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Mountain Foot Bridge: Temporary Bridge Designed and Analyzed by Software STADDPRO

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Abstract: The curiosity in me about the bridge construction was the reason behind writing this paper. Beside this main reason was my family army background led me this way. As we all know India is surrounded by mountains and hills in the northern part. This will mainly concentrate on design; analysis of temporary bridge .This analysis is done by SADD PRO software. The bridge has an extraordinary use in emergency situations like earthquake, floods, hurricane or any specific rescue peoples in any extreme situation. Also I would like to highlight the importance of temporary bridge. This paper gives us the whole design and analytical reading conclusion of this mountain bridge. This bridge we have used two type of nose 1) Rectangle 2) Tetrahedron and analyzed that the bridge with rectangle nose gives more deflection than for tetrahedron

I. INTRODUCTION

The holy book of "RAMVIJAY" written by "Valmiki" in 500 chapters. In those many Chapters one of the few chapters were of the temporary bridge constructed by "vanar sena". This was constructed in 5th century BCE .Bridge was constructed to bridging gap between two places Rameshwaram and Sri Lanka across the Indian Ocean. Taking leaf out of the ancient history the Indian armed people used this tactics in Bangladesh war it was also called as "Engineers war" due to the temporary bridge constructed at the eastern front of India. Indians used same tactics at the western frontier also. The bridge was used in World War II, at that time it was called as Bailey bridge. As the time progressed the size of bridge changed as well as their material. The names started to change from bailey to Engineers Bridge, temporary to mountainous bridge. The names changed but their uses and the importance's hasn't changed a bit. Constructing a permanent bridge would cost much more and time required constructing is even more. Timing of bridge at their war situation costs both money and human lives that are most important for country. The name suggests Bailey it would be huge and it has many components. The components were too heavy to handle by their soldiers they needed the trucks to carry the components and also it required time to construct it. Mountainous bridge has less weight around 20 kg of each components which can carried by a single soldier also. Numbers of components are carried by soldiers on their shoulders, assembled in a very quick time as compared to Bailey bridge. Time taken by bridge to launch is nearly 2hr by 12-15 peoples. India is surrounded by mountains and hills from north and east side of the country, so need of the temporary bridge is very much on the cards.

II. METHODOLOGY

These are four stages of methodology

A. Manufacturing

All the components above are manufactured separately in the factory.
Manufacturing contract of all the components is given to L&T Company.
The main bridge parts or the truss of the main bridge is hollow from inside.
According to the design, proper holes and margins are left for bolting and passing the bridge from the rollers. Entire assembly of the bridge is done on site, by the soldiers, that to manually

B. Transportation

As the soldiers have to perform any unexpected tasks, any condition can occur in which they have to cross any hurdles coming in their way, like, rivers, valleys, trenches etc.
Hence, the transportation of the bridge components should be comparatively easy.
As the weight of the individual components is less, they can be carried on the soldier's shoulder or in hands.

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C. Launching

The launching is typically performed in a series of increments so that additional sections can be added to the rear of the superstructure unit prior to subsequent launches.

However, the incremental launching method (ILM) may often be the most reasonable way to construct a bridge over an inaccessible or environmentally protected obstacle.

When used for the appropriate project, smaller, but more concentrated area required for superstructure assembly.

ILM can be used to construct a bridge over a wide range of challenging sites which feature limited or restricted access.

D. Assembly

Placement of the rollers is the first step before starting the assembly.

Then Nose is assembled and placed on the rollers, and pushed in the forward direction.

Then the Main bridge is joined to the nose and pushed in the forward direction.

As the nose touches the end bank by 1 or 2 feet, the launching is stopped.

Two soldiers place the trolley on the nose and carry a set of rollers and jack to the other end.

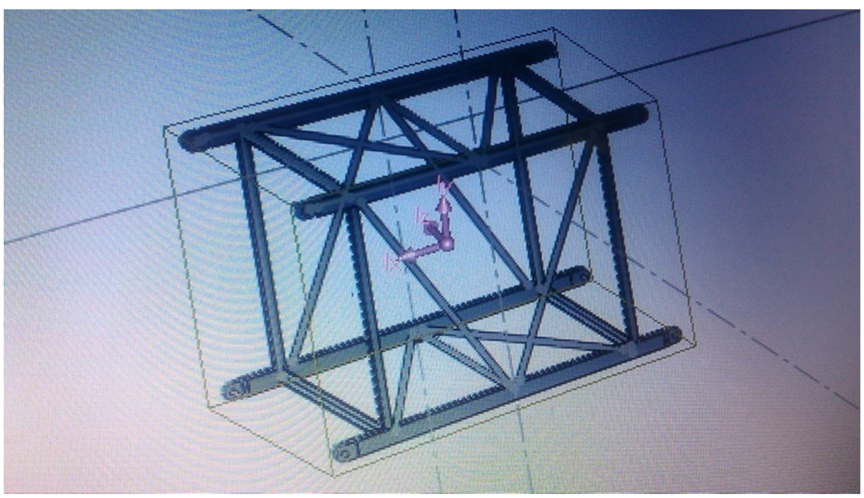
After the placement of rollers, the nose is placed on the rollers, manually.

Then the further launching is done, the rest of the bridge is assembled and pushed.

After achieving the wanted length, the launching is stopped, the nose is de-assembled and the bridge is jacked from both the ends.

Anchors are nailed and tied to bridge to avoid swaying.

III. RECTANGULAR NOSE STRUCTURE



A. Specifications

1) Total panels : 24
2) Aluminum Grade : 6061
3) Length of single panel : 1000mm c/c
4) Width of single panel : 690mm c/c
5) Height of single panel : 690mm c/c
6) Weight of single panel : 12 kg/m
7) Internal Strut Angle : 56O
8) Elastic Modulus : 70 GPa
9) Density : 27 kg/m3
10) Poisson's Ratio : 0.25

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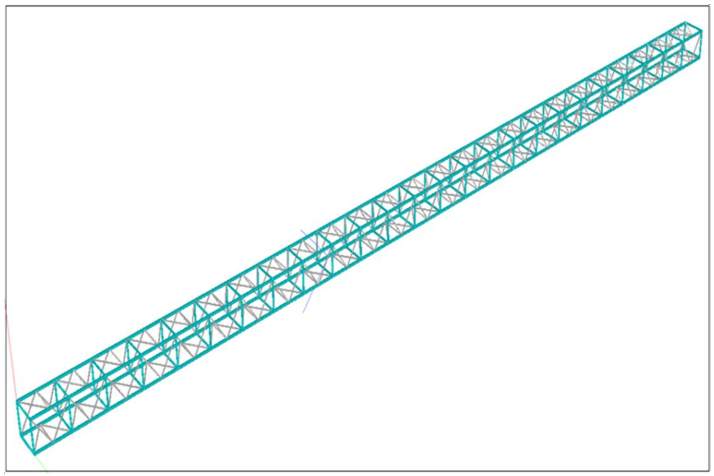
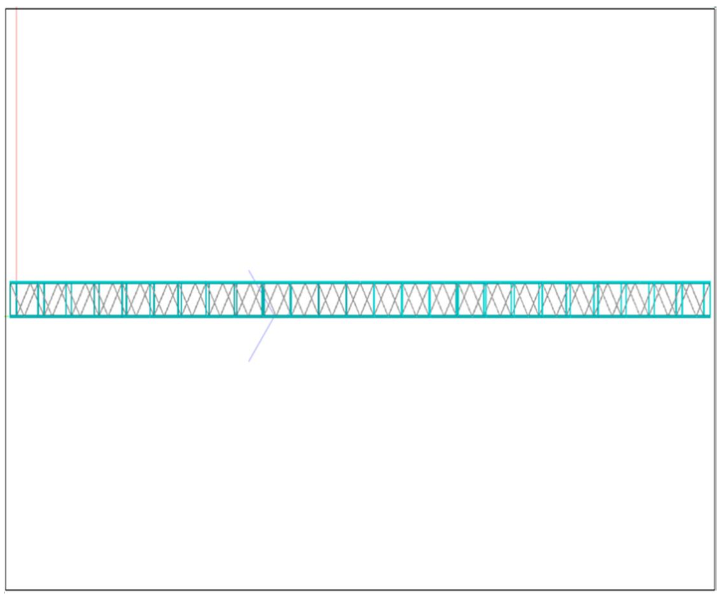
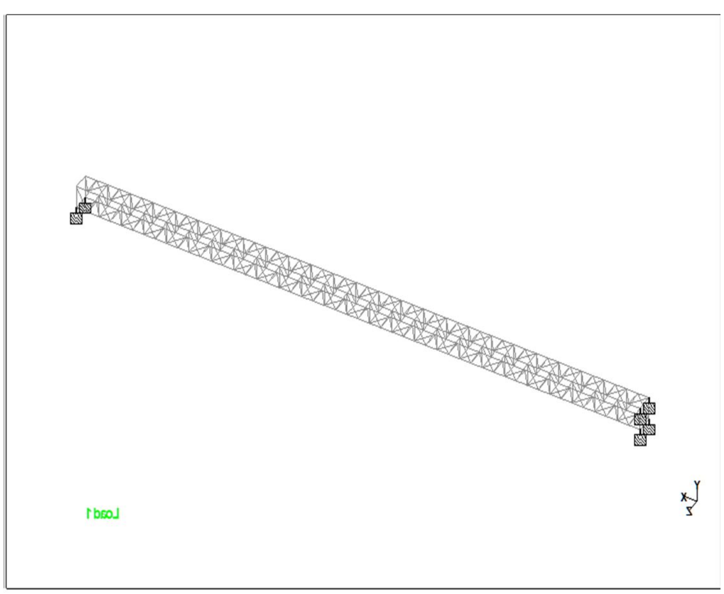
B. Structural views of Rectangular Nose







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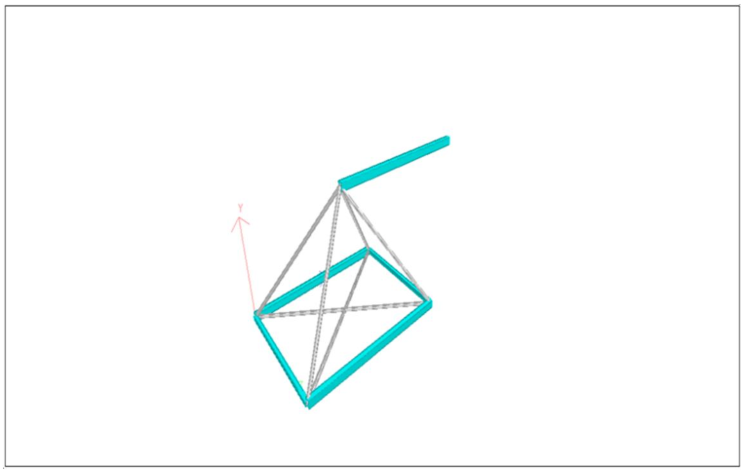
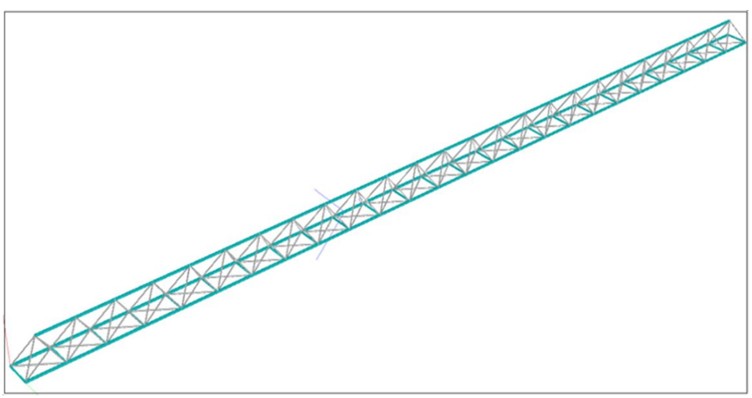
IV. TRIANGULAR TETRAHEDRON NOSE STRUCTURE

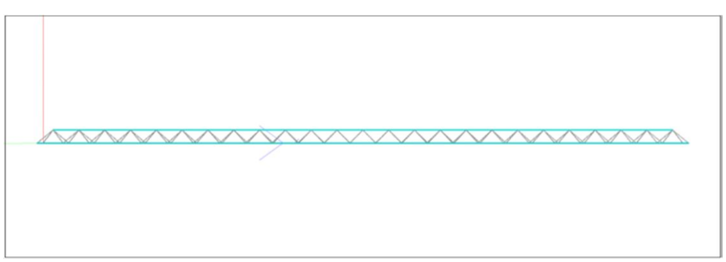


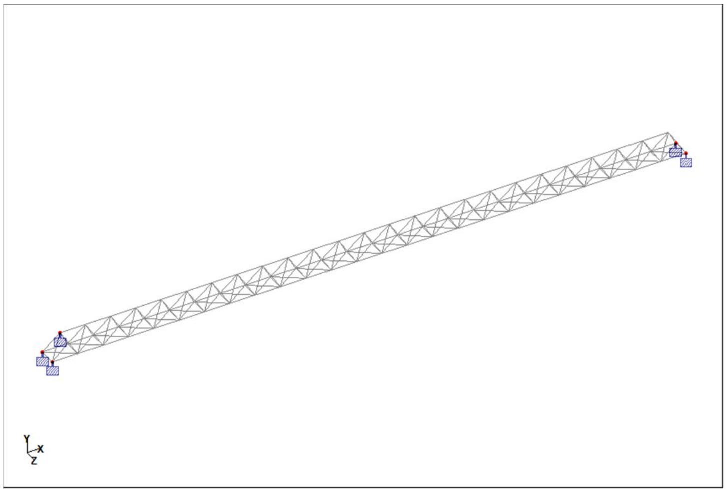
A. Specifications

1) Total panels : 24
2) Aluminum Grade : 6061
3) Length of single panel : 1000mm c/c
4) Width of single panel : 690mm c/c
5) Height of single panel : 690mm c/c
6) Weight of single panel : 7.73 kg/m
7) Slant height of panel : 850mm
8) Tetrahedron Angle : 48.87o
9) Bottom Bracing Angle : 38.45o
10) Elastic Modulus (E) : 70 GPa
11) Density : 27 kg/m3
12) Poisson's Ratio : 0.25

B. Structural Views

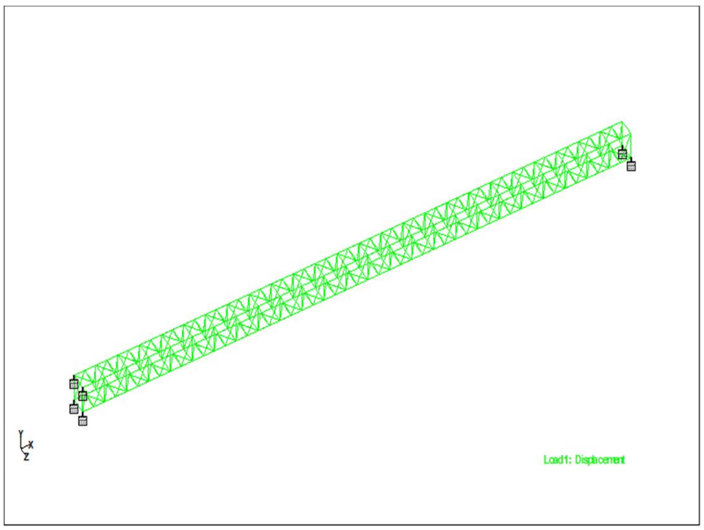




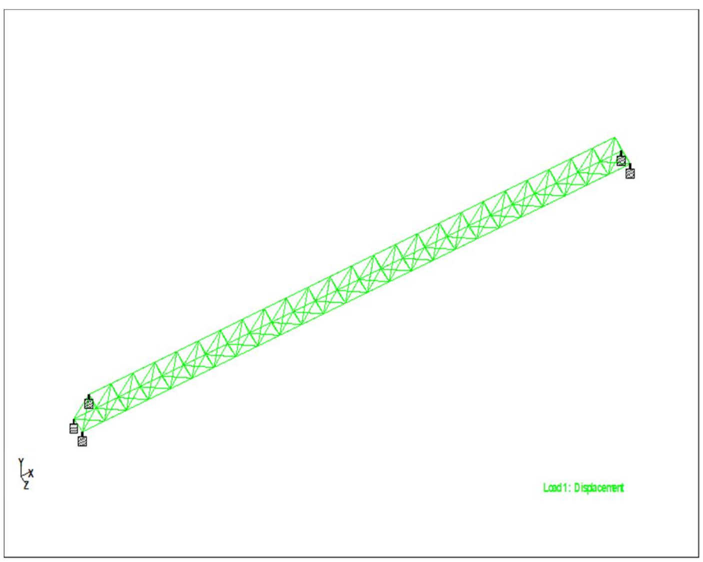


V. SOFTWARE RESULTS

A. Rectangular Nose Structure



B. Triangular Tetrahedron Nose Structure



VI. RESULTS COMPARISION

Specification	Rectangular Nose	Tetrahedron Nose
Total panels	24	24
Aluminum Grade	6061	6061
Weight of single panel	12 kg/m	7.73 kg/m ~ 8 kg/m
Total Weight	288 kg	192 kg
Number of Components	22	12
Area	0.982 m2	2.96 m2
Moment of Inertia	172.67 x 106	145.72 x 106
Overall Deflection(software)	-116.510 mm	-13.790 mm
Overall Deflection (Hand Calculation)	87.44 mm	66.57 mm
Elastic Modulus (E)	70 GPa	70 GPa

VII. CONCLUSION

From the above comparison we can analyze that the weight of single panel of tetrahedron is less than the rectangular nose, hence, the overall deflection of the tetrahedron nose is also less as compared to the rectangular nose. From that we conclude that the Tetrahedron nose is better than the rectangular nose. When connected to the Main bridge, it can be easily pushed to the far bank due to its light weight and less deflection, and make the Main bridge ready for crossing or rescue operations in emergency.

Emergence of a number of bridging systems in the post-cold war period, especially by the traditional leaders in the field, is a clear indicator that military bridging has a definite future in the future wars. While technology is driving some of the applications, operational compulsions will determine the choice of technology, equipment, and tactics in most cases.

Apart from these considerations, bridges have a place in the society and the national development. Military technologies can definitely make the future bridges in the world not just civil engineering structures; but as smart and intelligent structures that can help the process of development worldwide through new revolutionary concepts in communications. The investments in military systems of the past can help achieve these objectives in the decades to come. There are sufficient indicators, which have already reached the demonstration phase to support this hypothesis.

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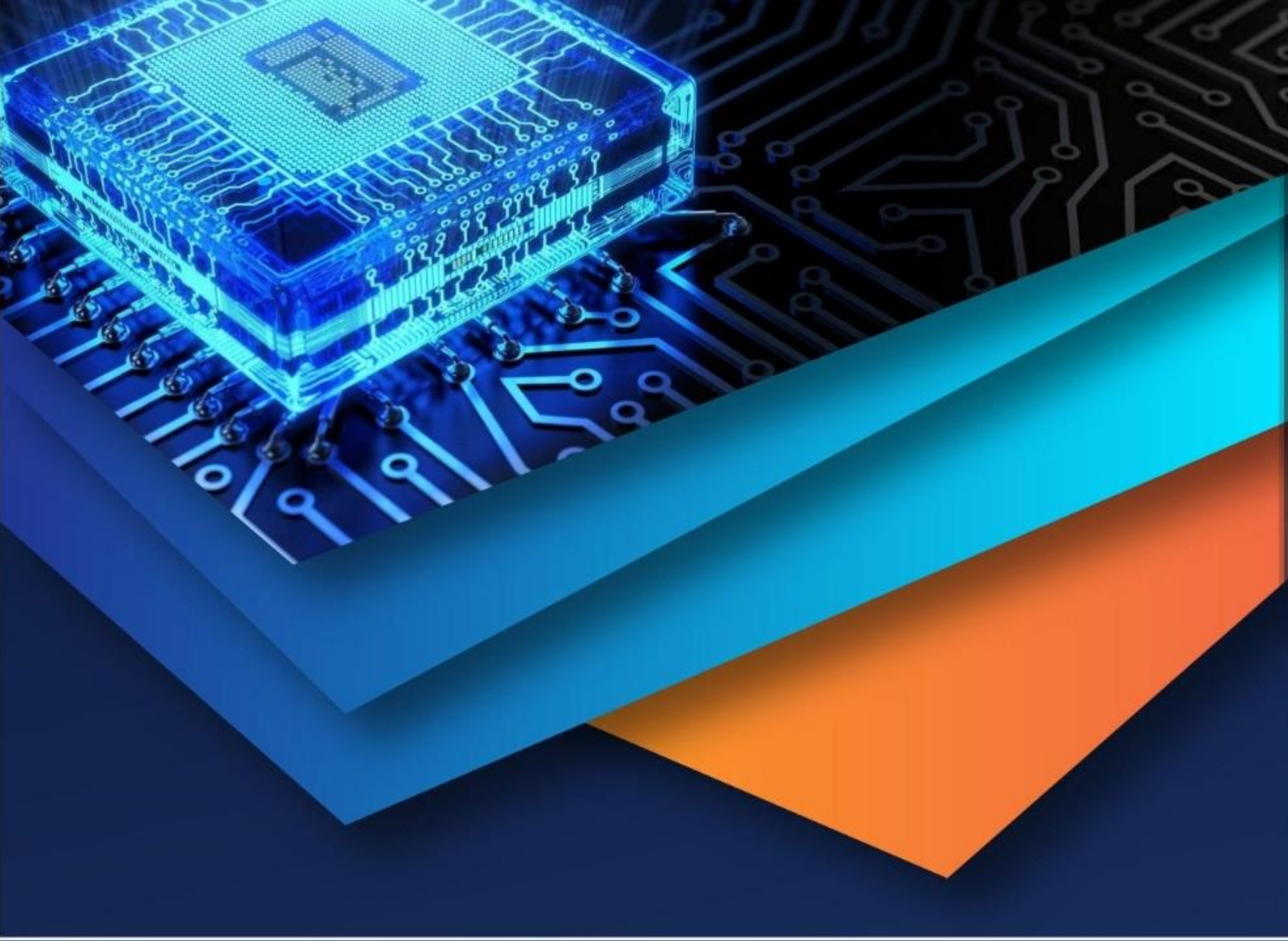

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