REVIEW OF SIDE FRICTION IMPACTS ON URBAN ROAD LINKS

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Abstract: Now a days in many cities road traffic and transport demand, are increasing a which has consequently lead to worsening in capacity and inefficient performance of traffic systems. In the past, it was thought that in order to resolve the capacity problem it was simply to provide additional road space. Various studies have been done on this problems and come to know that various factors responsible for worse traffic condition out of which is there is often a great deal of activity on and alongside roads, which affects the way in which they operate. This hindrance to the smooth flow of traffic is known as "side friction". Side friction factors are defined as all those actions related to the activities taking place by the sides of the road and sometimes within the road, which obstruct the traffic flow on the travelled way. The objective of this thesis is to review the effect of side friction factors on traffic performance measures on urban roads.

Key Words: Urban Transportation, Side friction factor, LOS

1.1 INTRODUCTION

Typical urban transportation facilities include railways, waterways, airways and roads. Among all road transportation is backbone and the major player in the economic activities of most urban centers. All countries are concentrating on research, planning and development on the road system.

Now a days in many cities road traffic and transport demand, are increasing a which has consequently lead to worsening in capacity and inefficient performance of traffic systems. In the past, it was thought that in order to resolve the capacity problem it was simply to provide additional road space.

1.2 NEED OF STUDY

Various studies have been done on this problems and come to know that various factors responsible for worse traffic condition out of which is there is often a great deal of activity on and alongside these roads, which affects the way in which they operate. This interference to the smooth flow of traffic is known as "side friction"

Side friction factors are defined as all those actions related to the activities taking place by the sides of the road and sometimes within the road, which obstruct the traffic flow on the travelled way. It includes but not limited to pedestrians, bicycles, and non-motorized vehicles, parked and stopping vehicles.

As these factors are very less effective in developed countries, they having less interest in this research area and having comparatively less literature about it. These factors are normally very regular in densely populated areas in developing countries. The objective of the proposed research is to analyze the effect of these factors on traffic performance measures on urban roads.

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.

Activities likely to disrupt traffic flow include the following;

- **Blockage of the traveled way (i.e. reduction of effective width) which include:**
  a. Public transport vehicles which may stop anywhere to pick up and set down passengers.
  b. Pedestrians crossing or moving along the traveled way.
  c. Non-Motorized vehicles and slow moving motor-vehicles.
- **Shoulder activities**
  a. Parking and un-parking activities.
  b. Pedestrians and non-motorized vehicles moving along shoulders.

• Roadside activities

a. Roadside accessibility including vehicles entering and leaving roadside premises via gates and driveways**.**
b. Trading activities (i.e. food stalls, vendors), and movement of vehicles and pedestrians depending on land use type.

In India traffic facilities found can be categorized into four main types: road links, roundabouts, un-signalized intersections, and signalized intersections. Road links will be the criteria. The following features characterize most of the road links:

a. Kerbs: common on downtown local streets but rare on major arterial
b. Shoulders: mostly potholed and occupied by various activities
c. Sidewalks: exist on many major arterial
d. Medians: exist on all multilane facilities
e. Lane markings: common with major arterials
f. Frontage roads and separators: exist on some four-lane two-way roads (normally called 'service roads')

To carry out this work, a research design will be formulated including special methods and prescribed restrictions. An empirical case study methodology will be adopted. The scope will include road-link facilities. A sample of these facilities will include two-lane two-way and four-lane two-way roads were selected and studied. The study will be conducted in two parts, of which each involved a distinctive approach. Part one will involved a macroscopic approach where traffic and friction data will be collected and will be analyzed at an aggregated level, whereas part two will involved a microscopic approach where individual frictional elements data will be collected and analyzed individually.

1.3 RESEARCH OBJECTIVES.

The objectives of study are:

a. To identify and assess the impact of side friction on speed and capacity of urban road links (macroscopic analysis).
b. To identify important factors affecting performance and capacity of different types of road links (macroscopic analysis).
c. To develop mathematical and simulation models and calibration.

1.4 SCOPE OF THE STUDY

The study will include 4lane-2way (width median) and 2lane-2way (without median) arterial road links, with restricted access, located in a different terrain in urban and suburban areas where mobility is the primary function The research will study four specific factors that include pedestrians (PED), bicycles (BIC), Non-Motorized Vehicles (VNM) and Parking-Stopping Vehicles (VPS).

The research will measure impact of side friction on travel speed and LOS on urban links. In study areas, presence of pedestrians, cycles and van-rickshaws on carriageway will be considered as friction elements creating resistance for through traffic movements. Classified traffic volume data, spot speed and friction data i.e., numbers of friction elements on the carriageway will be collected during field survey. Speed-flow graphs will be developed. Level of service (LOS) criterions will be suggested and impact of side friction will be investigated. Modeling will be done considering this parameter as dependent variable. The study will help to take decisions regarding strict imposition of laws to restrict development of such road side market areas and create more provisions for roads.

2.1GENERAL

Literature review bring out , very small work has been done till date for measurement of side friction and its ill effect on travel speed and LOS. Some of the relevant work in Indian scenario which dealt with LOS and capacity is reviewed for the study.

Literature Review

The literature review is structured as follows.

Patel Chetan R., Joshi G. J. (2014) In this paper study were carried out for two different cities Patna and Pune having distinct differences in terms of vehicle composition and road side parking. Field studies using videography was done to collect traffic data.

Data were extracted for one minute duration for vehicle composition, speed variation and flow rate on selected arterial road of the two cities. capacity was determine and Speed flow relationship is developed. vehicle is single unit is determined in the form of Equivalency factor in terms of dynamic car unit is determine to represent the. The change in the capacity due to side friction, presence of non motorized traffic and effective utilization of lane width was analyze at concluding remarks.

Pal Sudipta, Roy Sudip Kr (2016) To improve the LOS of various categories of road Indian Government had take number of steps like widening of road, strengthening, improving road surface conditions. But LOS has not been improved. Various socio-economic factors affects the Level of Service .

One of the measure factor is existence of road-side markets at regular interval along rural highways is very common in India. Market areas act as bottleneck points and disarray zones to the through traffic of highways. Three study areas had been identified and data were collected. Speed-Flow curves were developed for various side friction levels and five threshold values for LOS are suggested considering operational speed and freedom of maneuver as measure of effectiveness.

Elangovan E. et. al. (2015) In this paper author concentrated on study of traffic management during construction work of live road. Congested road network due to road width restrictions on certain stretches is further strained due to the construction activities. Traffic flow at work zones were studied using videography and probe vehicles (GPS fitted). Videography was used to record classified volume count of vehicles entering the work zone and the speed of vehicles at work zones. To study the behavior of heterogeneous traffic, GPS fitted cars were run and the probe vehicles formed 1-3% of the vehicular flow. Speed and capacity reduction at work zones on urban roads traffic was estimated.

Patel Chetan, Joshi Gaurang, The term Equivalency Factor as PCE was introduced in the 1965 by HCM. The present verifiable study is to determine the dynamic equivalency factor for mix traffic condition in Indian environment in which car is taken as reference vehicle as Dynamic Car Unit (DCU).During the peak hour Speed and Volume studies are carried out and homogenization coefficient approach is calculated based on the observed data dynamic car unit. To have the unique value of the DCU optimization method is used. After optimizing final values of the DCU and wii be utilised to present the traffic stream volume in terms of equivalent passenger cars.

Balakrishnan Srijith, Sivanandan R., (2015) Free-flow speed (FFS) is the speed of vehicles under low volume conditions, when the drivers tend to drive at their desired speed without being affected by control delay. It is influenced by driver behavior, vehicle characteristics, road factors, land use, geometric features, control factors, etc.

This study was conducted on 24 study sections four- and six-lane divided roads in Chennai, India. The details regarding site factors such as carriageway width, link length, landuse, presence of kerb and type of area were collected manually. The speed and lane data were extracted and tabulated from the video.

Various road factors such as carriageway width, link length, adjacent landuse type and presence of kerb on FFS also measure. This models can be reference in applications in planning and operational analysis of urban road facilities.

Chand Sai, et.al.(2015) Road transport infrastructure typically consists of road and highway networks, including structures, electrical systems, edge treatments and specialized facilities such as bus stops, walkways for pedestrian, etc. Bus stops are the designated places where passengers alight and board a public transport bus. Bus stops are generally provided on urban roads when sufficient land is not available to construct bus bays or separate bus bays. These type of bus stops have adverse effect on various traffic characteristics such as speed and roadway capacity Mathematical relations between bus frequency and capacity drop; dwell time and capacity drop have been proposed. These relations would be very useful for practising engineers to estimate capacity loss due to bus stop.

Chandra Satish and Upendra Kumar (2003). In this Paper new concept to estimate the passenger car unit ~PCU of different types of vehicles under mixed traffic conditions is presented. Data were collected from two-lane roads at ten sections. All vehicles were divided into nine different categories and their PCU's were estimated at each road section. In

this study found that PCU for a vehicle type and the capacity of a two-lane road is linearly proportional to the width of carriageway , the relationship between the two follows a second-degree curve. Using this relationship adjustment factors for substandard lane widths is derive the and the results are compared with literature.

Dey Partha Pratim et.al. (2008) Data were collected at several locations of two-lane roads in different parts of India and study the speed, placement, arrival, acceleration, and overtaking characteristics of different types of vehicles. With the help of newly developed computer program the traffic flows simulated on a two-lane highway incorporating all characteristics. Visual Basic language is used in the simulation program animated. The proportion of three-wheeler, tractor, or heavy vehicle increases in the traffic stream,the capacity of a two-lane road decreases . The capacity was found to increase with their own proportion in the case of two-wheelers. This is conceptd to the small size of two-wheelers and their mobility.

Mehar A. et.al (2014) Passenger car units (PCU) of different types of vehicles are required to convert a mixed traffic stream into a homogeneous equivalent as equivalent number of passenger cars. This study provides PCU values for different types of vehicles typically found on interurban multi-lane highways in India at different levels of service (LOS). To generate the traffic flow and speed data for conditions which are difficult to obtained from field observations, Traffic simulation model VISSIM is used t.

PCU values on four-lane and six-lane divided highways are suggested for different traffic composition and for different type of vehicles at different LOS .

Rao Amudapuram Mohan, Ramachandra K. (2014) Free-flow speed is an important characteristic for capacity and level-of-service analysis of urban arterials. To develop models for estimating free-flow speed is the objective of the study . Many general factors like weather, environment, vehicles, roadway characteristics, driver and traffic streams either singly or in combination influence the free flow speed. Data was collected from midblock segments of urban arterials in Delhi. By dividing the given stretch of the road into smaller segments the geometric properties of the arterial were collected. Some factors have a significant influence on free flow speeds total number of vehicles, major intersections, access points and length of the sections.

3.1 INTRODUCTION

To calculate the capacity of road and level of service , VISSIM software and regression analysis will be used.

Simulation is defined as creating a working analogy of real life problems into a computer based model. It is a technique whereby some part of the real world is represented by dynamically by building a computer model, running model through time to solve problems having any given constrains and input.

3.2 STEPS IN SIMULATION

Certain sequential operations are involved in any problem wherein simulation techniques are adopted.

a. Definition of problem.
b. Field studies to determine inputs needed for model formulation.
c. Development of Logic.
d. Development of computer Simulation Programme.
e. Calibration of model.
f. Simulation runs covering actual conditions.
g. Validation of the model.

3.3 VISSIM

Today, many micro-simulation software have been made available on the market and used as tools for the evaluation of traffic management and control. Released in 1992, VISSIM is a microscopic, time step and behavior based simulation model developed to model urban traffic and public transit operations. It is regarded today as a leader in the arena of micro-simulation software.

VISSIM is a program with abilities to display and visualize complex traffic flow in a graphical way. It is capable to cope with the analyses of various traffic and transit operations under various conditions and aid the assessment of traffic impacts of physical and operational alternatives in transportation planning.

VISSIM itself can be considered as a difficult program to handle due to its complexity and brief explanation in the manual. However, users cannot deny that some functions and interface provided by VISSIM has made the modeling of road networks more user friendly.

3.4 BIVARIATE AND MULTIPLE REGRESSION ANALYSIS.

The analysis part will base on statistical methods, chiefly regression analysis.

The principles and computational procedures of regression and multiple regressions are well known and covered in very many statistical textbooks. However, due to the nature of the study data on friction and flow, it is important briefly to review the principal constraints and potential sources of error in applying regression, especially to a problem where the independent variables, by their very nature (the flow and frictional variables) cannot be controlled or conditioned and also when some degree of correlation can be expected between some of the (so-called) independent variables. The key point about regression is that it is a parametric statistical technique, which consequently has a number of important constraints.

The key general constraints of bivariate regression may be summarized as follows:

a. For a fixed value of the independent variable, the dependent variable follows a normal distribution.
b. The residuals are randomly distributed

A simple linear regression model may legitimately be applied. The model states (Johnson 2000) that the line: **Y=a+bx**
They introduce two 'more subtle' assumptions

a. The explanatory variables are non-stochastic, i.e. the values of the x's are fixed or selected in advance, and
b. The x's will measure without error.

The modeling process above can be interpreted as follows:

The Greenshields model expresses the traffic flow characteristics rather satisfactorily on the studied sites. The statistical coefficient of determination R^2-value. Considering that the studied sites constituted of a representative sample of two-lane two-way roads in the study area, this model thus portrays traffic flow characteristics for the kind of roads and for the time during which the study will conducted in area. For instance, flow variables such as density at capacity and operating speeds at different density levels within the field data range can be predicted.

The linear model expressed the traffic flow characteristics on the studied sites fairly well with R^2-value though less than the level of Greenshields model. On similar assumptions that the studied four-lane two-way roads constituted of a representative sample of the type of roads in the study area, this model could be applied to predict operating speeds at different levels of flow rates within the field data range.

Conclusion: Side friction factors have fatal impact on level of service and capacity on urban road. Needs more study in developing countries like India.

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