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Identification of Accident Points and Measures to Rectify them on National Highways

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Abstract: ***The road transport has increased at a tremendous rate in recent years but the roadway facilities have not developed at the same rate. This lag in the development has resulted in overstrain of traffic on the existing roads. The overburden of existing roads has created lot of problems to road users, led to traffic congestion and road accidents. The road accidents have become one of the most common causes of deaths and injuries in the world. The rise in road accidents is due to increase in traffic volume, higher vehicular speeds, insufficient carriageway, bad roads, poor traffic control, drunk driving, less public awareness etc. As reducing traffic flow is not practically possible so the solution of this problem lies in providing modern and efficient road design and traffic control devices. In this study the attempts have been made to locate the accident prone spots on national highway NH-344 (Ambala to Dehradun) as it is vulnerable highway for accidents in Haryana state of India. As this highway connects various cities and towns like Ambala, Yamuna Nagar, Roorke etc. there has been an exponential growth in the number of vehicles plying through this area which has enhanced the number of road accidents. The detailed causes of road accidents and their preventive measures have been studied to sum up this dissertation.***

Keywords: Traffic accidents, Black spots, weighted severity index

I. INTRODUCTION

A. General

The alarming rise in road accidents is one of India's worst kept secrets. Road accidents are a negative externality associated with expansion in road network, motorization and urbanization in the country. One of the major causes of the deaths and disabilities of humans in the world is because of road traffic accidents. In case of India, road injuries are one of the top four leading causes of death and health loss among persons of age group 15-49 years. The number of road accidents caused in the year 2016 was 4,80,652 resulting in the 4,94,624 injuries and 1,36,071 deaths of human lives in the country. Analysis of this data shows that in a year almost 1317 accidents and 372 deaths occur on Indian roads. Such alarming statistics only show the lack of proper road safety measures in the country.

The state of Haryana contributes a major part in India's alarming accident count. According to Government of Haryana Transport Department, road traffic accidents accounted for 50.4% deaths in Haryana in 2017, surpassing the national average of 36.4%. Ambala Cantt is one of the most crowded city in Haryana and one of the fastest developing cities in India. With the rapid growth of population in the city, the traffic problems are also increasing at an alarming rate. . Due to the improvement of pavement surfaces in past few years by the States, there is increase in the speed of the vehicles travelling on these roads. The accident mitigation process was divided into various steps to improve the physical condition of the roadways. The starting point of all the processes is identification of locations for safety improvement, which is known as Black Spot identification or hazardous location identification. It is necessary to identify right site for safety improvement, if not resources will be wasted on sites and the unsafe spots will go untreated and remain unsafe. Therefore, accident spot identification is an important step for their improvement. Methodologies to identify an accident spot may vary from place to place. For accident free highway, normal causes of accidents are taken into consideration during designing of national highway. In this dissertation, we will study accidental data collected from national highway Authority of India, analyzed by Weighted Severity Index Method and Accidental Density Method and black spots on national highways were found out.

II. STUDY AREA PROFILE AND METHODOLOGY

The National highway-344 passing through Ambala Cantt is one of the most important National highways of India as it provides the entrance to various states and connects the city with other states of Eastern India. In this dissertation, an attempt has been made to determine such accident prone areas, called black spots on National highway-344 from Ambala Cantt to Yamuna Nagar.

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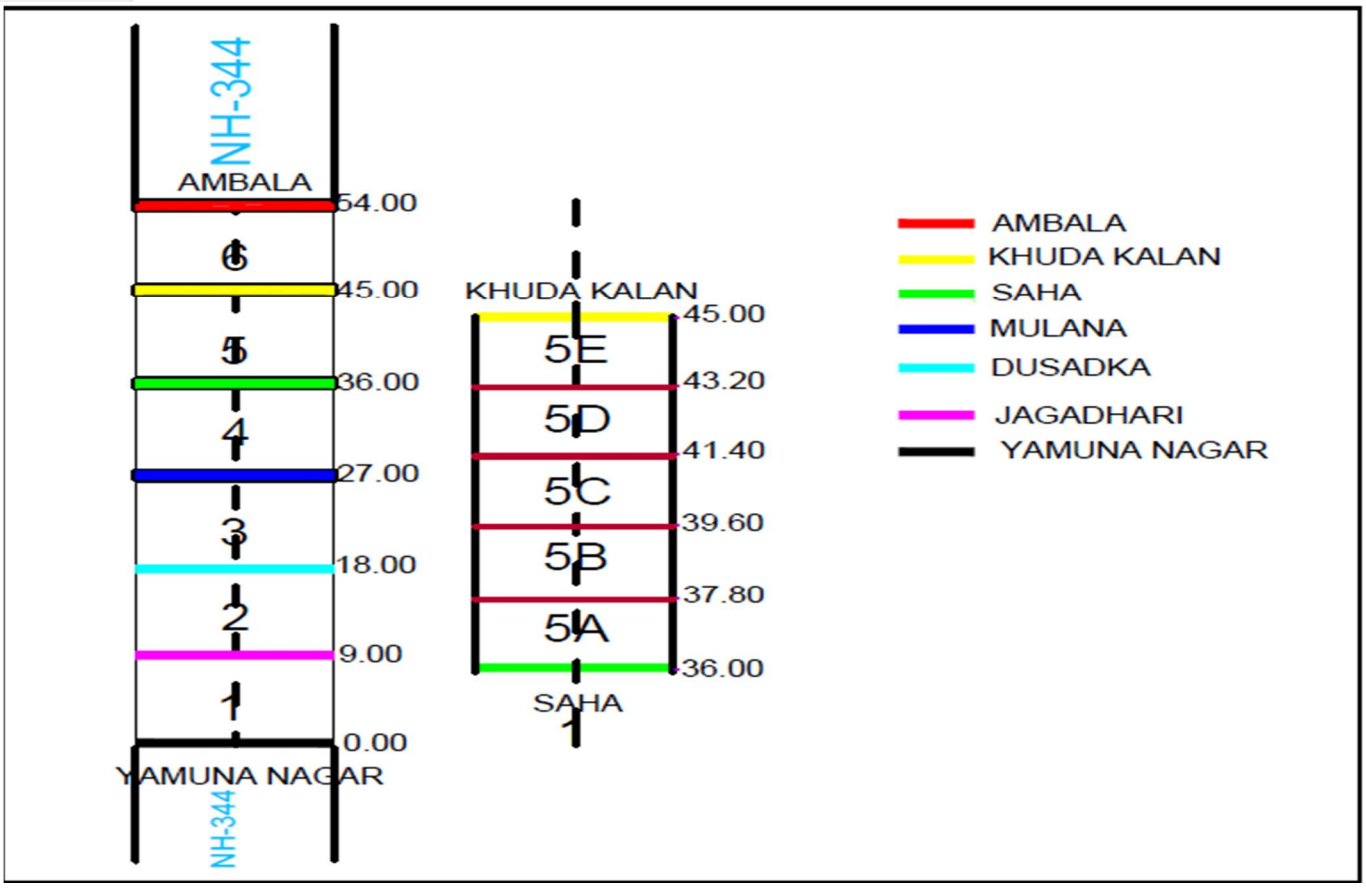

Fig. 1 Plan of study area

Methods for analyzing the hazardousness of locations include the following:

A. Spot Map Method

The simplest method for identifying hazardous locations is to examine an accident spot map. The map will show the spots or segments having the greatest numbers of accidents. This is an effective way to get a picture of the accident clusters in small areas.

B. Accident Frequency Method

The frequency method ranks locations by the number of accidents. The location with the highest number of accidents is ranked first, followed by the location with the second highest number of accidents, and so on. This method does not take into account the differing amounts of traffic at each location. Therefore, the frequency method tends to rank high volume locations as high accident locations, even if those locations have a relatively low number of accidents for the traffic volume. Many agencies use the frequency method to select a group of high-accident locations, and then use some other method to rank the locations in order of priority.

C. Accident Rate Method

The accident rate method compares the number of accidents at a location with the number of vehicles or vehicle miles of travel at a location. This comparison results in an accident rate. The rate is stated in terms of “accidents per million vehicles” for intersections (and other spots), and “accidents per million vehicle-miles of travel” for segments. The locations are then ranked in descending order by accident rate.

III. OBSERVATIONS AND DATA ANALYSIS

The data taken for the study is collected from various traffic outposts. The whole section is divided into six respective stretches each of 9 km starting from Yamunanagar as shown in the table below.

A. Accident Rate Method

Table 1 Accident rate for each section

Location	Stretch (Km)	Accident Rate
Location 1	9	23
Location 2	9	13
Location 3	9	13.67
Location 4	9	23.67
Location 5	9	38
Location 6	9	37.34

B. Accident Frequency Method

Table 2 Accident frequency for each section

Location	Distance from Origin (Km)	Stretch (Km)	Frequency
Location 1	0-9	9	15.5
Location 2	9-18	9	8.8
Location 3	18-27	9	9.2
Location 4	27-36	9	15.8
Location 5	36-45	9	25.6
Location 6	45-54	9	25.1
		Total	100

C. Weighted Severity Index

Table 3 WSI for each section

Location	**WSI**
Location 1	807
Location 2	760
Location 3	674
Location 4	1067
Location 5	1271
Location 6	988

It has been found that the highest value of WSI lies in the Location 5 i.e. between Saha and Khuda Kalan. Therefore, it can be predicted that the exact black spot over the entire stretch lies within this section.

By using 3 methods it has been found that the highest number of accidents in the Yamuna Nagar to Ambala Cantt stretch occurs within the section between Saha and Khuda Kalan. So, further analysis is carried out on the identified section to locate the exact black spot.

D. Accident Rate Method

Table 4 Accident rate for the accident prone zone

Stretch (Km)	Location	Accident Rate
1.8	Location 5A	10.2
1.8	Location 5B	18.33
1.8	Location 5C	41.67
1.8	Location 5D	41.67
1.8	Location 5E	43.33

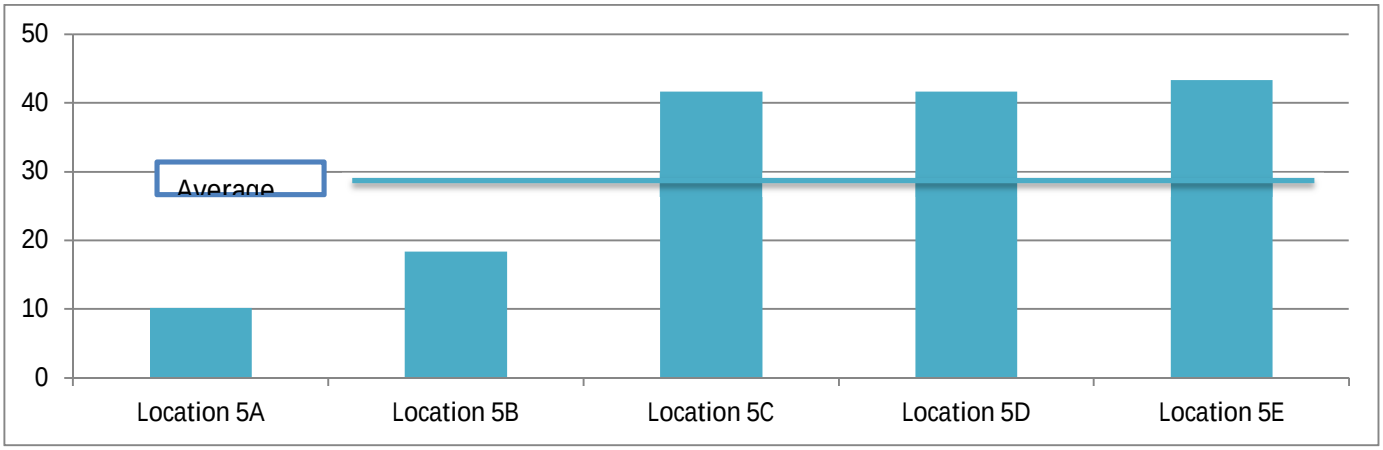

Fig. 2 Accident Rate Column Plot on the Accident Prone Zone

It is observed that the accident rate along 3 sections is more than the average accident rate of 34.67. These sections are-

1) Location 5C
2) Location 5D
3) Location 5E

E. Accident Frequency Method

Table 5 Accident frequency for the accident prone zone

Location	Accident Frequency
Location 5A	16.3
Location 5B	10.6
Location 5C	24.05
Location 5D	24.05
Location 5E	25

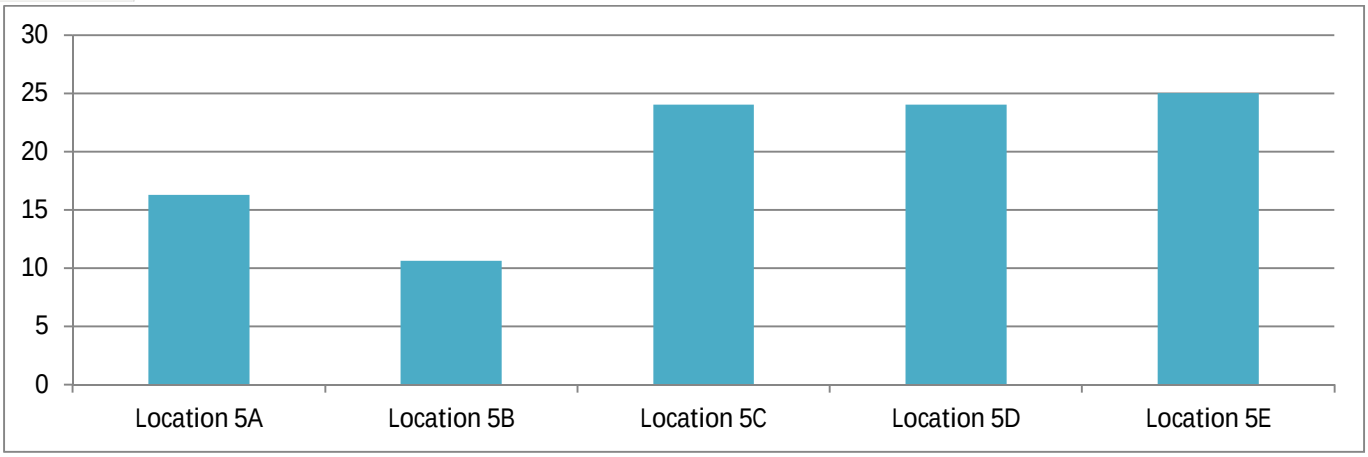

Fig. 3 Accident Frequency Column Plot on the Accident Prone Zone

5E has the highest accident frequency. Thus, this section is taken as a possible black spot.

F. Weighted Severity Index

Table 6 WSI for the accident prone zone

Location	WSI
Location 5A	208
Location 5B	104
Location 5C	187
Location 5D	263
Location 5E	449

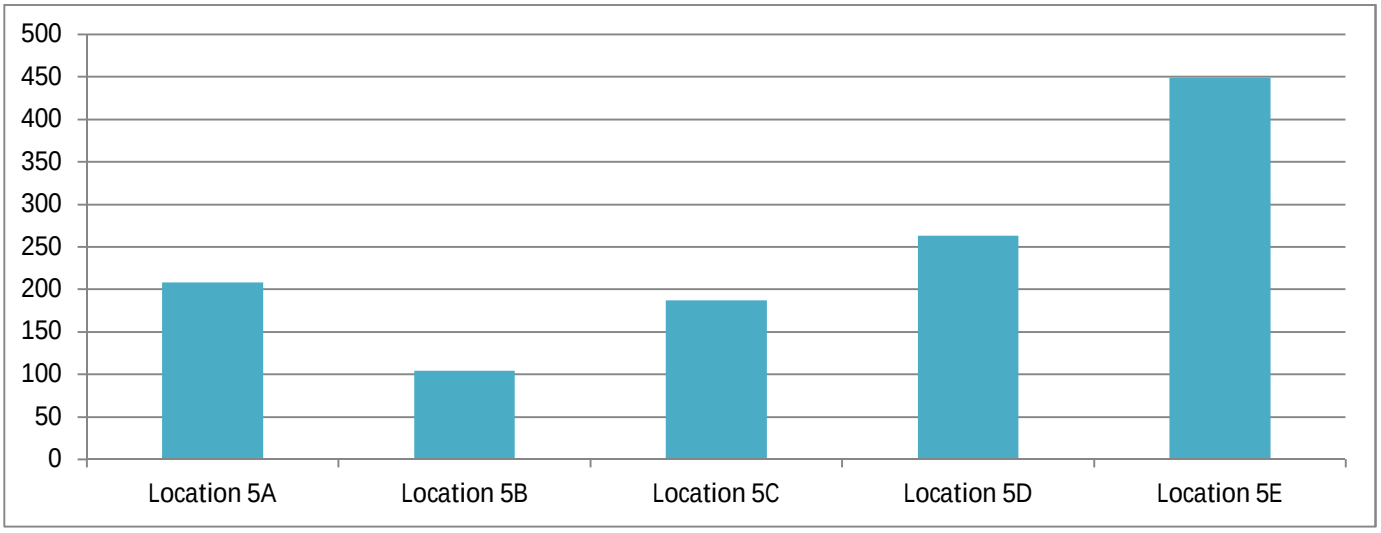

Fig. 4 WSI Column Plot on the Accident Prone Zone

Thus, all the sections having WSI value above 410 are classified as accident black spots.

IV. CONCLUSIONS

The conclusions that were drawn from this study are as follows A large number of unauthorized openings were found on national highway study stretch which should be closed down permanently to prevent accidents and reduce the traffic congestions. At accident spots the sight distance and overtaking distance should be enough to prevent any mishap. The horizontal and vertical curves should be designed as per recommended standards. The pavement surface characteristics like friction coefficient, unevenness, cross slopes and light reflecting characteristics should be given due consideration while designing a national highways. The median heights should be adequate to prevent the vehicles from passing over it. There should be a restriction on the height of trees in the median. The trees along the median obstruct the view of drivers as a result of which they are unable to see the pedestrians crossing the lanes. This is a root cause for pedestrian accidents which can be prevented by reducing the height of the trees in the median. More traffic control points should be installed in areas with high traffic flow. Vehicles often try to take a U-turn at open road dividers thereby causing serious accidents at these points. Hence, traffic control points should be installed at these dividers to control the movement of vehicles. Suitable measures should be taken to reduce the speed of vehicles. Separate bus bays should be provided to avoid accidents.

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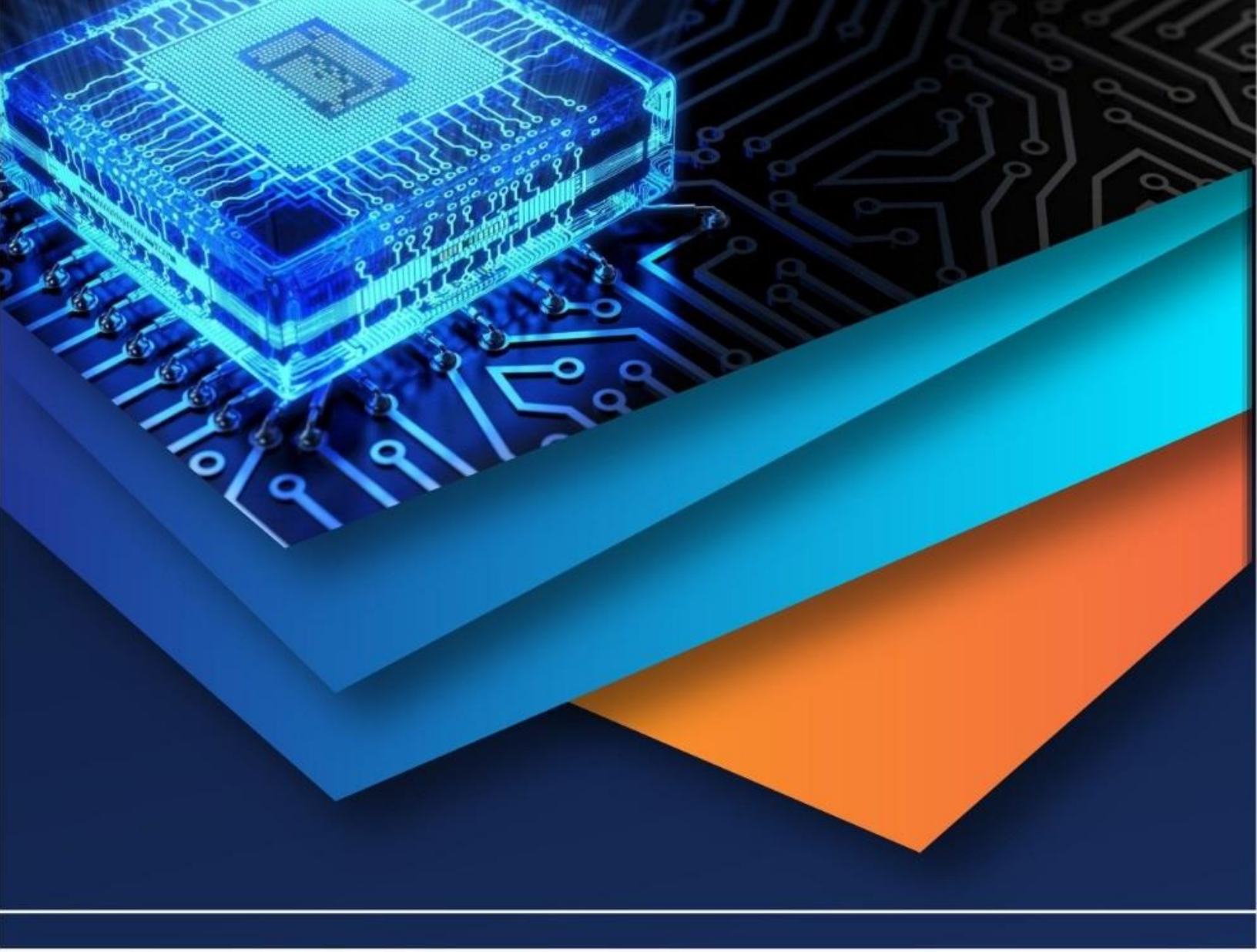

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