Journal of Civil Engineering and Environmental Technology
Print ISSN: 2349-8404; Online ISSN: 2349-879X; Volume 2, Number 7; April-June, 2015 pp. 569-572

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# Identification of Level of Service at Silchar City

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**Abstract—***Traffic jam and its consequences of delay is one of the most common problems in urban areas. Level of service (LOS) is used to measure the quality of service provided by a roadway. This paper attempts to identify the LOS in an arterial road stretch at Rangikhairi of Silchar city (Assam). LOS is obtained by estimating the percent time-spent-following (PTSF) and average travel speed (ATS) of the vehicles, as per recommendation provided in Highway Capacity Manual 2000. Traffic survey has been conducted during 9am to 9pm and the PTSF and ATS are calculated for each hour. The result shows that most of the hours exhibit PTSF in the range of 98% to 100%. Thus, a large percentage of the travel time is spent by the road users in following slower vehicles. The average travel speed is observed to be less than 20kmph. The LOS of the road stretch is obtained as F.*

## 1. INTRODUCTION

Silchar, the second largest town of Assam in terms of population and municipal area is witnessing very high rise in traffic volume leading to problems like traffic congestion, increase in travel time and travel cost, pollution and hence reduction in comfort and convenience of the road users. Thus, it is necessary to access the quality of service provided by the road network in Silchar in terms of level of service (LOS) which will help in future short term and long term planning. HCM defines six level of service A to F; F being the worst case. Highway Capacity Manual 2000 suggests the identification of level of service on the basis of percent time-spent-following (PTSF) and average travel speed (ATS). Percent time-spent-following is defined as the average percent of the travel time that vehicles must travel in platoons behind slower vehicles due to inability to pass on a two-lane highway. It is the percentage of vehicles travelling with headway less than 3 seconds at a representative location. Average travel speed reflects the mobility of a two lane highway. It is the length of highway segment divided by the average travel time of all vehicles traversing the segment in both directions during a designated interval.

## 2. SCOPE AND OBJECTIVE

### 2.1 Scope

The level of service concept and its evaluation is a key consideration in various traffic engineering analysis and application such as evaluating the quality of flow on different facilities, for making a decision in adding traffic lanes, for designing signals, intersections, interchange etc. The present study gives a scope to study the traffic conditions in Silchar. The identification of level of service may help in improving the present traffic condition and thus help in planning the road network in Silchar.

### 2.2 Objective

The present paper has the following objectives – (a) To find the average travel time (ATS) of the vehicles, (b) To determine the percent time-spent-following (PTSF) of the vehicles and (c) To identify the Level Of Service of the roadway by comparing the ATS and PTSF with the specifications provided in HCM 2000 .

## 3. BACKGROUND LITERATURE

Bhargav Maitra, P.K. Sirdar and S.L.Dhingra proposed a unified methodology to quantify congestion on urban mid-block sections. They proposed 10 different level of service with congestion levels of 5, 10, 20, 30, 40, 50, 60, 80 and 100%.

Partha Pratim Dey, Satish Chandra and S. Gangopdhyay developed a computer program to simulate the traffic flow on a two-lane highway incorporating speed, placement, arrival, acceleration and overtaking characteristics of different types of vehicles. They concluded that the capacity of a two lane highway under an all car situation is 2860 pcu/hr, for two-wheeler it is 5600 veh/hr and it is 580 veh/hr when there is all tractors situation.

Moshe Cohen and Abishai Polus gave an alternative to calculate PTSF from simulation runs which combines theory with field data, that can be a powerful tool to provide reasonable estimation of PTSF that are otherwise very difficult.

Jose Elievan Bessa Jr and Jose Reynaldo Setti adapted HCM2000's ATS and PTSF functions for two-lane highways in Brazil

Chetan R. Patel and Dr. G. J. Joshi carried out a study to determine the capacity based on speed-flow behavior under

mixed traffic condition and established level of service thresholds for prevailing traffic conditions. They estimated the capacity of six lane divided road to be 7450 vehicles and 2480 vehicles/lane.

Erampalli Madhu and S. Velmurugan studied the free speed and speed-flow characteristics on eight lane divided expressways in plain terrain (Delhi-Gurgaon expressway). They estimated that the roadway capacity of eight lane divided urban expressway is about 11435 PCU/hour/direction and also concluded the formation of virtual lanes by vehicle increases the roadway capacity. Restriction on virtual lanes reduces the average speed by 7% but the security situation is enhanced.

Ahmed Mohammad Semeida evaluated level of service and capacity on multi-lane highways by two modeling techniques – (i) traditional statistical technique and (ii) ANN technique. The results are useful for road authorities in Egypt as they can determine LOS and capacity for different tangent sections and improve their traffic performance.

Binod Singhi and Dr. Mokaddes Ali Ahmed found that the polynomial form of curve is best fitted for the upper uncongested segment and linear form of curve fitted best in lower congested segment of the speed-flow curve.

Jack Klodzinski1 and Haitham M. Al-Deek recommended delay to be the most credible measure of effectiveness for evaluating the level of service at a toll plaza. They established a level of service hierarchy based on the conclusions of this analysis, feedback from professionals, and reference to the U.S. Highway Capacity Manual.

Abishai Polus and Moshe Cohen presented five flow-characteristic measures for two-lane rural highways: the flow, the average platoon length, the traffic intensity, the percent-time-spent following, and the freedom of flow. They showed that the five measures could be calculated from easily collectible data parameters and also from empirical models related to the two-way flow that were developed based on the field-data collected. They developed the freedom-of-flow parameter and proposed that level of service can be estimated using this parameter.

Jim´enez-Meza, J. Ar´amburo-Liz´arraga, E. de la Fuente used Level of Service (LOS) as an alternate measure to characterize street segments, LOS categorizes the traffic status according to quality of service of an urban street, considering three categories: few traffic, moderate congestion and congested.

H. Rooney Malcom and Cynthia C. Lancaster suggested five levels of service to describe the functional quality of urban streams. The proposed level of service measures represents a reasonable approach to assessing the performance quality of an urban stream.

## 4. DATA COLLECTION

Data collection has been done during 9am to 9pm at Rangikhairi in order to collect traffic volume data and spot speed data.

### 4.1 Traffic volume data

Traffic volume data has been collected from video recordings of the traffic stream. The survey has been conducted on various week days in order to collect the data over a good range of traffic environment. The traffic volume recorded is tabulated below.

The variation of traffic volume (in vehicles/ hour) is shown in Figure1. It is seen that two peaks are formed, one at around 11am and the other at 6pm

**Table 1: Traffic volume**

| Time | Traffic volume (vehicles/hour) (Vf) |
|---|---|
| 9am-10am | 3672 |
| 10am-11am | 4392 |
| 11am-12pm | 5850 |
| 12pm-1pm | 6102 |
| 1pm-2pm | 4674 |
| 2pm-3pm | 3744 |
| 3pm-4pm | 3876 |
| 4pm-5pm | 4416 |
| 5pm-6pm | 5274 |
| 6pm-7pm | 5550 |
| 7pm-8pm | 5184 |
| 8pm-9pm | 4392 |

The demand volume for full peak hour (vehicles/hour) is converted to passenger car equivalent for peak 15 min period ($V_p$) (passenger cars / hour ) by using peak hour factor (PHF),grade adjustment factor ($f_G$) and heavy vehicle factor ($f_{HV}$).

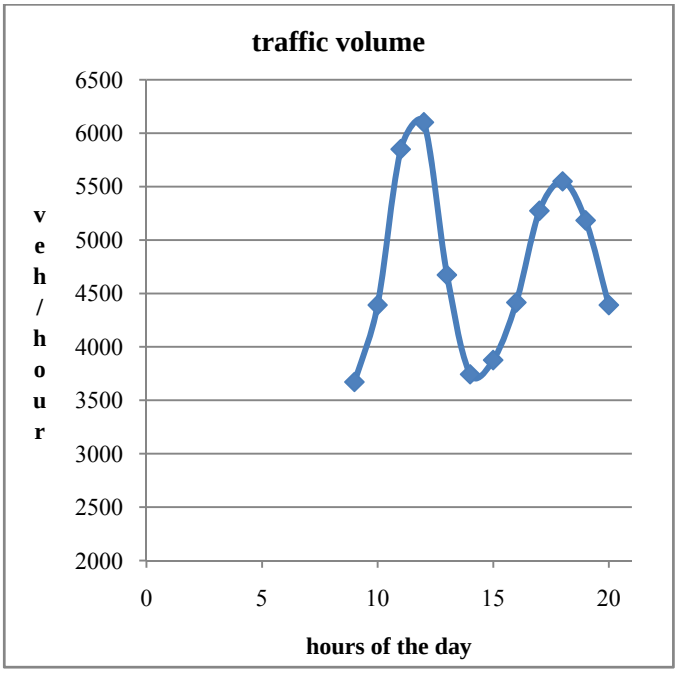


**Fig. 1: Traffic volume variation throughout the day**

### 4.2 Spot speed data

Spot speed data has been taken with the use of speed radar gun simultaneously with the video recording .


**Fig. 2: Speed radar gun**

Spot speed of random vehicles has been recorded for each hour and the average of these spot speeds has been reported. The average spot speeds of each hour are tabulated in Table 2.

The maximum spot speed has been recorded as 26kmph during 6pm-7pm and the minimum spot speed is recorded as 19kmph during 9am to 10am.

**Table 2: Average spot speed data**

| Time | Average spot speed (kmph) |
|---|---|
| 9am – 10am | 19 |
| 10am – 11am | 21 |
| 11am – 12pm | 23 |
| 12pm – 1pm | 28 |
| 1pm – 2pm | 22 |
| 2pm – 3pm | 21 |
| 3pm – 4pm | 21 |
| 4pm – 5pm | 23 |
| 5pm – 6pm | 25 |
| 6pm – 7pm | 26 |
| 7pm – 8pm | 23 |
| 8pm – 9pm | 21 |

## 5. CALCULATION AND RESULTS

### 5.1 Estimation of PTSF

The calculated PTSF are tabulated in Table 3.

**Table 3: Estimated PTSF values**

| Time | PTSF (in %) |
|---|---|
| 9am-10am | 98.13 |
| 10am-11am | 99 |
| 11am-12pm | 99.73 |
| 12pm-1pm | 99.79 |
| 1pm-2pm | 99.14 |
| 2pm-3pm | 98.29 |
| 3pm-4pm | 98.5 |
| 4pm-5pm | 98.88 |
| 5pm-6pm | 99.5 |
| 6pm-7pm | 99.66 |
| 7pm-8pm | 99.5 |
| 8pm-9pm | 98.9 |

As is evident from the table, most of the hours of the day exhibit PTSF in the range 98% to 100%. Therefore, most of the travel time is lost by the road users in following slower vehicles. This consequently causes delay, congestion and also results in pollution. Figure3. shows the calculated PTSF during the various hours of the day. It is approximately 100% at 12hours and 18 hours.

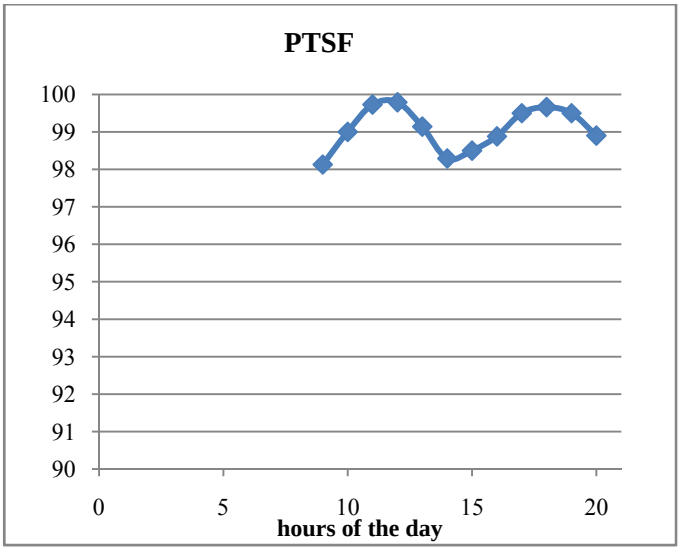


**Fig. 3: Plot of PTSF v/s hours of the day**

### 5.2 Estimation of ATS

Table 4 gives the calculated ATS values

**Table 4: Estimated ATS values**

| Time | ATS (in kmph) |
|---|---|
| 9am-10am | 8.23 |
| 10am-11am | 10.32 |
| 11am-12pm | 11.475 |
| 12pm-1pm | 15.98 |
| 1pm-2pm | 12.8 |
| 2pm-3pm | 9.96 |
| 3pm-4pm | 9.63 |
| 4pm-5pm | 14.31 |
| 5pm-6pm | 15.41 |
| 6pm-7pm | 14.24 |
| 7pm-8pm | 11.61 |
| 8pm-9pm | 14.49 |

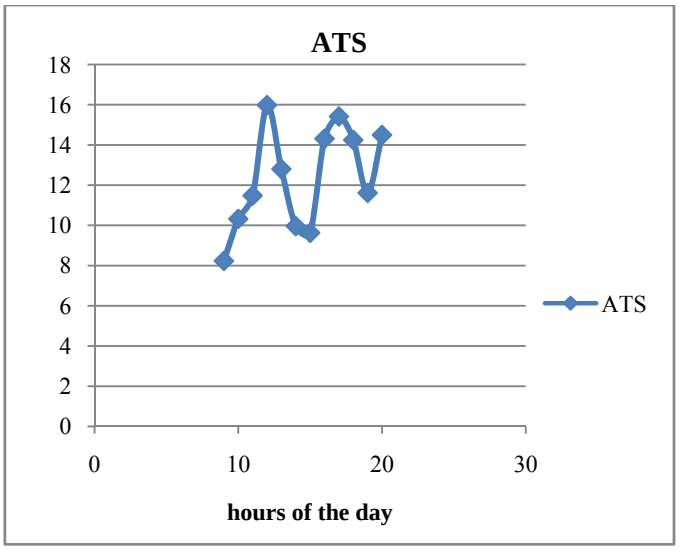


**Fig. 4: plot of ATS v/s hours of the day**

The average travel speed is the ratio of distance travelled by the vehicles to the total travel time. The estimated average travel speed is below 20kmph throughout the day.

### 5.3 Identification of LOS

Level of service is determined based on the value of PTSF and ATS obtained. HCM suggests the LOS to be E if PTSF > 80% and ATS ≤ 60 kmph. But if the traffic flow rate is more than the capacity of the road the LOS is F. Capacity of a two-way road is 3200pc/hour. The traffic flow of the surveyed road is tabulated in table 5 in terms of pc/hour.

**Table 5: LOS for each hour**

| Time (in hours) | Traffic flow (pc/hour) | PTSF | ATS | LOS |
|---|---|---|---|---|
| 9-10 | 4533 | 98.13 | 8.23 | F |
| 10-11 | 5247 | 99 | 10.32 | F |
| 11-12 | 6772 | 99.73 | 11.475 | F |
| 12-13 | 7063 | 99.79 | 15.98 | F |
| 13-14 | 5410 | 99.14 | 12.8 | F |
| 14-15 | 4627 | 98.29 | 9.96 | F |
| 15-16 | 4785 | 98.5 | 9.63 | F |
| 16-17 | 5111 | 98.88 | 14.31 | F |
| 17-18 | 6041 | 99.5 | 15.41 | F |
| 18-19 | 6491 | 99.66 | 14.24 | F |
| 19-20 | 6095 | 99.5 | 11.61 | F |
| 20-21 | 5144 | 98.9 | 14.49 | F |

Therefore, the LOS of the road can be identified to be F.

## 6. CONCLUSION

The primary objective of this paper is to monitor the traffic situation of Silchar. As presented in the previous sections, the traffic volume is found to be higher than the suggested capacity, the average travel speed is too low and also the percent time-spent-following is very high. The LOS of the roadway is identified to be F. Overall, the condition is worse and with the increasing rate of vehicle ownership, it will worsen in the years to come. Thus, the matter should be looked into by the traffic management authority for the improvement of the urban infrastructure in Silchar.

## 7. ACKNOWLEDGEMENTS

This work was supported in part by a grant from the National Institute of Technology, Silchar

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