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A Review : Impact of Road Side Friction on Capacity of Urban Roads

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ABSTRACT

Traffic congestion and capacity reduction in urban roads are very common in developing countries like India. Capacity is important fundamental to planning, design and operation of the roads. It is helpful for determination of a number of lanes required by considering a volume of the vehicles, their composition and other traffic-related parameters. Behind capacity reduction in the urban road, there are several reasons that affect the capacity factor such as on-street parking, pedestrian movement, the presence of street hawkers, roadside bus stop. This review paper is intended to highlight various studies reported with regards to the impact of side frictions in a capacity of urban road and gives a suitable measure.

Keywords: Capacity, Level of Service, Road Side Friction

I. INTRODUCTION

Rapid urbanization has resulted in tremendous growth in a vehicle. This increase in vehicular population along with Shortage of urban road space is present in the form of roadside frictions. Considering roadside friction as illegal on-street parking, pedestrian movement, and presence of street hawkers, roadside bus stop, and encroachment by shop owners, which are measure factors that affect the smooth traffic flow and slow down the whole traffic in the urban and suburban area. Different type of roadside friction increasing along with the heterogeneous traffic, have an ill effect on the capacity of urban roads as well as a serious impact on the safety of road users. Determination of these side friction factors is a difficult task to traffic engineers.

The speed and capacity are being an important quantitative measure of the transportation facility and it's decreasing continuously in an urban area.

Study Related Definition

A. Capacity

The Capacity is maximum hourly rate at which persons or vehicle can be reasonably expected to traverse a point or a uniform segment of a lane or roadway during a given time period, under prevailing roadway, traffic and control conditions.

Capacity depend on three certain condition:

1. Traffic condition - It refers to the traffic composition in the road such as the mix of cars, trucks, buses etc. in the stream. It also includes peaking characteristics, proportions of turning movements at intersections and the like.
2. Roadway characteristics - This points out to the geometric characteristics of the road. These include lane width, shoulder width, lane configuration, horizontal alignment and vertical alignment.
3. Control conditions – This primarily applies to surface facilities and often refer to the signals at intersections etc.

B. Speed

It is defined as the rate of motion in distance per unit of time, mathematically speed is given by,

$$\boldsymbol{v = \frac{d}{t}}$$

Where,
v = speed of vehicle (m/s, km/h),
d = distance travel in m,
t = time t is seconds.

C. Flow

The number of vehicles passing a specified point during a specified period of time. It is usual to express it in vehicle per hour.

$$q = \frac{nt}{t}$$

Where,
q = vehicle/hour,
n_t = counting the number of vehicle,
t = Specified period of time.

D. Density

Concentration also known as density (*K*) is the number of vehicle present in a specified length of road at an instant. It is usually expressed in vehicle per kilometer length of road per lane.
Or
Density is also calculated using the fundamental relation between the flow, density and speed as given in equation,

$$k = \frac{q}{v}$$

Where,
k = density (veh/km),
q = volume (veh/km),
v = avg. mean stream speed (km/h).

Factor Affecting Capacity

- ✓ Lane width,
- ✓ Lateral clearance,
- ✓ Shoulder,
- ✓ Surface condition,
- ✓ Alignment,
- ✓ Grades,
- ✓ Presence of intersection,
- ✓ Environmental condition,
- ✓ Parking and
- ✓ Presence of pedestrians,
- ✓ Congestion affecting.

Types of Side Friction affecting capacity on urban roads

- ✓ Illegal on-street parking,
- ✓ pedestrian movement (parallel or crossing),
- ✓ presence of street hawkers,
- ✓ road side bus stop,
- ✓ Encroachment by shop owners.

Congestion Affecting Capacity

- ✓ Speed as the principal characteristics which affecting the capacity and for a better understanding of the capacity standards case as geometric and environmental characteristics specified.
- ✓ The reason for the side activity and mix traffic generally people tend to drive a vehicle in the middle of the road that reduces capacity of the road.

Present Scenario

- ✓ The speed and capacity are being an important quantitative measure of the transportation facility and it's decreasing continuously in an urban area because of the heterogeneous and unpredictable traffic, driver behaviour, as well as the impact of side friction, is a major factor that affects speed and capacity of the urban road.

II. METHODS AND MATERIAL

Literature review

Chetan R. Patel (2014) [1] they carried out a study in six-lane divided urban road in Patna and Pune city of India. Videography method was used for data collection and data extracted for a one-minute duration for vehicle composition speed variation and flow rate. In both, the locations speed-flow relationships were developed and flow parameter at mix flow level are derived and compared with IRC study was conducted on a mid-block section. For both location traffic composition, flow rate, peak hour factor and spot speeds of each vehicles categories are calculated. Due to side friction like parking, effective lane width in Patna city reduces to 7.0m to 10.5m, which was result into 57% reduction in capacity and 14% reduction was observed due to the presence of NMV.

Ahmad Munawar (2011) [2] in this study takes the speed was a major factor that affects capacity in standard case geometric and environmental characteristics specified. In this study they found there was significant difference between predicted speed in IHCM (Indonesian highway capacity manual) and the

actual speed, also suggested that multi-regression formula is effective to determine high side friction activity because IHCM does not accommodate this type sensitivity.

Lin Irawati (2015) [3] different types of data like amount of vehicles, composition of vehicles, road geometric, side friction are calculated, and those data were inserted in VISSIM software and analyze, in result they found that with side friction delay is 128.838 time per vehicle(s) and without side friction it is 96.310 time per vehicle(s).

Karl L. Bang (1995) [4] selected two different types of roads for data collection viz, urban roads and interurban roads. For urban roads considered side friction parameters are flow of pedestrians along the highway (ped/h), pedestrians across the highway (ped/h/km), vehicle stopping is differentiated according to whether stop was on the shoulder or the carriageway, parking or un-parking of vehicles (veh/h/km), vehicles entering or exiting road facilities. For interurban roads considered parameter are no. of pedestrians walking along and crossing the road (ped/h/km), no. of stopping and parking maneuver (veh/h/km), no. of vehicles entering and leaving road facilities, the flow of slow moving vehicles (veh/h). Using above parameters and by giving weight to above parameters they concluded that on interurban roads free flow speed is reduced to factor 0.76 and capacity is almost reduced to 20%. Similarly, for urban roads speed is reduced to factor 0.59. They developed HDM-Q model for prediction of speed and capacity including side frictional parameters.

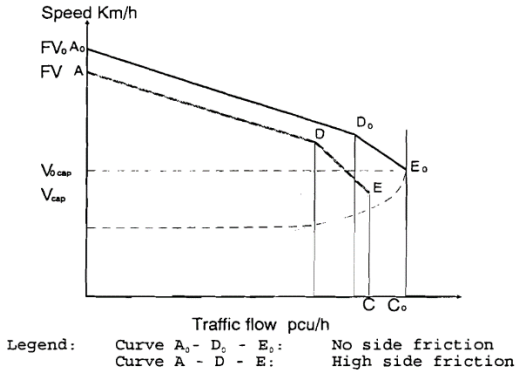

Figure 1. Impact of side friction on capacity

Sherin George (2016) [5] had proposed an analysis of roadside friction on a major arterial in thickly populated urban cities viz. Mumbai, Bengaluru, and Thiruvananthapuram. Side frictional factor was limited to pedestrian movement along the roadside, the bus stopped at bus stops and on street road parking. Multiple linear regression analysis is selected to represent their relationship. Reduction in speed is studied for all individual factors and also for combined effect. They have concluded that side friction has a significant effect on speed and need to include side friction in all traffic related study for proper result.

Sudipta Pal (2016) [6] they recommend interaction among non - motorized vehicle, fast-moving vehicle, and pedestrian. Based on data collection they took three study area location, every location includes marked area had a presence of roadside friction, according to their data collection developed speed – flow graph various side friction levels and Suggested five threshold value considering based on operational speed and freedom of manoeuvre as a measure of effectiveness.

Chand and Chandra (2014) [7] reviewed the resent findings on impact of bus stop on urban traffic characteristics and suggested few areas where further work can be taken up by the researchers as very few researches are done in case of heterogeneous traffic conditions.

Chinguma (2007) [8] studied the effect of side friction factors on urban traffic performance indicators speed and capacity. He considered a large number of study sections in urban areas and did macroscopic analysis as well as a microscopic analysis. In the macroscopic analysis, the combined effect of all side friction factors is considered whereas in the microscopic analysis impact of each factor on traffic flow characteristics is taken. The side friction factors considered in this study include pedestrians, bicycles, stopped and parked vehicles on road.

Amudapuram (2016) [9] in the present study they took three types different side friction for a study such as on street parking, bus bay-stop, curb side bus stops. They found average reduction in speed because of the side friction, 49-57% stream speed reduction found because of the bus stops and bays, where 45-67% speed reduced by on-street parking. In a study they use dynamic and static both types PCU because of the high percentage of heavy vehicle, by using both type of PCU values found that 10-53% capacity reduction in bus bays and bus stops, where 28-63% in on-street parking area location.

III. CONCLUSION

From the above study, it can be conclude that capacity reduction in urban roads is depend on roadside activity and it will varies with the intensity of side friction. Capacity reduction in urban roads is generally depended on roadside activity like on-street parking, pedestrian movement, the presence of street hawkers, lack of lateral clearance and lane discipline, heterogeneous traffic, which is very common in developing countries like India.

In some study they took speed is a major factor that adversely affects the capacity and level of service of the roads.

The Indonesian highway capacity manual has already included side frictional parameter in the calculation of speed and capacity.

Less research work found on capacity reduction because of the side friction it will need further study to counteract the ill effect of side activity on urban roads.

IV. REFERENCES

[1]. Chetan R. Patel, G. J. Joshi "Mixed Traffic Speed-Flow Behavior under Influence of Road Side Friction and Non-Motorized Vehicles: A Comparative Study of Arterial Roads in IndiaMixed Traffic Speed-Flow Behavior under Influence of Road Side Friction and Non-Motorized Vehicles: A Comparative Study of Arterial Roads in India." International Journal of Civil and Environmental Engineering Vol: 8, No: 11, 2014.

[2]. Ahmad Munawar, "Speed and Capacity for Urban Roads, Indonesian Experience" Procedia Social and Behavioral Sciences 16 (2011) 382-387.

[3]. Iin Irawati, "Delay Evaluation as the Impact of Side Friction on Heterogeneous Traffic towards Road Performance with Vissim Microsimulation" International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 Vol. 4 Issue 02, February-2015.

[4]. Dr. Karl-L. Bang, "Impact of side friction on speed-flow relationships for rural and urban highways." Regression model, HDM4 report (July 1995).

[5]. Salini s, sherin George and Ashalatha R. "Effect of Side Frictions on Traffic Characteristics of Urban Arterials" Transportation Research Procedia 17 (2016) 636 - 643.

[6]. Sudipta pal and Sudip kr roy "Impact of Roadside Friction on Travel Speed and LOS of Rural Highways in India." Transp. in Dev. Econ. (2016) 2:9.

[7]. Chand, S. and Chandra, S. (2014)," Impact of Bus Stop on Urban Traffic Characteristics - A Review of Recent Findings".

[8]. Chinguma, M.L.M. (2007),"Analysis of Side Friction Impacts on Urban Road Links".

[9]. Amudapuram Mohan Rao, S. Velmurugan and K.M.V.N.Lakshmi (2016) "Evaluation of Influence of Roadside Frictions on the Capacity of Roads in Delhi, India." Transportation Research Procedia 25 (2017) 4771-4782.