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Development of Road System for Controlling Traffic without Signals at Intersection

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Abstract: ***The volume of motor vehicle traffic in urban area is continuing to raise everyday which results in exceeding rate of road accident environmental impact and traffic jam at road intersection. This case study describes the design of road system at Kolhapur to overcome the problems of traffic jam, pollution and to reduce the travelling period of vehicles at the intersection. The primary objective of this project providing economical best alternative for traffic reduction at the intersection, also recommends the modified road system.***

Keywords: KMPH –Kilometres per hour, IRC-Indian road congress, PCU-Passenger car unit, road system, traffic, intersection.

I. INTRODUCTION

India has the second largest road network ~3.3 million km! in the world, second only to the USA ~6.6 million km!. Presently, there are nearly 30 million vehicles in India and about 2.5 million are added every year. The volume of traffic on roads increases at the rate of 12% per annum.

Capacity augmentation and improvement in the level of service is normally achieved by widening existing roads ~Gupta 2000!. The total length of National Highways is about 55,000 km out of which 66% is comprised of two-lane facilities with varying lane width. The national and state highways together account for about 10% of the total road length but carries 70% of the road traffic. One third of this length is still two-lanes wide.

The lane width on these roads varies from 2.75 m to more than 4.0 m. Indian cities are facing the crisis of urban transportation. Despite of investments in road infrastructure and plans for transport development, users face the problem of congestion, accidents and pollution. Accident is a major problem, especially at the intersection of national highway and other roads, as the vehicles on the national highway move at very high speed.

Also due to traffic jam, lot of time is wasted. Pedestrians face troubles in crossing the road. Due to congestion, pollution increases and it causes harmful effects on human health living adjacent to the area. National highway traffic delay and improper management as well as poor control over the flow of traffic increases rapidly.

Now a days in India due to high population growth the demands of peoples are increases so to complete this demands there is necessity of the transportation all over the county .so that large network of the road is provided all over due to this numbers of road intersection are formed at different location do number of problems are created at that intersection such as traffic jam, accident, vehicle travelling period, so to reduce these problems we designed road system.

II. METHODOLOGY

A. Site Selection

We are selecting Tararani Chowk Kolhapur for our case study, which is having high traffic intensity. The altitude and the latitude of the site is as per Google earth is 16º 42’ 25’’ N and 74º 14’ 53’’ E. The Kolhapur city has large amount of tourism attraction, as well as due to its educational growth ,industrialization , and also due to urbanization the large amount of traffic is attracted towards this city so this city contain large road network .Due to this toad network numbers of cross section are developed at different location of city. The tararani chowk is one of the important chowk as compared to others. So we selected this site.

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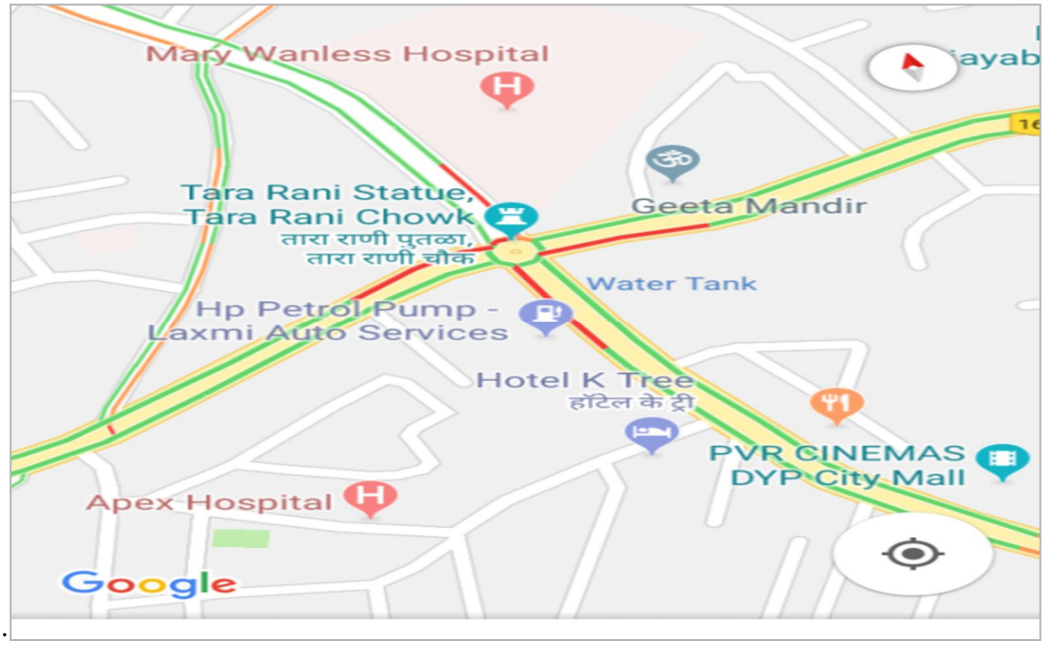

Fig.1. Tararani Chowk Kolhapur (Google map)

B. Traffic Volume Calculation

Traffic volume is the number of vehicles crossing a section of road per unit time at any chosen time. Traffic capacity or traffic volume is used as a amount measure of vehicle flow; the commonly used units are vehicles per day and vehicles per hour. Traffic volume survey was carried out on 9 entry/ leaving points in Kolhapur. Table gives the details of Traffic volume Survey in terms of Average Daily Traffic (ADT). The following table No. 1 shows the traffic survey was carried out in Kolhapur city entry/ leaving points

Various types of vehicles in a traffic flow have different characteristics like width, length and height And sometimes they produce cause inconvenience to other vehicles, so for expressing highway capacity, a unit is used called passenger car unit. Following table shows the PCU factor suggested by IRC 108-1996.

Table No. 1 PUC of Tararani Chowk

Sr. No.	Vehicle class	Equivalency factors	Traffic of Tararani chowk	Total PUC (PUC/hr)
1	Car, pick up Van , auto rickshaw	1	3888	3888
2	Bus, truck	3	1409	4227
3	LCV	1.5	290	435
5	Truck Trailer, agricultural tractor-tailor unit	4.5	20	90
6	Total		5607	8640

C. Observation of Road Components

The dimensions of different components of road are given below, the dimensions are on the existing measured road dimension at that intersection. This includes central verge, width of lane, road width, footpath width, land width and extra space for future widening etc. This Observation helps to design of new plan at that intersection also it gives idea about the future widening scope.

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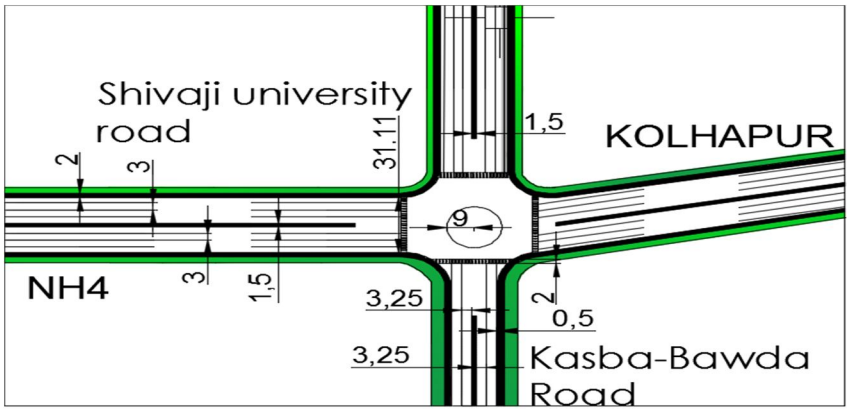

Fig 2 Road components at road intersection

D. Design Of Different Road Components

1) Design of turning radius of vehicle: For designing turning radius of vehicle we are considering the longest vehicle travelling through intersection, that is the single unit truck.

The perfect steering is achieved when all the four wheels are rolling perfectly under all conditions of running. While taking turn the perfect rolling is satisfied if the axes of the front wheels produced meet the rear wheel axis at one point. Then this point is the instantaneous centre of the vehicle. It is seen that the inside wheel is required to turn through a greater angle than the outer wheel. The larger the steering angle, the smaller is the turning circle. There is, however, a maximum to which we can go as regards the steering angle. It has found that steering angle can have a maximum value of about 44º. The figure No. 3 shows different turning angles for the single unit truck

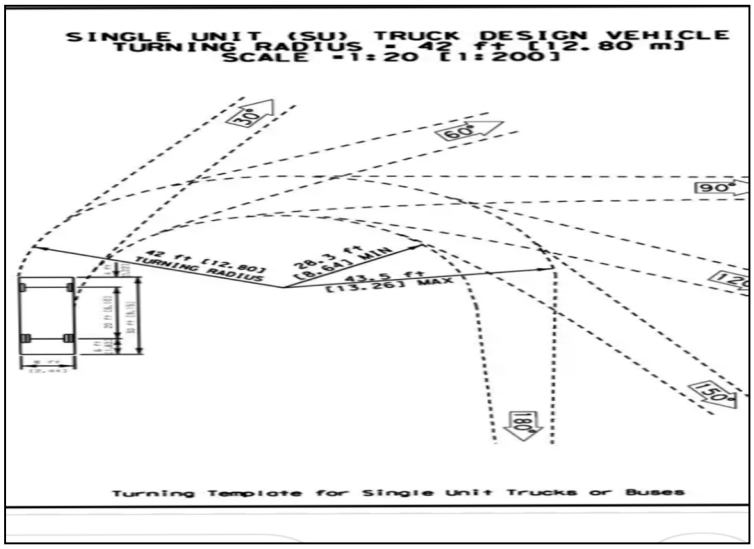

Fig 3 Turning radius of different angle

2) Design Of Speed Breakers And Design Speed: Speed breakers are formed basically by providing a rounded (of 17 meter radius) hump of 3.7 meter width and 0.10 metre height for the preferred advisory crossing speed of 25 km/h for general traffic (Fig.1). Trucks and buses having larger wheel bases may feel greater inconvenience on passage at such humps.

3) To facilitate appreciable and comfortable passage for larger and heavier vehicles (where their proportion is quite high) humps may be modified with 1.5 meter long ramps (1:20) at each edge. This design will also enable larger vehicles to pass the hump at about 25km/h, (Fig.2).

In certain locations, speed breakers may have to be repeated over a section to keep speeds low throughout. More humps may be constructed at regular intervals depending on desired speed and acceleration/deceleration characteristics of vehicles.

The distance between one hump to another can vary from 100 to 120 meter center to center. (As per IRC 99-1988)

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4) *Minimum distance of speed breaker from level of crossing:* Minimum distance of speed breakers from the level crossing shall depend upon speed of vehicle, reaction time, acceleration due to gravity and coefficient of friction (pavement surface and tyres).

5) *Calculation*

Stopping distance= $vt + v^2/2gf$

Here, v =speed,

t = Reaction time,

g= acceleration due to gravity

f = Coefficient of friction

For Example: Min. distance for Speed of vehicle 30KMPH (8.33 m/sec).

t =2.5 sec (As per recommendation of IRC)

f= 0. 36 (Coefficient of friction for speed 60Kmph),

g= 9.8 m/sec2

Stopping distance= 8.33x2.5 + 8.33x8.33/2x9.8x0.36= 30.56m say 31m

Table No. 2 Standard Humps

Max. Allowable speed (Km/hr)	Radius (m)	Length of cord (m)	Bus speed (Km/hr)
20	11	3	5
25	15	3.5	10
30	20	4	15
35	31	5	20
40	53	6.5	25
45	80	8	30
50	113	9.5	35

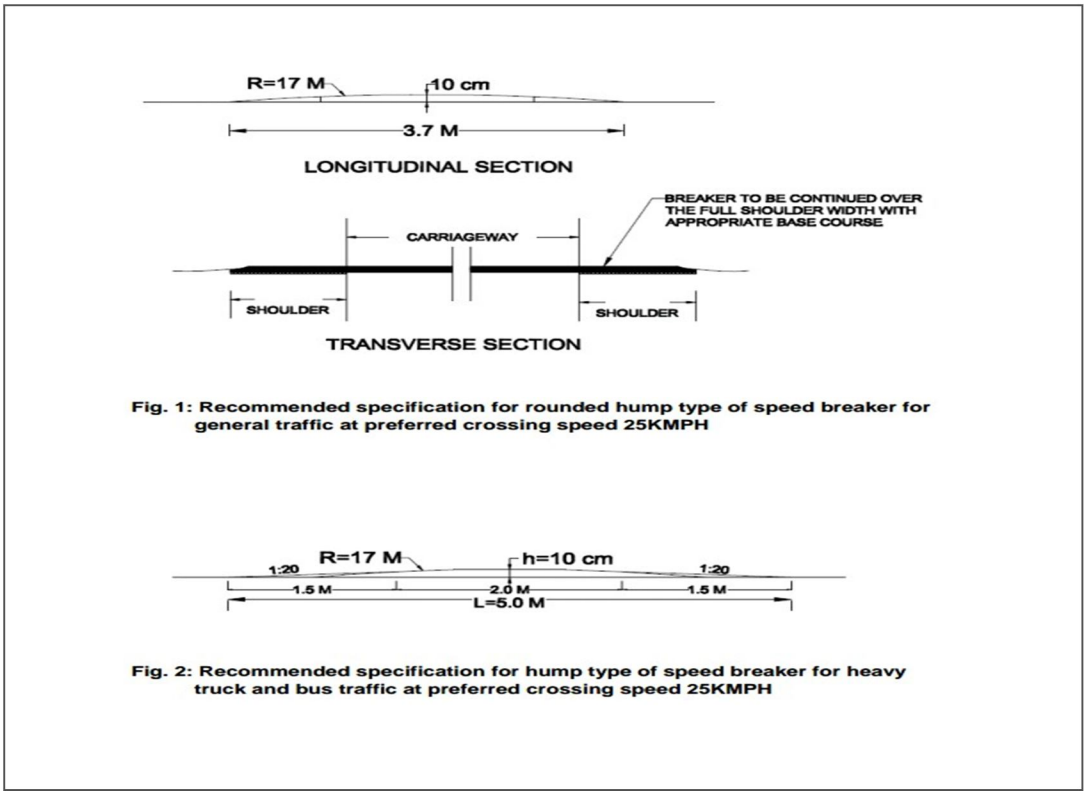

Fig 4 Cross section of the speed breakers

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E. Design Speed

Vehicles approaching as intersection at grade considerably slow down there speed when the design speed compare to the design speed standard of the highway under consideration. Though there is no need for vehicles in a traffic rotary to come to a dead stop before enabling them to cross the path of another vehicle within the rotary, still there should be considerable reduction in speed. With these in view the design speed for traffic rotaries in India is taken as 40 kmph for rotaries in rural area when one or more of converging roads form part of an important highway. In all other cases and for rotary in urban area, a speed 30 kmph is adopted for design.

F. Design of Sign Boards

The traffic signs has been divided into three categories with objective regulating, warning and guiding the users of motor vehicles, as per the motor vehicle act of India 1988. Accordingly IRC has standardized and classified the different traffic signs or the road signs into following three categories.

1) Regulatory signs
2) Warning signs
3) Informatory signs

The regulatory signs are circular in shape with two exceptions one octagonal in shape and another inverted triangle the warning signs are triangular in shape where as the informatory signs are rectangular in shape.

G. Size of signs and letters:

Three sizes of regulatory and warning signs has been specified namely,

The small size signs are 600mm in size, normal size signs are 900mm and large size signs are 1200mm in size. The size referred to the diameter of circular signs or height of octagonal size or height of triangular size. The specified font size of lettering on small, normal, and large size are 100, 150, 225.

The small signs are normally installed on minor roads when the design speed less than 60 Kmph. The normal signs are installed on important high ways and urban roads where the design speed are in the range of 60 to 100 kmph. The large size signs are installed on expressways and on urban arterial roads where the design speed exceed 100 kmph.

The size, shape, colour code and the symbol used and the location of signs should be as per specified by IRC 67-2010 under each category. The reverse side of all sign plates are painted gray. The warning sign should located on nonurban roads at the following distance in advance

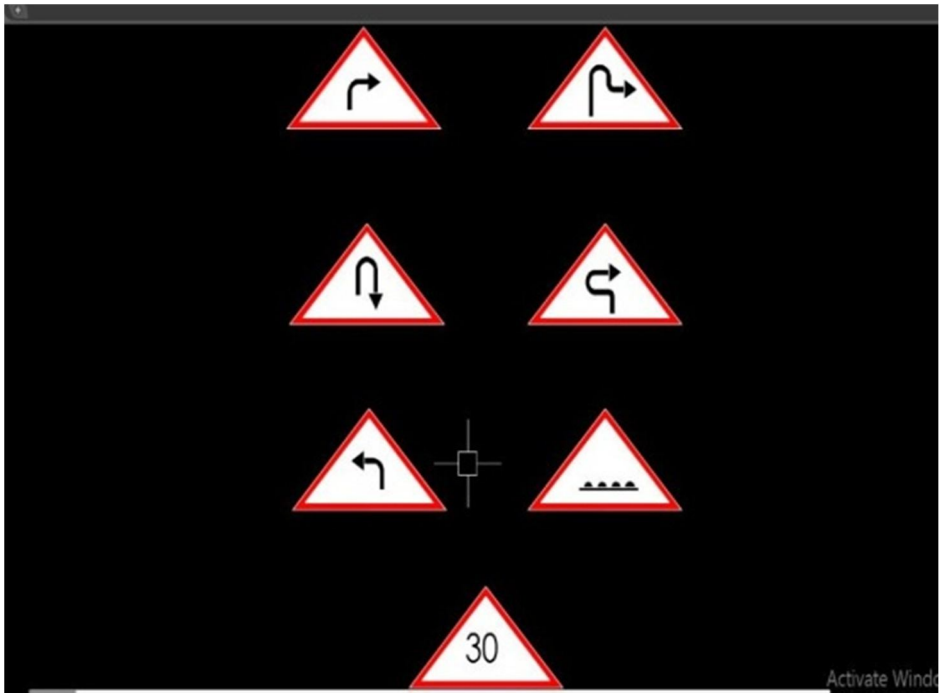

Fig No 5 Designed sign boards

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III. CONCLUSION

After completion of design of all the road components we implemented our plan as per IRC recommendation and plan is drafting on AutoCad software which is given in following figure

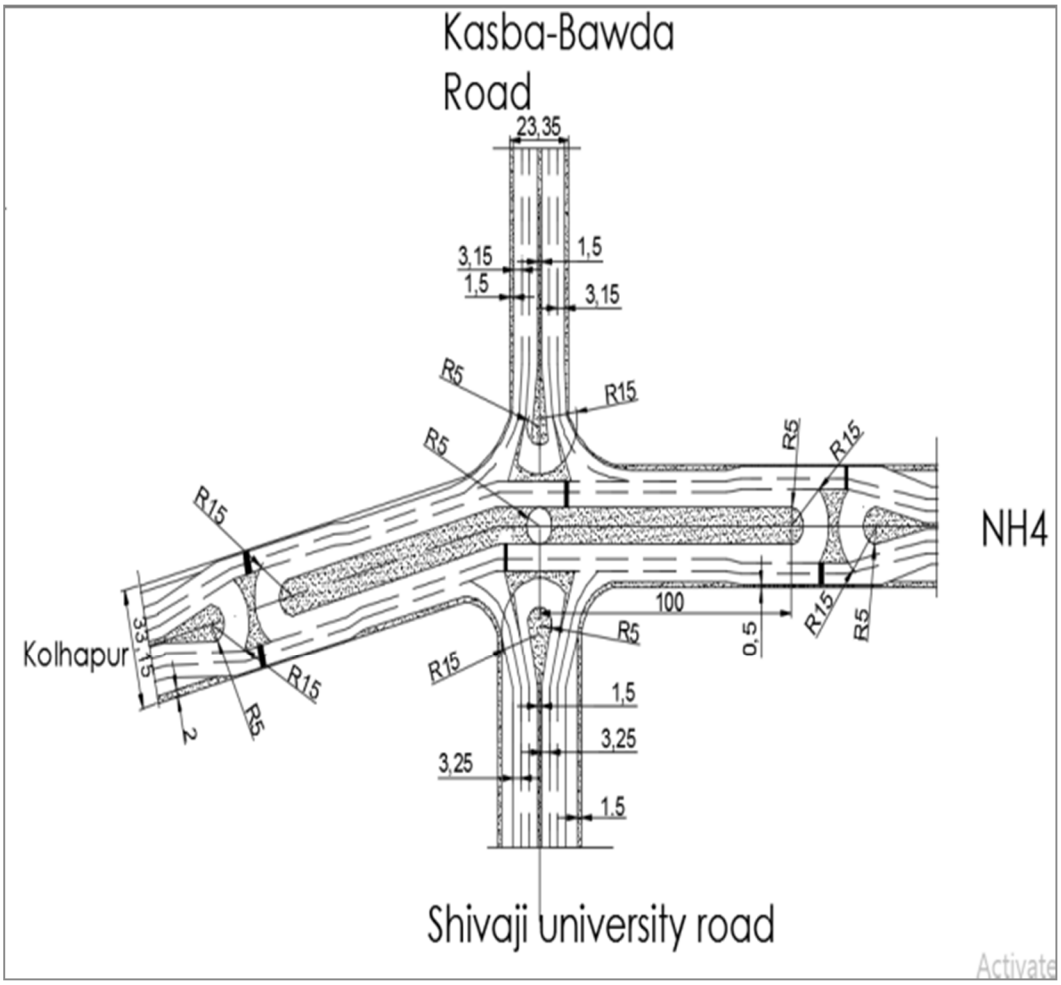

Fig 6 Final plan

By implementing this plan following results will obtain
Reduction of travelling period of vehicles
Reduction of traffic at road intersection
Reduction in air pollution
Reduction in fuel consumption

A. Recommendations

1) Increase road width which is kept for the future expansion
2) Increase awareness of traffic sign boards by installing at proper location before road intersection
3) Increase awareness of traffic low and regulation through workshop at license centre and media.
4) Provide footbridges for pedestrian which is not disturbing to continuous flow.

IV. ACKNOWLEDGMENT

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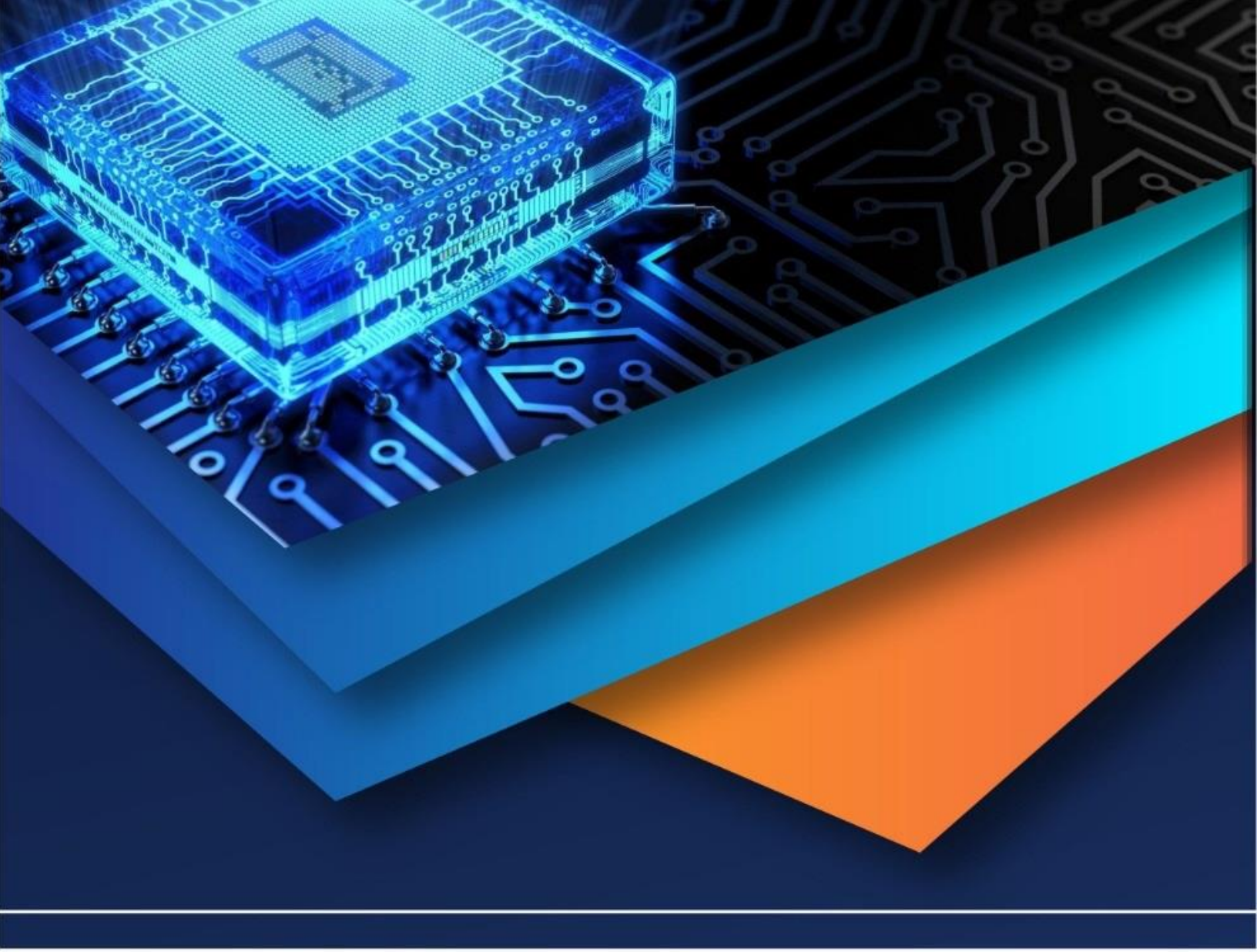

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