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Analysis of Urban Streets in Indian Context and It's Statis and Dynamic Conditions

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ABSTRACT

In India, condition of traffic due to various kind of vehicles maneuvering with different lane behavior and driver behavior resulting in supremely heterogeneous nature due to their static and dynamic features. Currently the traffic on the road rises rapidly and traffic volume overdoes normal limit. Study of several features of highway traffic is essentially required for preparation, design and maneuver of roadway facilities. For the improved vehicular road traffic it needs better roadway structure with greater capacity. An intension of this work is to analyze capacity for urban roads in heterogeneous condition. For the capacity estimation it is relatively tough to estimate traffic volume on the road. The problem of measuring flow may addressed by using Dynamic PCU values. The Capacity of urban roads is find out by green shield model and the results are compared with Microscopic simulation model. The sudden increase in width of lane on the road is checked and result shows that with the increase in road width Capacity of road also increases.

INTRODUCTION

In India, the length of total road network presently available is 4.2 million km still peoples in India, facing massive difficulties in providing superior Vehicular traffic flow and traffic operations. The traffic on Indian roads varies significantly as of Western condition. The proportion of vehicular movement is far diverse with poorer acting vehicle and deliberate mobile vehicles. Rapid as well as constant growth in population is foremost problem for highway engineers. As growth in population altered modes of transportation are rises and resulted in congested traffic flow situation on road, for the transport of goods and passengers for short to medium distance's -roads plays a significant role and road transportation package is much flexible than further modes of transport available, Road transport play significant part in percentage shares in India GDP. Now a day's condition of traffic due to various kind of vehicles maneuvering with different lane behavior and driver behavior resulting in supremely heterogeneous nature due to their static and dynamic features. For the effective and quick vehicular traffic service it needs better highway Infrastructure with greater capacity. Highway circumstances comprise of geometric parameters such as lane width of road, shoulder condition and width, pavement condition, horizontal and vertical geometric condition. For the capacity estimation it is relatively tough to estimate traffic volume on the road. The use of Dynamic PCU values which is used to convert heterogeneous flow into uniform flow. PCU values are complex parameters which depends on traffic parameters and geometric condition at the period of field survey. The main object of this research is to analyze the capacity of urban roads by means of traditional model (green shield) and result compares with microscopic model, and significant of width of lane is explored

THE GUIDELINES AND TOOLKITS FOR URBAN STREETS

The Guidelines and Toolkits for Urban Transport Development were prepared by a Technical Assistance on Urban Transport Strategy (TA 4836-IND) funded by the Asian Development Bank for the Ministry of Urban Development (MoUD), Government of India. These documents are designed to help decision makers and practioners in states and municipal governments who are concerned with urban transport development in medium- sized cities in India

STRUCTURE OF USDG MANUAL

The manual is structured into 4 sections consulting of various chapters giving detail description on the relevant topics for the particular **Section 1**: Introduction and Context of USDG This section gives an overview of the initiative for preparing these guidelines. It defines the purpose , structure and the utility of this manual. **Section2**: Goal and Design Principles of USDG This section highlights the need and approach for preparation of street guidelines for the city of GUNTUR. It specifies the basic principles for street design for GUNTUR in context to various street elements. It also includes chapter establishing the street hierarchy network for GUNTUR. This section is a basic step to approach the guidelines and should be referred by all those who will be making use of this manual in any context. **Section3**: Design Guidance This sections describes in detail about how to design the various street elements by understanding the existing issues of GUNTUR streets. It provides definition and purpose of every identified street elements, highlights the current issue and gives design recommendations for the same. This section also includes reference drawing templates with cross sections and plans for various RoW of streets and typical intersections. This section is of more utility to the designers/planners, the technical professionals and all those who use, work for or assess the streets and the transportation aspect in general in GUNTUR like the citizens and act visit organizations who are the stakeholders.**Section4**: Implementation guidelines and recommendations This section provides recommended approach for implementation of the guidelines. This section is basically for the policy makers who shall use the Recommendations to do the necessary policy interventions to accomplish the goals and objectives of Urban Street Design Guidelines.

LITERATURE REVIEW

There are number of extensive research work and studies has been carried out for the capacity estimation of roads for the developed and developing nations, in this paper the studies which are deal with capacity analysis are reviewed. Satish Chandra et.al, (2004) offers procedure for two lane roads to determine capacity under diverse traffic situation and analyze the affecting factors which influence and affect the roadway capacity and provide the modification factors for each of the field condition and depends on this modification factors capacity of road was determined in heterogeneous traffic situation. Arpan Mehar et.al, (2013) determine the capacity of Indian highway in diverse traffic flow operating situations by the use of microscopic simulation software (VISSIM) and compared the simulated traffic data with field traffic data and modify certain parameters(driver behavior) which disturb the simulation result. Chandra et.al, (2003) studied effect on the capacity by means of lane width of roads in varied traffic conditions, work on diverse roads is carried and study analysis express that PCU values for a different vehicle classes suddenly upsurge with width of lane . V.Thamizh Arasan et.al, (2005) provide a method used for showing extremely mixed traffic flow condition, author deceive diversified flow with vehicles with different steady and moving parameters without considering lane discipline and study result properly replicate heterogeneous traffic flow condition on roads wherever vehicles moving with consideration of absence of lane control. Thamizh Arasan et.al, (2010) provides a computer simulation model (HETEROSIM) to evaluate PCU values in heterogeneous traffic flow situation and state that with variation of traffic volume on road with roadway width PCU values significantly changes. Chetan R.Patel et.al (2014) a case study is carried by author on six lane roads of GUNTUR and Patna and sudden influence of roadside friction on given traffic flow condition is checked, presence of road side friction is examined by comparing service volume and stream speed at different volume to capacity ratios and study analysis shows that the capacity of urban arterials is greatly influenced by road side friction

METHODOLOGY

Field Traffic surveys are conducted to collect the data on selected vehicular volume and vehicular speed on chosen road sections of different roads

passes through the metropolitan city. Preliminary surveys are carried to collect the primary information about road condition, no. of lanes, shoulder condition, width of road etc. Field data require for study is obsessed on the study patch of inner city roads, the traffic data for the field study was taken on typical weekdays for this a 30m study patch is elected with consideration of no interaction several entry of intersection. Vehicular traffic volume and speed data are composed for 3hours for morning peak hour for 8.00 a.m. to 11.00 a.m., 2 hours during off peak hour for 2 hours from 1 to 3 p.m., and evening data for 2 h from 4.30 to 6.30 using video filming technique covering varied range of traffic conditions and flow behavior which intended to require for study intent, Entire motorcycles are categorized in eight class as Bus, Truck, LCV, Car, 2-Wheeler, 3-Wheeler, Bicycle and MAV. Physical vehicle dimensions of all vehicles on urban highway are specified in table.1. Speed parameters got from field situation for both the road are specified in table.2 and table.3 respectively based on the physical dimensions of all vehicles and speed parameters PCU values determined for both road are specified in table.

CAPACITY ESTIMATION USING TRADITIONAL METHOD

The capacity of road is determined by imperial method, depending by traffic volume and traffic attribute. Traffic data is extracted to obtain 5-5 minute speed data and flow data for each vehicles category, speed data for the vehicles obtained for 5-5 minute count interval are converted to average speed for each vehicles in traffic stream to obtain avg. spot speed for each vehicle category. In order to develop speed-volume relationship and to estimate roadway capacity the observed traffic volume is altered in an identical numeral of vehicles by use of passenger car unit. Dynamic PCU value is avail to novice heterogeneous traffic stream in homogeneous flow stream which given in table no.

NEED FOR STUDY

While the utility of urban streets has been multiplying demanding more space, the road widths are getting restricted due to space constraints within the fast expanding city. This has led to severe conflicts amongst various attributes like physical, social, environmental associated with the road development as also amongst the interests of various stakeholders. Traffic problems, degrading environment, encroachments are the manifestos' of such conflicts that slowly ruins the development of any city. With streets being the common platform serving various functions and stakeholders, the issues are ge ng intertwined and extremely critical to resolve with the changing me.

BLOS MODEL DEVELOPMENT AND STATISTICAL TESTS- MULTI-LANE URBAN ROAD SEGMENTS IN INDIAN CONTEXT

This study has investigated the bicycle activity on 44 multi-lane urban road segments under heterogeneous traffic flow conditions and subsequently, developed a highly reliable (R^2 = 0.74) Bicycle Level of Service (BLOS) model. A sensitivity analysis carried out on modeled parameters has reported that traffic volume has the highest influence on BLOS. Thus the provision of bicycle lane is highly expected. The effect caused on motor-vehicle users due to shrinkage in existing carriageway width while providing a bicycle lane is studied using the VISSIM tool. For the majority of segments, such a provision did not greatly hamper satisfactions of motor-vehicle users. This study has investigated the bicycle activity on 44 multi-lane urban road segments under heterogeneous traffic flow conditions and subsequently, developed a highly reliable (R^2 = 0.74) Bicycle Level of Service (BLOS) model. A sensitivity analysis carried out on modeled parameters has reported that traffic volume has the highest influence on BLOS. Thus the provision of bicycle lane is highly expected. The effect caused on motor-vehicle users due to shrinkage in existing carriageway width while providing a bicycle lane is studied using the VISSIM tool. For the majority of segments, such a provision did not greatly hamper satisfactions of motor-vehicle users. The preliminary step in developing a BLOS model is

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the identification of relevant road attributes those should be used as independent variables in the model building. For this purpose, a Pearson's correlation analysis was carried out over a wide range of road attributes collected from the study corridors. The variables significantly ($p < 0.001$) affecting the riding quality of bicyclists were identified. By using these relevant road attributes as dependent variables and perceived satisfaction of users as the dependent variable, a step-wise regression analysis was carried

out for developing the service prediction BLOS model.

RATIONAL FOR OPINION SURVEY

The terms 'road' and 'street' are commonly used . But these words have different meaning. The main function of a road is to distribute traffic whereas a street is multi-functional and is a place to live, work walk, cycle, interact and spend me.'Sociability is large part of why cities exist and streets are the major if not the only public place for that sociability to develop'.'A great street should be a most desirable place to be, to spend me, to live, to play, to work at the same me that it markedly contributes to what a city should be. By this definition of streets, it is evident that there are various stakeholders for streets and their expectations for making of the 'good street' differ . Such streets which satisfy the expectations for 'Good Street' of all or most of the stakeholders can then be termed as ' complete streets'.

METHOD FOR SURVEY

The easiest and the most popular method of garnering public participation is through opinion surveys. SI designed a survey, the results of which would help to represent the opinions of the public through a series of questions. and every responsible resident of the city. The survey was based on random sampling to get responses of all the stakeholders Streets are an inseparable part of urban life and used by all the citizens irrespective of age, gender or profession and income class. As the streets are being used by everyone and for various purpose, it is necessary that the design and construction of streets is done considering the needs of these street users. It is thus important to understand their views, aspiration and problems about the streets for achieving the goals and objectives as envisaged in USDG so that the streets best respond to their contexts and intended functions.

Street Topology: IRC 69:1977 - Space standards for roads in urban areas states that: In the interest of efficient road transportation, which effectively serves the various land uses in an urban area and at the same time ensures logical community development, it is desirable to establish network of roads divided into different classifications, each system serving a particular function or purpose. The principle factors to be considered in designating roads into appropriate classifications are mobility, activities and parking requirements. The typology defines the street with specific usage and purpose.

PROPOSED STREET TYPOLOGY FOR GUNTUR

To facilitate safe and independent crossing of disabled people, raised crossing and refuge islands are found to be effective. Raised crossings enable to flush the level difference between the sidewalk and the carriageway making it easy for the disables to cross the street. Also the raised crossing help to reduce he speed of the approaching vehicles and helps the driver to have be er view of the people

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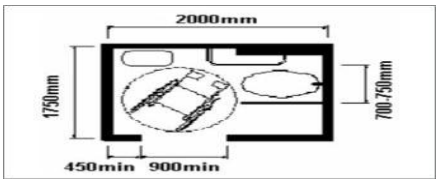
crossing streets. Refuge islands help to reduce the length of the crossing increasing the convenience of the user. Curb ramps of recommended design are to be provided at both sides of the raised crossings. Guide strips should be constructed to indicate the position of pedestrian crossings for the benefit of people with visual disabilities. A colored tac le marking strip at least 600 mm wide should mark the beginning and the end of a traffic island, to guide pedestrians with impaired vision to its location. Pedestrian traffic lights should be provided with clearly audible signals for the benefit of sightless pedestrians. Push buttons should be easy to locate and operate and should be placed between 0.90 m and 1.20 m off the ground for the benefit of wheelchair users.

STREET FURNITURE AND STREET SIGNAGE FORDISABLES

A minimum of one toilet compartment should have enough floor space of 2000mm x 1750mmfor wheelchair users to enter and exit. Provide a door of clear opening of at least 900mm with the door swing outwards or be folding or sliding type. The flooring should be slip resistant Accessible toilet should have a switch near the WC (one at 300mm and the other at 900mm from the floor level), which activates an emergency audio alarm (at the reception/attendants desk, etc.)



WC should have clear space of not less than 900mm wide next to the water closet should be located between 460mm to 480mm from the centerline of the WC to the adjacent wall and have a clear dimension of 800mm from the edge of the WC to the rear wall to facilitate side transfer. The top of the WC to be 475-490mm from the floor. Grab bars at the adjacent wall and the transfer side of the WC.On the transfer side-swing away/up type and on the wall side L-shape grab bars should be provided. **Fig**: Size and layout for toilets and WC for disables

CONCLUSIONS

The Traffic data for urban road, the dynamic PCU values are found by Dr.Satish Chandra method, Based on the parameters and Data obtained for capacity estimation the following conclusions have been drawn. The observed field capacity and simulated capacity is found to be ±5%The further increase in road width the PCU values for traffic composition are increases as well as capacity of road increases. This study has analyzed the bicycle activity on multi-lane urban road segments under the influence of heterogeneous traffic flow conditions. The preliminary data analysis carried out using Pearson's correlation analysis has reported that only seven variables are significantly ($p < 0.001$) affecting the perceived satisfactions of bicyclists. These parameters are such as: available road width, traffic volume, traffic speed, percentage of heavy vehicles, vehicular ingress-egress to the on-street parking area, land-use pattern on roadside area and interruptions from intermittent public transits. As observed in this study, presence of medians, curb and gutter pan, number of lanes, presence of street lights etc. are relative less important in bicycle service qualities and thus were not included in the model building. By using the relevant road attributes as independent variables in the model building, a step-wise regression based BLOS model has been developed in this study. The model is highly reliable in its applications and has a high coefficient of determination value (R^2 = 0.74) with averaged observations. A sensitivity analysis was carried out on modeled variables which reported that motorized traffic volume has the highest influence on bicycle

service qualities followed by the percentage of heavy vehicles, vehicular ingress-egress to the on-street parking area and roadway width. These parameters contributed 44.8%, 22.17%, 16.62% and 9.55% respectively in the model building. Provision of separate bicycle lane facility could minimize the negative influences from motorized traffic flow. On the other hand, it could also offer designated space for bicycle use. Hence, provision of the bicycle lane is the most feasible solution to enhance the bicycle service quality of multi-lane roads. But in the cities belonging to developing countries like India due to limitations in available land space, it is always not feasible to widen the existing roadway and provide a bicycle lane. Hence, it may need to avail the required bicycle lane width from the available road space; which is perhaps possible if roads are multi-lane and available roadway width is sufficient enough. The effect of shrinkage in road space on motor-vehicle drivers due to the provision of a bicycle lane (at least 1.2-meter width) from the available carriageway width was studied in a computer environment using VISSIM, a microscopic traffic simulation tool. In the observation, the motorized LOS as well as traffic speed did not get significantly hampered for majority of tested segments. This may be because, though road space is reduced, but separation from non-motorized traffic provides some extra comfort to the motorized vehicle users. However, for few segments, the motorized LOS, as well as traffic speed, get degraded. This perhaps is due to the presence of a high volume of traffic (approximately 1400 PCUs/h) on those roads. After shrinkage in roadway width, the reduced width was perhaps not sufficient enough to carry the high volume of traffic. In such cases, roads are required to be widened, and bicycle lanes should be provided. The major contribution of the study is the development of a highly reliable service prediction BLOS model that can be used by transportation planners and engineers to assess the bicycle service qualities offered by multi-lane urban roads under heterogeneous traffic flow conditions. The model has considered a unique parameter such as interruptions caused by intermittent public transits which have a considerable adverse effect on bicycle service qualities. This study has concluded that, if the traffic volume on any multi-lane road is below 1400 PCUs/h, a bicycle lane can be provided by utilizing the existing roadway width

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