase the concrete's density as much as feasible. Concrete with a dense microstructure has better durability, low carbonation, high strength, low permeability, and strong resistance to sulfate and chloride attacks. Void development brought on by inadequate compaction will negatively affect the mechanical and physical characteristics of concrete. The protection provided by the embedded steel reinforcement will also be affected by the presence of voids. In a building site, vibrators are used to manually compact concrete. Nonetheless, it will be challenging to do compaction in the following circumstances:

- Generous spaces for casting concrete. Congested reinforcement is present

S.No	Property	Result
1	Specific gravity	2.61
2	Fineness modulus	2.8
3	Bulk density(loose)	15.75KN/m^3
4	Grading of sand	ZONE-II

Table: 1 Properties of Fine Aggregates

III. METHODOLOGY AND EXPERIMENTATION

• Setup of the Laboratory

The project makes advantage of St. Martin's Engineering College's concrete lab. The tools for workability testing are used to determine passing and filling abilities.

• Purchasing Supplies

The following materials were utilized in the study: i) cement; ii) fine aggregate; iii) coarse aggregate; iv) water; and v) mixture.

i) Cement

Ordinary Portland Cement (OPC) of 53 Grade was found in the current investigation, Jaypee, confirming to IS:

the finished product may become noticeably weaker after curing.

Portland cement is without a doubt the type of cement that is used the most extensively worldwide. In order to make this cement, limestone (calcium carbonate) and other ingredients, such as clay, are heated to 1450 °C in a kiln, which releases a carbon dioxide molecule.

A wide range of coarse particle materials, such as sand, gravel, crushed stone, slag, recycled concrete, and geosynthetic aggregates, are utilized in construction. The most mined substance in the world is aggregate. In composite materials like asphalt and concrete, aggregates play a crucial role as reinforcement, enhancing the overall strength of the material. Aggregates have a higher hydraulic conductivity value than most soils, which makes them useful for drainage applications like foundation and

Coarse aggregate is gravel that has been crushed, cleaned, and sieved so that the particles range in size from 5 to 20 mm. Fine aggregate is natural sand that has been cleaned and sieved to remove particles larger than 5 mm. Delivery of the coarse and fine aggregate occurs independently. A produced blend of fine and coarse aggregate is more expensive than natural all-in aggregate since it needs to be sieved.

The rationale behind utilizing a combination of fine and coarse aggregate is that when the amounts are just right, a concrete with very few voids or spaces can be created, which lowers the amount of relatively expensive cement needed to create a strong concrete.

i) You can sieve without risk of sand leaking by holding the sieve with both hands and making delicate wrist movements. This will remain evenly dispersed across the screen. Throughout the sifting process, the sieve can rotate in a nearly constant manner. Slugs, washers, and shorts are not allowed on the sieve. After merely five minutes of sieving, the underside of the sieve needs to be gently wiped with a fragile brush measuring between 85 and 100 mm. Sand that satisfies the required fineness cannot be rejected; mechanical screening equipment may be employed.

Coarse Mixture

The coarse aggregate, nominally measuring 20 mm and 12 mm, was procured from a nearby quarry that attested to its compliance with IS: 10262:2009. Table 3.3.3 displays the coarse aggregate's characteristics. The coarse aggregate utilized in the formation of concrete is a 1:2 blend of size aggregates, 20 mm and 12 mm.

S.No	Weight of cement (gms)	Weight of residue Formed (gms)	Fineness of cement (%)
1	300	20	6.67
2	300	30	10
3	300	30	10

Table 2: Coarse Aggregate Properties

The development of quarries, which are currently utilized everywhere competent bedrock deposits of aggregate quality exist, was made possible by the invention of contemporary blasting techniques. Good bedrock deposits of limestone, granite, marble, or other types of stone are rare in many locations.

Natural sand and gravel are collected in these regions for use as aggregate. When sand, gravel, or stone are not readily available, aggregate is typically shipped in by truck, rail, or barge to meet building demand. Furthermore, recycled concrete and slag can be used to partially meet the demand for aggregates. On the other hand, these materials' lower quality and limited volume make them unsuitable for widespread use as a mined aggregate substitute. Nearly every population center is home to sizable sand and gravel enterprises as well as stone quarries. Large earthmoving machinery, belt conveyors, and devices made expressly for crushing and separating different sizes of aggregate are used in these capital-intensive activities to produce diverse product stockpiles. It is possible to recycle aggregates back into aggregates. In contrast to buildings and the destruction of them. For recycling asphalt aggregate, the recycling facility performs optimally. The qualities and characteristics of the material being recycled are typically very varied. Numerous aggregate products are frequently recycled for use in other industrial processes

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ii) Water

According to IS:3025:1964 (parts 22 and 23) and IS:456:2000, the water used to mix the materials for the concrete, cast, and cure the test specimens is free of contaminants that, when present, can negatively affect the strength of concrete

ii) Combination

important factor that enables SCC is mixing. Conplast SP430, a superplasticizer based on polycarboxylate, was the admixture employed in this experiment.The development of superplasticizers based on polycarboxylate is unquestionably one of the most significant breakthroughs in admixtures in recent years. When compared to the current offerings, they provided significant benefits. Fortunately, because they are based on designed molecules, they have undergone ongoing refining during the time they have been commercialized. The improvements include longer working hours and more reliable outcomes across all applications. These are the mixtures that enable SCC. Maintaining a low water content while producing exceptional fluid concrete is one of the primary challenges in SCC production. The excellent workability can't permit crumbling or These facts require special concrete admixtures that

- Give an extremely strong plasticizing effect
- Allow very high water reduction
- Help to keep the concrete stable and homogeneous

•Tests on Cement

i) Fineness of Cement After weighing the cement to the closest 0.01g, about 300g should be placed on the sieve. The sieve should be moved in a planetary, linear, and swirling manner until no more fine material can pass through it. To the nearest 0.3 percent, weigh the residue and report its mass as a percentage (w1) of the initial amount put through the sieve. All of the fine material should be gently brushed from the sieve's base. To obtain w2, repeat the entire process with a new 300g sample. Next, determine R by taking the mean of w1 and w2 and rounding the result to the nearest 0.1 percent. Do a third sieving and find the mean of the three numbers if the results vary by more than 1 percent absolute.

ii) Observation and Calculations:

Fineness of cement = W1+W2+W3/ avg x10= weight retain on sieve/total weight

Table 3 Fineness of Cement

Fineness of Cement= (10+6.67+10)/3 = 8.89%

The finesse of cement is 8.89%, which is less than 10%.

- Cement Soundness Test

Determine the amount of water needed to achieve the usual consistency (P) by calculating the cement's standard consistency before doing the test.To make a paste with a standard consistency, add 0.78 times as much water to the cement (0.78P).The Lechatelier mold should be lightly oiled before being set on a glass plate.Now fill the mold with the cement paste. Use a glass plate that has been lightly oiled to close the mold, and weight it down to prevent it from falling out.After that, immerse the entire assembly in a water bath that is 27 degrees Celsius for 24 hours.After taking the complete device out of the water, determine how far apart two

Measurement scale indicator points are noted as L1.Once more, immerse the entire assembly in a boiling-hot water bath for three hours.After the three hours are up, take the assembly out of the bath, measure the separation between two indicator points, and label it L2.

- Calculations: L1–L2 for cement expansion and soundness.

L1= Measurement made at a temperature of 27 ±20 C = 12 mm following a 24-hour immersion in water.

L2= Measurement obtained after immersion in boiling water for three hours = 15 mm

Cement	% of water added	Time	Penetration

		(sec)	(mm)
250gms	0.85x31% of weight Cement 0.85/100x(31)x(250) = 66.93575	5	0
		10	0
		15	0
		20	0
		25	3
		30	5
		35	6
		40	10

Soundness of Cement = 3 mm

- Normal Consistency of Cement sample

Take 250gm of cement and weight carefully and add 20% water in it. Care should be taken that mixing time is not less than 3min and gauging shall be counted from the time of adding water. Fill the paste in the mould .The excess paste to trim off and vibration are given to remove air bubbles. Fix the 10mm dia. plunger in the moving rod and bring down in touch with the paste. Release the plunger. Repeat the procedure till it penetrate 33-34mm from the top & note down the water percentage.

- Observations and Calculations:

Table 4 Normal Consistency

The percentage of water for normal consistency for the given sample of Cement is 31.67%.

- Determination of Initial and Final Setting Time Take about 500gms of cement. Add water of standard consistency. To make cement paste. To make the surface of the cement paste is till smooth and Level. The whole assembly kept in vicat's apparatus.

Bring the needle in the rod gently near the surface of the test block and release it quickly allowing it to penetrate into the block and note the time. Repeat the procedure till the needle fails to penetrate into the test block by 5mm to 7mm from the bottom of the mould. Generally the initial setting time of cement is not less than 30min.

•Observation:

•Quantity of cement = 250 gms.

•Water for standard Consistency = 31.67%

•Observation Table:

Table 5 Initial and Final Setting Time

•The initial setting time of the cement sample is found to be 33 minutes

•The final setting time of the cement sample is found to be 210 Minutes

Tests on Fine Aggregate Sieve Analysis

S.No	% of water added	Penetration
250gms	27X(250/100)	33
	28X(250/100)	25
	29X(250/100)	15
	30X(250/100)	10
	31X(250/100)	7

The properties of fine aggregate are shown in Tables below.

Weight of sand = 1000gmsWeight of pan = 814gms

S.no	Sieve Size (mm)	Percent Retained	Cumulative % Retained	Percentage Passing
1	4.75	4.91	4.91	95.09
2	2.36	3.24	8.15	91.85
3	1.18	8.47	16.62	83.38
4	600 microns	26.03	42.60	57.38
	300			

5	microns	32.50	75.10	24.90
6	150 microns	21.20	96.30	3.70

Weight of pan +sand = 1814gms Table 6 Sieve Analysis Results
The fine material is retained on the 150 micron screen after passing through the 4.75 mm sieve.

• Fine Aggregate Bulking
Fill a container with enough loose sand to fill it up to two-thirds full. Sand on top should be level.

Measure the height "h" by inserting the steel rule vertically through the sand from center to bottom. Remove the contents of the container and transfer the sand to a sanitized metal tray. By weight, add 2% water to the sand, and then thoroughly mix by hand.

Put back the loose sand into container without tamping it. Repeat above the procedure by increasing the moisture content in the sample till the bulking is maximum starts dropping ultimately zero.

Prepare bulking chart by plotting increase volume verses percentage increase in moisture content.

- Calculation:

Initial reading h=17.9cm

S.no	% of water added to the weight of the sand	Height of moist sand in cm(hi)	Percentage of bulking of sand (hi-h)/h*100
1	2	20.5	12.02
2	4	22.5	22.9
3	6	23	25.6
4	8	22	22.02
5	10	21	14.75
6	12	19.7	7.65

Table 7 Bulking of Fine Aggregate

Bulking of fine aggregate is 25.6%.
• Compacting Concrete on Its Own

Self-Suppressive Coarse gravel and a fluid cement that solidifies over time are combined to form the composite material known as concrete. The majority of concretes that are utilized are hydraulic cement-based or lime-based concretes, including Portland cement concrete.

A fluid slurry that is simple to pour and shape is created when aggregate, water, and dry Portland cement are combined. The cement chemically reacts with the water and other ingredients to create a solid matrix that holds the components together to create a long-lasting substance that resembles stone and has a variety of applications. Mixing concrete thoroughly is necessary to provide consistent, high-quality results. In order to create homogeneous mixtures with the lowest slump feasible for the task, tools and techniques for mixing concrete components should be able to do it efficiently while using the greatest possible aggregate.

mixes concrete thoroughly to produce consistent, high-quality results; tools and techniques for mixing concrete components should be able to do so efficiently while using the greatest possible aggregate. Concrete chemically reacts with water and other ingredients to create a solid matrix that holds the components together to create a long-lasting substance that resembles stone and has a variety of applications.

To put it simply, mixing concrete is the "complete blending of the materials which are required for the production of a homogeneous concrete." Batching refers to the "process of weighing or volumetrically measuring and introducing into the mixer the ingredients for a batch of concrete" In the beginning, we weighed water based on the w/c ratio and coarse, fine, and cement aggregates in accordance with the mix design. Next, we weighed the appropriate admixture amounts. In the concrete mixer, we put coarse aggregate first, then fine aggregate, cement, and admixtures. After that, turn on the mixer, let the materials mix on their own until they are well combined, and then begin adding water all at once. combined to create a homogenous blend.

In Japan, self-compacting concrete is a specialty that is limited to large general construction enterprises. New processes for the design, production, and building of self-compacting concrete must be developed if it is to be utilized as a regular concrete rather than a special one. As a result, numerous committee exercises pertaining to self-compacting concrete have been completed. Among them is a technique that enables the ready-mixed concrete sector to create self-compacting

In Japan, ready-mix concrete accounts for as much as 70% of total concrete production, suggesting that regular concrete is the most efficient type.

- Workability Test Slump Test

To ascertain the consistency of a concrete mix with specified proportions, the slump test is utilized. Significance and extent: fresh concrete that isn't supported runs to the sides and the height dips. Slump is the term for this vertical settling. In this test, new concrete is poured into a mold with predetermined dimensions, and when the supporting mold is removed, the settlement, or slump, is measured. As the water content rises, the slump increases. Different slump values have been suggested for various works. Verifying that IS:1199-1959 was applied

The consistency or workability of cement concrete is gauged by the slump. It provides an estimate of the water content required for various types of concrete.

If concrete is easily mixed, poured, compacted, and finished, it is considered workable. There shouldn't be any bleeding or segregation in a workable concrete. When coarse aggregate concentrates in one area and attempts to separate itself from the finer material, this process is known as segregation.

In comparison to traditional concrete, Self-Compacting Concrete (SCC), a contemporary concrete technology, offers a number of benefits. Superior workability, vibration-free self-compaction, and superior concrete quality enable innovative and captivating uses for concrete, catering to both competitive users and imaginative specifiers. The final users of the structure as well as the applicators (contractors) and producers of concrete (ready mixed concrete, precast concrete) value the benefits of SCC. A thorough understanding of SCC's characteristics, creation, and design is necessary for its effective application. Since the usage of this technology is still in its infancy and there are always new and intriguing uses for SCC, creativity is also required.

Large voids, decreased strength, and durability are the results. When surplus water rises to the surface of concrete, it is said to be bleeding. This is undesirable because it creates tiny pores throughout the concrete's mass. We can calculate the water content needed to produce a given slump value using this test. This test varies the water content, and each time the water content gives the desired slump value, the slump value is measured. This exam is not a reliable indicator of workability.

- Consistency Test
- Test of Flow Tables

The consistency of the concrete mix is ascertained by the use of a flow table test. The device is first made wet and then set up on a flat, stable surface to conduct the test. After that, a cone is set on the flow table, and two layers of concrete are poured inside of it. Since the concrete self-compacts, compaction is not required. After 30 seconds, carefully remove the cone at a 40mm height to let the concrete flow. Verifying the use of IS: 1199-1959.

- L-Box

The test evaluates the concrete's flow as well as the degree of reinforcement-induced blockage. The device is a rectangular box with a movable gate separating the vertical and horizontal sections. Vertical lengths of reinforcement bar are installed in front of the box. The apparatus is shaped like a letter "L." Concrete is poured into the vertical area, and the gate is then raised to allow the concrete to flow into the horizontal section. The height of the concrete at the end of the horizontal section is given as a percentage of the concrete that is still in the vertical part after the flow has stopped. It shows the concrete's slope when it is at rest. This is a sign of passing proficiency, or the

According to standard reinforcing considerations, the bar sections may be spaced at varied intervals and have varying diameters. Three times the maximum aggregate size may be suitable. The bar can essentially be positioned at any distance apart to put a somewhat rigorous test on the concrete's ability to pass.

This is a popular test that can be used in a lab or even on location. It evaluates the SCC's filling and passing capabilities, and a significant lack of stability (segregation) is visually discernible. By later sawing and examining portions of the concrete in the horizontal section, segregation can also be found. Comparing tests is challenging since, regrettably, there is no order for materials, dimensions, or the placement of reinforcing bars. results.

- V-Funnel

The apparatus is made up of a funnel with a v shape, as seen in Fig. An alternate V-shaped funnel with circular openings is called an O funnel. Ozawa et al. employed the test, which was created in Japan. Japan also uses the equipment, which consists of a V-shaped funnel section. Concrete with a maximum aggregate size of 20 mm is tested for filling ability (flow ability) using the V-funnel method mentioned above. About 12 liters of concrete are put into the funnel, and the amount of time it takes for the concrete to pass through the device is recorded. Concrete can then be added back into the funnel and allowed to settle for five minutes. The flow time will greatly increase if the concrete exhibits segregation. Verifying that IS: 1199-1959 was put to use.

Even though the test is meant to assess flow aptitude, factors other than flow can influence the outcome. Any potential for the concrete to block—for instance, if there is an excessive amount of coarse aggregate—will be reflected in the outcome due to the inverted cone shape. Because of the high paste viscosity and strong inter-particle friction, long flow times can also be linked to low deformability. Despite the simplicity of the device, it is unclear how the wall effect and the funnel's angle affect the flow of concrete.

To complete the test, approximately 12 liters of concrete must be sampled regularly. Place the V-funnel on a solid surface. Wet the funnel's interior surface. Keep the trap door open so that any extra water can drain. After shutting the trap door, set a bucket underneath. Without compacting or tamping, fill the device all the way to the top with concrete; just use the trowel to level the top of the concrete.

Once the trap door is filled, let the concrete naturally escape by opening it in ten seconds. Set the stop watch to start as soon as the trap door is opened, and record the duration of the full discharge (the flow time). For light coming from above and traveling through the funnel, this is taken to be the case. You have five minutes to finish the entire test.

The inside surface of the funnel gain shouldn't be cleaned or dampened. Once the flow time has been established, promptly close the trap door and fill the V-funnel.

There should be a bucket beneath. Pour concrete into the device to the full line without tapping or compacting. Next, smooth the top of the concrete with the trowel. When the funnel reaches its second full, wait five minutes, then open the trap door and let gravity do its thing.

As soon as the trap door is opened, begin the stop watch concurrently and record the flow time (the flow time at T5 minutes). This should be taken when light can be seen coming through the funnel from above..

- U-Box

The exam was developed in Japan by the Technology Research Center of Taisei Corporation. Occasionally, the tool is described as a "box-shaped" test. The test evaluates the self-compacting concrete files' performance. The apparatus consists of a tank with two sections divided by a central wall and a sliding gate positioned in the middle of the two sections. Reinforcing bars at the gate have a nominal diameter of 134 mm and are spaced 50 mm apart from one another. this causes a noticeable 35 mm space to form between the bars. The left-hand section receives about twenty liters of concrete, which flows upward into the other section when the gate is raised. The height of the concrete Despite being a simple test to administer, developing the

For the test to be completed, roughly 20 liters of concrete must be sampled routinely. Make sure the sliding gate can open freely after leveling the device on solid ground, and then close it. After wetting down the interior of the device and draining any excess water, insert the concrete sample into the vertical portion of the device.

Approximately 20 liters of concrete must be consistently sampled in order for the test to be finished. After leveling the device on firm ground, ensure that the sliding gate may open freely before closing it. Place the concrete sample into the vertical section of the device after thoroughly cleaning the inside and removing any remaining water.

Let it sit for a minute. Slide gate lifted to allow concrete to overflow into other compartment. After the concrete has dried, take two measurements of the material's height inside the filled compartment, then average the results (H1). Measure the height of the other equipment as well (H2). Ascertain the H1–H2 filling height. You have five minutes to finish the entire test.

- Mixing

According to the M20 grade mix design, mixing is done. The measured amounts of cement, fine aggregate, and coarse aggregate are first mixed together in a tray using a trowel. Next, the necessary water content is increased by adding an admixture (naptha PC) at a rate of 0.5% by cement weight. This combination is added to the cement mixture after two to three trials. Mixing results in a uniform mixture.

Self-consolidating concrete (SCC) is more sensitive to minute variations in the constituent elements and the mixing procedure while it is still fresh as opposed to traditional vibrated concrete. Many investigations have been carried out recently to ascertain the robustness of SCC and to develop methods for boosting its resilience. Ghent received a prize from the Flanders Research Foundation (FWO).

resilience of the cement paste to changes in the time spent applying the superplasticizer.

The third task focused on the order of adding the aggregates and their initial moisture content, validating the results acquired on cement pastes on a concrete scale. The fourth assignment examined the durability of thixotrophy and workability loss using cement paste and concrete scale. Two essential ideas are necessary to improve the use of SCC in the building and maintenance of transportation infrastructure: consistency and quality control. The transportation and mixing processes of SCC are referred to as consistent. It is advised to follow the same mixing process for each SCC that is made. This comprises the order in which the elements are added, the amount of time and speed that the mixture is mixed, and the volume of concrete (a quantity that is not evaluated but is reflected in the mixing energy).

IV. EXPERIMENTAL PROGRAM

An attempt is made to investigate the different characteristics of self-compacting concrete in this work. Additionally, the self-compacting concrete's strength properties, such as compressive strength, are discovered.

- This phase includes the following steps.
- 1 Concrete mix design
- 2. Blending concrete
- Three Test Subjects
- 4 Mould Preparation
- Five Robust Characteristics of Self-Compacting Concrete
- Six Insights and Test Outcomes

- Blending concrete

In a pan-style mixer, the coarse and fine aggregates were combined with enough water to moisten them, and they were stirred for 30 seconds. After adding 70% of the mixing water to the cement, stir for an additional two minutes. At last, the leftover water combined with the super plasticizer was added, and the mixture was left for a minute. Next comes the mixtures of test specimens

In these investigations, three different types of elements—cubes, beams, and cylinders—have been used. Sizes of the cubes utilized are 150*150*150 mm, the beams are 100*100*500 mm, and the cylinder is 150Φ*300 mm.

- Setting Up Moulds

To make demoulding easier, the cube, beam, and cylinder molds have been cleaned and oiled. The concrete mix was poured into the molds needed for the strength assessment once the flow characteristics studies were completed. Neither vibration nor manual compaction was used once the concrete had been poured into the molds. Not even the concrete needed any finishing work done to it. The specimens were demoulded and sent to the curing tank following a 24-hour casting period. The specimen is taken out of the curing tank and its entire surface is scoured off before being tested after the 7, 14, and 28-day curing periods.

- Strength test

The compressive test machine calculated the compressive strengths of the casted specimens, which are listed in the following tabular form:

- Compressive Strength Test:

The average of three or more standard-cured strength specimens, all created from the same concrete material and evaluated at the same age, is what is known as a test result. Most of the time, concrete must meet its strength criteria after 28 days of curing. The concrete cubes underwent the following tests to determine their compressive strength after 28 days. Following the compression testing machine's bearing surface cleaning, the specimen's axis was meticulously positioned in relation to the plate's center of thrust. The test specimen's faces and the testing machine's platen were not packed. Without using any shock, the load was placed and increased steadily at a rate of about 140 kg/cm2/min until the specimen's ability to withstand the rising force failed.

V. RESULTS AND ANALYSIS

- Workability Test
- Slump Test

Workability (slump) has been observed to diminish with varying mixes of super plasticizer and regular concrete at a fixed w/c ratio of 0.43. The following table lists the observed values..

Table 4.1.1 Slump Cone Results

S.No.	Desription	Slump Value
1	NOMINAL CONCRETE	270mm
2	SCC	650mm
3	SCC 2.5%	55mm
4	SCC 3%	62mm
5	SCC 3.5%	59mm

- Consistency Test
- Flow Table

The flow table is then lifted up 15 times, forcing the concrete to start to flow. Subsequently, the concrete's flow diameter is measured. The following are the concrete flow

- L-Box

The L-Box should be filled by the concrete upto its 1/3rd .The concrete flows through the L-Box by its self-weight. The time taken by the concrete to reach the end of L-Box is tabulated below

S.No	Description	Diameter of Flow	
1	SCC	48	48.5
2	SCC 2.5%	48	48.5
3	SCC 3%	47	48.4
4	SCC 3.5%	47.4	47.8

table 4.1.1 Slump Cone Results

S.No.	Description	Filling Height (mm)		
		H1	H2	H2/h1
1	SCC	58	58	1.0
2	SCC 2.5%	65	51.25	0.78
3	SCC 3%	77	73.15	0.92
4	SCC 3.5%	75	70	0.93

- V-Funnel

Concrete's ease of flow is determined by this test; a shorter flow time denotes a higher flow ability. A flow period of 10 seconds is thought to be suitable for SCC.

The flow is restricted by the inverted cone shape, and extended flow durations may indicate how susceptible the mix is to blocking. Concrete segregation will exhibit a less continuous flow with an increase in flow time after five minutes of settling.

diameter measurements:

Table 9-V Funnel

S.No	Description	Flow Time(sec)
1	SCC	12
2	SCC 2.5%	11.7
3	SCC 3	10.1
4	SCC 3.5%	9.8

- U-Box

H1-H2=0 since the concrete will be horizontal at rest if it flows as freely as water. Thus, the closest this

The closer the test number, or "filling height," is to zero, the better the concrete's flow and possibility.

Table 10 U-Box

S.No	Description	Filling Height(cms)
1	SCC 30	
2	SCC 2.5%	26
3	SCC 3%	26
4	SCC 3.5%	24

Compressive Strength Values

S.No	Mix Designation Characteristic Compressive	Strength(N/mm^2)	
		7 days	28 days
1	Nominal Concrete	17.52	20.8
2	SCC	19.81	22.32

Plots of the data are shown, and it is easy to see how the characteristic compressive strengths have increased. It was shown that the compressive strength increased at a higher percentage rate after 7 days as opposed to 28 days. Therefore, it can be concluded from the results of the experimental inquiry that nano-silica also enhances early strength.

Nominal concrete's and SCC's compressive strengths (without NS)

- Nano silica

Word The terms nano and silica refer to particles of matter with a diameter of one to one hundred nanometers (nm), whereas silica is also known as silicon dioxide.

When separating "fine particles" (those with sizes between 100 and 2500 nm) and "coarse particles" (those with sizes between 2500 and 10,000 nm), one can typically find nanoparticles. They belong to the subclass of colloidal particles, which are generally thought to have a diameter of 1–1000 nm. Instead, atom clusters are the common term for metal particles smaller than 1 nm.

Nanoparticles require the use of electron microscopes since they are significantly smaller than visible light wavelengths (400–700 nm) and cannot be viewed with standard optical microscopes. Nanoparticle dispersions in transparent media can also be transparent for the same reason.

A nanoparticle is defined as "a particle of any shape with dimensions in the 1×10^{-9} and 1×10^{-7} m range" by the International Union of Pure and Applied Science. The 1997 definition provided by IUPAC gave rise to this one. A nanoparticle is defined as an object with all three external dimensions in the nanoscale, whose longest and shortest axes do not differ significantly (a significant difference is usually defined as a factor of at least 3). This definition is based on the technical specification 80004 of the International Standards Organization (ISO). Even when a material is split into micrometer-sized particles, its characteristics in nanoparticle form are typically quite different from those of the bulk material. There are several factors that lead to that outcome. such is a high area to volume ratio, when A bulk substance ought to possess consistent physical

The most frequent forms of silica dioxide in nature are found in quartz and other living things. Silica makes up the majority of sand in various regions of the world. One of the most diverse and prevalent groups of materials is silica, which can be found both as a manufactured product and as a composite of many minerals. Fused quartz, fumed silica, silica gel, and aerogels are a few notable examples. It finds application in structural materials, microelectronics (as an electrical insulator), and as pharmaceutical and food industry components. The chemical compound silica, with the formula SiO2, makes up more than 10% of the crust of the earth. The only silica polymorph that is stable at the surface of the Earth is silica. It has been discovered that metastable instances of the high-pressure forms stishovite and coesite exist.

Rice husk ash, which is utilized, for instance, in cement production and filtering, primarily consists of silica.In the biological world, silicification in and by cells has been a regular occurrence for well over a billion years. It can be found in bacteria, plants, animals (including invertebrates and vertebrates), and single-celled organisms in the modern world. The building sector, for example, uses silicon dioxide (sand) for around 95% of its commercial uses, such as making Portland cement concrete,Sand, or silica, is the primary component of sand casting, which is used to create metallic components for use in engineering and other fields. These kinds of uses are made possible by silica's high melting point.

- The majority of the materials used to produce nano silica silicon dioxide are mined, including quartz purifying and sand mining.

..Quartz can be used for a variety of tasks, but in order to create a product that is purer or more appropriate in another way (such as more reactive or finely grained), chemical processing is needed.

A byproduct of heated processes such as ferrosilicon manufacturing is silica fume. It is not to be confused with fumed silica, as the latter is more pure. Fumed silica is not the same as silica fume in terms of its production method, particle properties, and areas of use.

VI. SCANNING ELECTRO MICROSCOPY

A concentrated electron beam is used to scan a sample's surface in a scanning electron microscope (SEM), creating images of the material. The sample's atoms and electrons interact to produce a variety of signals that reveal details about the sample's composition and surface topography. An image is created by combining the intensity of the detected signal with the position of the electron beam as it scans in a raster scan pattern. A secondary electron detector is used in the most popular SEM mode to detect secondary electrons released by atoms that have been stimulated by an electron beam. Specimen topography affects the quantity of detectable secondary electrons and, thus, the signal strength. SEM is able to

SAMPLE 1: CEMENT

Figure 1: Cement

Pixel Size: 49.60938, Voltage Acceleration: 30000 Working distance = 8700 u.m. Emission Magnification = 2000112000 nA of current 60 Micron Vacuum Marker = 20000

Grayscale is the color mode.
Situation=Vacc is 30 kV. WD=8.7mm, Mag=x2.00k
Cement particles range in size from 1.38 to 16.4 um. Particles also have irregular and round forms. There may be empty areas between cement particles.
Example 2: SILICA POWDER WITH NANO
Figure 2: PixelSize=39.6875 for Nano Silica Powder

Voltage Acceleration: 30.000 Volts Magnification of 2,500 DistanceWorked=8500 u.m.
Current of Emissions=108000 nA 60 Colors in VacuumGrayscale is the mode.

Situation=WD=8.5mm, Vacc=30kV Mag=x2.50k
Nano silica powder has irregularly shaped particles with sizes ranging from 0.915 to 1.45um. Nanoparticles are smaller than cement particles in size.

CEMENT + NANO SILICA SAMPLE 3

Figure 3: Cement + Nano Silica Powder

Pixel Size: 49.60938, Voltage Acceleration: 30000 Working Distance = 8500 u, Magnification = 2000 u

Vacuum equals sixty. Grayscale Color Mode; Condition:WD=8.5mm, Vacc=30kV Mag=x2.00k

Figure 3 illustrates the boundary cantain 22% of silica contain by adding nano silica the strength of the particle will increase.

CONCLUSION

The goal of this study is to incorporate nano-silica into an appropriate SCC mix. The four tests that we use to date the appropriate SCC mix are slump flow, V-Funnel, and L-Box. We also cast the concrete in cubes, place it in the compression machine, and measure the strength after it has cured for seven days. If we created a Scanning Electro Microscopy test using nano-silica. Additionally, we contrasted the compressive strengths of SCC without Nano-Silica and Nominal Concrete.

The main conclusions of this project are:

- SCC is advised for complex frameworks with confined spaces and crowded steel bars since it can pass through these areas vibration-free and smoothly while providing the greatest surface finishes and compaction.
- Since there is no set procedure for SCC in any institutes or concrete mix plants, the SCC mix was designed by trial and error.
- In comparison to Nominal Concrete, the compressive strength of SCC (without NS) increases by 2% in the test results after 7 and 28 days.
- Fourteen trials have been conducted on SCC, and the superplasticizer, VMA, and fine materials (cement & fly ash), which are important for the qualities of SCC, were the key elements.
- Self-compacting concrete (SCC) is not defined by a single test; rather, it is defined by passing each of the four tests..
- Self-compaction concrete exhibits a notable increase as compared to regular concrete because it is well-compacted; as density rises, so does concrete strength..
- We are incorporating superplasti by reducing the water percentage.
- According to SEM data, nano-silica fills in the gaps between cement particles and contributes to the concrete's increased density.
- The concrete's compressive strength improves in tandem with an increase in density.

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