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Pedestrian and Slow Moving Traffic Study in Urban Areas

Aamir Yousf[1] , Dr Rakesh Gupta[2]
[1]*M-Tech Scholar, Civil Dept.,SRMIET, Bhurewala, Ambala, Haryana, India*
[2]*Professor, Civil Engineering, SRMIET, Bhurewala, Ambala, Haryana, India*

Abstract: ***A good percentage of the total number of trips commencing in most of the urban areas of our country is shared by walking and using slow moving vehicles. When considerations and planning takes place for streamlining the traffic of the urban cities like Chandigarh very less efforts are made to analyze and study the level of service of pedestrian facilities and the effect of slow moving vehicles on the traffic heterogeneity. The slow moving traffic such as the pedestrians, cycles, cycle rickshaws etc. are the most used modes of transportation for the trips of short duration. Most of the trips commence and end either by walking or by using slow moving public transport. The pedestrian and slow moving vehicles are exposed to variety of the diverse environmental condition and are therefore vulnerable to the traffic related problems. They are the victims of large percentage of the accidents in our country. Therefore efforts should be made to provide better facilities to pedestrians for walking and crossing the road. The sidewalks of adequate capacity and quality must be available in all the urban cities. The cycles and other slow moving vehicles affect various parameters of the traffic and therefore need to be studied thoroughly for their effects on the traffic in urban areas. In this paper attempt is made to study the level of service of pedestrian facilities by highway capacity manual methodology and effect of slow moving vehicles on traffic characteristics in the study area. Recommendations are then made to improve the pedestrian and slow moving vehicle facilities in the study area and to reduce the conflicts between vehicle movements and slow moving traffic.***
Keywords: pedestrian, slow moving vehicle (SMV), pedestrian level of service, traffic density, traffic speed.

I. INTRODUCTION

The provision of properly designed and well maintained facilities for pedestrians and slow moving vehicles in urban areas is as important as the provision of facilities for the motorized vehicles because of the reason that pedestrians and slow moving vehicles form an important part of the transportation system of our country in particular and all other countries in general. Therefore the design of pedestrian and slow moving vehicle facilities needs to be done with equal preference and efforts as that of the vehicular traffic in urban transportation planning. Pedestrian level of service is the qualitative estimate of the travel conditions of a pedestrian on a footpath, crossing or walking facility. The pedestrian level of service is estimated in this paper by highway capacity manual methodology to highlight the conditions of the existing pedestrian facilities in urban areas.

There is a mixed traffic condition in India consisting of the motorized vehicles like buses, trucks, cars etc. and non-motorized vehicles or slow moving vehicles like cycles, cycle rickshaws and so on. The proportion of the slow moving vehicles is quiet significant in most of the urban areas of India and play a very substantial role in meeting the travel demands of an area. Therefore, the evaluation of the effect of these vehicles in the heterogeneous condition is very essential for the traffic planning of a city. When the number of slow moving vehicles increases in a traffic stream, they considerably affect the flow characteristics of that traffic stream like the traffic density, traffic capacity and flow speed. Hence, in this study the effects of the slow moving vehicles on the performance of the traffic stream on a study stretch is taken into account.

II. STUDY AREA PROFILE

The test location for studying the pedestrian level of service of footpaths and effects of slow moving traffic in urban areas is selected as Sector 26, Chandigarh. Three sites were selected for studying pedestrian level of service of footpaths and two road stretches for the effect of slow moving traffic as shown in fig. 1 below

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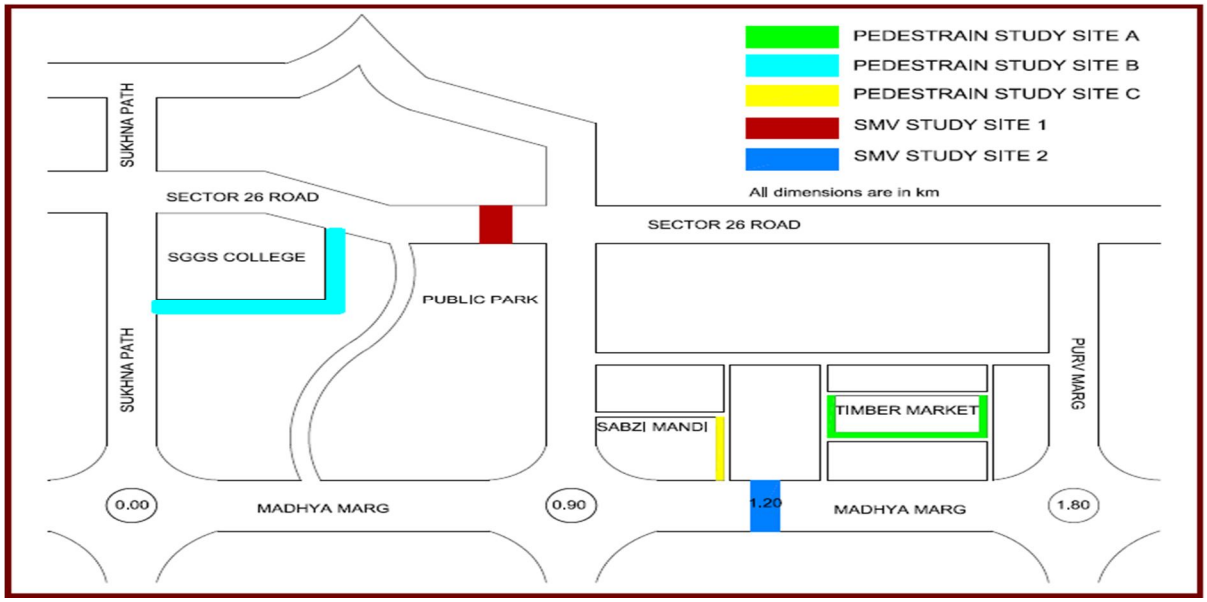

Fig. 1 Layout plan of Sector 26, Chandigarh showing study sites

III. METHODOLOGY

A) For the study of pedestrian level of service of sidewalks Highway Capacity Manual methodology was adopted. This method analyzes pedestrian level of service on the basis of measurement of pedestrian flow rate, sidewalk space and pedestrian speed. As the volume of pedestrians on a footpath increase their speed decreases. In the same way, with the increase in density of pedestrians on a facility the degree of mobility afforded to the individual pedestrians declines, which in turn decrease the space available. The highway capacity manual has divided the level of service of crosswalks into six categories A, B, C, D, E and F based on the values of various parameters used to define these categories as given in table1. The parameters involved in table1 have been determined on the footpaths at three study sites shown in fig 1 by manually counting the pedestrian volume, density and speed during different time intervals in morning peak hours. The space was then calculated from the inverse of density. The data collected is then compared with the standards given in the table to evaluate the level of service of the footpaths under study

LOS	Space (m^2/p)	Pedestrian Flow Rate (p/min/m)	Speed (m/s)
A	>5.6	≤16	>1.30
B	>3.7-5.6	>16-23	>1.27-1.30
C	>2.2-3.7	>23-33	>1.22-1.27
D	>1.4-2.2	>33-49	>1.14-1.22
E	>0.75-1.4	>49-75	>0.75-1.14
F	≤0.75	>75	≤0.75

Table1 pedestrian level of services as per highway capacity manual

B. For studying the Effect of Slow Moving Traffic on Mixed Traffic Following Methodology is Adopted

The traffic characteristics at the selected sites have been collected by using the video graphic technique. A five meter long section of road have been selected and marked at the four corners by using the marking tools and a video camera has been installed to record the traffic flow data. The data recorded by the video camera has been decoded at home to calculate the classified traffic flow, traffic speed and traffic density. For every 1hour interval the flow (*q*) of vehicles, i.e. the number of vehicles of each category passing the line in both directions and the density (*K*) within the subjected region has been determined for both motorized and non-motorized vehicles. Speed has been calculated by dividing the volume and density. The extracted data for both the sites is expressed in terms of passenger car units.

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IV. DATA COLLECTION AND ANALYSIS

The pedestrian data collected at three sites is given in table 2,3, 4 and for slow moving traffic is given in table 6 and 7 below:

Table 2 pedestrian data at siteA

Time Interval	Space (m2/p)	Flow Rate (p/min/m)	Speed (m/s)
6:00AM-6:30AM	3.5	26	1.45
6:30AM-7:00AM	2.8	28	1.32
7:00AM-7:30AM	2.3	38	1.28
7:30AM-8:00AM	1.6	34	1.39
8:00AM-8:30AM	1.1	41	1.23
8:30AM-9:00AM	0.89	45	1.11
9:00AM-9:30AM	0.83	54	0.98
9:30AM-10:00AM	1.2	44	1.13
Average	1.77	38.75	1.21

Table 3 Pedestrian data at site B

Time Interval	Space (m2/p)	Flow Rate (p/min/m)	Speed (m/s)
6:00AM-6:30AM	8.3	5	1.99
6:30AM-7:00AM	6.1	9	1.36
7:00AM-7:30AM	4.9	18	1.34
7:30AM-8:00AM	3.5	13	1.21
8:00AM-8:30AM	3.1	21	1.18
8:30AM-9:00AM	2.85	35	1.09
9:00AM-9:30AM	2.77	38	1.05
9:30AM-10:00AM	2.06	39	1.01
Average	4.19	22.25	1.27

Table 4 pedestrian data at site C

Time Interval	Space (m2/p)	Flow Rate (p/min/m)	Speed (m/s)
3:00PM-3:30PM	2.5	43	1.4
3:30PM-4:00PM	2.01	49	1.32
4:00PM-4:30PM	1.82	65	1.21
4:30PM-5:00PM	0.80	75	1.06
5:00PM-5:30PM	0.58	80	0.96
5:30PM-6:00AM	0.92	62	1.09
6:00PM-6:30PM	0.50	91	0.73
6:30PM-7:00PM	0.65	77	0.99
Average	1.23	67.75	1.095

Table 5 Slow moving vehicle data at site 1

Time Period	Motorized Vehicles (PCU)	SMV(PCU)	%age of SMV	Traffic speed (km/hr)	Density (PCU/km)
06:00AM-07:00AM	1236	45.6	3.5	47	27
07:00AM-08:00AM	1528	65.6	4.1	44	36
08:00AM-09:00AM	2103	258	10.9	42	86
09:00AM-10:00AM	3896	565.6	12.6	39	114
10:00AM-11:00AM	3958	644.3	13.9	37	124
11:00AM-12:00AM	2033	133.08	13.7	36	119
12:00AM-01:00PM	2975	165.9	5.28	43	73
01:00PM-02:00PM	2849	566.9	18.5	33	136
02:00PM-03:00PM	3659	786.6	21.5	31	143
03:00PM-04:00PM	4133	975	23.6	29	176
04:00PM-05:00PM	4326	856.5	19.8	32	141
05:00PM-06:00PM	2639	250.705	9.5	41	70

Table 6 Slow moving vehicle data at site 2

Time Period	Motorized Vehicles (PCU)	SMV(PCU)	% of SMV	Traffic speed (km/hr)	Density (PCU/km)
06:00AM-07:00AM	2132	63.96	2.9	52	42
07:00AM-08:00AM	2564	117.94	4.39	43	62
08:00AM-09:00AM	5964	834	12.9	39	174
09:00AM-10:00AM	6548	517.29	7.8	45	157
10:00AM-11:00AM	5968	675.57	11.3	40	166
11:00AM-12:00AM	3327	133.08	4.2	42	91
12:00AM-01:00PM	4162	162.31	3.9	50	86
01:00PM-02:00PM	5894	612.97	10.4	41	158
02:00PM-03:00PM	6245	730.66	11.7	40	174
03:00PM-04:00PM	6857	1295.95	18.9	34	239
04:00PM-05:00PM	7102	937	13.2	37	217
05:00PM-06:00PM	7312	541.5	7.4	46	170

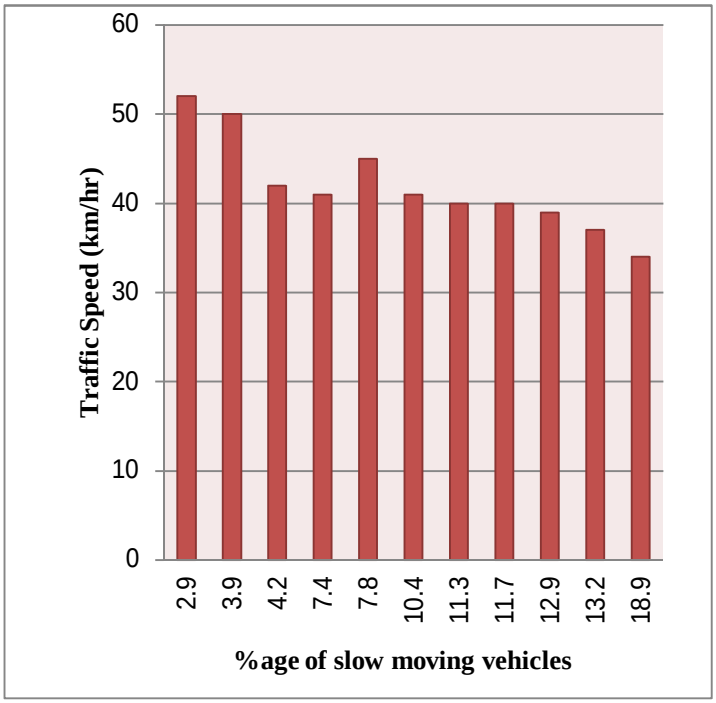

Fig. 2 Variation of traffic speed withSMV %ages for table 6

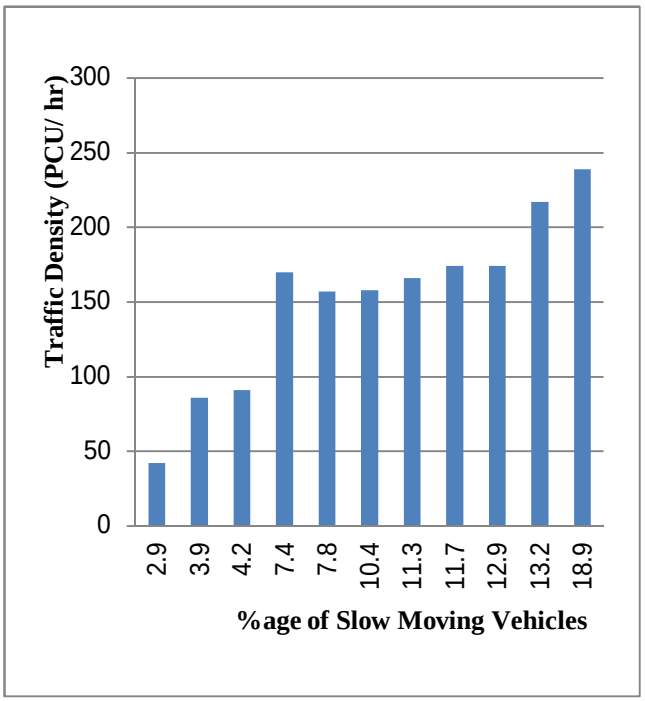

Fig. 3 Variation of traffic density with SMV %ages for table 6

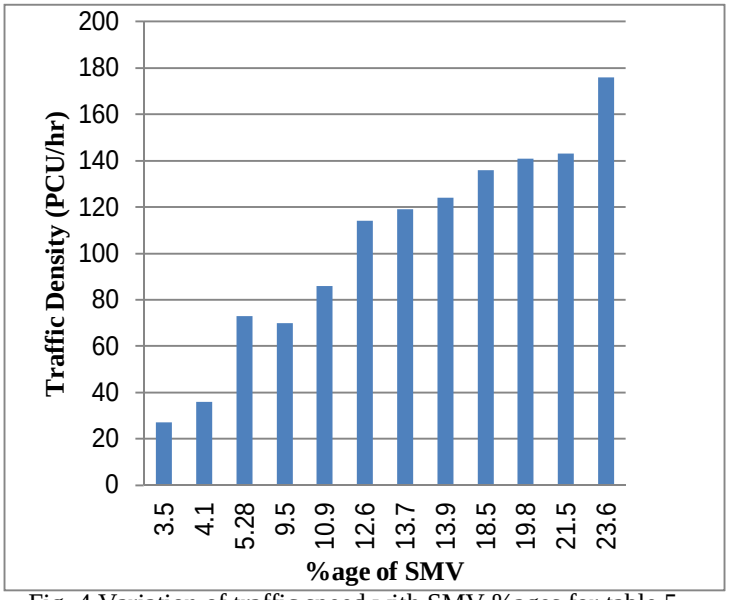

Fig. 4 Variation of traffic speed with SMV %ages for table 5

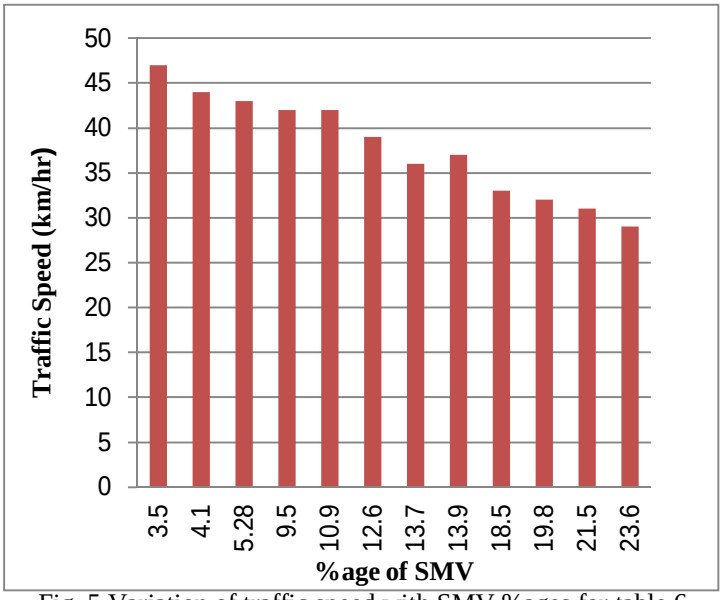

Fig. 5 Variation of traffic speed with SMV %ages for table 6

A. Analysis of Data

From the data collected at three pedestrian footpath sites it was found that the service level of the fopotpaths at site A,B and C falls under category "D", "B" and "E" on comparing with table 1,which implies that the footpaths provide poor qualitative service to its users.

The above data collected for determining the effect of slow moving vehicle on traffic flow shows that with increase in the number of slow moving vehicles in a traffic stream the traffic speed decreases and traffic density increases which hamper the overall movement of the traffic and therefore need to be segregated from the traffic by providing separate tracks for movement. The separate tracks will not only improve the traffic flow characteristics of motorized vehicles but will also provide safe and smooth ride to cyclists.

V. CONCLUSIONS

From the pedestrian study it has been observed that the footpaths available for pedestrians have a lower service levels due to improper management and steep increase in population of the urban areas in recent years and therefore need to be redisgned. The pedestrian movement should be separated from the heavy moving vehicles to provide safe passage to the pedestrians. The heavy pedestrian movement areas should be recognized to provide appropriate walking facilities for pedestrians. The space and geometrics of the footpaths existing in urban areas should be revived as per the present needs. Elevated and visible designated areas for crossing of roads should be placed in all possible places. The various obstructions such as advertising boards, poles, street vendors, parked vehicles etc. which reduce the effective width of the footpaths should be removed from the footpaths.

The study of slow moving traffic showed that due to the improper management or non-availability of right of way for slow moving vehicles in urban areas these vehicles reduce the overall traffic speed of the roads and increase the traffic density which lead to congestion and many other traffic related problems The provision of separate tracks for non-motorized traffic should be done on country level to encourage their use so as to prevent our cities from environmental issues such as air pollution as faced by our Capital city Delhi. The cycle tracks in urban areas like Chandigarh are not properly functional due to the reasons like unavailability of lights after sunset, presence of potholes, improper entry and exit points, lack of signals, encroachment by street vendors and parked vehicles, nonexistence of separate lanes at intersections.

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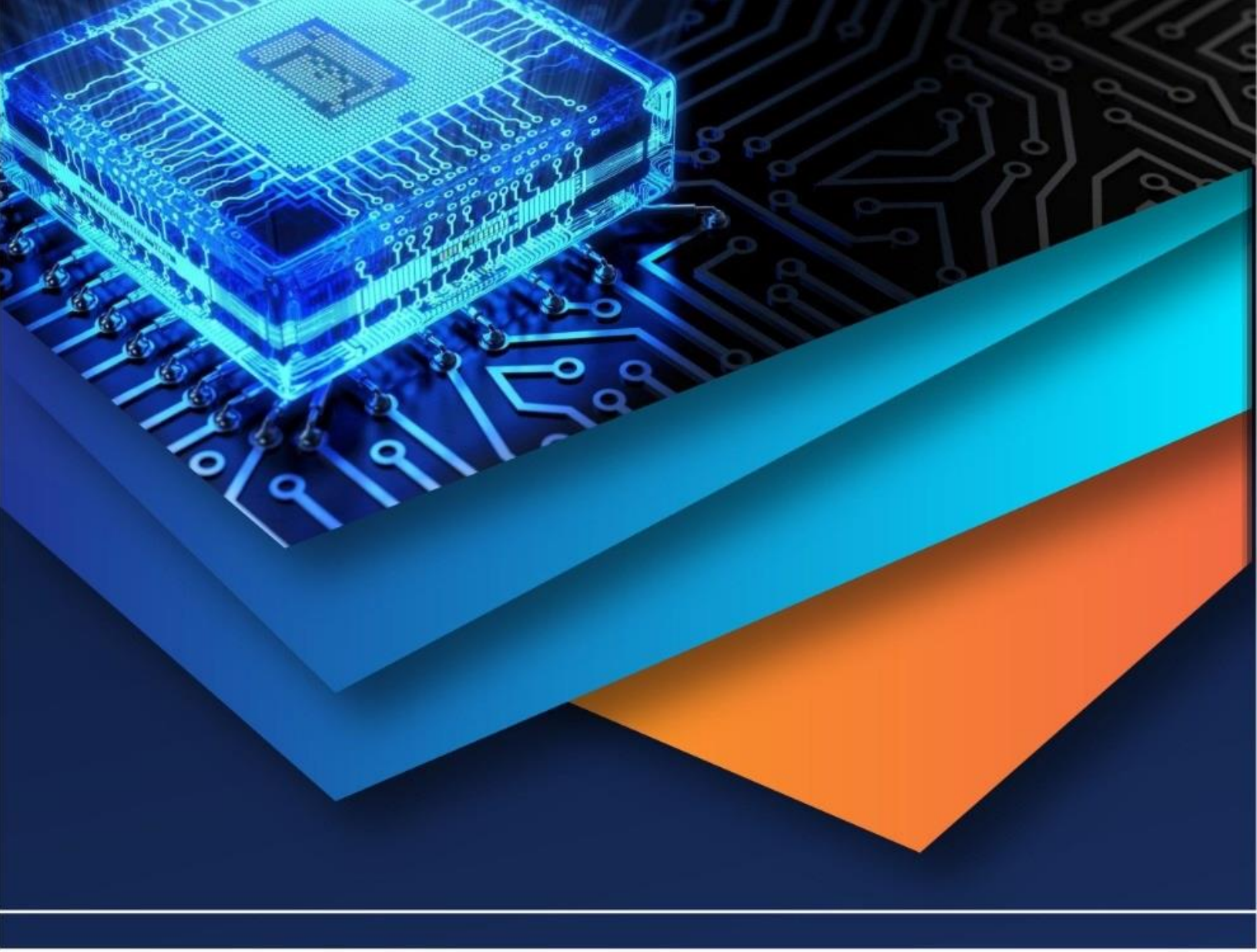

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