Level of Service Analysis on Volume Capacity Ratio at the Intersections of OMR Stretch (Chennai)

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Abstract— The challenges of the urban transportation in India are growing rapidly, and government agencies at various levels are taking steps to address the performance gaps in service delivery. The study deals with the analysis of service levels at the intersections of Old Mahabalipuram Road stretch (OMR) in Chennai. The traffic volume is counted with the photographic method by taking video graphic survey and the classified count of vehicle is done. The volume to capacity ratio is found for the major intersections and is ranked with the level of service. Based on the level of service, the transportation engineers will be able to suggest a sustainable solution for the traffic congestion. The travel time in the major arterial roads can be effectively improved and forecasted for the future travel demand.

Key words: Intersections, Traffic Volume, Photographic method

I. INTRODUCTION

There has been a phenomenal growth of motor vehicles in India in the recent past. The disproportionate growth in the traffic vis-a-vis growth in road length, along with unauthorised encroachments on road space, lack of traffic and lane discipline and deficiencies in traffic control have contributed to the increasing problem of congestion in urban areas. In addition to increased travel time and delays, traffic congestion increases air pollution due to vehicular emissions. There is no consistent definition of congestion in terms of a single measure or set of measures that considers severity, duration, and spatial extent. Measures related to travel time and speed are the most flexible and useful for a wide range of analyses. Congestion can be defined as follows.

- Congestion is travel time or delay in excess of that normally incurred under light or free flow travel conditions.
- Unacceptable congestion is travel time or delay in excess of an agreed upon norm. The agreed upon norm may vary by type of transportation facility, travel mode, geographic location and time of day.

Research organization and technical bodies have recommended standards and specifications for all design parameters to the generalized situations. The type and intensity of congestion depends on many quantifiable factors such as volume, speed, headway, ratio of slow moving and fast moving vehicles etc.

II. LEVEL OF SERVICE

When a road is carrying a traffic equal in volume to its capacity under ideal roadway and traffic conditions, the operating conditions become poor. The concept of levels of service is defined as qualitative measure describing the operational conditions with in a traffic stream, and their perception by motorists and passengers.

The following factors considered in evaluating level of service:

- Speed and travel time
- Traffic interruptions or restriction
- Freedom to man oeuvre to maintain the desired operating speeds
- Driving comforts and convenience
- Economy, with due consideration operating cost of the vehicle

Highway Capacity Manual (HCM), therefore, utilizes:

- Travel speed
- Ratio of the service volume to capacity, depending up on the particular problem the latter is often referred to as "υ/c ratio" in the manual

A. Level of Service A:

Free flow, with low volumes and high speeds. Traffic density is low, with speeds controlled by drivers desired speed limits and physical roadway conditions.

B. Level of Service B:

Zone of stable flow, with operating speeds beginning to be restricted somewhat by traffic conditions. Drivers still have reasonable freedom to select their speed and lane of operation. Reduction in speed is not unreasonable

C. Level of Service C:

Most of the drivers restricted in the freedom to select their own speed, lane changing or overtaking, man oeuvres. A relatively satisfactory operating speed is still obtained with service volumes perhaps suitable for urban design practice.

D. Level of Service D:

Fluctuations in volume and temporary restrictions to flow may cause substantial drops in operation speeds, drivers have little freedom to man oeuvre.

E. Level of service E:

It cannot be described by speed alone but also represents operations at even low speeds than in level D, with volumes are near capacity of highway. Speeds are typically not always in neighbourhoods of 50 K.P.H.

F. Level of Service F:

Forced flow operations at low speeds, where volumes are below capacity. Speeds are reduced substantially and stoppages may occur for short or long periods of time, because of downstream congestion. In the extreme, both speed and volume can drop to zero.

III. SELECTION OF STUDY AREA:

The area selected for this study is OMR stretch in Chennai which is abbreviated as Old Mahabalipuram Road corridor. The stretch elongates up to 45.1 km starting from Madhyakailash to Mahabalipuram. OMR stretch is one of the heavy traffic floating road in Chennai because of the road containing IT parks and serves as one of the way to mahabalipuram. It includes six intersections on the entire stretch.

A. Reasons for selecting the study area (OMR):

- OMR has heavy traffic which serves in accurate results while surveying.
- More number of intersections.
- Easy to analyse since its nearer to our university campus.
- Well known road, which facilitates the making of survey easier.
- Heavy traffic, which helps to determine the survey at any time.

IV. SELECTION OF INTERSECTIONS:

OMR stretch generally include six intersections namely Madhyakailash, Thiruvanmiyur, SRP, Shollinganallur, Kelambakkam-vadapalani, Kelambakkam-ECR. But we have selected mainly three intersections for the video graphic survey. They are intersections of Kelambakkam, Shollinganallur and Thiruvanmiyur which are main very main intersections with heavy floatation of traffic all the time.

V. STUDY ON TRAFFIC FLOW

The latest development in the field of instrumentation for traffic studies is the video system. The central road research institute in New Delhi acquired this instrumentation system developed by Australian road research board. The system can be mounted on a car at a stationary point by the side of a road or assemble in a laboratory. The instrumentation consists of following components.

- Video camera to take photos of traffic from a moving vehicle or a stationary position.
- Video recorder and player to record the images taken from the camera on to video cassettes and to play back the recorder cassettes at any time later.

The system can be used for speed volume, speed, fuel consumption overtaking and crossing studies. The simulation model for predicting speed and fuel consumption under Indian conditions developed in India utilizes this instrumentation system.

TRAFFIC DIRECTION	Veh/hr
ECR to Shollinganallur	436
ECR to Kelambakkam Bus stop	360
Kelambakkam Bus stop to ECR	312
Shollinganallur to Kelambakkam Bus stop	760
Shollinganallur to ECR	640
Inflow to vandaloor	430
Out flow to vandaloor	326
Kelambakkam bus stop to Shollinganallur	520

Table 1: Volume study at Kelambakkam Intersection

TRAFFIC DIRECTION	Veh/hr
Madhyakailash to kelambakkam	1552
Madyakailash to E.C.R	440
Madhyakailash to Tambaram	768
Kelambakkam to Madhyakailash	1768
Kelambakkam to Tambaram	1076
Kelambakkam to E.C.R	660
Tambaram to Madhyakailash	1152
E.C.R to Kelambakkam	408

Table 2: Volume Study at Shollinganallur Intersection

TRAFFIC DIRECTION	Veh/hr
Shollinganallur to Madhyakailash	2036
Shollinganallur to Thiruvanmiyur	1041
Thiruvanmiyur to Madhyakailash	1761
Thiruvanmiyur to Shollinganallur	894
Madhyakailsh to Shollinganallur	1840
Madhyakailash to Thiruvanmiyur	1236

Table 3: Volume Study at Thiruvanmiyur Intersection

VI. LEVEL OF SERVICE ANALYSIS

S.No	Number of Signal Phases	Capacity (vph)
1	Two-phase	1850
2	Three-phase	1760
3	Four or more	1700

Table 4: Design Capacity

The design capacity is considered based on the number of signal phases at each intersection. Hence for the Kelambakkam and Thiruvanmiyur which is of 3phase signal and hence the design capacity is 1760 vehicles per hour and for Shollinganallur which is of 4 phase signal is 1700 vehicles per hour

Level of Service	Interpretation	V/C Ratio
A	Uncongested operation	<0.6
B	Very light congestion	0.6 TO 0.69
C	Light congestion	0.7 TO 0.79
D	Significant congestion on critical approach	0.8 TO 0.89
E	Sever congestion	0.9 TO 0.99
F	Total breakdown, stop and go operation	1 and greater

Table 5: Range of Level of Service

A. Study Area Analysis:

The intersections in the study area is ranked based on the volume capacity ratio and are tabulated in Table. The Level of Service is found to be C for Kelambakkam, E for Shollinganallur and D for Thiruvanmiyur by considering volume capacity ratio.

INTERSECTION	Traffic Volume veh/hr	V/C	L.O.S
Kelambakkam	1294	0.7	C
Shollinganallur	1675	0.95	E
Thiruvanmiyur	1531	0.87	D

Table 6: LoS for the intersections of study area

VII. SUMMARY AND CONCLUSION

The major intersections are chosen from the study area and the traffic flow study has been conducted by video graphic survey and the traffic volume is found out from the videos. The design capacity is taken as per the highway capacity manual and the volume capacity ratio is calculated for each intersection. The level of service is ranked by considering the volume capacity ratio in each intersection.

(1) The traffic volume is found to be maximum in Thiruvanmiyur intersection and followed by Shollinganallur. This clearly shows that between Thiruvanmiyur and Shollinganallur, the traffic congestion plays vital role which generally depends on the commercial areas in this region such as IT industries, Educational Institutions, Shopping malls
(2) The level of service for the major intersections are found to be:
   - Kelambakkam Intersection – C
   - Shollinganallur Intersection – E
   - Thiruvanmiyur Intersection – D
(3) The results are clearly showing that the traffic flow is quite stable in Kelambakkam intersection whereas in case of other two intersections, it is nearer to unstable.

REFERENCES

[1] Kittelson and Associates (1999), "Development of a Transit Level of Service Indicator – Final Report", Florida Department of Transportation
[2] Karen J. Wiley(2009), "Exploring and Modelling the Level of service of Public Transit in Urban Areas: An Application to the greater Toronto and Hamilton Arca", M.Tech Dissertation, McMaster University, Canada
[3] "Service Level Benchmarks for Urban Transport at a Glance", MoUD, Government of India
[4] Dr. Kadiyali L.R.(2011), Traffic Engineering and Transportation Planning, 8th Edition, New Delhi, Khanna Publishers
[5] Khanna S.K. and Justo C.E.G(2001), Highway Engineering, New Delhi

