iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** VI **Month of publication:** June 2017

DOI:

www.ijraset.com
IC Value: 45.98

Volume 5 Issue VI, June 2017
ISSN: 2321-9653

International Journal for Research in Applied Science & Engineering Technology (IJRASET)

Effect of Proportion of Flyash and Plasticizer on High Strength Concrete [M60 Grade]

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Abstract: in the twentieth century concrete has brought about much technological advancement in all areas of construction. It is the current state-of-the-art technology in concrete construction. Hsc is a truly efficient building material continually being pushed to ever-greater strengths and newer used by leading professionals. And hsc is self-possessed for further development in the coming century and beyond. As we know in the ready mix and precast industries it is the result of on-going research and development to augment concrete ingredients, proportioning, mixing, placing, and quality control methods. For commercially available hsc, materials technology has perhaps out-paced available engineering information; accordingly, this publication has been developed to investigate the effect of 28 days compressive strength of the concrete with varying proportion of fly and chemical admixture and results were encouraging.due to the excessive dosage of chemical admixture the final setting time of the concrete was delayed.

key words: high strength concrete, fly ash, super plasticizer.

I. INTRODUCTION

High Strength Concrete is required in engineering projects that have concrete components that must resist high compressive loads.HSC is typically used in the erection of high rise structures. It has been used in components such as columns (especially on lower floors where the loads will be greater, shear walls and foundations. High strengths are also occasionally used in bridge applications as well. High strength concrete (HSC) may be defined as concrete with a specified characteristic cube strength between 40 and 100 N/mm^2, although higher strengths have been achieved and used. Strength levels of 80 to 100 N/mm^2 and even higher are being used for both precast and in-situ works. In high rise structures, high strength concrete has been successfully used in many countries across the globe. High Strength Concrete is occasionally used in the construction of highway bridges.HSC also permits reinforced or prestressed concrete girders to span greater lengths than normal strength concrete girders. High Strength Concrete enables to build the super structures of long span bridges and to enhance the durability of bridge decks.

II. MATERIALS FOR HIGH STRENGTH CONCRETE

A. Cement

A high quality binder is necessary for High Strength concrete. Cement that yields high compressive strength at a later stage is obviously preferable. The use of fine cementitious material such as micro silica or fly ash is useful as the fine particles grading would be extended; which would result in good filler action and reduced porosity. Furthermore, the pozzolanic reaction with Portland cement would further strengthen the cement matrix and improve the bond strength between aggregates and the paste. Since the cement content of High Strength Concrete is unavoidably high, the heat of hydration resulting from the exothermic reaction of cement with water is high. Hence it would be advantageous to use an additional cement replacement material such as Silica fume or Fly ash etc. which is locally available in the market. Also the use of such cement replacements would improve the impermeability of concrete to chlorides and sulphates; thus, the durability especially in relation to steel reinforcement, corrosion protection would be improved.

B. Coarse aggregate

Since coarse aggregate forms the largest fraction of volume of concrete the characteristics of aggregates significantly influence the strength of concrete. The size of coarse aggregate plays an important role in determining the strength of concrete. In normal strength concrete, as the size of coarse aggregate increases, the water requirement reduces. So the net effect is gain in strength. But in High Strength Concrete large size of coarse aggregate tends to reduce the strength. It may be attributed to smaller surface area available for bonding. Cement-Aggregate bond increases as aggregate shape changes from smooth and rounded to smooth and angular, and this must be considered for selecting the aggregate for HSC.

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C. Fine aggregate

The shape and surface texture of fine aggregate has a greater influence on water demand of concrete because fine aggregates contain a much higher surface area for a given weight. Rounded and smooth fine aggregate particles are better from the view point workability than sharp and rough particles. This project involved use of locally available, moisture free fine aggregate. The following are the various tests that are carried out on the fine aggregate.

The locally available sand is used as fine aggregate in the present investigation. The sand is free from clayey matter, salt and organic impurities. The sand is tested for various properties like specific gravity, bulk density etc., in accordance with IS 2386-1963(28).

Table1: Physical properties of materials

S.NO	Material	Value
Cement-Portland pozzala cement (53 Grade)		
1	Fineness of cement	1%
2	Normal Consistency	30%
3	Specific gravity	3.15
4	Initial Setting Time (30Min)	5mm from Bottom.
Coarse aggregate -12.5mm(granular)		
1	Specific gravity	2.56
2	Aggregate Impact value	14.46%
3	Fineness of modulus	8.22
4	Aggregate Crushing Value	16.58%
Fine Aggregate –River Sand		
1	Fineness of modulus	2.87
2	Specific gravity	2.61

D. Admixture

Admixture are widely Increased Workability and durability for High strength concrete .These materials include chemical admixture and mineral admixture.

E. Chemical Admixture

Water-Cement ratio plays a vital role in achieving High Strength Concrete. Reduction in water content increases the strength considerably. This can be achieved by using water reducing admixture or super plasticizer. The use of super plasticizer generally reduces the amount of water required by 15%-40%.Super plasticizers are usually the chemical compounds like Sulphonated Melamine Formaldehyde(SMF),Sulphonated Naphthalene Formaldehyde(SNF) and Modified Lignosulphonates.SMF and SNF based admixtures are the most commonly used. They work by helping the particles of cement to disperse when water is added, which causes the cement paste to behave more like a fluid.

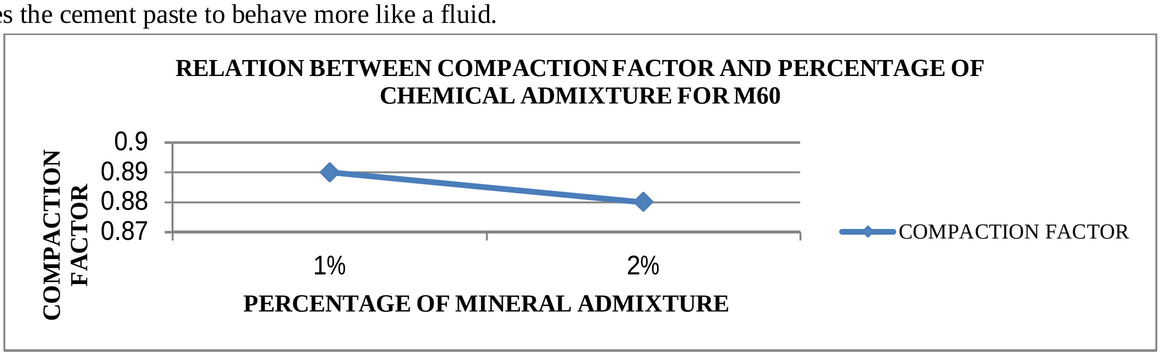

Fig-1Variation of compaction factor with percentage change in chemical admixture for M60

F. Mineral Admixture

These admixtures are generally natural or by product materials. Mineral admixtures generally include fly ash, silica fume, ground

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granulated blast furnace slag. Fly ash is produced as a byproduct of combustion of pulverized coal in electric power generating plants. Silica fume is a byproduct resulting from the reduction of high purity quartz with coal in electric arc furnaces in the manufacture of Silicon or Ferro Silicon alloys. Ground granulated blast furnace slag is obtained by quenching molten iron slag from a blast furnace in water or steam, to produce a glassy, granular product that is then dried and ground into a fine powder.

Component	*Proportion (Wt. %)*
SiO_2	51
Al_2O_3	12
Fe_2O_3	7
MgO	2
SO_2	4
C	2
H_2O	3

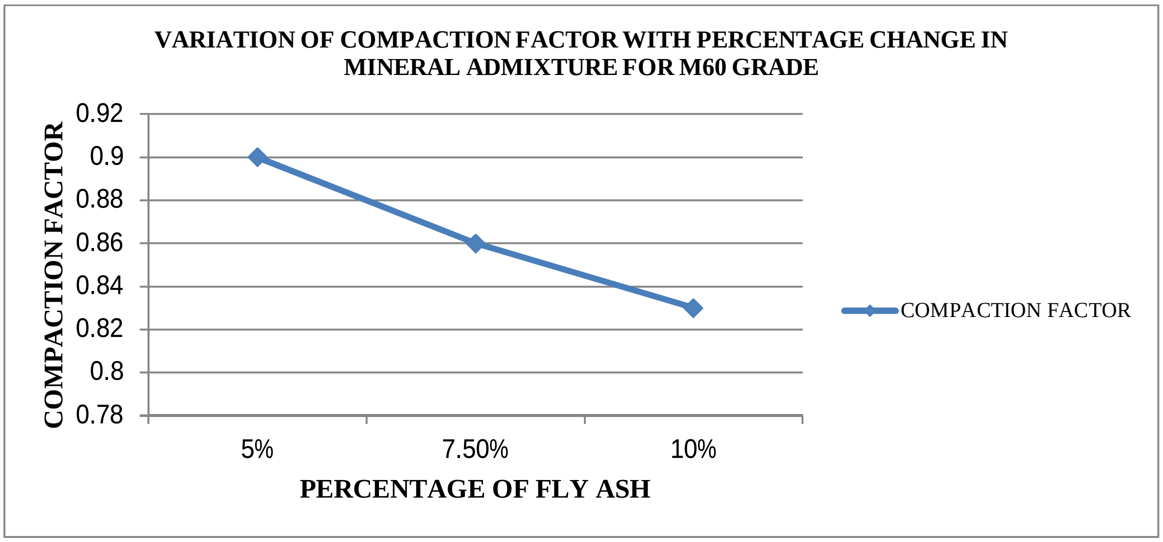


Fig-2Variation of compaction factor with percentage change in mineral admixture for M60

III. MIX DESIGN

The main aim of the project was to achieve a mix proportion for M60 and M70 in the laboratory that we can propose for further use and can be used to calculate cost for the above grades of concrete. To get the control mix Entropy and Shack lock graphs were used during the first trials. It was designed for low workability.

Mix Design can be defined as the process of selecting ingredients of concrete and determine their relative proportions with the object of producing concrete of certain minimum strength and durability as economically as possible. The object of any mix proportion method is to determine an economical combination of concrete constituents that can be used for a first trail batch to produce a concrete that is close to that which can achieve a good balance between the various desired properties of concrete at the lowest possible cost.

A. The mean design strength is obtained by applying suitable control factors to the specified minimum strength.
B. For a given type of cement and aggregates used, the reference number corresponding to the design strength at a particular age is interpolated from the graphs.
C. The water-cement ratio to achieve the required workability and corresponding to reference number is obtained from the aggregates with maximum sizes of 20 mm and 10 mm.
D. The aggregate-cement ratio to give the desired workability with the known water-cement ratio is obtained by absolute volume method.

Batch quantities are worked out after adjustments for moisture content in the aggregates

Mix Proportions: 1:1.29:2.95:0.35

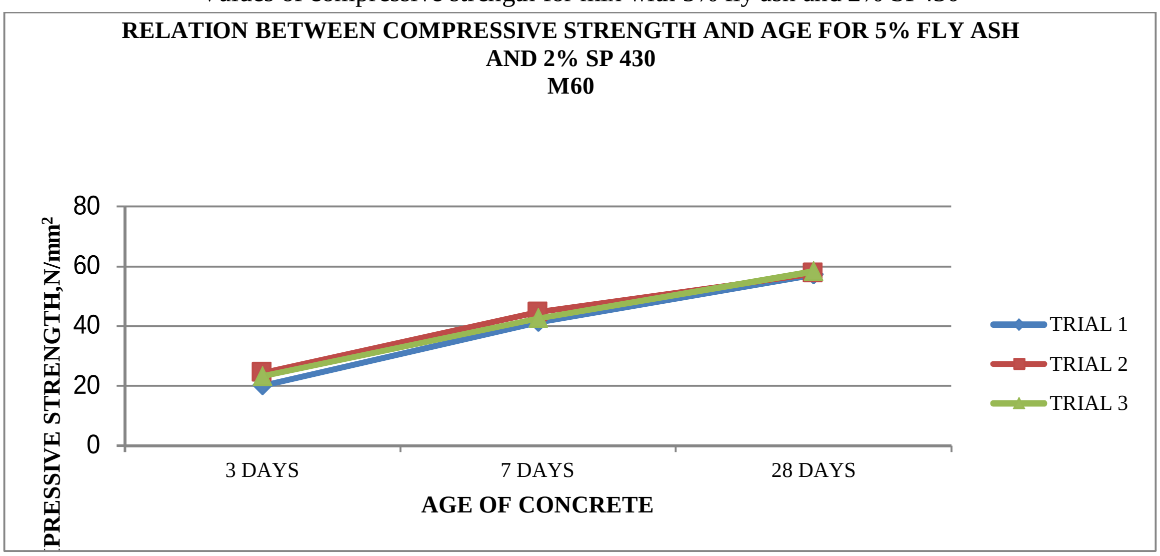
Mix	Cement (Kg)	Fine aggregate (Kg)	Coarse aggregate (Kg)	Water (Kg)	Fly ash (Kg)	SP 430 (Kg)
3	420.70	542.61	1241.86	155	22.14	8.86
4	420.70	544.18	1245.44	155	22.14	4.42
5	409.64	544.18	1245.44	155	33.21	4.42
6	398.56	544.18	1245.44	155	44.28	4.42

IV. RESULTS

A. *Compressive Strengths*

Table	Trial No.	3 Days(N/mm^2)	7 Days(N/mm^2)	28 Days(N/mm^2)
`1	1	20.12	41.37	57.2
	2	24.40	44.70	57.64
	3	23.20	42.60	58.30

Values of compressive strength for mix with 5% fly ash and 2% SP430



Relation between compressive strength and age for 5% Fly Ash and 2% SP 430

Table	Trial No.	3 Days(N/mm^2)	7 Days(N/mm^2)	28 Days(N/mm^2)
2	1	29.40	37.10	61.28
	2	30.20	42.70	59.73
	3	29.80	41.30	58.97

Values of compressive strength for mix with 5% fly ash and 1% SP430

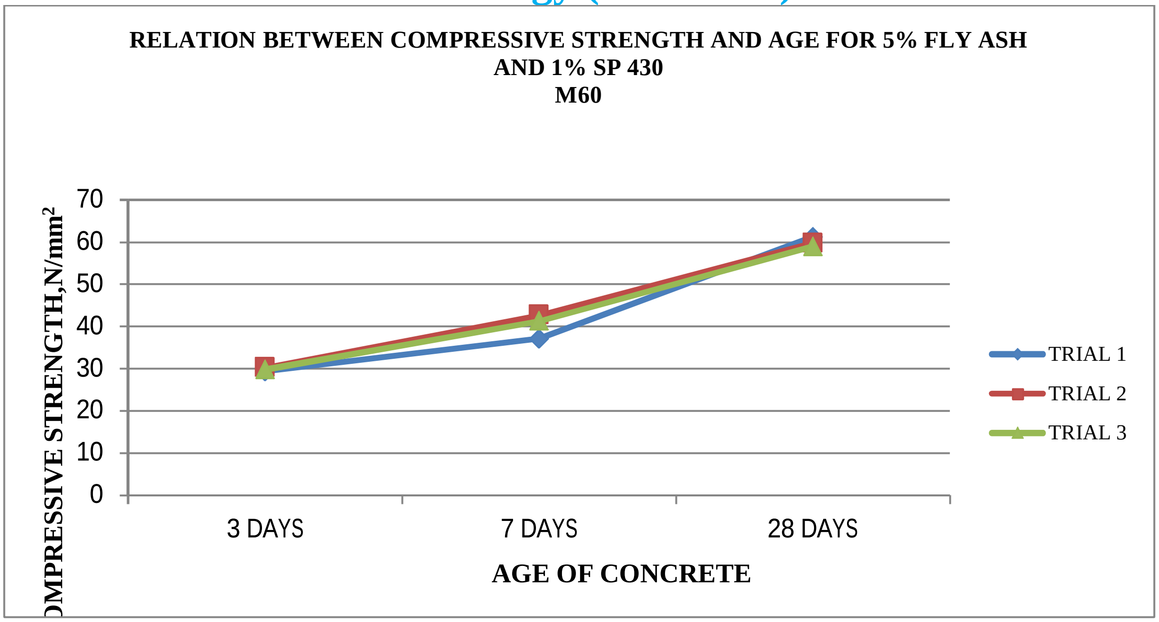


Table	Trial No.	3 Days(N/mm^2)	7 Days(N/mm^2)	28 Days(N/mm^2)
3	1	24.70	39.50	58.20
	2	23.02	40.70	58.90
	3	22.16	43.92	59.60

Values of compressive strength for mix with 7.5% fly ash and 1% SP430.

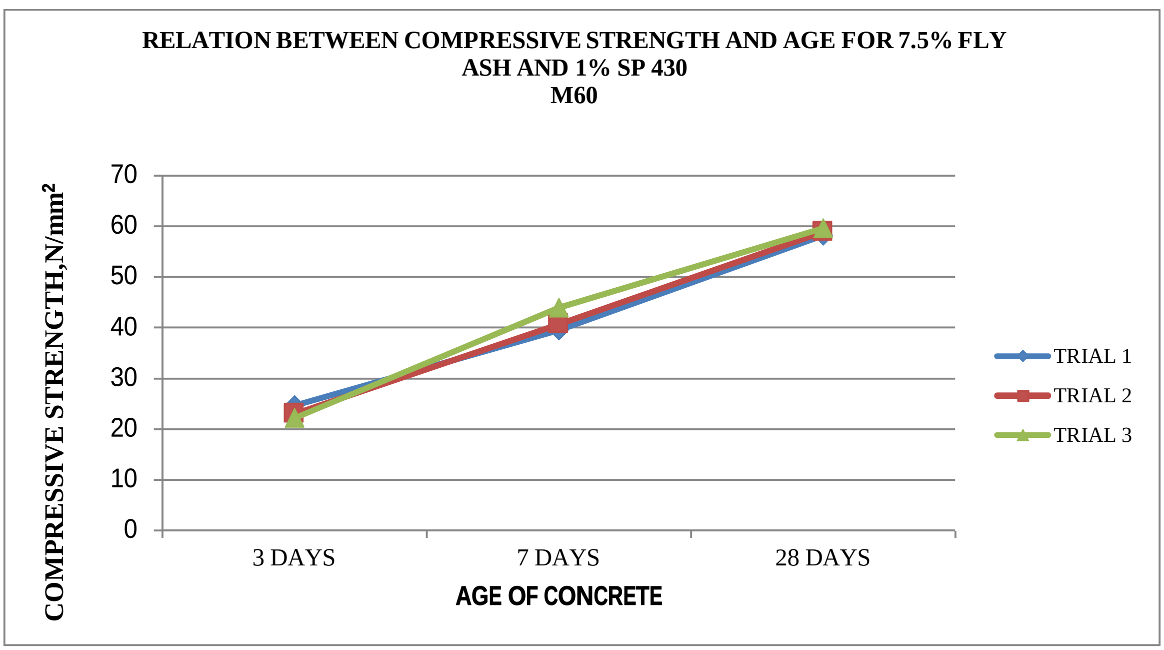
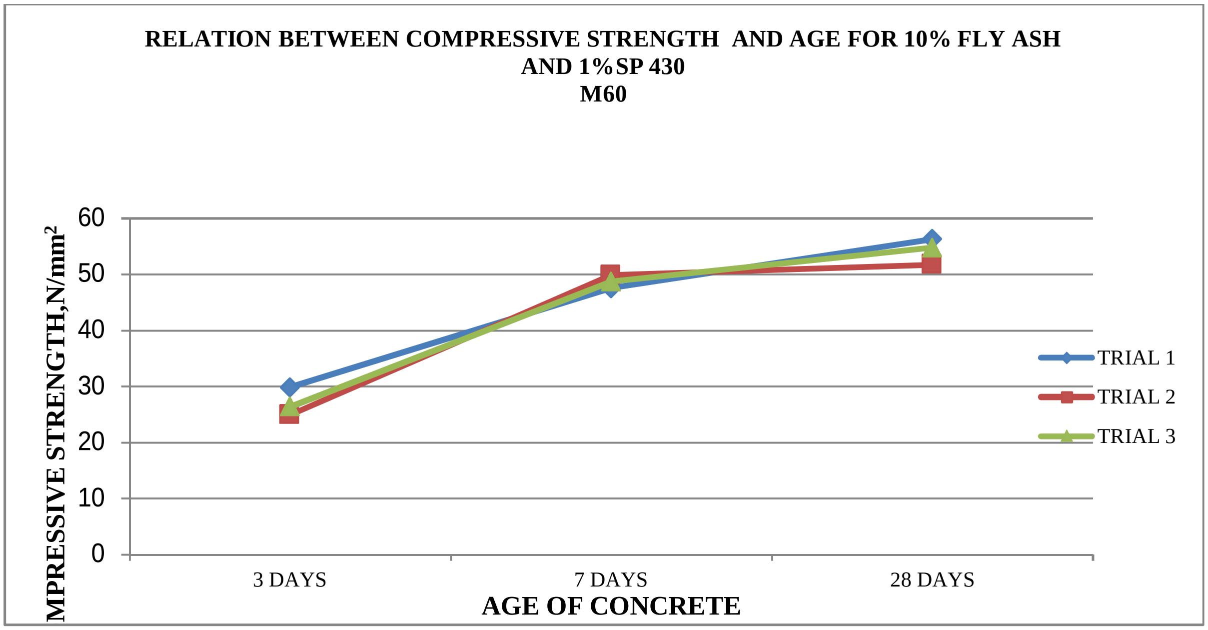


Table	Trial No.	3 Days(N/mm^2)	7 Days(N/mm^2)	28 Days(N/mm^2)
4	1	29.90	47.60	56.30
	2	24.96	49.90	51.73
	3	26.40	48.75	54.80

Values of compressive strength for mix with 10% fly ash and 1% SP430



V. ACKNOWLEDGEMENT

At first, we would like to thank everyone who contributed to our education and research at VITAM COLLEGE OF ENGINEERING during the last 2 years of stay in the campus. I wish to express my sincere thanks to Dr.V. SRIDHAR PATNAIK Principal of VITAM. College of Engineering for extending his support and co-operation in providing all the requirements for successful completion of the project We would like to express my gratitude to Mr.V. Ramachandra for his guidance and supervision throughout this work, without which we would never have completed this work. I wish to express my thanks to Dr. P. SRIDHER Head, Department of Civil Engineering, VITAM College of Engineering, for his support and encouragement during the period of my dissertation work. I thank all the other faculty members for their moral support during the course work of the PG Programme. I thank all my fellow classmates of the PG Programme for their mutual cooperation and technical staff of structures laboratory who helped me in the experimental programme.

VI. CONCLUSIONS

A. The compressive strengths of the concrete vary with change in percentage of fly ash i.e. with increase in fly ash content the compressive strength decreases.
B. The value of slump is increased from 10 mm to 100 mm with change in the percentage of chemical admixture. Also the value of slump increased with decrease in the content of mineral admixture.
C. Compaction factor of the concrete decreased with increase in percentage of mineral admixture.
D. The values of compaction factor decreased with increase in percentage of chemical admixture.
E. Also the values of 28 days compressive strength decreased with percentage increase in fly ash.
F. Due to the excessive dosage of chemical admixture the final setting time of the concrete was delayed.

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G. Recommendations for Further studies

There are several points that were noted through the process of theses thesis, which are worthwhile investigating in order to extend and get more accurate results of the desired concept of the inclusion of fly ash as either partial replacement of cement or fine aggregate.

H. Fly Ash Classes

As was discussed in there are two different classes of fly ash class F and class C. So, it would be more efficient to investigate the effects of both classes on the mechanical properties of concrete. In other words, determining which class provides a higher compressive strength.

I. High level of fly ash replacement

In this research only up to 50% of either cement or fine aggregate was replaced by fly ash. High volume of fly ash content was not discussed in this research; however it sounds like a great idea to be tested in further studies.

J. Compaction Method

A compaction method that would allow sufficient compaction should be developed. If such a method was developed, stable specimens would be obtained and therefore, reliable data would also be obtained.

K. Aggregate Types and Grading

This research could be taken further by investigating different aggregates such as recycled aggregate. Various grading such as blended aggregates of 10 and 7mm or 20 and 14 mm can be tested. In addition to that, the optimum aggregate size and grading that provides the highest compressive strength should be discovered.

L. Cube Test

A cube test if the compressive strength of the concrete mixes that were prepared for this research can be conducted, as it provides a more stable test specimen, and therefore a more accurate and reliable data. The results of the cube test along with the results of the cylinder test (which was done in this research) are compared in order to determine which test provides more accurate results.

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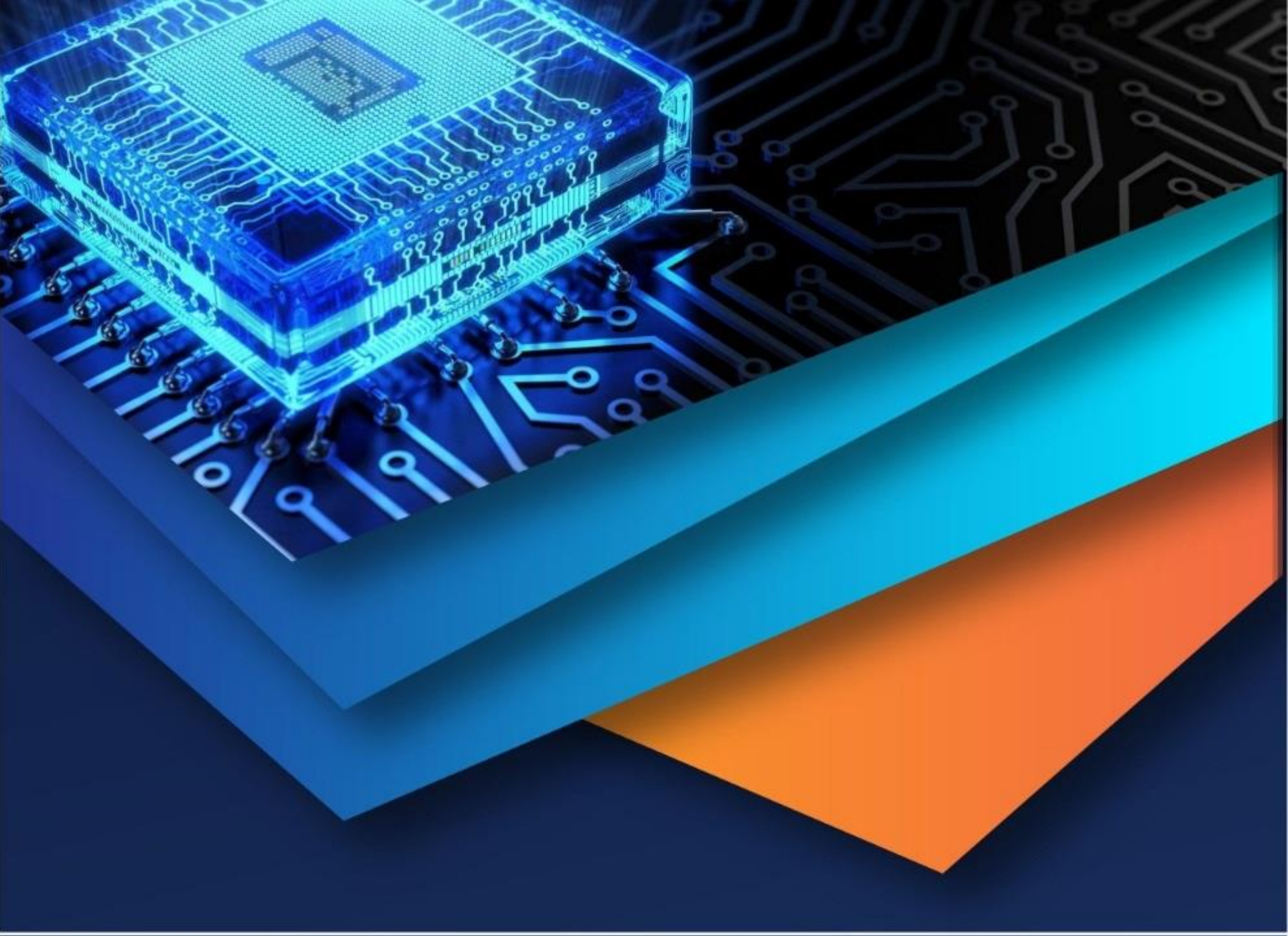

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