INVESTIGATION OF MECHANICAL PROPERTIES (WORKABILITY, COMPRESSIVE STRENGTH) OF SELF COMPACTING CONCRETE BY ADDING IRON SLAG AND FLY ASH

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ABSTRACT: *This thesis examines the mechanical properties (performance, compressive strength) of self-compacted concrete, ground granular blast furnace slag and fly ash, for partial replacement of cement. Use 10%, 20%, and 30% substitutes and perform various tests to check the permeability, circulation, air exchange and compressive strength of concrete. The closing price of 10% is more than 20% and more than 30%. It means that compacted concrete is good at 10% replacement. 10% compressive strength, which replaces self-compacting concrete, is also 20% or more than 30%. The compressive strength of GGBFS is higher than the strength of ash.*

Keywords: Self-Compacting Concrete; Admixture; Iron GGBFS; Mechanical Properties.

1. INTRODUCTION

For the first time, we have developed a self-Compacting concrete to darken concrete structures. In comparison to normal concrete, the SCC does not require a force compaction of external mechanical products, such as immersion vibrators. High-performance SCC concrete requires excellent filling capacity. Research has been conducted to develop a rational mixed structural structure and self-compaction methods for the strength of self-compacted natural concrete. **[1]**

Self-compacting concrete (SCC) is a fluid concrete distributed across a congested framework, filling and reinforcing each corner by weight. Self-compressed concrete (SCC), with its auto compacting properties and strength, also known as self-compacting concrete is one of the most widely used concrete formations. SCC is a high flux, separating, a special concrete medium which, by its own weight and by its thin, tightly wrapped, deep parts can be formed. In comparison to normal concrete, the SCC does not require force compaction of external mechanical products, such as immersion vibrators. High-performance SCC concrete requires excellent filling capacity, good mobile mobility and a sufficient segregating resistor and these desired benefits in order to maintain usual mechanical properties and power. However, primary performance metrics are not highly intense and accurate.

Mechanical self-compression is related to the rheology of fresh concrete. On the other hand, the requirements for workability are also related to management and implementation. Rheology is a fundamental factor that affects SCC production in the new state, especially during casting and self-compaction.

SCC Rheological Behavioral Analysis has been intensively studied in numerous academic institutions for more than ten years. Fresh concrete can be described as a suspension of a particle. The definition of particles and fluid phases can be based on a broad variety of particle sizes in the suspension system.

On the other hand, the SCC tensile strength of the calcareous filler is smaller than the standard concrete shapes. A significant number of commodity slags are typically used without consuming or disposing of their properties. Water is suspended and fine particles and cement grains are suspended for paste rheology. In the suspension study, the consistency of the trapped air is overlooked. The GGBFS area was used as either a mineral blend or as part of the cement mix for several years in Portland concrete. GGBFS usually replaces Portland cement with concrete between 35% and 65%. **[2]**

The fusion of computational approaches and computational methodology is also rising. The fusion of part shape and proportion relies primarily on mixed performance criteria. The water/cement ratio and the shift of the super-plasticizer are one of the main properties of the SCC mixture proportioning. There is a variety of SCC combining techniques. The strongest test is based on the application of estimation, i.e. numerical techniques and the original adjustment of the mixture. The European Directive determines the minimum average number of SCC components by weight and height. Fresh concrete can be described as a suspension of a particle. The definition of particles and fluid phases can be based on a broad variety of particle sizes in the suspension system. The suspended medium is a liquid mortar (a blend of water, cement and fine particles) in the case of concrete rheology and the soil aggregates are suspended. However, paste (a procedure consisting of water, cement and other powdered particles) could be regarded as a suspension medium for suspension of sand particles in the case of the rheology of the mortar. Water is suspended and fine particles and cement grains are suspended for paste rheology.

The SCC mix was not intended to be mixed with regular concrete. Okamura and Ouchi concluded that the SCC would maintain an equilibrium between the paste's flowability and viscosity and mortar. A filler material or natural or polished mineral materials may be a ground material comparable to cement fineness of Portland above 0.15 mm. The thinness and characteristics are the same. In compliance with BS EN 197-1:1992, the weight of the filler or additive was limited to 5% of the cement content. However, the use of LSP requires up to 35% of cement storage.

2. EXPERIMENTAL WORK

2.1 MATERIAL USE

a) Cement

The choice of cement brick depends on the general properties of concrete, such as strength and hardness. 53 Portland cement Regulatory Note: 8112-1989.

Table 1: Properties of Cement

Physical Property	Results
Fineness (retained on 90-µm) sieve)	8%
Normal Consistency	28%
Vicat initial setting time(minutes)	75
Vicat final setting time (minutes)	215
Specific gravity	3.15
Compressive strength at 7-days	20.6Mpa
Compressive strength at 28-days	51.2Mpa

b) Coarse and Fine Aggregates

Both aggregate forms are sufficient. The standard size adopted is 10-12 mm and is limited to 20 mm. Rating accuracy is of critical significance. Individual gravity, sufficient modulus and overall tone per unit weight, local natural sand with a maximum size of 4.75 mm and a maximum weight of 16 mm, sufficient modulus and stone weight units were used.

Table 2: Physical Properties of Coarse and Fine Aggregates

Property	Fine Aggregate	Coarse Aggregate
Specific Gravity	2.66	2.95
Fineness Modulus	3.1	7.69
Surface Texture	Smooth	--
Particle Shape	Rounded	Angular
Crushing Value	--	17.40
Impact Value	--	12.50

c) Ground Granulated Blast Furnace Slag (GGBFS)

Ground Blast Granulated Slag powder is a fine white powder. It is made of Blast-Furnace Slag – an iron and steel co-product.

Table 3: Properties of GGBFS

Characteristics	Test Results
Fineness (m2 /kg)	33
Specific Gravity (%)	2.24
Magnesia content (%)	8.34
Supplied sculpture (%)	0.50
Sulphite content (%)	0.52
Loss on ignition (%)	0.16
Manganese content (%)	0.09
Chloride content (%)	0.010
Glass content (%)	93

d) Fly Ash

Roasting the soil is a very grey powder that is obtained after burning coal. Coal is burned in thermal power plants. . Water is suspended and fine particles and cement grains are suspended for paste rheology. For this work, we received a fly from the Thermal Power Station.

Table 4: Physical Properties of Fly Ash

Sr. No.	Physical Properties	Test Results
1	Color	Grey(Blackish)
2	Specific Gravity	2.13
3	Fineness	18

Table 5: Chemical Properties of Fly Ash

Sr. No.	Constituents	Percent by Weight
1	Loss on ignition	4.17
2	Silica (SiO2)	58.55
3	Iron Oxide (Fe2O3)	3.44
4	Alumina (Al2O3)	28.20
5	Calcium Oxide (CaO)	2.23
6	Magnesium Oxide (MgO)	0.32
7	Total Sulphur (SO3)	0.07

e) Admixture (Super Plasticizer)

Super Plastics is the most effective material used to reduce water by more than 20%. Fluidizers are an essential component of SCC to achieve the required performance. In particular, the new superplastic polycarboxylated ether (PCE) used in SCC.

Table 6: Physical Properties of Super Plasticizer

Physical Properties	Results
Chloride Content	Nil
Specific Gravity	1.25
Color	Greenish

f) Mixing Water

Water quality should be adjusted in one row when using reinforced concrete or coated concrete.

2.2 Preparation of cubical specimens:

Prepare two cubical specimens with 10%, 20% and 30% of GGBFS and Fly Ash replacement of cement.

2.3 Curing of the concrete specimens.

- Allow the specimens to fit at standard room temperature for about 24 hours and to cover the top surface in order to avoid moisture loss.
- Roll out the mould of the specimens to be equipped for processing in the curing plant.

2.4 Compression testing procedure.

- Extract the organism from the treatment plant shortly before the processing takes place.
- Specimens are examined in a wet state while still current. Measure the specimen diameter, measured by mid-height at a right angle to each other.
- The mean of these is 0.25 mm (0.01 in.) closest. Average.

2.5 Loading Rate

- For hydraulic machines, they should be used at a speed of 0.15-335 MPa / s (20-50 psi / s) per cylinder load speed.
- A portable machine uses increasing power until the cubes flow.
- Acceleration speed 0.6 ± 0.2 MPa / s (N / mm2 / s).
- Charge to failure.

3. PROPERTIES OF SCC

Three properties define concrete as self-compacting concrete

- Bandwidth - the ability to full fill all the fields and corners of an embedded form.
- Flow - the ability to pass heavy valves without blocking components.
- Anti-separation - Ability to maintain a rough part of the component by hanging to ensure uniformity.

3.1 Fresh Properties of SCC

Concrete self-compaction has special, non-standard concrete fresh-status properties. SCC's current concrete qualities are closely connected to its own compacting properties. Mechanical self-compression is related to the rheology of fresh concrete. There is a variety of SCC combining techniques. The strongest test is based on the application of estimation, i.e. numerical techniques and the original adjustment of the mixture. The European Directive determines the minimum average number of SCC components by weight and height. Fresh concrete can be described as a suspension of a particle. The definition of particles and fluid phases can be based on a broad variety of particle sizes in the suspension system In the other hand, the requirements for workability are also related to management and implementation. Rheology is a fundamental factor that affects SCC production in the new state, especially during casting and self-compaction.

SCC Rheological Behavioral Analysis has been intensively studied in numerous academic institutions for more than ten years. Fresh concrete can be described as a suspension of a particle. The definition of particles and fluid phases can be based on a broad variety of particle sizes in the suspension system. The suspended medium is a liquid mortar (a blend of water, cement and fine particles) in the case of concrete rheology and the soil aggregates are suspended. However, paste (a procedure consisting of water, cement and other powdered particles) could be regarded as a suspension medium for suspension of sand particles in the case of the rheology of the mortar. Water is suspended and fine particles and cement grains are suspended for paste rheology. In the suspension study, the consistency of the trapped air is overlooked.

3.2 Harden Properties of Self-Compacting Concrete

a) Compressive Strength

The compressive strength of the regular cube specimens was close to the compressive strength of traditional vibrated concrete supplied with equivalent amounts of water-cement in all SCC blends. However, paste (a procedure consisting of water, cement and other powdered particles) could be regarded as a suspension medium for suspension of sand particles in the case of the rheology of the mortar. Water is suspended and fine particles and cement grains are suspended for paste rheology. If the performance is greater than that of normal vibrant concrete, the SCC In-situ quality actually is far better because calcareous powder may be used as a filler, likely because of a densifying process and the reduced propensity to improper cure.

b) Tensile Strength

The splitting test on the cylinders calculated the tensile strength indirectly. Both tensile strengths themselves were similar in nature to standard SCC vibrated concrete and the tensile/compressive strength relationship.

c) Bond Strength

For institutional technology and housing teams, the power of the SCC is measured by pumping tests using reinforced steel with two separate diameters inserted into the concrete pipe, combined with a more numerous standard compressive strength reference goes. For cyclical technology and building teams, we calculate the capabilities of the SCC.

c) Modulus of Elasticity

Our present results show that the relationship between the static elastic modulus and the compressive strength of the SCC is the same. The relationship at E / (FC) 0.5 is frequently stated, and all values in this section are identical to those suggested for the standard deviation of the standard deviation by Action.

d) Freeze/Thaw Resistance

After daily periods of 18 years at 30C and 66 hours at room temperature, their properties were measured by the lack of ultrasonic pulse speed. However, paste (a procedure consisting of water, cement and other powdered particles) could be regarded as a suspension medium for suspension of sand particles in the case of the rheology of the mortar. Water is suspended and fine particles and cement grains are suspended for paste rheology. If the performance is greater than that of normal vibrant concrete, the SCC In-situ quality actually is far better because calcareous powder may be used as filler, After 150 SCC cycles, no significant UPV loss was found.

e) Shrinkage and Creep

None of the findings demonstrate that the shrinkage and splitting of the SCC blend is considerably higher than the conventional vibrated concrete.

4. FACTORS AFFECTING SCC

Please do not use it indiscriminately, which is troublesome. These factors can affect the impact and performance of composite concrete.

- Hot weather.
- The flow capacity of free-standing concrete allows long distances to be shortened.

- Workplace delays could impact the construction efficiency of the concrete mix.
- The addition of Job Site Water to Self-Compacting Burner cannot always contribute to anticipated flow growth and stability issues.

5. Advantages and Disadvantages of Self-compacting concrete

5.1 **Advantages of Self-Compacting Concrete**

1. The permeability of concrete structures is reduced.
2. SCC allows the free design of concrete structures.
3. SCC construction is fast
4. The vibration problem is solved.
5. Concrete is easy to install and leads to significant cost savings
6. The quality of the building has improved.
7. Vibration noise is reduced. It also alleviates the problem of wrist tremor syndrome.

5.2 Dis-Advantages of Compacting Concrete

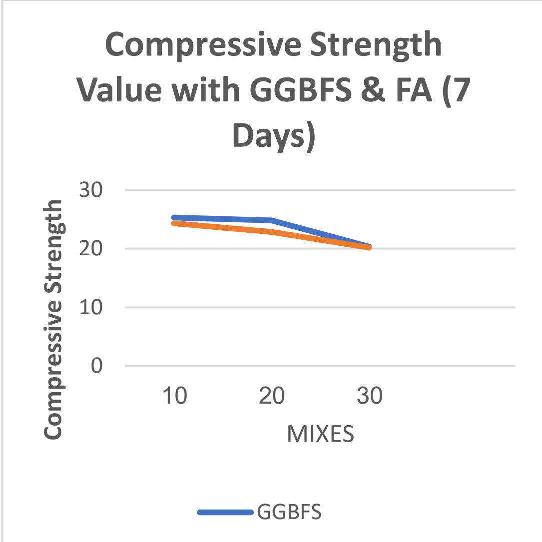
Building an SCC has the following restrictions:

1. There is no widely accepted test standard for SCC integrated design.
2. Construction costs are higher than traditional concrete buildings.
3. To use the design mix, you need multiple test sets and lab tests.
4. For SCC, material selection is more complicated.

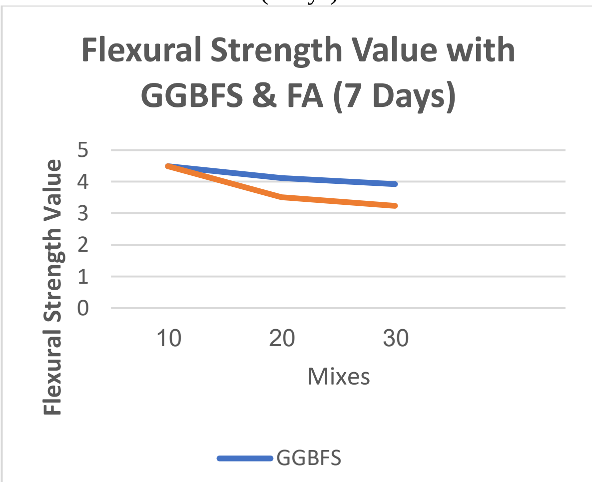
6. RESULTS

GGBFS is used to support cement materials with three different densities (10, 20, 30 percent). Follow the SCC instructions in a new way, determine the flow characteristics of the soluble cone, V-funnel and L-test, and adjust the EFNARC-controlled dose superplasticizer (HRWRA) to adjust the water/powder dose ratio. Test results are shown in the table below.

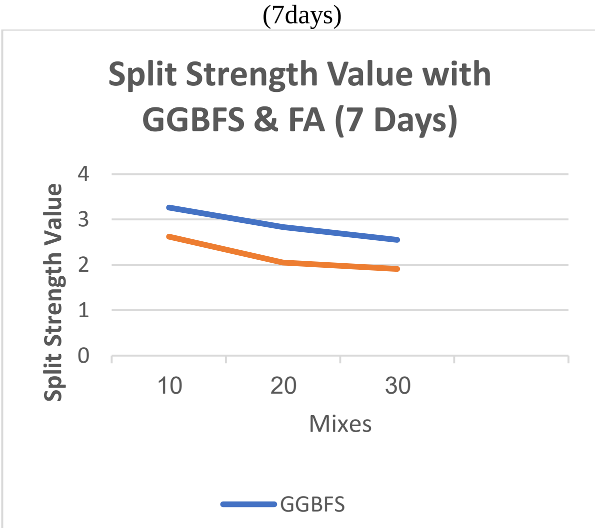
Types	Mix-1		Mix-2		Mix-3	
Compressive Strength	24.5Mpa	24.33Mpa	22Mpa	22.83Mpa	22Mpa	20.17Mpa
	24Mpa		24Mpa		20Mpa	
	24.5Mpa		22.5Mpa		18.5Mpa	
Flexural Strength	4.59Mpa	4.49Mpa	3.51Mpa	3.51Mpa	3.24Mpa	3.24Mpa
	4.39Mpa		3.51Mpa		3.24Mpa	
Split Tensile Strength	2.62Mpa		2.05Mpa		1.91Mpa	



This graph showed that the split strength of GGBFS is greater than the split strength of FA at each percentage (7days)



This graph showed that the flexural strength of GGBFS is greater than the flexural strength of FA at each percentage (7days)



This graph showed that the split strength of GGBFS is greater than the split strength of FA at each percentage (7days)

7. CONCLUSIONS

1. As long as you use the right ratio when you combine ordinary Portland cement with GBGBS and fly Ash, you can increase the life of the building and increase the longevity of the concrete.
2. In SCC blends, the addition of 10%, GGBFS and Fly Ash improves self-compact performance characteristics such as loading performance, moving performance, and flow capacity and segregation resistance.
3. After seven days, 28 days and 91 days of renewal, the tensile, flexural and tensile strength of SCC will increase and Fly Ash will be replaced with 10%, 20% and 30% GGBFS.
4. However, compressive force, flexural strength and break tensile strength can also be used relative to 20 percent and 30 percent as a 10 percent overall substitute.

8. RECOMMENDATION

- Compacted concrete loses its strength because of the high percentage of metal slag and Bagasse ash we can use later as alternative concrete.
- For best results, we can use a mixture of bagasse and fly ash as part instead of cement.

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