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ANALYSIS OF THE PHYSICAL CHARACTERISTICS OF CONCRETE MIXTURE PREAPRED WITH DIFFERENT PERCENTAGE OF SUPERPLASTICIZER

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ABSTRACT

In recent years, much attention has been paid to the use of superplasticizer as a chemical admixture in cement concrete mixtures. However, the use of chemical admixtures in cement concrete is a very common method for producing high-performance concrete. Previous researchers have emphasized that the use of chemical admixtures imparts desirable properties to cement concrete in both the fresh and hardened states.

This thesis work attempts to investigate the effect of superplasticizer doses of 0.5, 1, and 1.5 percent on the performance of cement concrete. By using superplasticizer, we can reduce the water demand of the concrete mix. In this study, a superplasticizer called Sulphonated Naphthalene Formaldehyde (SNF) is utilised in varying amounts in the concrete mix. Specifically, the dosage of SNF superplasticizer typically varies between 0.5% and 3% by weight of cement. The manufacturer's instructions and the particular requirements of the mix determine the precise dosage. Using superplasticizer improves the strength of the concrete while also lowering the amount of water used. Superplasticizer use contributes to environmental preservation by saving the water. Finding the proportion of superplasticizer that can be added to the concrete mix in order to reach the desired mean strength is the primary goal of this study. The findings of the experimental tests conducted on the fresh and hardened properties of concrete for the M25 grade are analysed and contrasted with those of regular concrete. The focus of this current research project is on using superplasticizer to lower the mix's water requirement. A number of experiments were conducted to find the slump value, compressive strength, and flexural strength with and without the superplasticizer addition. The findings indicate that adding more superplasticizer to the cement concrete mixture increases not only slump but also gains good ability. Furthermore, compared to regular concrete, there is a minor increase in both the flexural and compressive strengths.

One crucial quality of cement concrete is its strength. In order to compare the results of previous studies on the compressive strength and flexural strength of cement concrete with those obtained from laboratory experiments on samples of cement concrete cube casted for this purpose, this thesis examined the relationships between aggregate size, quantity of admixture, compaction, water-cement ratio, and aggregate-cement ratio.

In order to promote and expand the use of new generation products, such as concrete created with superplasticizer, in the civil engineering construction business, it is crucial to conduct research into the characteristics of both fresh and hardened concrete. The characteristics of both fresh and hardened concrete produced with varying amounts of superplasticizer added to the concrete mix are examined in this study.

1. INTRODUCTION

One kind of chemical additive that offers concrete in both fresh and hardened states a number of advantages is water-reducing admixture. A variety of water-reducing admixtures are readily accessible in the market; the range of those admixtures is quite high. The primary admixture type that significantly improves the qualities of concrete is type F, sometimes referred to as superplasticizer or water reduction additive. This additive, known as mega flow SP1 and SP4, is made in our nation and can enhance the permeability, compressive strength, and workability of concrete. However, admixtures have not yet been the subject of studies or investigations in our nation. Therefore, this study has looked into several advantages that come from using superplasticizing admixture as an extra building component. Laboratory experiments were conducted by adding dosages of 0%, 0.5%, 1%, and 1.5% superplasticizing admixture in the concrete mixes prepared by used and virgin aggregate with four stages in order to demonstrate the effects of superplasticizing admixture on the properties of the concrete, such as: workability, strength, and permeability. The results of the experiments were determined. Next, in light of the experimental findings, inferences are made and suggestions are sent.

Many buildings have been torn down because of their limited lifespan, inappropriate location inside an ever-expanding city, and damage from risks and natural disasters. Due to unforeseen disposal and a shortage of dump sites, the demolition of the buildings is producing concrete debris and creating environmental issues. The majority of demolition debris that could be helpful is dumped in landfills. These wastes cannot be transported or disposed of in an environmentally or economically viable manner. Alternative aggregates are becoming more popular in the building sector as a solution to these issues (Md. Safiuddin, Ubagaram Johnson Alengaram, et al. June, 2011).

When compared to other materials used for similar features and functions, cement concrete accounts for 90–95% of the global market for construction materials, including for structural and non-structural uses. Cement Generally speaking, concrete is a mixture of cement, water, and aggregates. Admixtures are extra materials that are occasionally added to cement concrete to change specific characteristics. The chemically active part of the concrete mixture is cement, but its reactivity isn't activated until it mixes with the water. Although the aggregate plays little part in the chemical reaction, its success results from its use as a cheap filler or hard composite material that has fine resistance to volume fluctuations that occur. enhancing cement concrete's durability even more. Cement concrete has a great compressive strength and resembles a rock when it has set. Cement concrete may be moulded into any shape while it is still pliable, and it can be used primarily for decorative purposes or to great benefit in architecture. Due to its poor tensile strength, cement concrete is mostly employed in reinforced cement concrete (RCC) along with steel bar reinforcement to withstand tensile stresses. Conversely, cement concrete is typically utilised in the construction of roadways, electric polls, cooling towers, railway sleepers, shell constructions, bridges, columns, beams and slabs, as well as foundation work and other building components. Cement concrete is widely utilised in the precast concrete industry for things like electric lamp posts, pipes, piles, concrete blocks, and shell panels (Jackson, N. at.al. 1996).

The ready mixed concrete (RMC) business currently produces more than 70% of the in-situ cement concrete produced worldwide. Producers of ready-mix concrete (RMC) use an additive called superplasticizer (SP), which is readily accessible from a number of suppliers. In order to improve workability without altering the water/cement (W/C) ratio, superplasticizer (SP) is utilised.

2. LITERATURE REVIEW

The effect of superplasticizers on different formulations of binary and ternary cement and alkali-activated cement (AAC) is compared. The necessity to discover sustainable alternatives to the production of Ordinary Portland Cement (OPC), as well as the growing need for superplasticizer admixtures for a variety of applications. This research is motivated by a variety of applications. Because superplasticizer admixtures are developed for OPC, their performance may alter in the presence of extra cementitious materials such as metallurgical slags and combustion ashes, or in alkaline settings. The fresh and hardened characteristics of the cementitious matrixes are examined to determine the influence of the admixtures on these formulations in the presence of additions and alkaline media with high and low pH. According to experimental results, the plasticizing effect in composite cement is independent of the type of addition (fly ash or slag) and is maintained for at least the first two hours after mixing. However, in the case of AAC, this effect rapidly decreases, most likely as a result of the admixtures' lack of chemical stability in alkaline media. With respect to the characteristics after hardening, polycarboxylate admixtures. Although there are no appreciable differences in mechanical strengths at an early age with composite cement, there is a 17% disadvantage with AAC. The addition of polycarboxylate improves the cementitious matrixes' pore structure, according to mercury intrusion porosimetry.

MARÍA JIMENA DE HITA et. al (2023).

As per the ASTM C125-97 guidelines, an admixture is any substance that is added to a batch of concrete or mortar, other than water, aggregates, or hydraulic cement, and is applied right before or after the in order to improve the workability when mixing. It's crucial to use superplasticizer (SP) to increase durability. Superplasticizers can be broadly classified into four categories: modified lignosulfonates, sulfonic acid and carbohydrate esters, sulfonated melamine formaldehyde condensates, and sulfonated naphthalene formaldehyde condensates. In order to improve the workability, compressive strength, compaction factor, and water absorption of fresh and hardened concrete in severe weather, three different chemically composed superplasticizers were used in this study for a single grade of M 30 concrete. Tests on both fresh and hardened concrete included the Split Tensile Strength, Cube Compressive Strength Test, Flexural Strength Test, and Slump Cone Test. The effects of the three admixtures were significantly diverse from one another, but when applied at a constant water-to-cement ratio, all three admixtures boosted workability and produced a compaction factor of greater than 0.84.

SYED MUDABIR ALTAF et. al. (2022).

This study aimed to study the effects of a superplasticizing admixture, namely, Sikament NN superplasticizer, on concrete properties, such as workability and compressive strength. Experiments were performed on different concrete mixes with water–cement ratios of 0.48, 0.55, and 0.60. The superplasticizer dosages by weight of cement were 0%, 0.8%, 1%, and 1.2%. The experiments were classified into two phases: the first phase focused on the effects of superplasticizer admixture on workability and compressive strength, and the second phase determined the influence of superplasticizer admixture on concrete quality by reducing the amount of mixing water. Results showed that the addition of superplasticizer admixture improved workability and compressive strength. The experiment program included tests on workability, slump test, and flow table. For hardened concrete's compressive strength test, we compared the properties of superplasticizer-based concrete with those of concrete without superplasticizer. The superplasticizer led to a significant water reduction but maintained workability.

SALAHALDEIN ALSADEY et. al (2022).

Concrete admixtures perform specific properties on fresh and hardened concrete; admixtures are natural minerals and chemical additives to enhancethe consistency and performance of hardened concrete.The paper investigated the performance of super-plasticisersmixed with combine supplementary cementitious materials (SCM) partly replaced cement in concrete production. The research works used the chemical admixture Sulphonated Naphthalene Formaldehydeand mineral admixtures of ground granulated blast furnace slag (GGBFS), metakaolin (MK) and partly cement to produce concretes at 0, 30, 40, 50, 60% and addition of 1.5% Sulphonated Naphthalene Formaldehyderespectively by weight of cement. Concrete mix ratio of 1: 1: 2, water/ cement ratio 0.4 added to the mix. The study produced 48 numbers of 150 x 150 x 150 mm cubes and 36 numbers of beam size 100 x 100 x 450 mm tested at 7, 14, 28 and 60 days curing period to determine the workability, density, compressive and flexural strength of the concrete.The slump test carried out on the freshly mixed concrete due to the addition of Sulphonated Naphthalene Formaldehyde showed plastic consistency ofMB, MC, MD,and MEresultedin slump ranges between 50-85 mm of medium workability while the control MA was a stiff concrete and low in workability of 30 mm slump. The compressive strength performed on the hardened concrete mixed with 1.5% Sulphonated Naphthalene Formaldehydeat 28 days, MB 22.9%, MC and MD proportioned with supplementary cementitious materials resulted in 45.9 and 33.3% increase over MA the control without Sulphonated Naphthalene Formaldehyde . The flexural strength tested on the beam samples MB, MC and MD resulted in 5.5, 17.1 and 10.5% increase over the control MA without Sulphonated Naphthalene Formaldehydeat 28 days. The study revealed that Sulphonated Naphthalene Formaldehydeenhanced the fluidity, improved the consistency and workability of the concrete and enhance the proportioned combine supplementary cemetitious materials in attainment of high strength of the concrete products Olaleye, 2Olaleye, (2021).

Different types of cement and super plasticizer are available in the market, even though the cements and super plasticizers complied with the respective code of practice, their performance are not the same in concrete, even if quality and source of other ingredients are kept constant. This has created a lot of problem among the users about what type of super plasticizers to be used with what type of cement and what optimum dosage of super –plasticizer should be added. Consequently, this study involves the application of Conplast SP 430 Superplasticizer on three different cement brands in northern part of Nigeria. The same Grade 42.5N of the three cements were selected and coded as NB, ND, and NS respectively. American concrete Institute (ACI) method of mix design was used to obtain the required proportion of the constituent materials for 30N/mm2produced for the study. The study was limited to fresh properties (unit weight and slump test) and hardened properties (density, water absorption and compressive strength test). All the three cements indicated an improvement for the performances studied Nasir Kabir, at.al.2019**.**

The purpose of this study is in the consideration of using SULPHONATED NAPHTHALENE FORMALDEHYDE superplasticizer upon attainment of desirable strength of concrete and optimizing same for highway pavement using four different new types of cement produced in Nigeria. In the facet, one normal cement type tagged 42.5Np and three rapid cement types tagged 42.5Rd, 32.5Rs and 32.5Rt were individually mixed with granites, sand and water plus SULPHONATED NAPHTHALENE FORMALDEHYDE superplasticizer for the production highway cement concrete pavement. Individual mixture was at a very low water-cementitious material ratio (w/cm) of 0.32 and concrete mix ratio of 1:1.5:3. Cement tests included specific gravity, fineness, consistency, setting time, chemical and metallic compositions. Tests carried out on the fine and coarse aggregates used included particle size distribution, specific gravity, chemical and metallic compositions. Laboratory tests that were also carried out on the coarse aggregate included crushing, impact and abrasion. Tests carried out on fresh concrete included slump and compaction factor while those on hardened concrete were compressive, tensile splitting and flexural strengths. At 28 days curing age, each of the compressive strength value for the concrete specimens produced based upon the four cements used are respectively 26.67 N/mm2 , 25.63 N/mm2 , 25.56 N/mm2 and 25.11 N/mm2 . The concrete specimens' tensile splitting strength values are respectively 2.78 N/mm2 , 2.48 N/mm2 , 2.10 N/mm2 and 1.89 N/mm2 while that of the flexural strength amounts are respectively 5.274 N/mm2 , 4.208 N/mm2 , 4.208 N/mm2 and 3.496 N/mm2 for the cements used. The significance of this study is that although the required compressive and tensile splitting strength values are not satisfied, the flexural strength value is satisfactory for highway pavement only by cement tagged

42.5Np. The justification for this research is in identifying the newly Nigerian made cement among the readily available ones to produce enhanced concrete at a cheaper economy and satisfying the required standard strength specification for highway pavement design and its construction Isaac Akiije, at.al. 2017.

One most important chemical admixture in preparing the High Performance Concrete is superplasticizer. The most significant improvement in the concrete technology during the past 30 years has been the use of superplasticizers. However, the reason that superplasticizers are much more important than any other chemical admixture is the number of improvements, which can be achieve by its use. However, the reason for widespread usage of admixtures is that admixtures are able to impart considerable physical and economic benefits with respect to concrete. However, usage of admixture is not remedy for poor quality of concrete due to the use of incorrect mix proportion, poor workmanship in concrete mixing and the problems caused by low quality raw materials selection. According to Yamakawa, the utilization of superplasticizer will have positive effects on properties of concrete, both in the fresh and hardened states. In the fresh state, utilization of superplasticizer will normally reduce tendency to bleeding due to the reduction in water/ cement ratio or water content of concrete. However, if water/ cement ratio is maintained, there is tendency that superplasticizer will prolong the time of set of concrete as more water is available to lubricate the mix. In the case of hardened concrete, (Yamakawa C., Kishitani K., Fukushi I. and Kuroha K., 1990) highlighted that the use of superplasticizer will increase compressive strength by enhancing the effectiveness of compaction to produce denser concrete. Risk of drying shrinkage will be reduced by retaining the concrete in liquid state for longer period of time. In addition, rate of carbonation become slower when water/ cement ratio is decreased with the presence of superplasticizer.

Admixtures

Historically, the admixtures are almost as older as concrete itself. They have been recognized as significant components of concrete used to enhance its performance. The original use of admixtures in cementitious mixtures as an additional material is not well documented. It would be a logical development to use such materials, which imparted desired qualities to the surface, as an integral part of the mixture. It is known that the Romans used milk, animal fat and blood to improve their concrete properties. Although these were added to improve the workability of concrete, blood is a very effective air entraining agent and might well have improved the durability of Roman concrete; eggs during the middle ages in European country; polished gluey rice paste, gloss, tung oil, blackstrap molasses and extracts from elm soaked in the water and boiled bananas by the Chinese; and in Mesoamerica and Peru, cactus juice and latex from rubber plants (Edward G.N, at.al. 2008).

At the present time, admixtures are very important and necessary components for the modern concrete technology. The concrete properties both in fresh and hardened states can be modified or improved by the addition of admixtures. Currently, admixtures are obtained as mineral and chemical admixtures which used to improve the short term and long term properties of the concrete (ACI Manual of concrete practice, at.al 2009).

The effect of size of Recycled Aggregate on compressive strength described by the researchers. The 100% of RA used in concrete mix to replace the natural coarse aggregate in concrete with 100 x 100 x 100 cube mm were cast with target compressive strength is 25 MPa. The 28-day compressive strength was crushed at 3, 14, 28 days are reported found that the size of 10 mm and 14 mm of RA in RAC is quite similar performance with 10 mm and 14 mm size of Natural Aggregate (NA) in natural aggregate concrete (NAC) (Ismail Abdul Rahman at al., 2009).

The recycled aggregate that are obtained from site-tested concrete specimen makes good quality concrete. The compressive strength of used aggregate concrete (UAC) is found to be higher than the compressive strength of normal concrete. Used aggregate concrete is in close proximity to normal concrete in terms of split tensile strength, flexural strength and wet density. The slump of used aggregate concrete is low and that can be improved by using saturated surface dry (SSD) coarse aggregate (Yong, P.C et al., 2009).

3. MATERIALS AND METHODOLOGY USED

3.0 Introduction

This Chapter provides detailed information about the materials and test procedures used to achieve the objectives of this thesis research work. The mixtures of cement concrete require careful analysis of aggregate size distribution and properties for a road paving material to be capable of bearing the expected loads. This research approach examined with multiple mixes prepared by different aggregate sizes, water/cement ratios and varying quantity of admixtures.

The main objective of this study is to perform the experimental study to investigate the properties of concretes produced with superplasticizer i.e. Sulphonated Naphthalene Formaldehydeand varying W/C ratios and comparison of them with conventional concrete prepared without superplasticizer i.e. Sulphonated Naphthalene Formaldehyde .

During the experimental work, different concrete samples with variable percentages of superplasticizer i.e. Sulphonated Naphthalene Formaldehydeand varying W/C ratios in mix designs were investigated by different ages (7 days and 28 days).

3.1 Preparation

Various test specimens were prepared to determine the slump value, compressive strength, split tensile strength and other properties of the concrete mix. The data is the reference of the study experiment that has to be done. Experiments needed to be done to achieve the objectives given are sieve analysis, specific gravity, water absorption, Aggregate Impact Value and crushing strength of aggregate.

3.2 Materials and their testing methods

3.2.1 Materials used

Materials - Ordinary Portland Cement, fine aggregate, coarse aggregate, superplasticizer i. e. Sulphonated Naphthalene Formaldehyde .

3.2.1.1 Ordinary Portland Cement (OPC)

Generally OPC is used in common concrete construction where there is no exposure to sulphates in the soil or in ground water. This cement is obviously produced in the maximum quantity than other cements. OPC is classified into three grades namely 33 grade, 43 grade and 53 grade depending upon the compressive strength of cement at 28 days. OPC 43 grade was used in this study as shown in Figure-3.1. The properties of cement were determined and are given in the next Chapter.

3.2.1.2 Fine Aggregate

During the experimental process of sieving the aggregates most of which passes through 4.75 mm BIS Sieve known as fine aggregates.

i) Natural Sand - Fine aggregates resulting from the natural disintegration of rock and which have been deposited by rivers or glacial agencies.

ii) Crushed Stone Sand - Fine aggregates produced by crushing hard stone is known as crushed stone sand.

iii) Crushed Gravel Sand - Fine aggregates produced by crushing natural gravel is known as crushed gravel stone.

According to the particle size, the fine aggregates may be classified as coarse, medium or fine aggregates. Depending upon the particle size distribution, the fine aggregates are divided into four grading zones as per BIS: 383-1970 that are zone I, zone II, zone III and zone IV. The grading zones become finer from grading zone I to grading zone IV. The sand confirming to zone II was used in this study shown in Figure-3.2. The properties of fine aggregates such as specific gravity and fineness modulus were determined and are given in the next chapter.

3.2.1.3 Coarse Aggregates

The aggregates most of which retained on 4.75 mm BIS Sieve while performing the sieve analysis in the laboratory are known as coarse aggregates. The various types of coarse aggregates are as follows:

i) Uncrushed gravel or stone which results from natural disintegration of rock due to weathering process.

ii) Crushed gravel or stone when it results from the crushing of gravel or hard stone in quarry.

iii) Partially crushed gravel or stone when it is a product of the blending of above two.

The graded coarse aggregate is categorized by its nominal size i.e. 40 mm, 20 mm, 16 mm and 10 mm. Regarding the characteristics of different types of aggregates, crushed aggregates be likely to improve the strength because of interlocking of angular particles, while rounded aggregates improved the flow ability of the concrete mix because of lower internal friction between rounded aggregate. Crushed stone aggregates of nominal size 20 mm and 10 mm in the proportion of 50:50 were used throughout the experimental study shown in Figure-3.3. The aggregates were washed to remove dust and dirt and were dried to surface dry condition. The properties of coarse aggregates such as specific gravity and fineness modulus were determined and are given in the next chapter.

3.2.1.4 Superplasticizer (Sulphonated Naphthalene Formaldehyde)

In this thesis work we use a high range superplasticizer (Sulphonated Naphthalene Formaldehyde) with variable proportions to reduce water cement ratio in the mix and also to found out its effect on properties of prepared concrete. SNF superplasticizers reduce the internal friction between the particles in the concrete mix, allowing for easier placement, compaction, and finishing.

This is particularly useful for high-strength and high-performance concrete, where low water-cement ratios are critical.

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3.2.1.5 Potable Water

The quality of water that we are using is important as it can affect the setting time of fresh concrete and the strength of hardened concrete. Additionally, it causes the risk of corrosion of the fibres, especially in case of using steel fibres. However, water is required for the hydration of cement and moulding and placing of concrete in the required shape and location.

(Balaguru and Shah, 1992) stated that the adequate water for the hydration requires a minimum water/cement ratio of 0.28 according to their research. Water that fit for drinking is suitable for used in cement concrete mix. If there is a high concentration of sodium, potassium salts or high suspended solids contain in the water, that water cannot be used for concrete mixing. Concern on the water must be taken to avoid contamination of water, such as split admixtures. Fresh and clean tap water was used for casting the specimens in our study. The water was relatively free from any organic matter, sugar, silt, oil, chloride and acidic material as per **BIS: 456-2000**.

3.2.2 Testing Methods

Sieve Analysis Test

Fineness modulus (F.M.) of aggregate is an index number which gives an idea about the coarserness of an aggregate. Fineness modulus of an aggregate is approximate proportion of the average size of particles in the aggregate. Fineness modulus is determined by adding the cumulative percentage of material retained on each sieve and dividing the sum of cumulative percentage of material retained on each sieve by 100. In this method, the fineness modulus of coarse and fine aggregate are determined separately.

- **Specific Gravity Test:** Specific gravity is the ratio of the weight of given volume of dry aggregate to the weight of equal volume of distilled water
- **Impact Test-** The property of a material to resist impact is known as toughness. Due to movement of vehicles on the road the aggregates are subjected to impact resulting in their breaking down into smaller pieces. The aggregates should consequently have adequate toughness to resist their disintegration outstanding to impact. This characteristic is measured by impact value test. The aggregate impact value is a measure of resistance to sudden shock or impact, which differs from its resistance to gradually applied compressive load.
- **Crushing value Test-** The strength of coarse aggregate may be determined by aggregate crushing strength test. The aggregate crushing value gives a relative measure of the resistance of an aggregate sample to the crushing under gradually applied compressive load.
- **Compressive Strength Test-** According to Cement Association of India (2003), compressive strength of concrete can be defined as the measured maximum resistance of a concrete to axial loading. Compression test is the most common test used to test the hardened concrete specimens because the testing is easy to make. The strength of the concrete specimens with different percentage of Used Aggregate replacement can be indicated through the compression test.

The specimens used in the compression test were cubes of 150 X 150 X150 mm size. Six specimens were used in the compression testing for every batch of mix. Differences of the strength among the different percentage of used aggregate used at the age of 7 and 28 days was also indicated through the compression test. The compression testing procedures was according to the Indian Standard Code.

4. ANALYSIS OF RESULTS

4.1 Compressive Strength Test Results

The laboratory test results are presented below in the tabular form for different mixes with variable percentage of superplasticizer in the mixtures.

Table-1 Test Results of Compressive Strength of All The Mixes (Prepared With Superplasticizer)

S. No.	Quantity of Superplasticizer in the mix (%)	Compressive strength at 7 days (N/mm^2)	Compressive strength at 28 days (N/mm^2)
1	0	21.56	31.10
2	0.5	22.22	31.65
3	1.0	23.10	34.90
4	1.5	21.20	30.42

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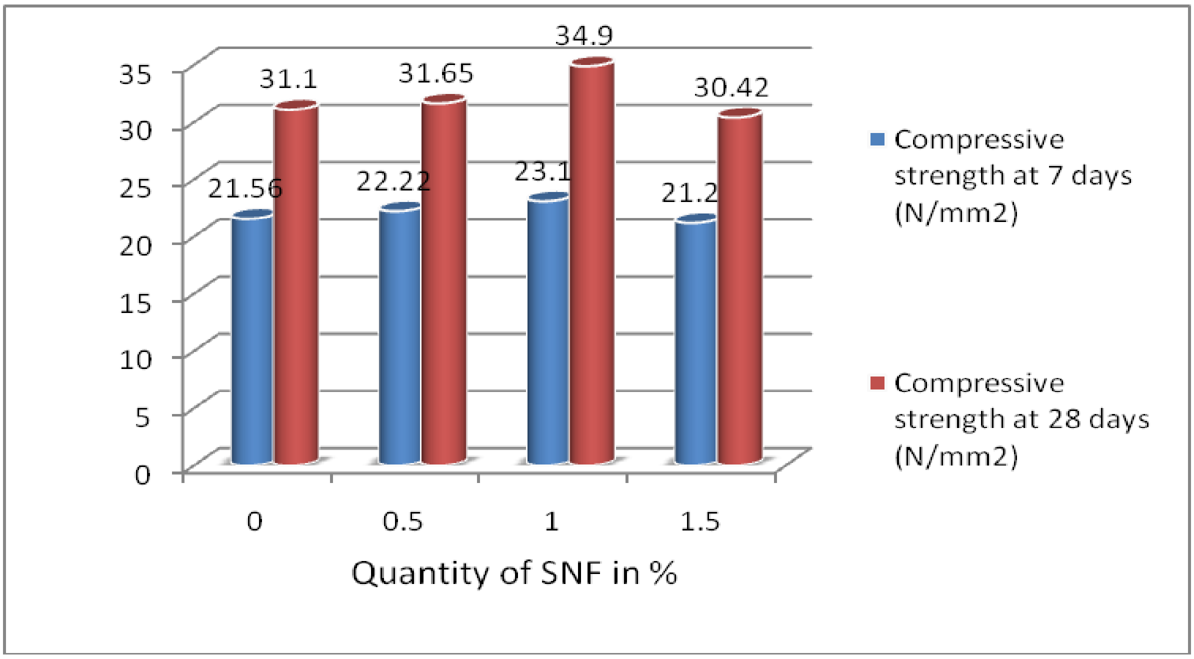


Graph-1 Test Results of Compressive Strength of All The Mixes Prepared With Variable Quantity of Superplasticizer

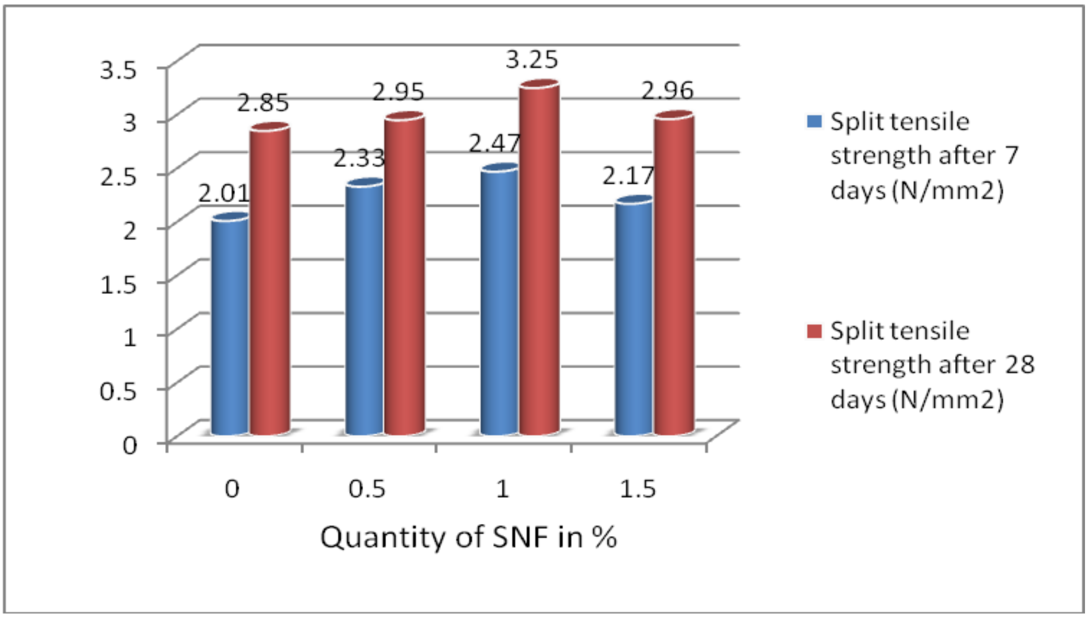
After comparing all these test results we found that when we add 1.0 % Superplasticizer in the mix the results of compressive strength at 7 days shows approximately 7 % increment in compressive strength and at 28 days shows 12 % increment in compressive strength.

4.2 Split Tensile Strength Test Results

The laboratory test results are presented below in the tabular form for different mixes with variable percentage of Superplasticizer in the mix.

Table-2 Test Results of Split Tensile Strength of All The Mixes Prepared With Variable % of Superplasticizer

S. No.	Quantity of Superplasticizer in the mix (%)	Split tensile strength after 7 days (N/mm^2)	Split tensile strength after 28 days (N/mm^2)
1	0	2.01	2.85
2	0.5	2.33	2.95
3	1.0	2.47	3.25
4	1.5	2.17	2.96



Graph-2 Test Results of Split Tensile Strength of All The Mixes Prepared With Variable Quantity of Superplasticizer

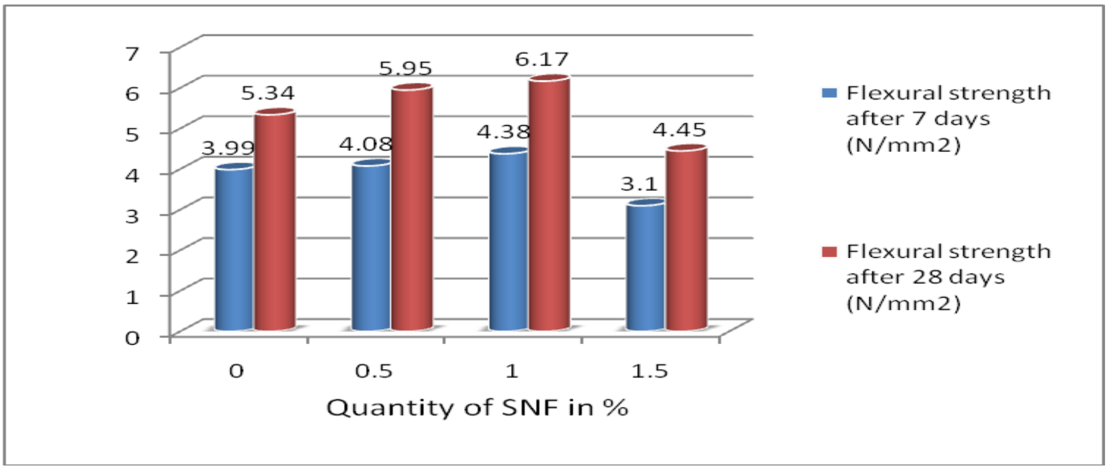
After comparing all these results we can say that Superplasticizer increases the Split Tensile Strength of a concrete mix up to 22.8 % at 7 days curing and approximately 14 % at 28 days curing a certain limit but after that range it starts reducing its strength.

5.4 Flexural Strength Test Results

The laboratory test results are presented below in the tabular form for different mixes with variable percentage of Superplasticizer i.e. Sulphonated Naphthalene Formaldehyde .

Table-3 Test Results of Flexural Strength of All The Mixes Prepared With Variable Percentage of Superplasticizer

S. No.	Quantity of Superplasticizer in the mix (%)	Flexural strength after 7 days (N/mm^2)	Flexural strength after 28 days (N/mm^2)
1	0	3.99	5.34
2	0.5	4.08	5.95
3	1.0	4.38	6.17
4	1.5	3.10	4.45



Graph-3 Test Results of Flexural Strength of All The Mixes Prepared With Variable Percentage of Superplasticizer

After comparing all these results we can say that lime Sulphonated Naphthalene Formaldehyde increases the Flexural Strength of a concrete mix up to 9.7 % at 7 days and 15.54 % 28 days respectively till certain limit but after that range it starts reducing its strength.

5. CONCLUSION AND RECOMMENDATION FOR FUTURE RESEARCH

6. CONCLUSION

The prime objective of this thesis research work was to understand the effect of addition of Superplasticizer (Sulphonated Naphthalene Formaldehyde) in the cement concrete mixtures. In this experimental study we determine the best composition of the cement concrete mix prepared with appropriate quantity of Superplasticizer (Sulphonated Naphthalene Formaldehyde). For determination of compressive strength, split tensile strength and flexural strength of the various mix prepared with variable percentage of Superplasticizer (Sulphonated Naphthalene Formaldehyde). These are the following conclusions of this research.

1. After comparision of the experimental research results we found that the compressive strength of cement concrete can be increase up to 7 % at 7 days curing and 12 % at 28 days curing with use of 1.0 % Superplasticizer (Sulphonated Naphthalene Formaldehyde) in the concrete mixture.
2. After comparision of the experimental research results we found that the split tensile strength of cement concrete can be increase up to 22.8 % and 14 % at 7 days and 28 days respectively by adding 1.0 % Superplasticizer (Sulphonated Naphthalene Formaldehyde) in the concrete mixture.
3. After comparision of the experimental research results for flexural strength test are 9.7 % and 15.54 % increment respectively for 7 days and 28 days curing by adding 1.0 % Superplasticizer (Sulphonated Naphthalene Formaldehyde) in the concrete mixture.
4. By our research we recommend best suitable mix for the higher desirable properties using Superplasticizer.

By these test results we can say that addition of Superplasticizer i.e. Sulphonated Naphthalene Formaldehydein the cement concrete mixture can be a useful material in Civil Engineering construction work.

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7. RECOMMENDATION FOR FUTURE RESEARCH

Theses are some recommendation for future work in this field.

1. In future experimental work one should also check the other different superplasticizers available in the market in the cement concrete mixture.
2. In future experimental work one should also check the effects of using other different types of admixtures in the cement concrete mixture.
3. In future research work some additional materials like glass powder, granite dust and other stone's powder with these materials could be tested for all types of strength.
4. The effect of using stone dust and marble powder in these mixes can be tested in future study.
5. The long term properties of the various types structures made by these mixes could be study for detailed information on these materials.

8. REFERENCES

[1] Amorim, Pedro, Jorge de Brito, and Luis Evangelista. Concrete Made with Coarse Concrete Aggregate: Influence of Curing on Durability. ACI Materials Journal, 2012, 195-204.
[2] Anderson, Keith W, Jeff S Uhlmeyer, and Mark Russel. Use of Used Concrete Aggregate in PCCP: Literature Search. Olympia: Washington State Department of Transportation, 2009.
[3] Balaguru P.N. and Shah S.P., 1992, Fibre-Reinforced Cement Composites, McGraw- Hill Inc., New York, United State of America. https://www.amazon.com/Fiber-Reinforced-Cement-Composites-Perumalsamy-Balaguru/dp/0070564000.
[4] Borsai A., 1994. Effect of superplasticizer type on the performance of high- volume fly ash concrete.
[5] Building Innovation and Construction Technology, 1999, Recycled Hit, New High, viewed 30 August 2004.
[6] CRISO and Wilmot, Commonwealth Scientific and Industrial Research Organisation, viewed 4 April 2004.
[7] Edward G.N, Concrete Construction Engineering Handbook, Second Edition, the State University of New Jersey New Brunswick, New Jersey, 2008.
[8] Esayas G/Y., chemical admixture, handout for civil engineering students, Addis Ababa University, Institutes of Technology, 2006.
[9] Fact File C & D Recycling Industry, n.d., History, viewed 11 April 2004.
[10] Garber, S, et al. Development of a Technology Deployment Plan for the Use of Used Concrete Aggregate in Concrete Paving Mixtures. Ames: National Concrete Pavement Technology Center, 2011.
[11] Jackson, N.; and Dhir R.K. (Eds.). 1996. Civil engineering materials. 5th ed. McMillan, London, UK.
[12] Hameed, M. 2009. "Impact of transportation on cost, energy, and particulate emissions for used concrete aggregate". Master's Thesis, University of Florida, Florida, USA.
[13] Irving Kett, 2010 Engineered Concrete Mix Design and Test Methods; Second Edition.
[14] Isaac Akiije, 2017 "Effects Of CONPLAST SP 430 Superplasticizer Using Four Nigerian Produced Cements Individually In Concrete Production For Highway Pavement" Journal of Multidisciplinary Engineering Science and Technology (JMEST) ISSN: 2458-9403 Vol. 4 Issue 6, June – 2017.
[15] Ismail Abdul Rahman and Hasrudin Hamdam (2009), "Assessment of recycled aggregate concrete," Modern Applied Science, vol.3, No.10, pp. 47-54.
[16] Jitender Sharma, Sandeep Singla (2014), "Study of Recycled Concrete Aggregates" International Journal of Engineering Trends and Technology (IJETT) – Volume 13 Number 3 – Jul 2014.
[17] Kajima Corporation Research and Development, 2002, recycled aggregate concrete for Within-Site Recycling, viewed 9 September 2004.
[18] Ken W.D, concrete mix design, quality control and specification, second edition, E & FN Spon, London, 1999.
[19] Kumar M. P. and Paulo M. J. M., Concrete Microstructure, Properties, and Materials, Third Edition, University Of California at Berkeley, Department Of Civil And Environmental Engineering, United States of America, 2006.
[20] Lemay, L. 2011. "Life cycle assessment of concrete buildings" A report (concrete sustainability report) prepared by NRMCA.
[21] Liaqat A. et al. 2016 "Effect of Using Recycled Concrete as Coarse Aggregate on Tensile and Flexural Strength of Concrete" Fourth international conference on sustainable construction materials and technologies. http://www.claisse.info/proceedings.htm

[22] Limbachiya, Mukesh, Mohammed Meddah, and Youssef Ouchagour. Use of Recycled Concrete Aggregate in Fly-Ash Concrete. London: Kingston University, 2012, 439-449.

[23] María jimena de hita, María Criado 2023 "Influence of superplasticizers on the workability and mechanical development of binary and ternary blended cement and alkali-activated cement" journal homepage: www.elsevier.com/locate/conbuildmat.

[24] Md. Safiuddin, Ubagaram Johnson Alengaram et al,"Properties of high-workability concrete with used concrete aggregate" Mat. Res. vol.14 no.2 São Carlos 2011 Epub June 03, 2011.

[25] Mirjana Malešev et al. 2014 "Properties Of Recycled Aggregate Concrete" UDK 666.97/.98:691.32 doi: 10.7251/COMEN1402239M.

[26] Nasir Kabir, Aminu Sallau, Adamu Umar Chinade, 2019 "Experimental Study of Sulphonated Naphthalene Formaldehydein Concrete Using Selected Brands of Portland cement" American Journal of Engineering Research (AJER) e-ISSN: 2320-0847 p-ISSN : 2320-0936 Volume-8, Issue-6, pp-225-233.

[27] Neville A.M., Properties of Concrete, Third Edition, Long Man Scientific & Technical Series, Singapore, 1994.

[28] Neville A.M, 2005. Properties of concrete, Pearson. Prentice Hall, p 255- 262.

[29] Olaleye, 2Olaleye, 2021 "Characteristics of Sulphonated Naphthalene FormaldehydeMixcombine Supplementary Cementitious Materials Produced Concretes" International Journal of Advances in Engineering and Management (IJAEM) Volume 3, Issue 12 Dec 2021, pp: 1448-1455 www.ijaem.net ISSN: 2395-5252.

[30] Portland Cement Association. Design and Control of Concrete Mixtures. Skokie, IL: Portland Cement Association, 2002.

[31] Ramachandran V. S., Concrete Admixtures Handbook: Properties, Science, and Technology, Second Edition, Institute for Research in Construction, National Research Council Canada, Ottawa, Ontario, Canada, 1995.

[32] Sandrine Braymand et al. 2015 "Rheological Properties of Recycled Aggregate Concrete Using Superplasticizers" Journal of Civil Engineering and Architecture 9 (2015) 591-597 doi: 10.17265/1934-7359/2015.05.011.