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Level of Service Criteria of Roads in Urban India Context

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ABSTRACT

Traffic congestion has become a serious problem in metropolitan cities like Guntur. This enormous traffic congestion is due to huge explosion in job opportunities created by these cities. Traffic congestion has now become a very serious problem particularly in metropolitan cities because cities have expanded dynamically without any planning and control. Such rapid development has increased the number of vehicles in Guntur city which is creating a huge increase in traffic congestion thereby increasing the delay time in each midblock. This traffic congestion is causing pollution due to idling of vehicles for a long time. The present study is an attempt to study different parameters such as capacity, level of service, vehicle to capacity ratio, average journey time, average delay in each midblock, peak hour traffic and to provide necessary improvement measures in this midblock. For the present study 6 mid-blocks were selected in Chilakaluripet bypass road area of Guntur city. Traffic volume count was conducted on all these 6 stretches from morning 6 AM to 10 PM. Speed and delay studies were conducted three times during peak and non-peak hour and the average journey time was determined. Average delay of all these mid-blocks were also determined using speed and delay studies. Road inventory survey was done to determine the width of the road, median, footpath. Capacity calculation was done on the basis of spot speed studies. Level of service was found out based on the average speed among each mid-block. The traffic data collected from the field shows that the mid blocks are congested during peak hours. The vehicle to capacity ratio during peak hour was found to be exceeding 1. The level of service of the entire stretch was found to F during the entire survey. The average time required to travel the entire 3.8km stretch during peak hour was found to be 17min and the average travel speed was below 13kmph. Improvement measures should be done in Sony signal junction where maximum delay is occurring.

INTRODUCTION*:* Traffic congestion has been one of major issues that most metropolises are facing and thus, many measures have been taken in order to mitigate congestion. It is believed that identification of congestion characteristics is the first step for such efforts since it is an essential guidance for selecting appropriate measures. Congestion both in perception and in reality impacts the movement of people and freight and is deeply tied to the history of high levels of accessibility and mobility. Traffic congestion causes waste of time and energy, thereby causes pollution and stress, decreases productivity and imposes costs on society.There are two principal categories of causes of congestion, and they are; (a) micro-level factors (e.g. relate to traffic on the road) and macro-level factors that relate to overall demand for road use. Congestion is "triggered" at the "micro" level (e.g. on the road), and "driven" at the "macro" level by factors that contribute to the incidence of congestion and its severity. The micro level factors are, for example, many people and freight want to move at the same time, too many vehicles for limited road space. Many trips may be delayed by events that are irregular, but frequent: accidents, vehicle breakdowns, poorly timed traffic signals, special events like mass social gatherings, political rallies, bad weather conditions, etc. which present factors that cause a variety of traffic congestion problems. On the other side, macro level factors e.g. land-use patterns, employment patterns, income levels, car ownership trends, infrastructure investment, regional economic dynamics, etc. also may lead to congestion.Level of service measure requires following steps to be conducted on the segment of road considered for defining L.O.S Cities and traffic have developed hand-in-hand since the earliest large human settlements and forcing inhabitants to congregate in large urban areas and in turn enforcing need of urban transportation. To develop efficient street transportation, to serve effectively various land use in an urban area, and ensure community development, it is desirable to establish a network of streets divided into systems, each system serving a particular function or particular purpose. Accordingly, a community should develop an ultimate street-classification in which each system has a specific transportation service function to

perform. There are several operational performance measures and level of services (LOS) which have to be taken into account to evaluate the system of streets. Increasing population of urban areas due to shifting of people from rural to urban areas and thus certainly increasing vehicular population on urban streets, have caused problems of congestion in urban areas. Roadtraffic congestion poses a challenge for all large and growing urban areas.This document provides a summary of urban street with respect to their classification, related operational performance measures and level of services (LOS) involved in each class of urban street and it also provides strategies necessary for any effective congestion management policy to curb the congestion.

LITERATURE REVIEW: Antony Stathopoulos [1] proposed an approach for estimating the duration of congestion on a given road section and the probability that, given its onset, the congestion will end during the following time period. . Rahman et. al. [2] developed a model for LOS using passing-overtaking manoeuvres in terms of total traffic volume and percent of rickshaw. M.V.LR Anjaneyulu et.al. [3] studied the relationship of congestion with speed variation and quantified the congestion using speed variation also he defined the 5 Level of Services from A to E based on the coefficient of variation of speed. Chetan R. Patel [4] proposed an empirical investigation in the behavior of mixed traffic stream speed and flow rate on an access controlled urban arterial in Surat city in Gujarat state of India. Eleonora Papadimitriou [5] analyzed the perceived highway level of service in relation to drivers personal characteristics and traffic conditions. The results confirm that the relationship between perceived level of service and traffic conditions has a piecewise linear form with significant differences in slopes and breakpoints. Milica Selmic [6] developed a model for the best strategy selection from transportation and drivers point of view for transportation demand management aimed to reduce the congestion. Ning Wu et.al. [7] Developed a model which takes into account the total segment of freeway merge diverge and weaving as an entire object. A combined volume-capacity ratio is used for determining the LOS of the total sections. Indrajit Ghosh [8] summarized the evolution on the research of determining the level of service of two lane roads and provides discussion for future directions pertinent to Indian mixed traffic situation. Takashil Sakai et.al [9] proposed a simplified method for measuring driver satisfaction (CS) in real time with observable data and proposed six level of services in accordance with HCM based on the customers satisfaction.Maitra et. al. [10] proposed development of LOS criteria based on congestion, 10 levels of service have been proposed depending upon the percentage of congestion, with 9 in stable zone as A-E, and one representing an unstable operation as F. The model is applicable to undivided urban streets with relatively high proportions of rickshaws. In this context, present study is carried out to determine the flow behaviour under mixed traffic conditions and also to establish LOS for the prevailing traffic conditions.

METHODOLOGY

- Reconnaissance survey.
- Classified traffic volume count was conducted in each mid-block: Traffic volume studies are conducted to determine the number, movements, and classifications of roadway vehicles at a given location. These data can help identify critical flow time periods, determine the influence of large vehicles or pedestrians on vehicular traffic flow, or document traffic volume trends.
- Spot speed studies were conducted in all mid blocks: Spot speed studies were done at different times to identify the speed of vehicles in each midblock. The instrument used for spot speed study is RADAR gun which gives as instantaneous speed of each vehicle.
- Speed and delay was done by floating car method: Speed and delay studies were conducted during peak hour and non-peak hour on each midblock by floating car method. Here the time required to cover the entire road stretch is noted down and also delay caused due to different factors in noted.
- Road inventory survey: Road inventory survey is conducted on each mid block and the following are recorded Road way width, Shoulder width, and

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Median width, Distance of each mid-block, Footpath width and Car parking areas. Three highways (MSH-248, MSH-255, MSH-260) were selected for assessment of level of service. Level of service of each highway section is assessed by using HCS-2000 Software. Traffic surveys are conducted to collect the data of vehicular volume and speed on the selected road sections for different highways passing through the metropolitan city. Inventory surveys are carried out for gathering the primary information regarding road surface characteristics, number of lanes, lane width etc. On the basis of inventory surveys the detailed surveys are planned. The surveys are conducted on normal working days during morning and evening peak as well as off peak hours covering wide range of traffic conditions and flow behaviour.

LEVEL OF SERVICE: The level-of-service concept was introduced in the 1965 HCM as a convenient way to describe the general quality of operations on a facility with defined traffic, roadway, and control conditions. Using a letter scale from A to F, a terminology for operational quality was created that has become an important tool in communicating complex issues to decision-makers and the general public. The HCM 2000 defines level of service as follows: "Level of service (LOS) is a quality measure describing operational conditions within a traffic stream, generally in terms of such service measures as speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience."A term level-of-service closely related to capacity and often confused with it is service volume. When capacity gives a quantitative measure of traffic, level of service or LOS tries to give a qualitative measure. Service volume is the maximum number of vehicles, passengers, or the like, which can be accommodated by a given facility or system under given conditions at a given level of service. Level of service (LOS) qualitatively measures both the operating conditions within a traffic system and how these conditions are perceived by drivers and passengers. It is related with the physical characteristics of the highway and the different operating characteristics that can occur when the highway carries different traffic volumes. Speed-flow-density relationships are the principal factor affecting the level of service of a highway segment under ideal conditions

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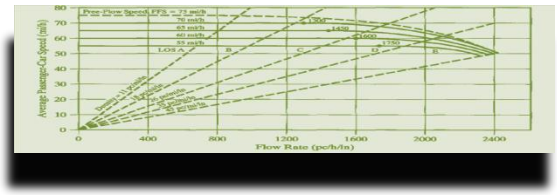
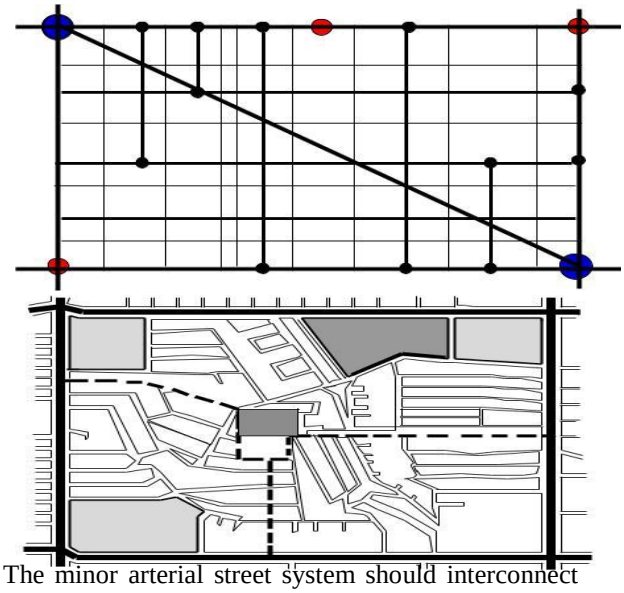
Represents reasonable free-flowconditions. Comfort and convenience levels for road users are still relatively high as vehicles have only slightly reduced freedom to maneuver. Minor accidents are accommodated with ease although local deterioration in traffic flow conditions would be more discernible than in service A. Describes a state of breakdown orforced flow with flows exceeding capacity. The operating conditions are highly unstable with constant queuing and traffic moving on a ‘stop-go’ basis.



Capacity analysis procedures for freeways and multilane highways are based on calibrated speed-flow curves for sections with various free-flow speeds operating under base conditions. Base conditions for freeways and multilane highways indicated above. Figures 4.2 and 4.3 show the standard curves calibrated for use in the capacity analysis of basic freeway sections and multilane highways. These exhibits also show the density lines that define levels of service for uninterrupted flow facilities. Modem drivers maintain high average speeds at relatively high rates of flow on freeways and multilane highways. This is clearly indicated in Figures 4.2 and 4.3. For freeways, the free-flow

speed is maintained until flows reach 1,300 to 1,750 pc/hr/ln. Multilane highway characteristics are similar. Thus, on most uninterrupted flow facilities, the transition from stable to unstable flow occurs very quickly and with relatively small increments in flow.

FUNCTIOALL CLASSIFICATION: Functional classification is the process by which streets and highways are grouped into classes, or systems, according to the character of service they are intended to provide. Basic to this process is the recognition that individual roads and streets do not serve travel independently in any major way. Rather, most travel involves movement through a network of roads. It becomes necessary then to determine how this travel can be channelized within the network in a logical and efficient manner. Functional classification defines the nature of this channelization process by defining the part that any particular road or street should play in serving the flow of trips through a highway network.



The minor arterial street system should interconnect with and augment the urban principal arterial system and provide service to trips of moderate length at a somewhat lower level of travel mobility than principal arterials. This system also distributes travel to geographic areas smaller than those identified with the higher system. The minor arterial street system includes all arterials not classified as a principal and contains facilities that place more emphasis on land access than the higher system, and offer a lower level of traffic mobility. Such facilities may carry local bus routes and provide intra-community continuity, but ideally should not penetrate identifiable neighborhoods. This system should include urban connections to rural collector roads where such connections have not been classified as urban principal arterials. The spacing of minor arterial streets may vary from half to one km in the central business

DESIGN BASED CLASSIFICATION: These are the streets with very low driveway or access point density. These are provided with separate right turn lanes and; no parking is permitted on street. Streets may be multilane divided or undivided or two lane facility with shoulders. Signals are infrequent and spaced at long distances. Road side development is very low. A speed limit on these roads is 75 to 90 kmph. They represent streets with a low driveway/access-point density, separate or continuous right turn lane and some portions where parking is permitted. These roads possess comparatively higher density of roadside development than that on high speed streets. It has about three signals per Km. and speed limit on these roads is 65 to 75 kmph they represent urban streets with moderate driveway/access point density. Like sub-urban streets they also have some separate or continuous right turn lane and some portions where parking is permitted. These roads possess comparatively higher roadside development than that on sub-urban streets. It has about two to six signals per Km. and speed limit on these roads is 50 to 60 Kemah They represent urban streets with high driveway/access point density. These are usually pro-vided with road side parking. It has highest road side development density among all above stated four classes. Signal density is about four to eight per Km. Speed limit is 40 to 55 Kmph

Limitations and Future Scope: There are some limitations in this research work and further study can be carried out to overcome these limitationsThe research is carried out only for the city of Mumbai and this research can be further executed in other cities to determine the Level of Service (LOS)

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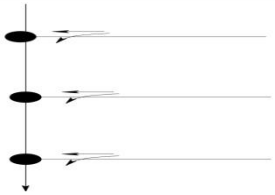
criteria of roads due to heterogeneous of traffic flow, road condition of other cities and driving characteristics. The mid-sized vehicle is only used for this research work. Trimble GeoXT GPS receiver fitted on mid-sized vehicles for this research, because it provides consistency, automation, finer levels of resolution and better accuracy in measuring travel time, delay and speed. The study can be further carried out by using other modes of vehicles. The user perception should be given consideration in defining LOS criteria of roads in urban Indian context. This study is based on quantitative measure of service, which can be extended for qualitative measurement to develop comprehensive LOS criteria.

CONGESTION MANAGEMENT: When demand on a facility exceeds the capacity Congestion takes place. The travel time or delay is in excess of that normally incurred under light or free flow traffic condition. The travel time or delay is in excess of agreed upon norm which may vary by type of transport facility, travel mode, geographical location, and time of day. In the procedure for congestion management initially we have to find out the root cause of congestion and finding out the remedies for managing the congestion, updating the signalization if it is needed. It is always better to use good signalization for minimizing impact of congestion. We can provide more space by making use of 'turn bays' if geometry permits. Parking restrictions also help in congestion management on urban streets. Now we will discuss some important strategies to manage the congestion on urban streets

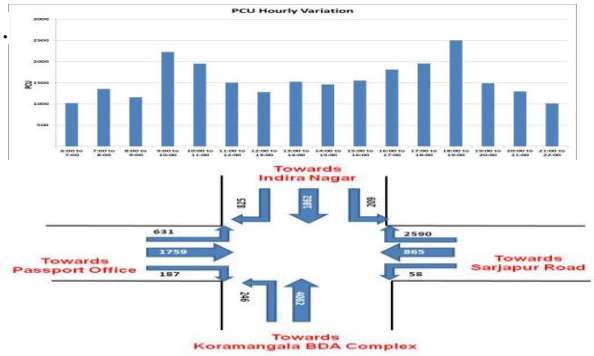
SHORTER CYCLE LENGTH: If on any intersection higher cycle time is provided then it will certainly create problems like increase in queue length and platoon length discharged and it will lead to increase in blockage



of intersection, with substantial adverse impact on system capacity. This is particularly when short link lengths are involved. Length of downstream space should be greater than queue length to store the vehicles. Note that a critical lane flow of Vi nominally discharges Vi*C/3600 vehicles in a cycle. If each vehicle requires D meters of storage space, the downstream link would be

HOV LANES: High occupancy vehicle (HOV) lanes are designed to help move more people through congested areas. HOV lanes over users a faster, more reliable commute, while also easing congestion in regular lanes - by moving more people in fewer vehicles. HOV lanes on provincial highways are reserved for any of the following passenger vehicles carrying at least two people (often referred to as 2+)

EVALUATION OF CAPACITY AND LEVEL OF SERVICE: The district administration started land acquisition for 17 km long Chilakaluripet bypass road which will be laid at a cost of Rs 600 crore to solve traffic problem on the national highway.The sixth- lane bypass road will start at Timmapuram and it will end at Konayakunta near Boppudi village.The revenue department will acquire land from the farmers in Boppudi, Purushottamapatnam, Chilakaluripet and Nadendla



CONCLUSION: The following conclusions were obtained from the present traffic conditions

a. Vehicle composition of the traffic shows that more than 50% of the vehicle composition consists of two wheelers and three wheelers.

b. The hourly variation of the traffic shows that most the midblock has peak hour traffic between 9AM to 11AM and 6PM to 8PM.
c. The volume to capacity ratio of each midblock exceeds 1 during the peak hour traffic.
d. The speed and delay studies shows that the average journey speed for the entire stretch is 12.83kmph from Forum to Sarjapur road and 13.95 kmph from Sarjapur road to Forum during the peak hours.

e. The average delay during the peak hours in the entire stretch is found out to be 6.75 min in the stretch from Forum to Sarjapur road and 5.76 min in the stretch from Sarjapur Road to Forum. The maximum delay occurs in stretch Sony Signal to NGV 2min 12sec and Sony Signal to Tanishq 2min 38sec.
f. The most congested traffic was found in the stretch starting from NGV- Sony Singal-Tanishq and the level of service of the entire stretch at peak and non peak hour was found to be F.It can be understood that urban streets are integral part of transportation system. Urban streets plays vital role in development of country. These are classified on their function, design for various considerations taking into account. Performance measures are to be worked out to determine LOS. Congestion is a huge problem which can be curbed by some preventive measures and design strategies. Signalized remedies are more efficient than any other measures of street congestion management. Non signalized remedies can be used to manage congestion by providing more space in terms of extra lanes.

REFERENCES

1.) Highway Capacity Manual. Transportation Research Board. National Research Council, Washington, D.C., 2000.
2.) Amudapuram Mohan Rao, Kalaga Ramachandra RaoInternational "Measuring Urban Traffic Congestion "Journal for Traffic and Transport Engineering, Volume- 2(4): pp 286 – 305,2012.
3.) Fungai Hamilton Mudzengerere and Virginia Madiro "Sustainable Urban Traffic Management In Third World Cities: The Case Of Bulawayo City In Zimbabwe" Journal of Sustainable Development in Africa Volume 15,No.2, 2013.
4.) Syed Shahan Ali Shah , Mohammad Ayaz, Rawid Khan3 Khan Shahzada, Hassan Khan Zaigham Ali "Traffic Analysis Of Warsak Road Peshawar Pakistan" International Journal of Applied Sciences, Engineering and Management ISSN 2320 – 3439, Vol. 02, No. 03, pp. 58 - 64 May 2013.
5.) Ahmad Munawar "Speed and Capacity for Urban Roads, Indonesian Experience" 6th International Symposium on Highway Capacity and Quality of Service Stockholm, Sweden June 28 – July 1, 2011.
6.) Chetan R Patel, Dr G.J Joshi "Capacity and LOS for Urban Arterial Road in Indian Mixed Traffic Condition" Transport Research Arena Europe, 2012..
7.) Satyam Mukherjee "Statistical analysis of the road network of India" Indian Academy of science, Vol. 79, No. 3 ,pp. 483–491,Journal of September 2012.
8.) Sanjay Kumar Singh "Urban Transport in India: Issues, Challenges, and the Way Forward" European Transport Issue 52, Paper no 5, 2012.
9.) Rijurekha Sen, Andrew Cross, Aditya Vashistha, Venkata N. Padmanabhan, Edward Cutrell, and William "Accurate Speed and Density Measurement for Road Traffic in India" IIT Bombay Research Paper
10.) Anitha Selva Sofia S.D., Nithyaa.R, Prince Arulraj.G "Minimizing the Traffic Congestion Using GIS" IJREAT International Journal of Research in Engineering & Advanced Technology, Volume 1, Issue 1, March, 2013.
11.) Ninad Lanke , Sheetal Koul "Smart Traffic Management System" International Journal of Computer Applications(0975 – 8887) Volume 75– No.7, August 2013.

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