

A BRIEF STUDY ON COMPARISON OF PROPERTIES OF DIFFERENT TYPES OF CONCRETE

A Report

Submitted in partial fulfilment of the requirements
For the degree of

Bachelor of Technology

In

Civil Engineering

By

Ratnamanjari Behera-(2021298018)

Nitish Kumar Dhal - (1901298056)

Sonali Pradhan -(2021298024)

Sagnik Patra -(2021298020)

Under the guidance of

Asst. Prof. Ananya Punyotoya Parida



**DEPARTMENT OF CIVIL ENGINEERING
GANDHI INSTITUTE FOR TECHNOLOGY, AUTONOMOUS
BHUBANESWAR-752054 2022-23**

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Department Of Civil Engineering

**Gandhi Institute of Technology,
Autonomous**

Bhubaneswar – 752054, Odisha, India

(Approved by AICTE & Govt. of Odisha and affiliated to BPUT)

www.gift.edu.in

CERTIFICATE

This is to certify that the thesis entitled “**A BRIEF STUDY ON COMPARISON OF PROPERTIES OF DIFFERENT TYPES OF CONCRETE**” submitted by **Ratnamanjari Behera (2021298018) Nitish Kumar Dhal (1901298056) Sonali Pradhan (2021298024) Sagnik Patra (2021298020)** in partial fulfilment of the requirements for the award of **Bachelor of Technology Degree in Civil Engineering** at Gandhi Institute For Technology, Bhubaneswar is an authentic work carried out by him under my supervision and guidance.

To the best of my knowledge, the matter embodied in this Project Report has not been submitted to any other University/Institute for the award of any Degree or Diploma.

Arunima Parida
Project Guide
Dept. of Civil Engineering

[Signature]
31/5/23

Dept. of Civil Engineering
Project Coordinator

[Signature]
31/5/23

Head Dept. of
Civil Engineerig

[Signature]
31/5/23
External



DECLARATION

We declare that this project report titled " **A BRIEF STUDY ON COMPARISON OF PROPERTIES OF DIFFERENT TYPES OF CONCRETE**

“submitted in partial fulfilment of the Degree of B.Tech in Civil Engineering is a record of original work carried out by us under the supervision of **Asst. Prof. Ananya Punyotoya Parida**, and has not forward the basis for the award of any other degree or Diploma, in this or any other institutions or University. In keeping with the ethical practice in reporting scientific information, due acknowledgements have been made wherever the findings of others have been cited.

Ratnamanjari Behera

(2021298018)

Nitish Kumar Dhal

(1901298056)

Sonali Pradhan

(2021298024)

Sagnik Patra

(2021298020)

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Ratnamanjari Behera

(2021298018)

Nitish Kumar Dhal

(1901298056)

Sonali Pradhan

(2021298024)

Sagnik Patra

(2021298020)

ABSTRACT

The abstract distinction refers to a distinction among concepts, which is typically characterized as follows. Concrete concepts are those whose referents can be experienced through perception.

- Concrete is composed of cement, water & coarse aggregate, when mixed together they create a construction material that hardens over time. We can choose the appropriate form of concrete to accomplish the task.

- 1. Nominal concrete

- 2. Reinforcement concrete

- 3. Fly ash concrete {Cement is to be replaced 10%, 20%, 30%.}

Plastic concrete consists of aggregate, cement, water & bentonite, mixed at a high water-cement ratio. Aggregates use 10%, 20%, 30%. Brick dust was used in plain cement concrete in check. It's checked & hardness property.

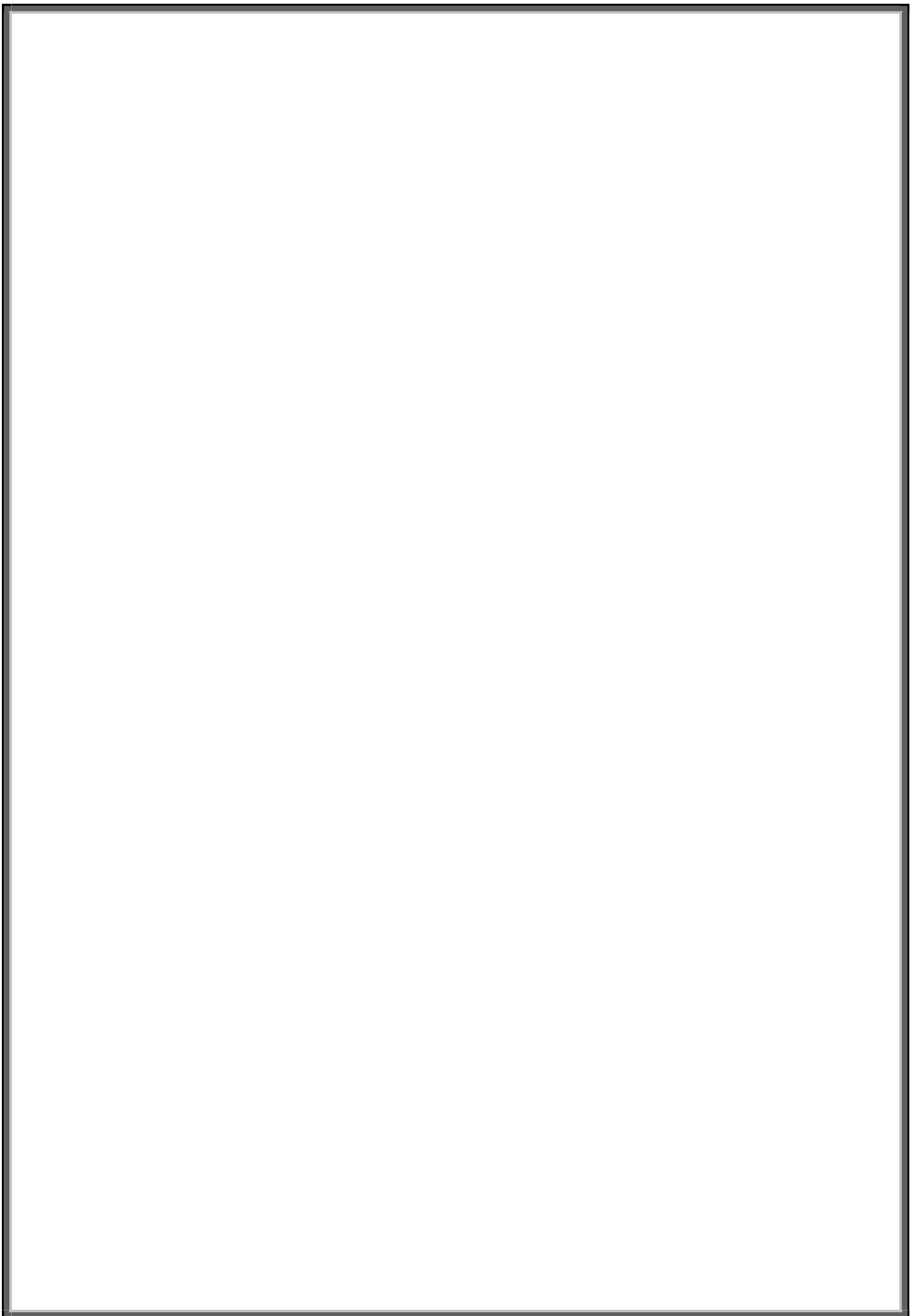
- Foam concrete also known as light weight concrete, low density cellular concrete and other term is defined as a cement-based scullery.

- Vermiculite concrete is a low density non-structural construction product. It is normally made simply by mixing exfoliated vermiculite as the aggregate with cement & water + additive such as plastic if required. High performance concrete is concrete that has been designed to become durable & if necessary stronger than conventional concrete. It's used in the construction of bridges, hydropower, structures, pavement.

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CHAPTER I



INTRODUCTION

INTRODUCTION

Electricity is important for development of any country. Coal is a major source of fuel for production of electricity in many countries in of the world. In the electricity generation process, a large quantity of fly ash gets produced and becomes available as a by product of coal-based power stations. Fly ash is a fine powder resulting from the combustion of powdered coal which is transported by the flue gases of the boiler and collected in the Electrostatic Precipitators (ESP). Conversion of waste into a resource material is an old practice of human society. In the year 1930, in USA, the fly ash became available in coal based thermal power station. For its profitable utilization, scientist started research activities and R.E. Davis, in the year 1937, and his associates at university of California published research details on use of fly ash in cement concrete. This research had laid foundation for its specification, testing & usages. Availability of power is one of the major factors responsible for economic and industrial growth of the country. In India also, coal is a major source of fuel for power generation. About 60% of power is produced using coal as fuel. Indian coal is having low calorific value (3000-3500 Kcal.) & very high ash content (30-45%) which results in the generation of huge quantity of ash in the coal based thermal power stations. During 2005-06 about 112 million tone of ash has been generated in 125 such power stations.

NON FINE CONCRETE

Today in the present world we are very much fond of sustainable and eco-friendly means of construction. Particularly in a country like India where flooding and water-logging problems are the major environmental issues sustainable development has become a necessity.

Various sustainable and eco-friendly means are being implemented to tackle these problems where No-fine concrete pavement is one among them. Working on rain-drain" concept No-fine concrete allows a significant amount of storm water to seep into the ground, thereby recharging the ground water and reducing the storm water runoff. No-fine concrete is a light-weight concrete produced by omitting the fines from conventional concrete. No-fine concrete (sometimes referred to as porous or open-textured concrete) is a concrete consisting of cement, coarse aggregate and water. It has its origin in late 1940s and now been widely used in the United States, Japan and Europe because of its various environmental benefits such as controlling storm water runoff, restoring groundwater supplies and reducing water and soil pollution. Apart from this, it has the potential to reduce urban heat island effects and can be used to reduce acoustic noise in roads. No-fine concrete is a discontinuous mixture of coarse aggregate, hydraulic cement and other cementations materials, admixtures and water. By creating a permeable surface, storm water is given access to filter through the pavement and underlying soil, provided that the underlying soil is suitable for drainage. This allows for potential filtration of pollutants. The advantages of no-fine concrete are:

- Water treatment by pollutant removal;
- Less need for curbing and storm sewers.
- Improved road safety because of better skid resistance.
- Recharge to local aquifers.

Pervious concrete can be used for a number of applications, but its primary use is in road pavement such as in rural areas.

This report will focus on the pavement applications of the concrete, which also has been referred to as porous concrete, permeable concrete, no-fines concrete, gap-graded concrete, and enhanced-porosity concrete. Pervious concrete pavement in rural areas is a unique and effective means to achieve important environmental issues and support green, sustainable growth. By capturing storm water and allowing it to seep into the ground, porous concrete is instrumental in recharging groundwater, reducing storm water runoff.

SOURCES AND OCCURRENCE OF FLY ASH:

The pulverized coal which is used by Coal fired power plants is typically ground to fineness with 75 percent or more passing the 200 No. Sieve. Depending on the source and grade of coal, it consists of 10 to 40 percent non-combustible impurities in the form of clay, shale, quartz, feldspar, dolomite, and limestone. In the high-temperature zone of a furnace, the volatile matter and carbon are burnt, leaving the non-combustible impurities to be carried by the flue gases in the form of ash. This travels through the combustion zone where the particles become fused. As the molten ash leaves the combustion zone, it is cooled rapidly (from about 1500 °C to 200 °C), making it solidify into spherical glassy particles. While a fraction of the fused matter agglomerates and settles to form the bottom ash, a majority of it flies" out with the flue gas stream to be collected later as fly ash. Fly ash undergoes a sequence of processes to be separated from the flue gas. It passes through a series of mechanical separators followed by electrostatic precipitators. Fly ashes from modern thermal power plants do not require any further processing for use as a supplementary cementations' material.

FLY ASH FOR SUSTAINABLE DEVELOPMENT OF CONCRETE INDUSTRY:

- Carbon dioxide (CO₂) emissions are at the highest levels in recorded (mg/L) in 1950 to the current levels of about 390 ppm according to the

National Oceanographic and Atmospheric Administration, with annual global output of over 29,000 million tons. Current rates of increase in CO₂ levels are at an alarming level, and there is widespread recognition of the need for immediate actions to control irreversible and large-scale damage to humanity and the planet.

- Portland cement is the most common building material worldwide. Currently, production is about 2.5 billion tons/yr. In the cement clinker manufacturing process, direct release of CO₂ occurs from two sources. The first is from the decomposition of the principal raw material, calcium carbonate, amounting to about 0.53 ton of CO₂/ton of clinker. The second source is from the combustion of fossil fuels amounting to about 0.37 ton of CO₂/ton of clinker
- Therefore, nearly a ton of CO₂ is produced for each ton of cement. Over 7 percent of the total human-produced CO₂ is from the production of cement, and the potential for cement replacement with fly ash is a big step in the direction of reducing greenhouse gas emissions. The use of fly ash reduces environmental impacts in two ways: It diverts coal power generation residue from landfills to beneficial use. It reduces the use of cement and hence cement production's impact on CO₂ emissions: Additionally, because fly ash is simply a by product of coal burned for electricity generation, no process energy is attributed to fly ash. According to the annual survey results published by the American Coal Ash Association (ACAA, 2009), for the year 2009 the following statistics are offered: 63 million tons of fly ash were produced. 25 million tons were used in various applications. 10 million tons were used in concrete and concrete products, and about 2.5 million tons were used in blended cements and raw feed for clinker.

Need of No-Fine Concrete

The porosity of pervious pavements is provided by omitting all or most of the fine aggregates which impart the necessary percolation characteristics to the concrete. In 2001, the ACI, “Pervious Concrete”, to develop and maintain standards for the design, construction, maintenance, and rehabilitation of pervious concrete. This recent interest in porous surfaces as a substitution for impervious surfaces can be attributed to desirable benefits such as storm water retention, which includes storm water treatment. Because of the high void content PCPC generally has low strength (800-3000 psi) which limits applications in cold weather regions and is responsible for various distresses and pavement failures. The need to develop a high performing pervious concrete specification for Indian conditions was the basis of this report. Several admixtures were tested along with regional materials often used in road projects. Structural and durability characteristics were measured against a control mix. Investigation of pervious concrete performance under cold weather conditions has been studied.

Benefits of No-fine Concrete

- It reduces the storm water runoff.
- Eliminates the need for detention ponds and their costly storm water management practices.
- Mitigates surface runoff.
- Replenishes the aquifers and water table.
- Allows more efficient land development
- Prevents water from entering into the stream and also prevents it from being polluted.

OBJECTIVES

No-fines concrete has been predominantly used in non-pavements applications with limited use in pavements applications. The purpose of this project is to assess the suitability of no-fines concrete to be used for the construction of road pavements. This assessment will include investigating current literature on the topic and also conducting some mix designs and standard concrete testing on conventional concrete and no-fines concrete to determine and compare their properties.

To study the compressive strength of No-fine concrete.

To prepare mix design for M20 grade of No-fine concrete.

To check porosity of No-fine Concrete.

CHAPTER II



LITERATURE REVIEW

LITERATURE REVIEW

GENERAL

This chapter presents an overview of literature of the various experiments conducted by many authors on the replacement of fly ash instead of cement in construction works. It include the literature about high class "C" and "F" fly ash concrete.

EARLIER RESEARCHES

- Tarun R. Naik, Bruce W. Ramme, and John H. Tews (1995) have conducted a experiment to establish fly ash concrete mixture proportions for highway paving work. Concrete mixes were proportioned to replace 20 and 50 percent cement with a Class C and 40 percent with a Class F fly ash. These mixes were tested for compressive strength, tensile strength, flexural strength, freezing and thawing resistance, shrinkage, deicing salt scaling, permeability, and abrasion resistance. Both the high-volume mixtures (40 percent Class F and 50 percent Class C) showed better results than that required for paving concrete with respect to most of the preceding parameters. Therefore, these mixes should provide an excellent alternative to conventional paving material.
- M. N. Haque, B. W. Langan, and M. A. Ward conducted a experiment using Concretes containing fly ash up to 75 percent by weight of the cementations material have properties that make them attractive as a sub base or base course component in pavement construction shown that fly ash concrete pavement was good performance in the test section.

- CD Atis, A Kilie, UK Sevim (2004) - A laboratory study was undertaken to assess the compressive and flexural tensile strength and drying shrinkage
- properties of mortar mixtures containing high-calcium nonstandard Afsin-Elbistan fly ash (FA). Possibility of using Afsin-Elbistan FA in cement-based materials as shrinkage-reducing or compensation agent was also discussed. Five mortar mixtures including control Portland Cement (PC) and FA mortar mixtures were prepared. FA replaced the cement on mass basis at the replacement ratios of 10%, 20%, 30% and 40%. Water cementitious materials ratio was 0.4 for all mixtures. The mixtures were cured at 65% relative humidity and 20[±]2 °C. The compressive and flexural tensile strength and drying shrinkage values of the mortar mixtures were measured. The results show that Afsin-Elbistan FA reduced drying shrinkage of the mortar by 40%. Therefore, it was concluded that Afsin-Elbistan FA can be used as a shrinkage-reducing agent. The mortar containing 40% FA expanded. This indicates that Afsin-Elbistan FA may be utilized to compensate drying shrinkage of cement-based materials.
- This paper describes an extensive laboratory study of air entrained high fly ash concrete mixes (air entrained and non-air entrained) of medium to low workability suitable for placement by slip forming and roller compaction, respectively. The concretes were characterized as to their compressive, indirect tension, and flexural strengths: drying shrinkage; and freeze-thaw durability. It is confirmed that cohesive non-segregating concretes can be manufactured containing 40 to 75 percent fly ash in the cementations fraction.

- When air entrained, these mixes provide concretes having adequate freeze-thaw durability, at least in the richer mixes. Tensile and compressive strengths achieved are adequate for the proposed applications with drying shrinkage within acceptable limits.
- SH Hong, BD Lee, SH Han have done a test in a test section of concrete pavement used crushed aggregate was constructed that fly ash have 20 percent weight of cementations materials to prevent expansion by ASR. This study was performed flexural strength test for elapsed days and durability by freeze-thaw test. It was shown that flexural strength was increased elapsed days and good performed freeze-thaw test.

CHAPTER III



MATERIALS AND METHODOLOGY

MATERIALS AND METHODOLOGY

COLLECTION OF MATERIALS:

fly ash For concrete, materials are collected and their physical properties also to define by conducting experiments.

Materials should be qualitative and obtained from proper place. Following materials are used for preparing of fly ash cement concrete

- **Cement** - ordinary Portland cement of conforming the Indian standard IS 12269(1987) was used for the present experiments.

Table No-1

SI No	Properties	Requirement
1	Specific Gravity	3.10-3.15
2	Standard Consistency	30-35
3	Initial Setting	30
4	Final Setting	600

- **Fly ash** –It is obtained from thermal power plant of class F.

Table No -2

Specific Gravity	2.27
Moisture Content	19.48

- **Aggregate** – 22.4mm to 4.75mm aggregate taken as a coarse aggregate and below 4.75mm aggregate taken as fine aggregate.

Table No-3

Specific Gravity	2.65
Water Absorption	1.01

Table No-4

Fine Aggregate

Specific Gravity	2.68
Water Absorption	0.8%

PHYSICAL PROPERTIES OF MATERIAL:

Physical property as colour, specific gravity, moisture content etc is determined.

MIXING PROCESS:

Materials were weighted in proper way and as required for mixing. After then it mixed in proper way nominal mix method. For this experiment study M-20 grade of concrete was prepared by nominal mix method. For present study concrete was mixed in 1:15:3 proportions and w/c ratio was kept 0.6. Cement was replaced with fly ash; fly ash was added 10 to 50% of cement weighted which was used in mixing concrete.

Table No-3.3

Fly ash Content(%)	Fly ash (kg)	Cement (kg)	Sand (kg)	Aggregate (kg)	w/c
0	0	1.5	2.5	4.5	0.5
10	0.15	1.35	2.5	4.5	0.5
20	0.3	1.2	2.5	4.5	0.5
30	0.45	1.05	2.5	4.5	0.5
40	0.65	0.95	2.5	4.5	0.5
50	0.75	0.75	2.5	4.5	0.5

MOULDING PROCESS:

Concrete mixer moulded in cube sized 150*150*150 mm³. Totally 18 cubes were moulded in which 6 cubes tested after 7days, 6 cubes after 14 days and 6 after 21 days. Concrete is mixed by hand and thoroughly mixed and concrete placed in cubes with the minimum delay. It was well Compacted by Roding, temping and vibrating to remove all air voids after placing.

REMOVING OF MOULD:

After 24hour moulds were removed. After removing each cube was marked with legible identification on the top or bottom using a waterproof marker.

CURING PROCESS:

Concrete cubes were cured normally in fresh water for 7, 14, 28 days at room temperature. Curing plays an important role in gaining the strength of concrete. If concrete cube not properly cured than it will not gain enough strength and on other hand if concrete cube cured for more time than also its strength decreases Curing process in concrete increases strength and decreases permeability.

TESTING PROCESS:

After removing mould, concrete cubes are tested in laboratory. Various tests were done. to find physical property of material, specific gravity of cement, initial setting time. moisture content and standard consistency was determined, to check workability of concrete slump test was conducted and for strength of concrete compressive strength was conducted by compressive strength testing machine.

CHAPTER IV



LABOTORY TESTS

LABOTORY TESTS

Initial and Final Setting:

Initial setting time of cement is the time lapse between the addition of water and the instant cement paste starts to lose its plasticity. Final setting time is the time lapse between the additions of water to the instant the cement paste completely loses its plasticity. For OPC initial setting time is 30 minutes.



FIG. 01

Table No-5

Sl No	% of cement	% of fly ash	Initial setting	Final setting
1	100	0	30min	510 min
2	90	10	32 min	519 min
3	80	20	32 min	522 min
4	70	30	33 min	528 min
5	60	40	34 min	531 min
6	50	50	34 min	539 min
7	40	60	35 min	540 min
8	30	70	36 min	545 min
9	20	80	36 min	556 min

Initial And Final Setting Time Graph

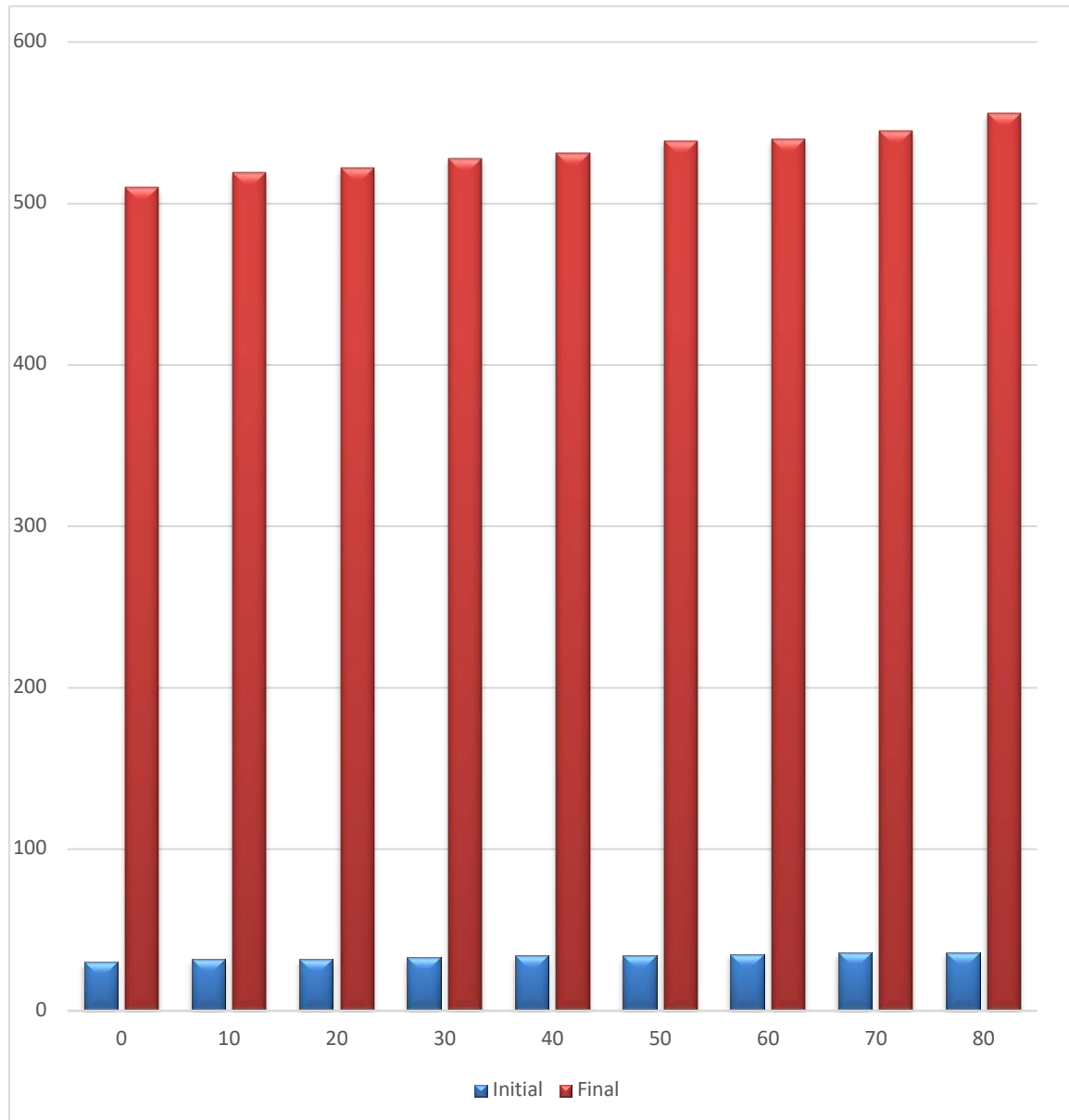


Table No-6

Sl No	% of cement	% of fly ash	Consistency
1	100	0	34
2	90	10	32
3	80	20	32
4	70	30	31
5	60	40	30
6	50	50	30
7	40	60	28
8	30	70	28
9	20	80	27

Cement Consistency Graph

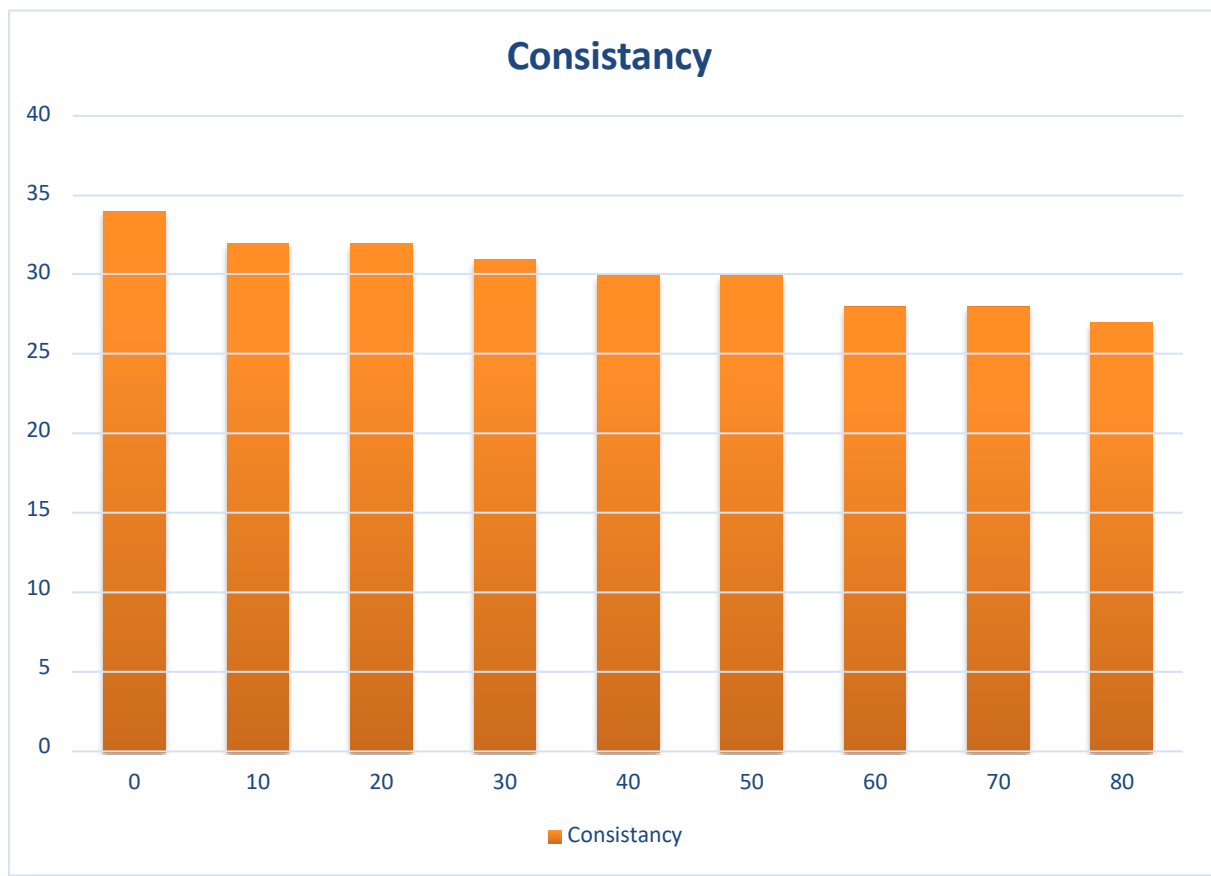




Fig. 02

Slump Test

The slump test is a means of assessing the consistency of fresh concrete. It is used, indirectly, as a means of checking that the correct amount of water has been added to the mix. This cone is filled with fresh concrete in four stages. Each time, each layer is tamped 25 times with a 2 ft (600 mm)-long bullet-nosed metal rod measuring 5/8 in (16 mm) in diameter. At the end of the lifted vertically upwards, so as not to disturb the concrete cone. The slump of the concrete is fourth stage, the concrete is struck off flush with the top of the mould. The mould is carefully measured by measuring the distance from the top of the slumped concrete to the level of the top of the slump cone.

Slump Test (Non Fine Concrete)

The slump test was done in accordance with the IS 1199-1959. As the No-fine concrete falls under the category of no slump concrete therefore it shows poor workability. However, the slump of the No-fine concrete has no correlation with its workability.



Fig . 03

SLUMP TEST VALUE

Table no-7

Sl No	% of cement	% of fly ash	Slump value in mm
1	100	0	40
2	90	10	38
3	80	20	35
4	70	30	32
5	60	40	30
6	50	50	27
7	40	60	24
8	30	70	21
9	20	80	19

Table no-7 slump test value

Slump value

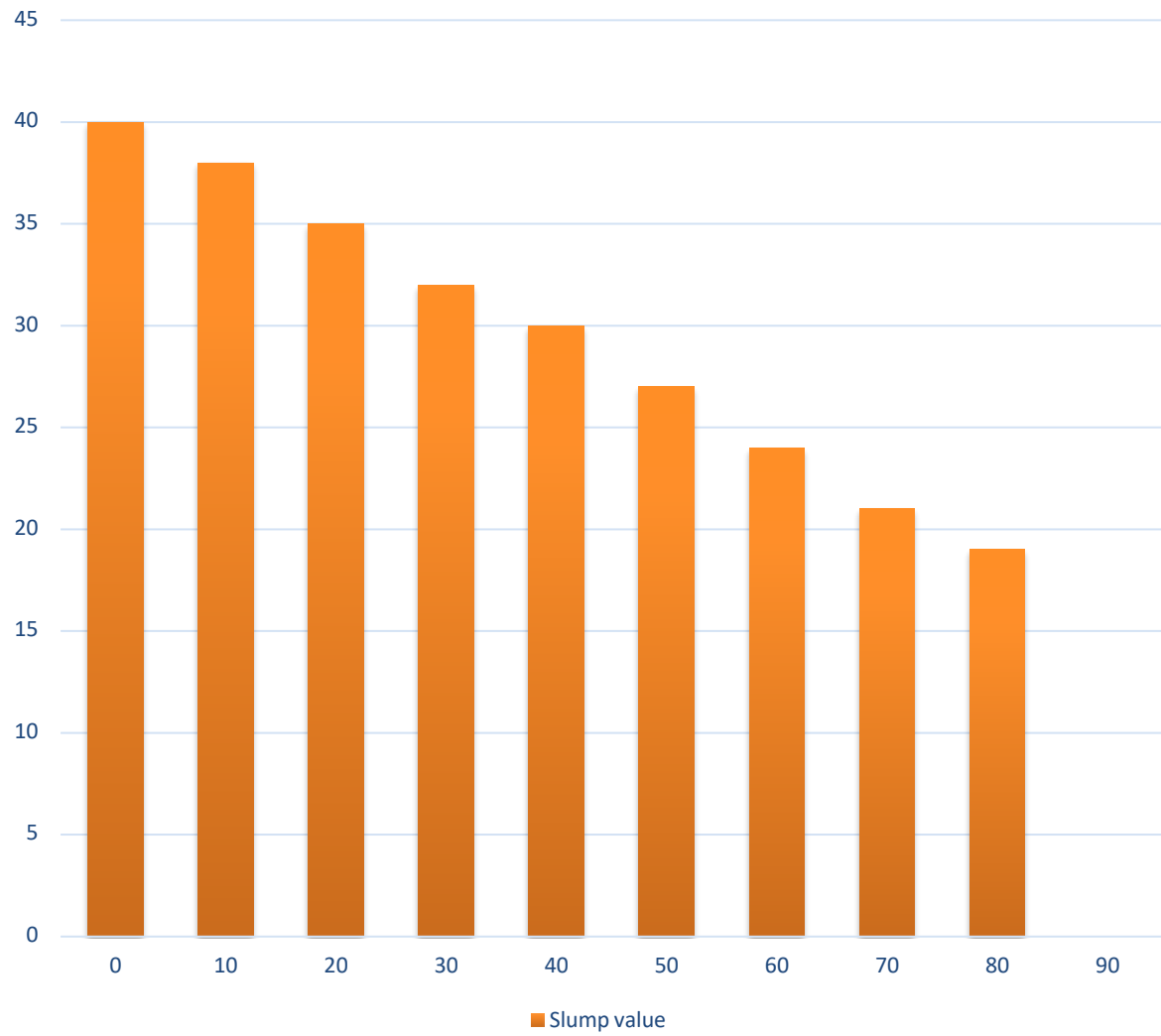
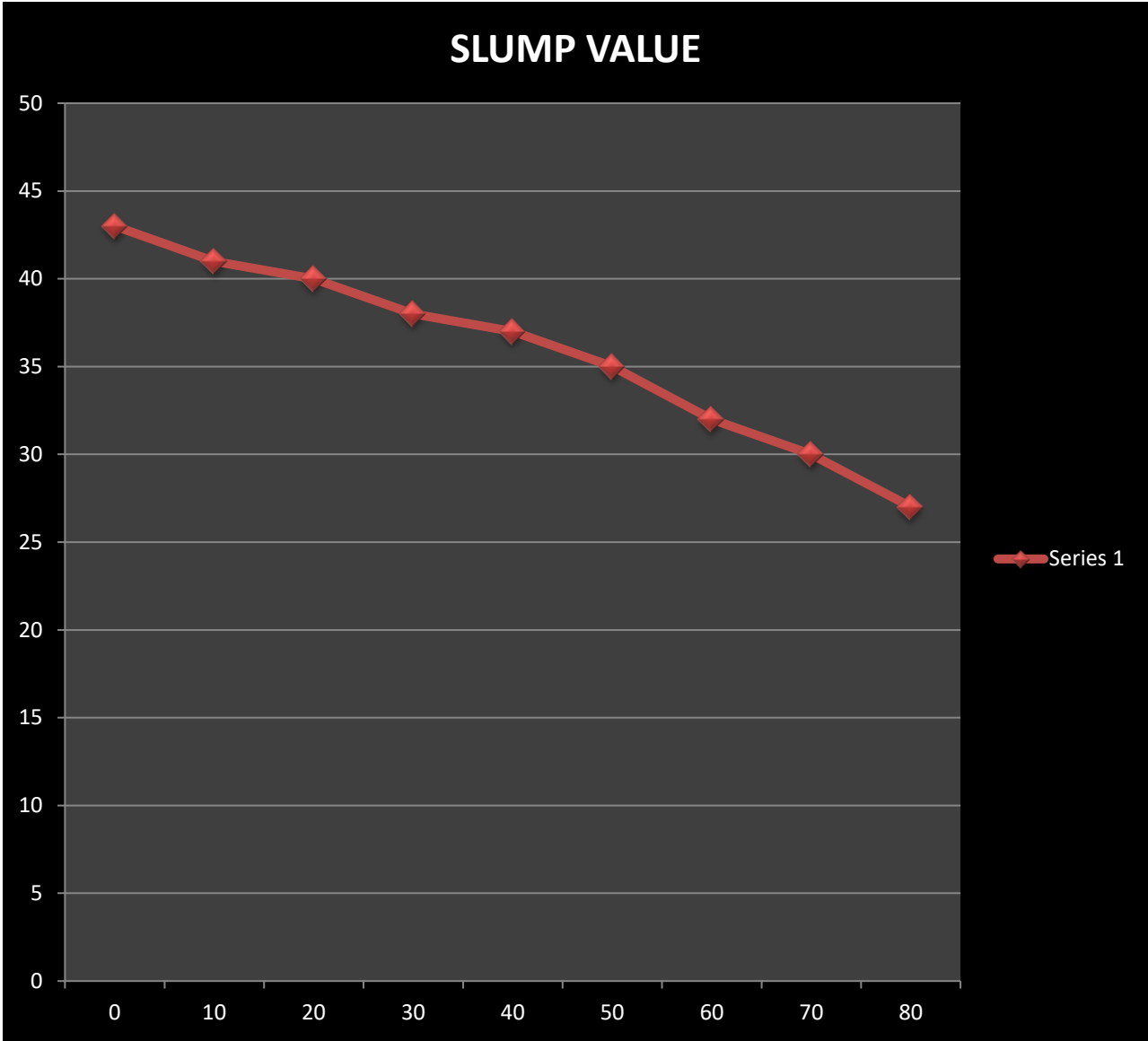


Table no-8

Sl No	% of cement	% of non fine	Slump value in mm
1	100	0	43
2	90	10	41
3	80	20	40
4	70	30	38
5	60	40	37
6	50	50	35
7	40	60	32
8	30	70	30
9	20	80	27

SLUMP VALUE GRAPH



Water Absorption Test:

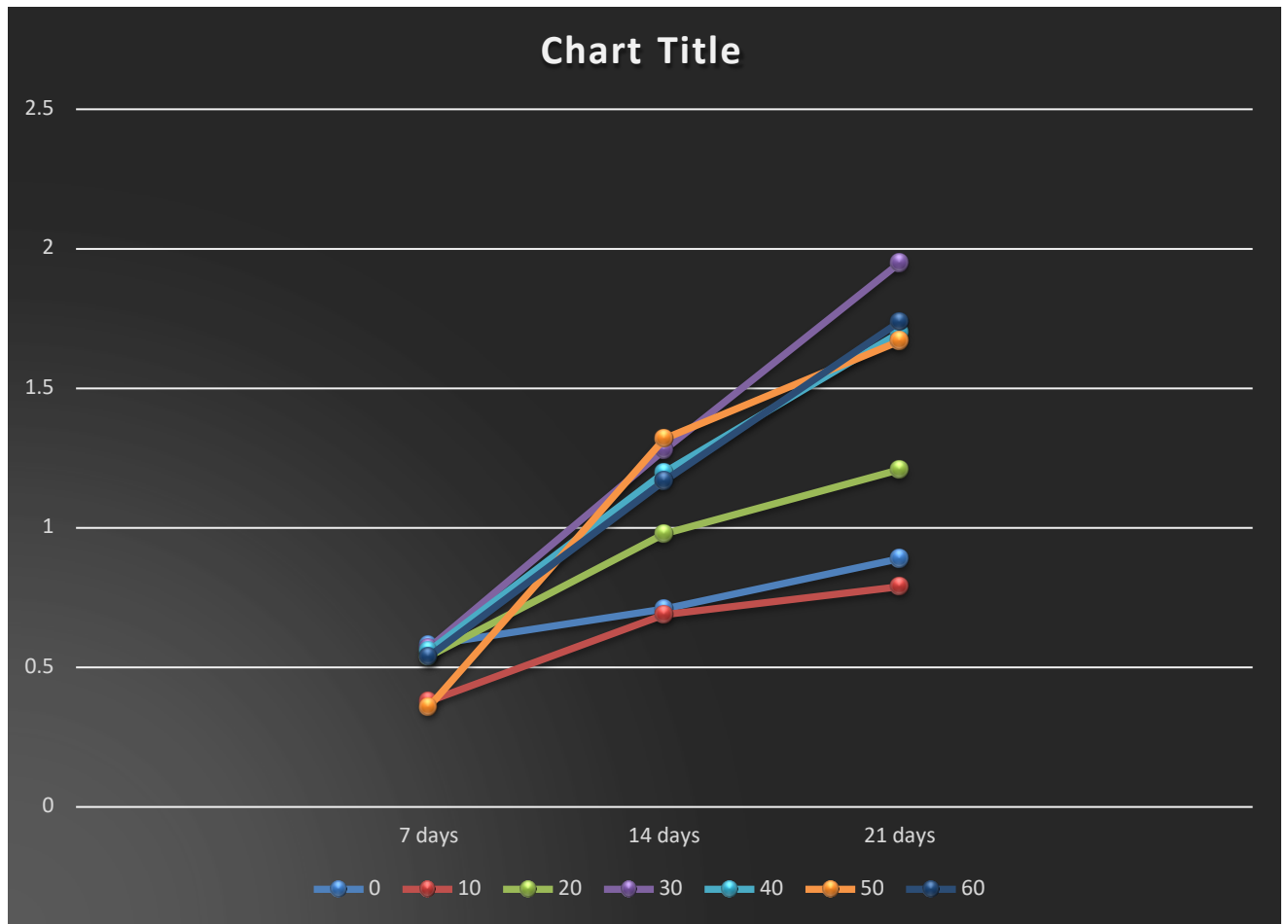
Water absorption is measured by measuring the increase in mass as a percentage of dry mass. The weight of cubes of 7, 14 and 21 days in water were taken before and after adding into water and the difference between the weight were calculated.



Fig. 04

Table No-9

Sl No	% of cement	% of fly ash	Normal weight	Water absorption in 7 days(in kg)	Water absorption in 14 days(in kg)	Water absorption in 21 days(in kg)	% of 7 days	% of 14 days	% of 21 days
1	100	0	8492	8542	8553	8569	0.58	0.71	0.89
2	90	10	8490	8523	8549	8558	0.38	0.69	0.79
3	80	20	8446	8492	8530	8550	0.54	0.98	1.21
4	70	30	8272	8320	8380	8437	0.57	1.28	1.95
5	60	40	8229	8276	8329	8372	0.56	1.2	1.7
6	50	50	8178	8208	8288	8317	0.36	1.32	1.67
7	40	60	8144	8189	8241	8289	0.54	1.17	1.74



Compressive Test:

Testing hardened concrete plays an important role in controlling and conforming the quality of cement concrete work. The main factor in favor of the use of concrete in structures is its compressive strength. One of the important properties of the hardened concrete is its strength which represents its ability to resist forces. The compressive strength of the concrete is considered to be the most important and is often taken as an index of the overall quality of concrete. The compressive

strength of concrete is defined as the load which causes the failure of specimen per unit cross section on compression under given rate of loading.



Fig. 05

Table No-10

Sl No	% of cement	7 days	14 days	21 days
1	0	14.5	22.1	22.8
2	10	9.6	18.2	19.9
3	20	8.1	14.1	17.5
4	30	6.2	11.8	14.7
5	40	3.7	6.5	9.8
6	50	2.1	3.6	5.7

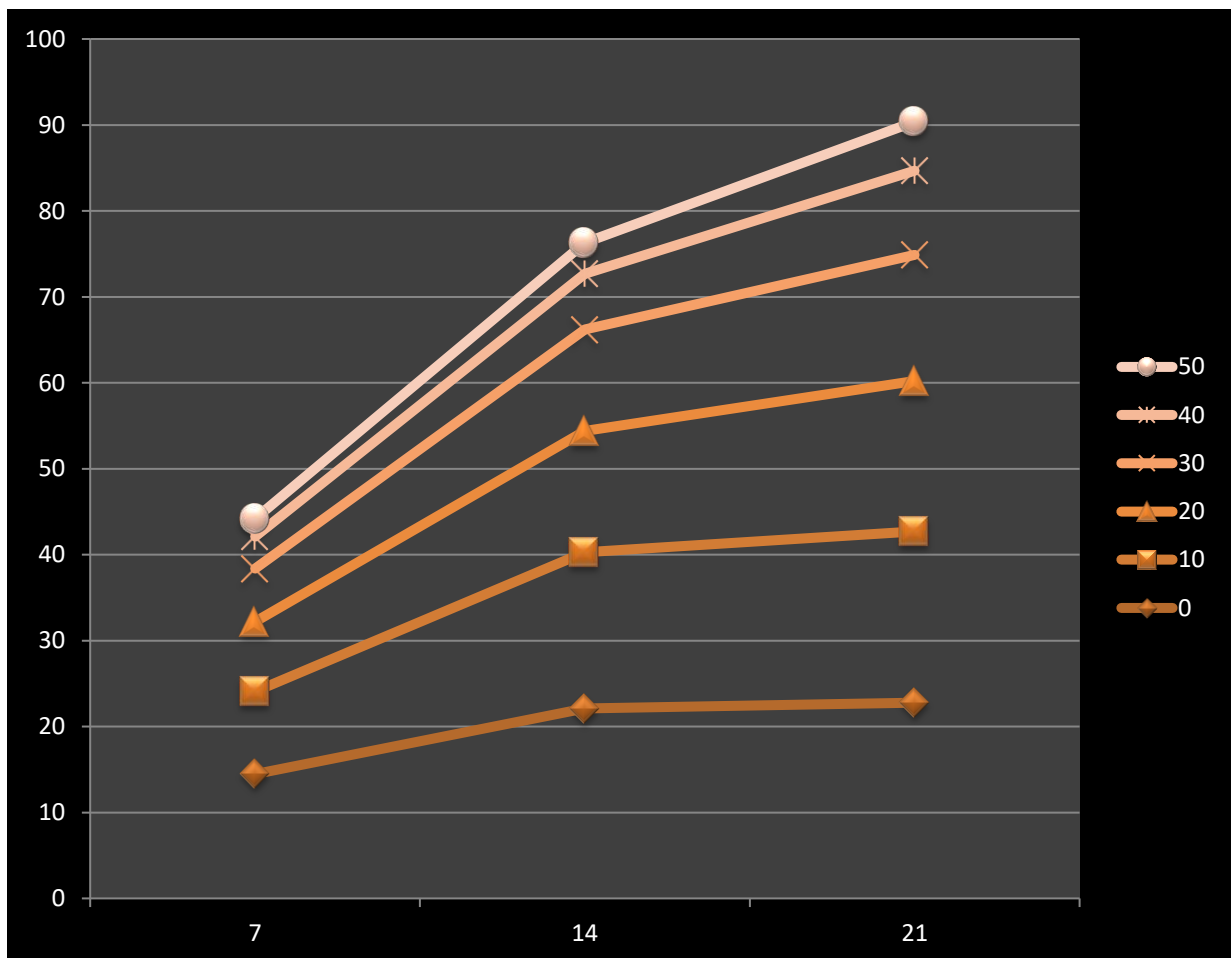
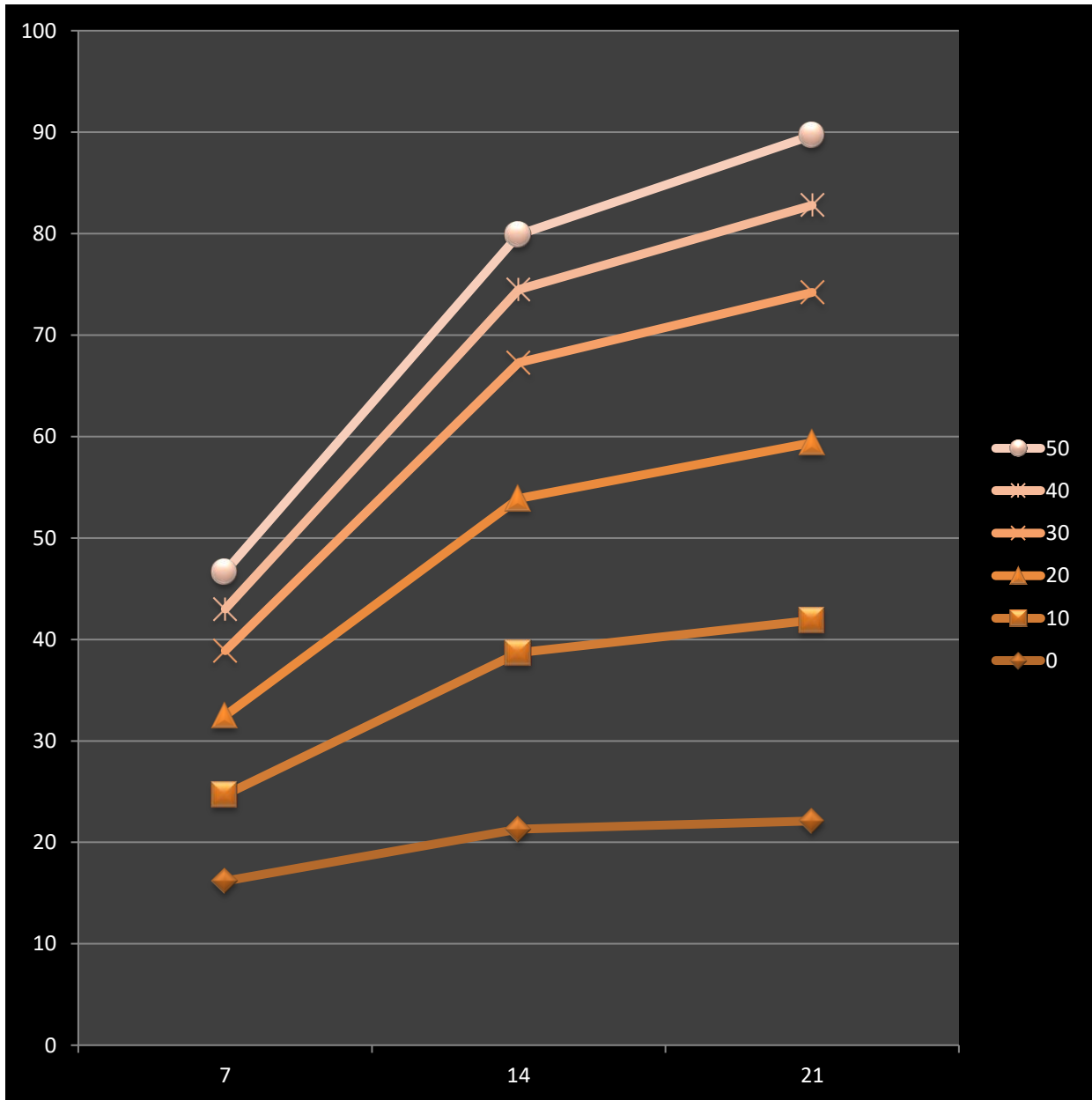


Table no-11 (Non Fine Concrete)

Sl No	% of cement	7 days	14 days	21 days
1	0	16.2	21.3	22.1
2	10	8.5	17.4	19.8
3	20	7.8	15.2	17.5
4	30	6.4	13.4	14.8
5	40	4.1	7.2	8.6
6	50	3.7	5.4	6.9



Compressive test graph

RESULT

The cubes of size 150 × 150 × 150 mm are placed in the machine such that load is applied on the opposite side of the cubes as casted. Align carefully and load is applied, till the specimen breaks. The formula used for calculation Compressive Strength = Total Failure Load/ Area of the Cube

CHAPTER V

ADVANTAGES OF FLY ASH & NON FINE CONCRETE:

ADVANTAGES OF FLY ASH CONCRETE

- Fly ash in the concrete mix efficiently replaces Portland cement that turn can aid in making big savings in concrete material pieces.
- It is also an environment friendly solution, which meets the performance specification. It can also contribute to LEED points.
- It improves the strength over times and thus, It offers greater strength to a building
- Increased density and also the long term strengthening action of flash that ties up with free lime and thus, results in lower bleed channel and also decreases the permeability.
- The reduced permeability of concrete by using fly ash, also aids to keep aggressive composite on the surface where the damaging action is reduced. It is also highly resistant to attack by mild acid, water and sulphate.
- It affects combines with alkali from cement, which thereby prevents the destructive expansion.
- It chemically and effectively binds salts and free lime, which can create efflorescence. The lower permeability of fly ash concrete can effectively reduce the effects of efflorescence.

ADVANTAGES OF FLY NON FINE CONCRETE

- The density of no fines concrete is very low.
- No fines concrete does not segregate and the capillary movement of water is almost nil.
- It has better thermal insulating characters due to the presence of large voids.
- This concrete can be used by dropping from a permissible height.
- Shrinkage is also lower than normal concrete.
- It is lightweight.
- The formwork can be removed earlier.
- No mechanical vibrator is required for compacting no fines concrete, simple rodding method is sufficient for full compaction.
- It gives better and attractive appearances.
- Production cost is comparatively lower than other conventional concrete because lower cement content is used.

CHAPTER VI



CONCLUSION

CONCLUSION:

- Thus, by results we can see as the amount of fly ash is increased, consistency decreased. And as the amount of fly ash is increased in the mix, it requires less water as compared to cement.
- Thus by result it can also be seen that as amount of fly ash increased in cement, initial setting time also increased and it take more time to settle.
- It can also be seen that as the amount of fly ash increased compressive strength decreased, up to 20-30% is safe to use in concrete mix.
- 1:4 mix proportions gives more compressive strength than the other two proportions.
- The effect of water/cement ratio have greater impact on compressive strength as 0.35% water content gives more strength for SET-B (16 mm) than other water content used in the project.
- The effect of water/cement ratio have greater impact on compressive strength as 0.40% water content gives more strength for SET-A (10 mm) than other water content used in the project.
- The use of water content more than 0.40% causes the flow of cement to the bottom of the specimen.
- The use of different size of aggregate also have greater impact on the ultimate strength as SET-B (16 mm) size aggregate gives more strength than other sizes of SET-A (10 mm).
- The porosity of No-fine concrete is largely affected by the smaller size of coarse aggregate used in concrete mix. Concrete mix containing 10 mm size aggregate shows higher porosity in comparison to concrete mix a containing 16 mm size aggregate.

- From the project study we conclude that there is a considerable saving of 12.95% in amount for construction of 1m³.
- From the project it clarifies that No-fine concrete can be easily use for the application of parking pavements, footpath pavements, tennis ground, rural areas with low volume traffic as per IRC.

CHAPTER VII



FUTURE SCOPE

FUTURE SCOPE

- Effect on the strength of fly ash concrete by using different water cement ratio should be tested.
- For use of Fly Ash Concrete as a structural material, it is necessary to investigate the behaviour of reinforced concrete under flexure, shear, torsion and compression.
- The logistics of implementing the use of Fly Ash concrete in developing country construction should also be investigated to ensure that this low cost construction material is helping the people who need it most.
- The variation in different grade of concrete is investigated to determine the best source of Fly Ash for the use in concrete.
- Achieve 30 Mpa compressive strength or more than 30 Mpa compressive strength for No-fine concrete which can be useful for the design of high volume road traffic such as major district roads, national highways.

CHAPTER VIII



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