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Accidental Survey of Different Intersection of Junagadh City

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Abstract: ***Intersections are known to be high-risk areas for traffic accidents due to the convergence of different streams of traffic. By conducting an accidental survey, identify patterns and common causes of accidents. This study attempts investigation and analysis to prevent accidents at intersection which have high number of accidents. To get an insight into the trend of road accidents we collect last 3 years of accident data of different intersection of Junagadh city from District Traffic Office of Junagadh by taking permission from SP office Junagadh. And selected intersection is "Majevadi gate" Because in last 3 years, maximum number of accidents have occurred at this intersection. To reduce accidents at this intersection, we design a rotary intersection at the Intersection.***

Keywords: Road Accidents, Traffic Congestion, Road Intersection, Traffic Island, Rotary Design

I. INTRODUCTION

Road Network is the heart of a nation and transport services are considered as growth engines of the country. The increasing number of vehicles on the roads across the world has made the issue of congestion and accidents. Therefore, prevention and control of accidents has become the necessary. Intersections are known to be high-risk areas for traffic accidents due to the convergence of different streams of traffic. Road intersections play a crucial role in transportation systems as they facilitate the movement of vehicles and pedestrians. Analysing road intersections is essential for understanding their efficiency, safety, and overall performance. In order to deal with the traffic safety and vehicle safety of intersections, it is necessary to analyse the accident data in the intersection.

A. Need to study

Increased traffic volumes, infrastructure, and evolving urban dynamics have led to congestion, potential safety hazards, and inefficiencies at this intersection. To address these issues, research are needed to analyse accident data, assess safety conditions, and identify development opportunities.

B. Study Area

The Intersections I have selected is "Majevadi Gate" in Junagadh. Because in last 3 years, maximum number of accidents have occurred at this intersection.

II. OBJECTIVES

Following are the important objectives:-

1) Improved road safety, traffic management, urban planning, and overall transportation system effectiveness
2) Reducing accidents at intersections results in lower healthcare costs, vehicle repair expenses, and congestion-related losses. Survey-based interventions can lead to substantial economic benefits
3) Rotary Island help to reduce congestion and delays by keeping traffic moving in a circular motion instead of stopping at traditional intersections.
4) Rotary Island have been shown to be safer than traditional intersections
5) In Rotary Island by continuous traffic moving, they reduce the amount of time that vehicles are idling, which can lower emissions and improve air quality

III. DATA ANALYSIS

To collect accident data, first of all I take permission letter from the college. And visit all the police divisions for accident data but I did not get any data from all division they says we have no right share any accident data.

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So, I go to SP office Junagadh and request for accident data for my research, He will give me permission and suggest to get accident data from Junagadh District Traffic Office. Therefore, I go to the District Traffic Office of Junagadh with the permission of the SP office. I tell him, I want accident data of time of accident, vehicles involved, location and cause of accident etc. They ask me to give them me some time to collect accidental data as per my requirement After half a month they called me to collect accident data in hard copy from District Traffic Office Junagadh.

A. Analysis of different timing of Accidents

In Morning rush hour from 7am to 9am during this time may lead to an increased number of accidents due to heavy traffic and rushed drivers.

In Evening rush hour from 4pm to 6pm Similar to the morning rush, evening rush hour sees increased traffic and potentially tired or impatient drivers.

In Late Night from 10pm to 2am Fatigue, reduced visibility, and potential alcohol consumption may contribute to a higher risk of accidents during these hours.

B. Analysis of Various Reasons of Accidents

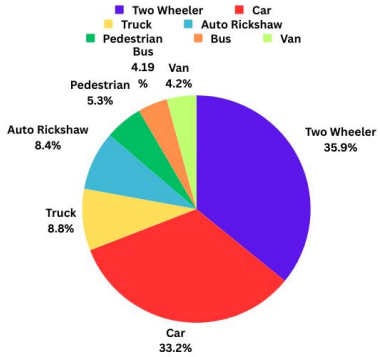
Accidents can occur for various reasons, and analysing these reasons is crucial for developing effective preventive measures. Here's an analysis of different factors contributing to accidents:

No.	Reasons of Accidents	Ratio of Accidents
1.	Over-Speeding	25.31%
2.	Distracted Driving	10.12%
3.	Overtaking in Wrong Manner	7.60%
4.	Bad Road Condition	5%
5.	Bad Weather Condition	1.8%
6.	Driving in the Wrong Lane	7.60%
7.	Running Traffic Light	3.80%
8.	Accident Due to Animal	8.86%
9.	Break Traffic Rules	2.53%
10.	Aggresive Driving	8.22%
11.	Drunk Driving	3.80%
12.	Drive Without valid Licence	1.26%
13.	Vehicle Defect	2.53%
14.	Using Mobile while Driving	11.33%

[Table 3.2.1 - Analysis Of Various Reasons of Accidents]

C. Analysis of Different Vehicles of Accidents:

Analysis of Different Vehicles of Accidents are given below



[Fig 3.3.1 - Accident Analysis of different vehicles]

IV. DESIGN OF ROTARY ISLAND

It may be described as an enlarged road intersection, where all entering vehicles can find suitable gaps to move around an island in one direction before they can "Weave" out of the traffic flow into their respective directions radiating from the island. With rapid growth of traffic it is experienced that widening of roads and providing flyovers have become imperative to overcome major conflicts at intersections such as collision between through and right-turn movements. In this way, major conflicts are converted into milder conflicts like merging and diverging. The vehicles entering the rotary are gently forced to move in a clockwise direction. They then weave out of the rotary to the desired direction.

A. IRC Guidelines For Selecting Rotary Intersection

Because of the above limitation, rotaries are not suitable for every location. There are few guidelines that help in deciding the suitability of a rotary. They are listed below

1) Lowest traffic volume for which rotary treatment should be considered is about 500 veh/hr.
2) The maximum volume, that a traffic rotary can efficiently handle, can be taken as 3000 veh/hr. entering from all intersection legs.
3) A rotary is advantageous at locations where the proportion of right turning traffic is high.
4) A rotary is preferable if there are other junctions so near, that there would be insufficient space for the formation of queues

B. Design speed

All the vehicles are required to reduce their speed at a rotary. Therefore, the design speed of a rotary will reduction, the geometry may lead to very large size incurring huge cost of construction. The normal practice is to keep the design speed as 30 and 40 KMPH for urban and rural areas respectively.
For Urban areas, V=30 Kmph

C. Shape of Central Island

The shape and disposition of central island depend upon various factors such the number and disposition of intersecting roads and traffic flow pattern. The conditions under which a particular shape is favoured are discussed below table:

Type	Remarks
Circular	Equal importance to all the roads meeting
Square with round edges	Suitable for predominantly straight ahead Flows
Elliptical, elongated oval or rectangular shapes	To favor through traffic/to suit the geometry of the intersecting legs/ to provide longer weaving lengths
Irregular	Shape is dictated by the existence of large number of approaches

[Table 4.3.1 - Conditions under which a particular shape]

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D. Radius of Rotary Roadway

Normal radius of roadway in curves,

$$R=\frac{v^2}{127(e+f)}$$

Where
f = coefficient of friction= 0.43 to 0.47
for v=30 kmph. F=0.47
e = super elevation (e) is neglected i.e. e = 0

$$R = \frac{30^2}{127\times0.47}$$
$$= \frac{900}{59.69}$$
R = 15m

E. Curves at Entrance and Exit

The radius at the entry depends on various factors like design speed, super-elevation, and coefficient of friction. The entry to the rotary is not straight, but a small curvature is introduced. This will force the driver to reduce the speed. The speed range of about 20 kmph and 25 kmph is ideal for an urban and rural design respectively.
The exit radius should be higher than the entry radius and the radius of the rotary island so that the vehicles will discharge from the rotary at a higher rate. A general practice is to keep the exit radius as 1.5 to 2 times the entry radius. However, if pedestrian movement is higher at the exit approach, then the exit radius could be set as same as that of the entry radius.
As per the IRC Guidelines
for V=30 Kmph,
Radius of Entry Curve=15m
Radius of Exit Curve = 1.5×Radius of Entry Curve = 22.5 m

F. Radius of Central Island

The radius of the central island is governed by the design speed, and the radius of the entry curve. The radius of the central island, in practice, is given a slightly higher reading so that the movement of the traffic already in the rotary will have priority of movement. The radius of the central island which is about 1.3 times that of the entry curve is adequate for all practical purposes.
Radius of Central Island=1.33×Entry curve radius = 19.95 m = 20m

G. Width of Carriage way at Entry and Exit (e1)

For Urban areas, 2-lane road with each 7 m width, Width of the Entry(e1)= 7 m

H. Width of Non-Weaving Section (e2)

Width of the Non-Weaving Section(e2)=7 m

I. Width of the Rotary(W)

The entry width and exit width of the rotary is governed by the traffic entering and leaving the intersection and the width of the approaching road. The width of the carriageway at entry and exit will be lower than the width of the carriageway at the approaches to enable reduction of speed. IRC suggests that a two lane road of 7 m width should be kept as 7 m for urban roads and 6.5 m for rural roads. Further, a three lane road of 10.5 m is to be reduced to 7 m and 7.5 m respectively for urban and rural roads. The width of the weaving section should be higher than the width at entry and exit. Normally this will be one lane more than the average entry and exit width. Thus weaving width is given as,

W= (e1 + e2) / 2 + 3.5
=10.5m

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J. Weaving Length(L):

The weaving length determines the ease with which the vehicle can maneuver through the weaving section and thus determines the capacity of the rotary. The weaving length is decided on the basis of the factors, such as, the width of weaving section, average width of entry, total traffic and proportion of weaving traffic in it. It is desirable to prevent direct traffic cuts and this can be achieved by making the ratio of weaving length to weaving width large enough. A ratio 4:1 is regarded as minimum.

L= W×4 = 10×4 = 42m

K. Capacity of Rotary Intersections (Qp)

The capacity of rotary is determined by the capacity of each weaving section. Transportation road research lab (TRL) proposed the following empirical formula to find the capacity of the weaving section

$$Qp = \frac{(280 \times W \left(1 + \frac{e}{W}\right) \times (1 - \frac{p}{3})}{1 + \frac{W}{L}}$$

Where,

W = width of weaving section

e = average width of entry and width of non-weaving section

L = weaving length

p = proportion of weaving traffic,

The proportion of weaving traffic to non-weaving traffic in the rotary is in the range of 0.4 to 1

assume p = 1 for minimum capacity

$$Qp = \frac{280 \times 10.5 \, (1+7/10.5) \times (1-1/3)}{1+(10.5/42)}$$

$$= \frac{3269}{1.25}$$

= 2615 pcu/hr

V. CONCLUSION

Design values of the proposed rotary intersection are given in below table:

1.	Shape of the Central Island	Circular
2.	Design Speed	30Kmph
3.	Radius of Rotary Roadway	15m
4.	Radius of Entry Curve	15m
5.	Radius of Exit Curve	22.5m
6.	Radius of Central Island	20m
6.	Width of Entry (e1)	7m
7.	Width of Non-Weaving Section (e2)	7m
8.	Width of Weaving Section (W)	10.5m
9.	Length of Weaving Section (L)	42m
10	Capacity of Rotary	2615PCU/hr

[Table 5.1 - Design values of the proposed rotary intersection]

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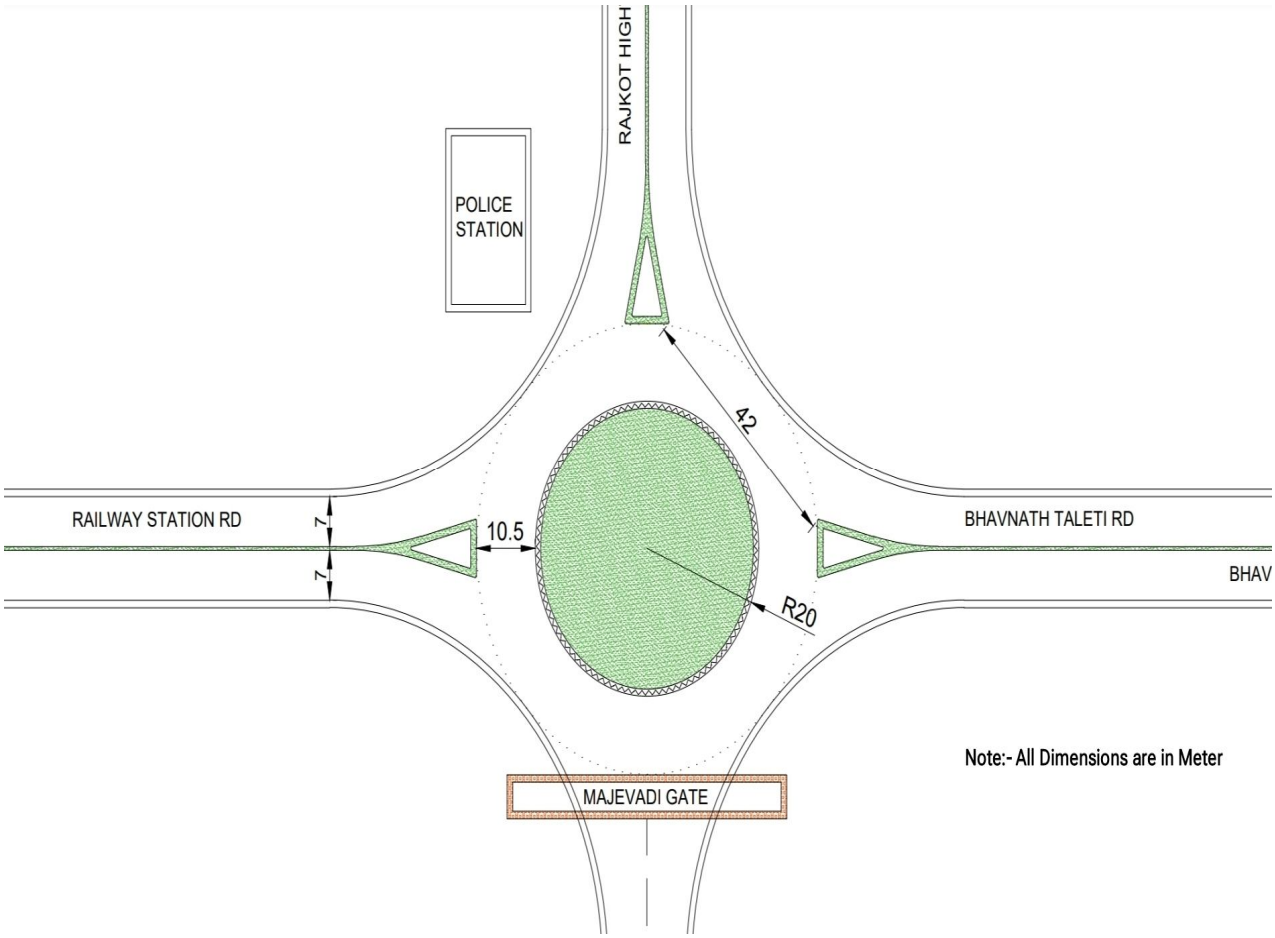
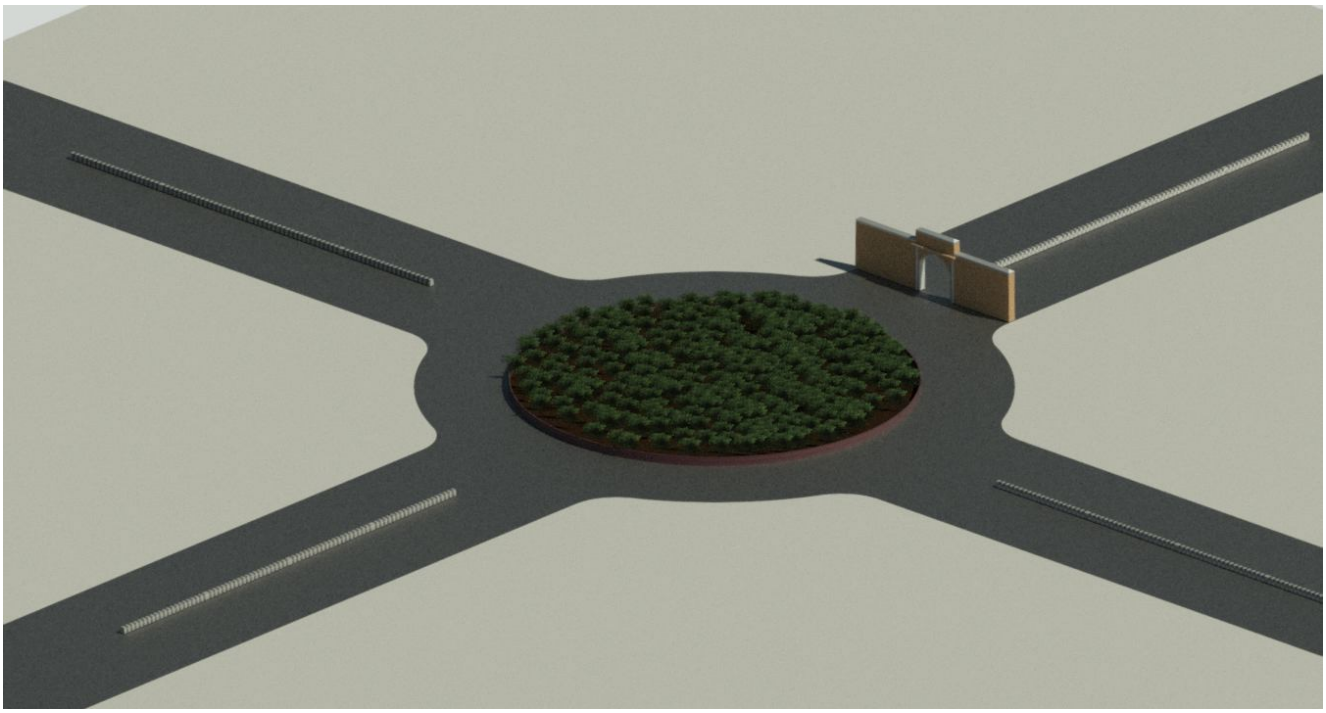
1) The calculated Capacity of the rotary is 2615PCU/hr. The observed traffic volume is less than the calculated capacity of the rotary. Hence the design of the rotary is effective. The proposed rotary intersection which is designed will be effective for 5-8 years from construction. Based on the condition, the rotary intersection can be redesigned with reference to present proposed design.
2) Improving traffic flow: Rotary Island help to reduce congestion and delays by keeping traffic moving in a circular motion instead of stopping at traditional intersections.
3) Enhancing safety: Roundabouts have been shown to be safer than traditional intersections
4) Reducing air pollution: Because rotary island keep traffic moving continuously, they reduce the amount of time that vehicles are idling, which can lower emissions and improve air quality.
5) Improving pedestrian safety: Roundabouts often have crosswalks and pedestrian islands that make it safer for pedestrians to cross the street.
6) Traffic rotary reduces the use of signal. It is self-governing and no vehicle stop at the rotary intersection. It also reduces the complexity of weaving traffic. Traffic rotaries reduce the congestion and provide smother movement of traffic. Basically it is preferred for larger area. Capacity analysis of rotary is done which is having the highest proportion of weaving traffic.
7) Enhancing aesthetics: Rotary Island can be designed with landscaping, public art, and other features that make them more visually appealing than traditional intersections. Overall, the main objective of rotary intersections is to provide a safer, more efficient, and aesthetically pleasing alternative to traditional intersections

A. *Layout Of 2D Design*



[Fig 5.1 - 2D Design of Rotary Island]

B. Layout Of 3D Design



[Fig 5.2 - 3D Design of Rotary Island]

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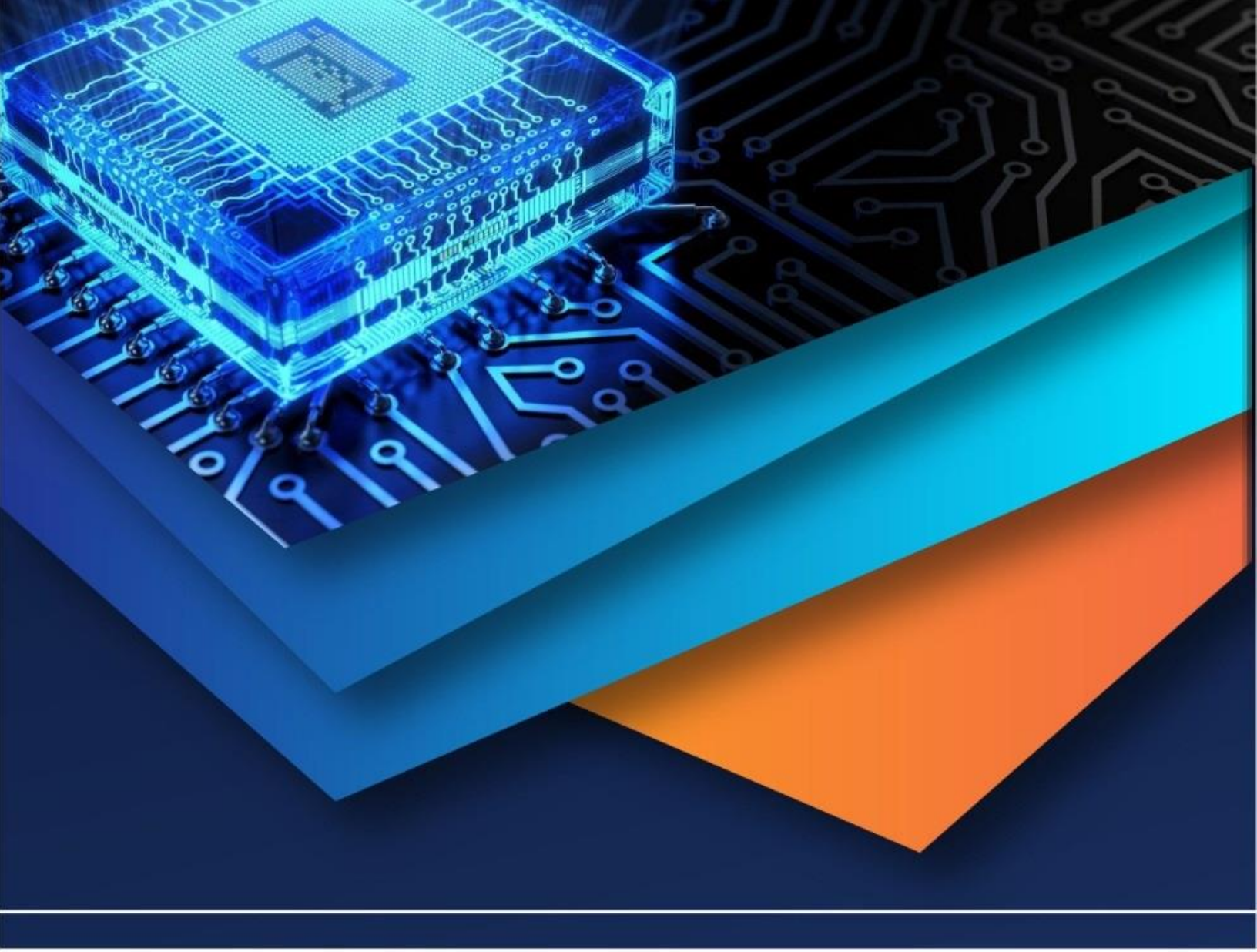

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