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Review Of Influence Of Road Side Friction In Urban Area

Mayank Kanani
Government Engineering College, Modasa
mkanani8@gmail.com

R. G. Motwani
Government Engineering College, Modasa
ravindra.motwani@gmail.com

H. K. Dave
Government Engineering College, Modasa
hiteshgecm@gmail.com

Abstract: India is a developing Asian country which faces various traffic problems. Among which side friction is one of the major problem in metro cities. Side friction can be defined as all that activities which are going on or along the roadway facility. It includes but not limited to pedestrians, slow moving vehicles (SMV), on road parked vehicles, roadside vendors, on-road stopping vehicles. These factors are frequent in developing countries but they are sparse and random so making it of less interest for the researchers for their studies. But in day to day life everyone is interacting with these factors. So this paper is mainly focused on reviewing the influence of side friction causing parameters on traffic speed and road capacity for urban arterial roads. Many urban areas in India are influenced by side friction which needs to be defined with their causes and influence to arrive at mitigation techniques using relevant design standards.

Keywords: Side Friction, Traffic parameter, Pedestrian, SMV, Traffic.

I. INTRODUCTION

Urban transportation is acting as a key to each economical communication in all urban communities all over the world. The increase in urban population growth tends to increase vehicular growth and travel demand. Transportation mainly consists of Railways, Airways, Waterways and Roadways. Among all categories, Roadways is a most important facility for urban areas. So planning and research techniques are focused mainly on Road transportation. Many researchers have studied about urban traffic problems and suggested many solutions as per their study and also concluded that there are some activities on or along the roadsides are going on which influences the performance of smooth traffic flow and capacity of the road network which are known as “Side Friction”.

Figure -1 Side Frictional Events

Side friction is defined as a composite variable describing the degree of interaction between the traffic flow and activities along the side(s) and sometimes across or within the traveled way. It can be also defined as a variable representing activities going on or along the carriageway. Various activities representing side friction are as follows:

- Reduction in traveled way which includes:

(a) Vehicles stopping for pick up & set down of passengers
(b) Pedestrians crossing or moving along roadside
(c) Non-motorized and slow moving vehicles (SMV)
(d) On road parking
(e) Improper coordination and lack of multimodal terminals

- Shoulder activities include:

(a) Parking and un parking activities
(b) Pedestrian and non-motorized vehicles moving along shoulders

- Roadside activities include:

(a) Vehicles entering and leaving road
(b) Food stalls vendors etc.

II. GENERAL PROBLEM

As per the Indian scenario, roadside markets and vendors are common problems in every city. It will attract people to stop by, which reduce the effective road width due to roadside parking of vehicles and other parking and un-parking manoeuvre.

On urban roads, pedestrian movement on or along the road side also affects the smooth traffic flow. Due to roadside markets, vendors, food stalls or lack of pedestrian facilities people used to walk on or along the road which disturbs the traffic flow. Another problem of SMV and non-motorized vehicles on urban roads also contributes to side frictional events.

Many of the above-stated problems are arises due to lack of parking, pedestrian and terminal facilities on urban road links. Also, roadside commercial development, the market area also contributes to these factors.

III.TRAFFIC FLOW AND SIDE FRICTION

In Indian scenario urban cities are generally overcrowded which faces problems due to side friction activities. Activities are often going on or along the carriageway of the urban road which interacts with ongoing traffic flow which affects traffic flow parameters. These activities are also presented on a rural road but its severity is less. Various studies conducted so far on this topic are briefly explained below.

Birva Shah [1] has selected C.G. Road of Ahmedabad city of Gujarat state. She determined traffic volume and speed relationship of peak hour for the study area. The capacity is determined and compared with the IRC guidelines. She has concluded that the observed capacity is 16% higher than the specified in IRC guideline. Traffic composition and side friction also affect the capacity of the road. She also used VISSIM software for capacity which is also more than suggested by IRC.

Ahmed Bellal and Alvin Harison [2], they collected data from Naini, Allahabad urban/suburban road segments. The counted side friction events were converted to computer sheets directly from the observation reports. Based on these result intensity of various weighted side frictional events are classified according to IHCM classification. As per IHCM they found Side friction class as medium and high which severely affect traffic parameters.

In Irawati [3] has selected Mrageen city of Indonesia as his study area. He collected different data like total vehicles, amount of vehicles, road geometry, side friction etc. he used VISSIM software for delay analysis with and without side friction. He concluded that with side friction delay is 128.838 time per vehicle(s) and without side friction, it is 96.310 time per vehicle(s).

Sudipta Pal & Sudip Roy [4] had proposed interaction among fast moving vehicles, pedestrian, and non-motorized vehicles. Based on data collection from three study sections, the speed-flow curve has been developed for various side friction levels and five threshold values for LOS are suggested considering operational speed and freedom of manoeuvre as a measure of effectiveness. They have calculated roadside friction index based on the present amount of side friction. They developed speed-flow curves for different RSFI.

Sherin George [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.

Chetan R. Patel & G.J.Joshi [6] had studied on the six-lane divided urban road in Pune and Patna city of India. Speed-flow density relationships were developed for both the roads and parameter for mixed flow condition are derived and compared with IRC. They have taken Dynamic car unit instead of Passenger car unit. Due to side parking, effective lane width decreases from 10.5m to 7.0m which results into decrement of 57% in capacity in Patna city. Also due to presence of NMV 14% reduction in speed is observed in Patna city compares to Pune city.

Parmar Dushyant [7] has focussed mainly on the concept, theories, and methods related to side friction impact on performance and capacity of urban road links, and were performed in Ahmedabad city as a case study. Mainly this thesis is focused on a finding of issues related to the identification of side friction factors. FARIC is established for many road links by performing regression analysis involving flow and individual friction items as independent variables and speed of light vehicles as the criteria variables.

Ahmed Munawar [8] studied comparative analysis between predicted speed by IHCM formula and actually observed speed. From this study it is concluded that, when side friction is high, there is a significant different between the speed predicted by IHCM and actual speed, IHCM does not include sensitivity in speed reduction with increase inside friction, there is no clear

statement in IHCM whether parking/stopping vehicles are included inside friction or not, all the results regarding to capacity and speed in IHCM are expected values obtained from a large population of data collection sites. Therefore, there is a need in doing further research to find whether the result of this research is only an exception of the IHCM formula or there is a need to improve IHCM.

Aronsson, Karin F.M [9] studied speed characteristics of an urban street. Macro and microsimulation of the influence of traffic flow with other road users were carried out. Vehicle speed profiles were collected from the field and several variable influencing traffic flows were identified from the various urban streets. The significant variables were traffic flow, pedestrians, bicycle movement, buses entering and exiting from the bus stop and street type and design. These traffic behavioral functions were modified and added into the microscopic simulation model prior to final validation and calibration runs of the urban street model. In the macro analysis, speed reduction caused by the variable was from 1 to 6 Km/h. and in microanalysis; speed reduction was 1 to 4 km/h.

Karl L. Bang [10] selected two types of roads for data collection viz. urban roads and interurban roads. For urban roads 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 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 he concluded that on interurban roads free flow speed is reduced to factor 0.76 and capacity is reduced to 20%. Similarly, for urban roads speed is reduced to factor 0.59. He developed HDM-Q model for prediction of speed and capacity including side frictional parameters.

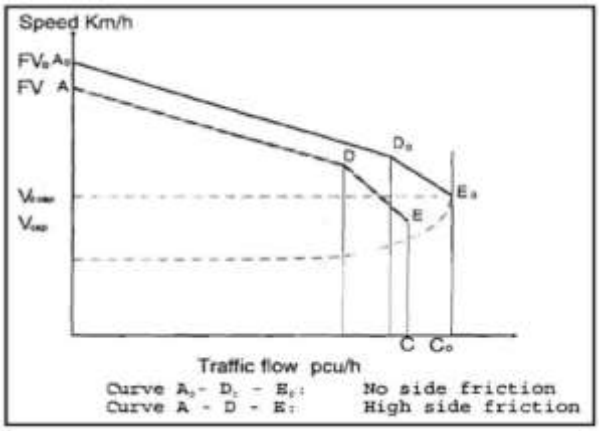

Figure 2 Impact of side Friction on Capacity (Bang 1995)

Nicholas W. Marker [11] collected data from 35 road links in 11 Indonesian cities. Among all sites nearly half of road, links were located in one city (Bandung). The surveys were performed on homogeneous road segment of 200-300m length using video recording. Regression analysis was done for speed-flow relation. For each type of road (4lane divided, 2lane divided etc.) capacity and speed were calculated by regression model by including adjustment factor for carriageway, shoulder width, directional split, side frictional factor, city size. Results of this study are included in IHCM for calculation of capacity and speed

IHCM has weighted different side frictional events as follows:

Table -1 Unit Weight for Side Friction Events (IHCM, 1997)

Event Type	Code	Relative Weight	
		Urban Roads	Inter-Urban Roads
Pedestrian Flow (Walking ped/hr. +Crossing ped/hr.)	PED	0.5	0.6
Vehicles stopping and parking manoeuvre (events/hr.)	PSV	1	0.8
Vehicles exiting / entering road side premises (veh/hr)	EEV	0.7	1
Slow moving vehicle (veh/hr)	SMV	0.4	0.4

Table-2 Side Friction Class According to Side Friction Value (IHCM, 1997)

Weighted frequency of events (on both sides of road) (FRIC)	Typical condition	Side friction class	
<100	Residential area, almost no activities	Very Low	VL

100-299	Residential area, some public transport etc.	Low	L
300-499	Industrial area with some roadside shops etc.	Medium	M
500-899	Commercial area with high roadside activities	High	H
>900	Commercial area with high roadside market activities	Very High	VH

Table-3 effect of parked vehicle on capacity (Ministry of Transport, U.S.A., 1965)

Parked vehicle per km	3	6	31	63	125	312
Effective loss of carriageway, m	0.9	1.2	2.1	2.55	3.0	3.6
Loss of capacity at 25 Kmph, (pcu/hr)	200	275	475	575	675	800

The effect of parked vehicles on capacity is illustrated in above table. It can be seen that how small amount of parked vehicle can affect traffic flow characteristics.

CONCLUSIONS

As from the above discussion it is concluded that overall performance of traffic parameters is affected due to the presence of Side Friction. Traffic Speed and Roadway Capacity can be enhanced by doing some modifications. Heterogeneous traffic which consists of slow moving vehicles and non-motorized vehicles, reduce the effective road width due to roadside parking of vehicles and other parking and unparking maneuver are some of the obstacles that degrade its performance. Generally, these events are observed at nearby commercial area/ market. IHCM has already included side frictional parameter in the calculation of speed and capacity. Generally, heterogeneous traffic conditions are found in Indian urban cities. In Gujarat also many urban cities are present where this type of situation arises due to lack of proper pedestrian, terminals, parking etc. facilities and Jamnagar are having such problem as shown in figure 1. So it is necessary to study in detail about these parameters for calculating its effect on traffic stream and other parameters. Also to find out unit weighting factor for each event to have single friction index value viz. Road Side friction Index (RSFI). It will be easy for analysis effect with single unit rather than dealing with each individual parameter.

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