Capacity of Urban Arterial Networks in Urban Areas

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ABSTRACT

Indian traffic conditions are mixed in nature, different vehicles will operate with different operating speeds and having different physical dimensions. The early warnings of incidents of urban arterials roads in a congested city reduce delay, accidents and pollutant emission. To account this non uniformity in static and dynamic characteristics of vehicles it is necessary to convert all vehicles into a common unit as passenger car unit. It was developed to find relative effect of alternative modes travelling on the roads. Capacity of a roadway is necessary for evaluating the deficiencies of the road network, designing new facilities by considering future travel demand and current capacities.

This paper develops a definition for an arterials incident and describe a case study on an arterial road in Hyderabad, Telangana state. In this study an attempt was made to develop PCU$^{'}$ factors and capacity for five midblock sections of Ameerpet to Kukatpally corridor in Hyderabad. To develop PCU$^{'}$ values and capacities Speed and flow data was obtained from filed surveys. Manual Method was used to collect traffic volume, time headway data and Laser gun was used for spot speeds. PCU$^{'}$ factors for the selected site were developed by using traffic stream speed, physical dimensions of the vehicles and longitudinal gap. It also identifies occupancy and speed as the appropriate parameters to characterize and defect arterial incident. Capacity of urban arterials is determined by fitting Speed-flow data into polynomial equation. In urban area capacity is influenced by many factors, in this study lane width and road side commercial activities are considered to find out its influence on capacity.

Keywords: PCU, DPCU, LASERGUN

INTRODUCTION

GENERAL

The traffic on Indian roads is heterogeneous or mixed in nature and character. Traffic stream comprises of varieties of slow and fast moving vehicles. The slow moving category consists of cycles and bullock carts. Fast moving traffic is dominated by two wheeled vehicles like scooters, motor cycles and three wheeled auto-rickshaws. In addition to the above, the

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traffic consists of cars, buses etc. In urban areas most of the traffic comprised of two wheelers, three wheelers, cars and buses.

This paper explores these issues and aims to:

(a) Outline possible approaches to detect arterials incidents,

(b) Provide the results from a case study in Hyderabad, Telangana State.

The case study in Hyderabad aims to characterize some arterials incidents, study the impact of these incidents on the three basic traffic parameters: occupancy, volume and time headway in an arterial road content.

Growth in the number of motor vehicles cannot be matched by a corresponding expansion in road space, as there are limits to how much road space can be provided within a city. Resource constraints have come in the way of adequate investments in increasing road capacity and even in undertaking timely repair. Inefficient systems of construction coupled with poor maintenance have resulted in poor road infrastructure. The situation is further exacerbated by unimaginative design of roads that do not allow segregation of vehicles travelling at vastly different speeds. Mobility is thus restricted to the speed of the slowest vehicle. Even at low proportions (10 per cent of the traffic mix), non-motorized vehicles reduce the operating speed of motor vehicles significantly (Moazzem and McDonald 1998). Smaller towns with narrow

and poorly maintained roads face this problem more acutely.

LITERATURE REVIEW

Ramanayya et al. (1980) used 'equivalent Design Vehicle' in place of passenger car unit to model the traffic observed on urban roads in India. From this study it was shown that PCU value of the passenger car itself is not constant due to heterogeneous traffic conditions. In this model an attempt was made to convert all vehicles including car into 'equivalent design vehicle unit'. Subsequently this was not validated in any of the future studies. He has adopted simulation study to obtain speed flow relationships for various combinations and types of roads.**Justo et al. (1984)** developed a model for estimating the passenger car units for urban roads. PCU values had developed for urban mid block sections, signalized intersections, and kerb parking. PCU value for a vehicle at a mid block section was estimated by considering mean speed, mean lower time headway, and average effective width

METHODOLOGY

GENERAL

The intent of this chapter is to explain the procedure which is going to adopt in this study. Flow chart of proposed methodology is shown in Figure 3.1.1 below. Six steps are

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identified and each is discussed in the following paragraphs.

IDENTIFICATIONOFPARAMETERS

The main trust of the objectives is development of PCU factors, speed flow curves, capacity of urban arterial and effect of lane width and road side friction on capacity. The important parameters are location details (carriageway width and shoulder width, road side friction, etc.), physical dimensions of the vehicles, and classified traffic volume speed of the vehicles and time headway of vehicles.

DATA COLLECTION

Data collection will be planned in two stages.

1. Collection of preliminary data.
2. Collection of field data.

Collection of preliminary data

Selection of survey location: Ameerpet to Kukatpally corridor in Hyderabad was identified as the study area. To achieve the intended objectives the road stretches in that corridor are identified based on following criteria.

a) Stretches having different lane widths.

b) Obstructions to traffic because of road side developments.

SUMMARY AND CONCLUSIONS

GENERAL

In this chapter, the summary of the work carried out, conclusions drawn and scope for further work are presented.

SUMMARY

➢ The present study is intended to develop PCU factors, speed-flow curves, and Capacity for urban arterials. In India, highway traffic is of heterogeneous nature and hence it is necessary to know the relative effect of different types of vehicles on the traffic flow in comparison with passenger car.

➢ A review of various approaches and techniques available for developing PCU factors and estimating capacity from speed-flow curves was carried out so as to select a simple and best method. An equation was proposed to develop PCU factors shown in Eq. 6.1

$$PCU_i = \frac{A_i U_c G_i}{A_c U_i G_c}(6.1)$$

➢ Ameerpet to Mytrivanam, Mytrivanam to SR Nagar, SR Nagar to ESI, ESI to Moosapet were the selected stretches in Ameerpet to Kukatpally corridor. Classified volume count, spot speed and time headway surveys were conducted in all the stretches.

➢ Speed flow curves developed for all locations using PCU values suggested by IRC and PCU values obtained by using the equation 6.1. Capacities from these curves are estimated by fitting the speed flow data to second degree polynomial equation

The second degree polynomial equation is in following form

$$av^2 + bv + c = f$$

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The capacity can be estimated by using Eq. 6.3

$$f = \frac{-b^2 + 4ac}{4a}$$

➢ The capacities using IRC PCU values and PCU values in this study are compared. Correction factors for lane width and road side friction were developed.

In this study only lane width and road side friction are considered to find its influence on capacity. So, this study can be extended by considering other influencing parameters like parking, pedestrians, bus stops etc., to find their influence on capacity. In this dissertation data was collected manually but it is advisable to capture the traffic flow using a video camera and the arrival vehicles of the successive vehicles using appropriate capturing technique.

CONCLUSIONS

➢ PCU values obtained in this study for 2-wheeler is around 0.15, auto rickshaw is around 0.5, and Bus is around 4.5.

➢ As carriageway width is increasing, PCU values are increasing for all modes.

➢ The capacity of a section with side friction is approximately 12 percent lower as compared to a section with no side friction.

➢ The capacity of a section is decreased as lane width decreases. For 1m

reduction in lane width the capacity is reduced by 15 percent.

➢ Capacities using PCU values suggested by IRC were almost exceeded 50% than capacities estimated by using dynamic PCU values obtained in this study.

➢ Using of Signal Sytem with U turn can decrease volume flow.

➢ Preffer signal time is minimum of 15 seconds to free of traffic and to cross the junction for the pedestrian.

➢ Signal system also helps to reduce the speed limit of vehicles to avoid accidents.

LIMITATIONS

The following are the limitations of the study

➢ Data is collected only for 12 Hours, from which continuous behaviour of the traffic cannot be evaluated

➢ PCU factors vary with traffic characteristics, roadway conditions, control conditions and environmental conditions. The effects of curvature, gradient, Etc were not taken into consideration.

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