iJRASET
International Journal For Research in Applied Science and Engineering Technology



# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

**Volume:** 11 **Issue:** VI **Month of publication:** June 2023

**DOI:** https://doi.org/10.22214/ijraset.2023.54102

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
*ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538*
*Volume 11 Issue VI Jun 2023- Available at www.ijraset.com*

# A Brief Study on Comparison of Properties of Different Types of Concrete

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

- *Concrete is composed of cement water & coarse aggregate, when mixed together they create a construction materials that harden over time. We can choose the appropriate form of concrete to accomplish the task.*
- *Nominal concrete*
- *Reinforcement concrete*
- *Fly ash concrete {Cement is to be replace 10%, 20%, 30%.} Plastic concrete consist 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 check & 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 extoliated vermiculite as the aggregate with cement & water + additive such as plastic of required. High performance concrete is concrete that has been designed become durable & if necessary stronger than conventional concrete. It's used in the construction bridge hydropower, structure pavement.*

***Keywords:** specific gravity, slump test , initial and final setting , compressive strength*

## I. 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 goal-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.

## II. SOURCE AND OCCURANCE 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.

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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 a supplementary cementations' material.

*A. Fly Ash For Sustainable Development Of Concrete Industry*

*1)* Carbon dioxide (CO2) emissions are at the highest levels in recorded history. CO2 concentrations are estimated to have increased from 315 ppm (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.

*2)* 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.

*3)* 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.

*B. Physical Properties Of Material*

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

*1) 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 |

*2) Moulding Process*

Concrete mixer moulded in cube sized 150*150*150 mm^3. 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.

*3) Removing Of Mould*

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

*4) Curing Process*

Concrete cubes were cure and 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.

*5) Testing Process*

After removing mould, concrete cubes are tested in laboratory. Various testes were done. for 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 impressive strength testing machine.

## III. LABROTORY TEST

*A. 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.




Figure 1

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 |

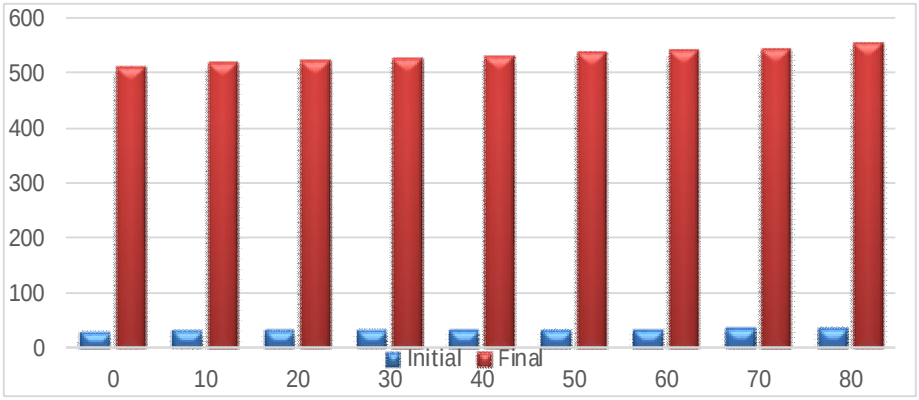



Figure 2

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 |

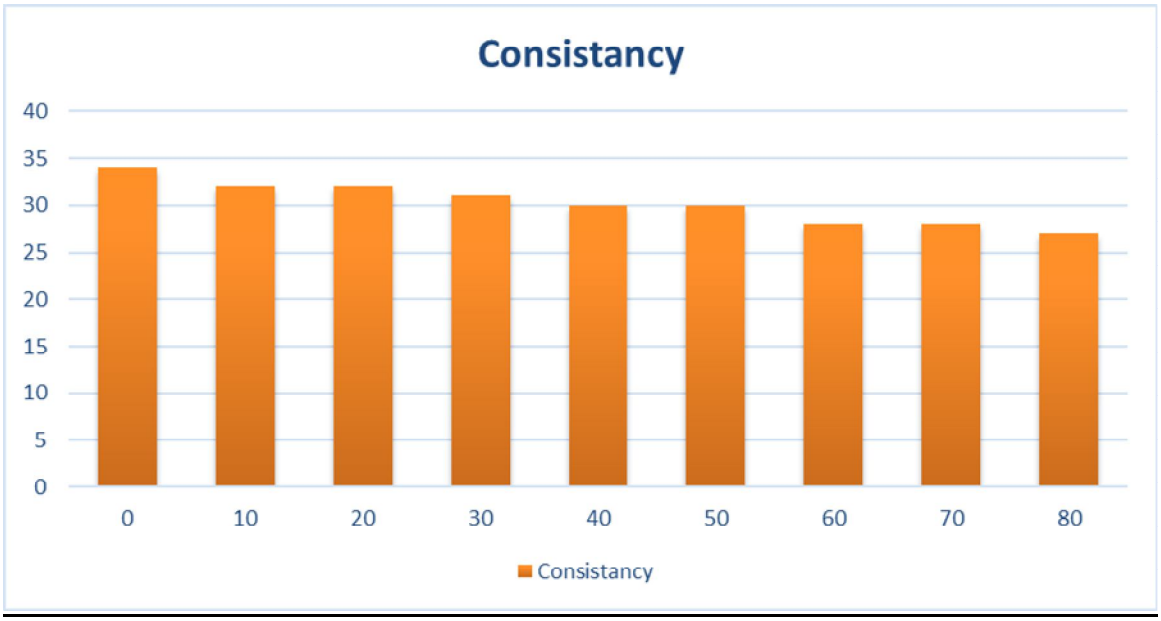



Figure 3

*B. 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 fit (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.



Figure 4

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 |




Figure 5

*C. 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.

Table No-8

| 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 |

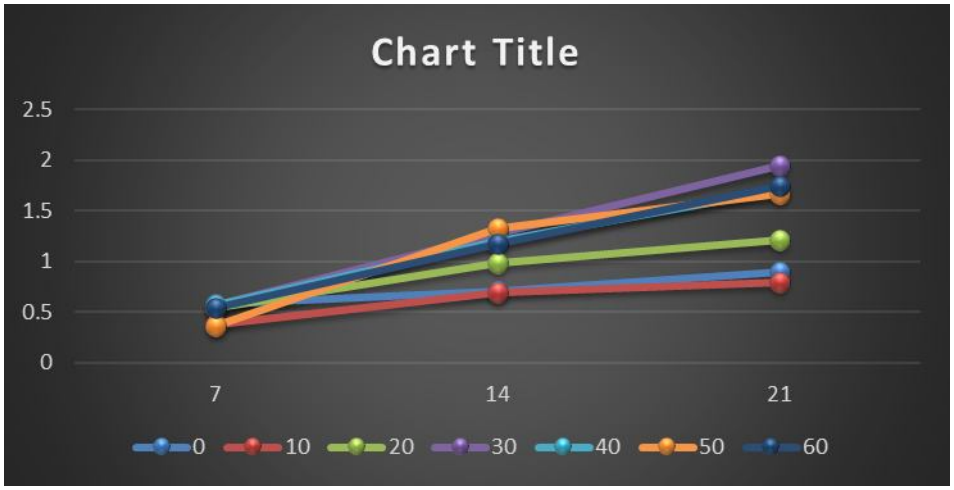



Figure 6

*D. 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.

Table No-9

| 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 |

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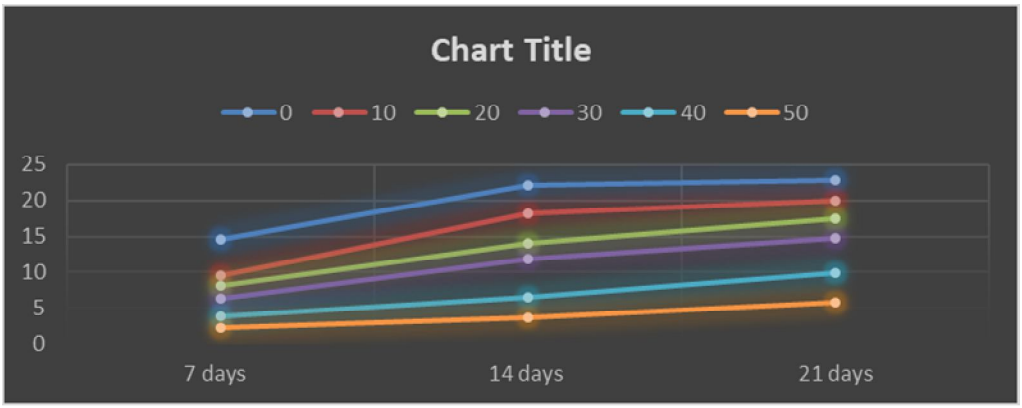



Figure 8

## IV. ADVANTAGES OF FLY ASH CONCRETE

The advantage of fly ash in concrete includes the following:

1) Fly ash in the concrete mix efficiently replaces Portland cement that turn can aid in making big savings in concrete material pieces.
2) It is also an environment friendly solution, which meets the performance specification. It can also contribute to LEED points.
3) It improves the strength over times and thus, It offers greater strength to a building
4) 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.
5) 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.
6) It affects combines with alkali from cement, which thereby prevents the destructive expansion.
7) 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.

## V. CONCLUSION

1) 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.
2) 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.
3) 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.

## VI. FUTURE SCOPE

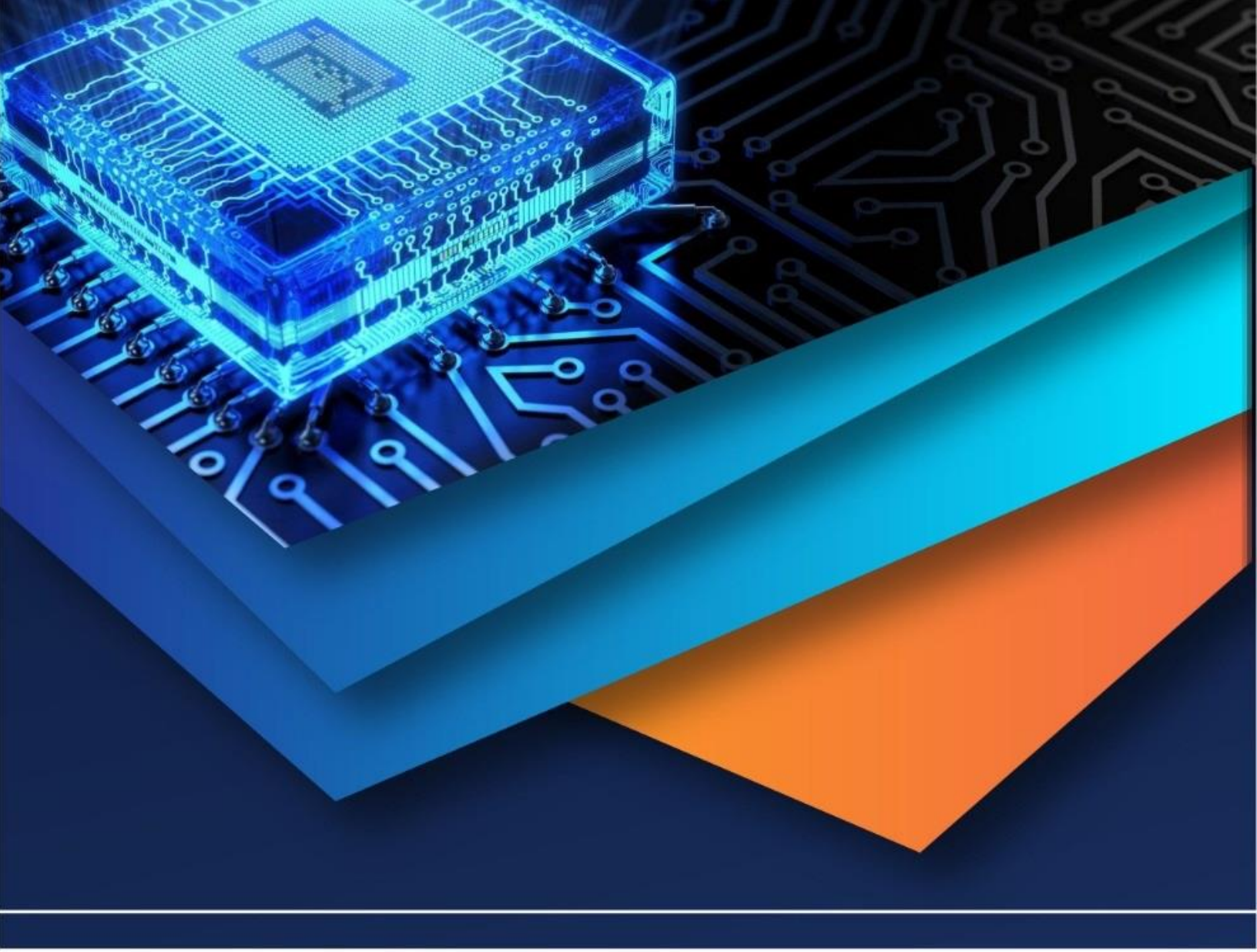
1) Effect on the strength of fly ash concrete by using different water cement ratio should be tested.
2) For use of Fly Ash Concrete as a structural material, it is necessary to investigate the behaviour of reinforced concrete under flexure, shear, torsion and compression.
3) The logistics of implementing 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.
4) The variation in different grade of concrete is investigated to determine the best source of Fly Ash for the use in concrete.

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