

# Estimation of Congestion and Level of Service for Improvement Plan of Urban Road

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## ABSTRACT

The aim of this research is determine the alternative route for improving level of service for urban roads. Alternative route provides road good driving manoeuvre for road users and it is save human hour from the congestion. Through literature review and case study, a systematic approach and techniques to improve alternative route will be developing.

A rapidly growing component of urban transportation problems in the cities across the world is problem of traffic congestion. It is believed that identification of congestion is the first step for selecting appropriate mitigation measures. Because of population, economic and vehicle ownership growth, increasing traffic demand exceeds the carrying capacity of the intersection during peak periods, which causes congestion. The congested and hazardous traffic conditions in the city increase fuel consumption of the vehicles, causes noise and air pollution, delay and accidents. In Ahmedabad city, most of arterial roads are congested. An attempt has been made to quantify congestion with delay, speed and volume to capacity ratio. There is a need for defining traffic congestion on rational bases and use that for measurement LOS (Level of Service) of roads. The congestion is measured by determining the level of service of the street (LOS) through calculating the traffic flow rate of the street and free flow rate. For determining peak hour traffic volume is calculated through videography of vehicles and multiplying by passenger car Unit (PCU). Level of service is determined by volume capacity ratio. Public opinion survey is necessary for the alternative route.

**Keywords:** Traffic Volume, Congestion, Level of Service, Capacity

## I. INTRODUCTION

The second biggest street system 3.3 million km on the planet India has, second just to the USA 6.6 million km. without further ado, there are almost 30 million vehicles in India and around 2.5 million are included each year. Limit increase and change in the level of administration is typically accomplished by enlarging existing streets (Gupta 2000). Today India have 32% urban, somewhere around 2010 and 2050 India will go from 32% urban to 52% urban and in 2070 75% urban (United Nations projections).

The urban streets of India for the most part convey the heterogeneous movement which is the blend of different vehicles like Cars, Busses, Trucks Motor cycles, Light products vehicles, Auto Rickshaws, Pedal Cycles, Hand

drawn trucks, and Animal drawn trucks and so on. These all vehicles have distinctive velocities, size, Load conveying limits or traveller limits and so on which influence the urban heterogeneous activity stream. The issue is more in the event of blended movement stream when speed differential among various classifications of vehicles is entirely generous.

The term Level of Service (LOS) means any of a various number of contrasting blends of vehicular and roadway working conditions that may happen on a given path or street while it is pleasing different movement volume. It is an imperative parameter for activity engineers, transport organizers and street clients. In this manner, levels of administration ought to be reliably characterized and justifiable to every one of them.

The Highway Capacity Manual (HCM) has characterized level of administration for the most part for nations having overwhelmingly homogeneous movement surges of mechanized vehicles. Fewer studies have been directed on level of service criteria on urban heterogeneous movement stream. The stream of heterogeneous movement on urban roads is profoundly intricate in nature. Also, in the HCM there is no procurement for levels of administration characterization criteria for blended activity stream (mechanized vehicles and non-mechanized vehicles utilizing the same street/road).

## Objective and Scope of Study

### Objectives

- To study the existing traffic conditions study area.
- To carry out traffic volume counts in study area at peak hours.
- To estimate level of service in study area.
- To propose the solution for reducing traffic congestion.

### Scope

- Identification of priority route for congestion and level of service estimation.
- To analyse delay survey, traffic volume counts and public and driver opinion surveys.
- To analyse major problem on the routes due to existing road condition in study area.
- To review and improve upon the existing road condition under study.

### Study Area

The study is carried out on the important traffic corridor of Ahmedabad city, selected for this study is known as Ashram road in Ahmedabad. Selected for this study are 4.9 km long and 10 m width of the road. This traffic corridor six lane divided two-way urban road. For this study the mid-block section of each road has been selected.

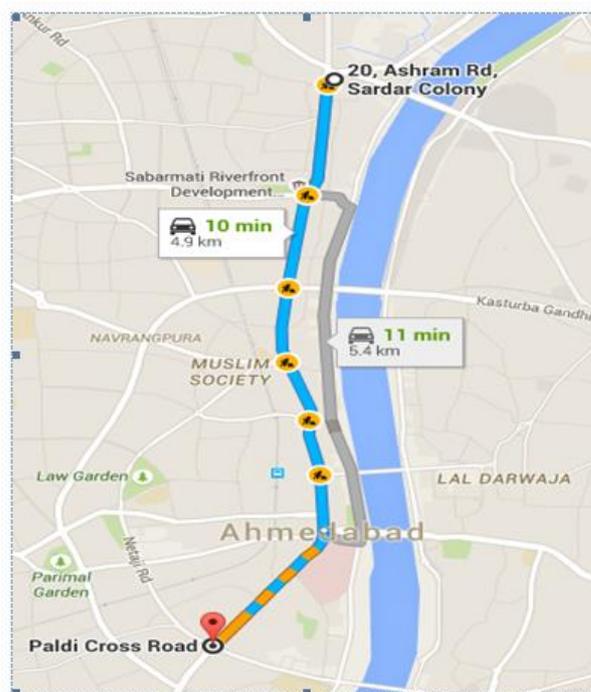


Figure 1 Study Area

## II. METHODS AND MATERIAL

### Delay Survey

Table 1 Delay survey

| Vadaj to Paldi (0 to 4.9 km) |          |     |               |                 |     |                  |     |                      |                     |
|------------------------------|----------|-----|---------------|-----------------|-----|------------------|-----|----------------------|---------------------|
| No.                          | Distance |     | Control Point | First stopwatch |     | Second stopwatch |     | Vehicles over taking | Vehicles over taken |
|                              | Km       | m   |               | Journey Time    |     | Delay Time       |     |                      |                     |
|                              |          |     |               | Min             | Sec | Min              | Sec |                      |                     |
| 1                            | 0        | 0   | Vadaj         | 0               | 0   | 0                | 0   | 79                   | 51                  |
| 2                            | 1        | 000 | Usmanpura     | 3               | 18  | 1                | 14  |                      |                     |
| 3                            | 1        | 800 | Incometax     | 5               | 47  | 1                | 02  |                      |                     |
| 4                            | 2        | 400 | Bata          | 8               | 30  | 0                | 41  |                      |                     |
| 5                            | 2        | 900 | BOB           | 11              | 25  | 1                | 58  |                      |                     |
| 6                            | 3        | 400 | Nehrubridge   | 13              | 34  | 1                | 32  |                      |                     |
| 7                            | 3        | 900 | VS Hospital   | 15              | 59  | 3                | 29  |                      |                     |
| 8                            | 4        | 900 | Paldi         | 20              | 52  |                  |     |                      |                     |

Table 2 Summary

| Travel Time | Delay Time | Running Time |
|-------------|------------|--------------|
| Min         | Min        | Min          |
| 20:52       | 9:56       | 10:56        |

In study area travel time 20:52 minutes and delay time 9:56 are determined. Overall running time on study area is 10:56 minutes. It shows that study area is congested area.

## Road Inventory

Table 3 Road Inventory

| No. | Name of stretches       | No. of Lanes | Width of Lanes(M) | Width of Median(M) | Width of Shoulder(M) | Width of Footpath(M) |
|-----|-------------------------|--------------|-------------------|--------------------|----------------------|----------------------|
| 1   | Vadaj – Usmanpura       | 6            | 10.5              | 1.2                | 0.5                  | 1.5                  |
| 2   | Usmanpura– Incometax    | 6            | 10.5              | 1.2                | 0.5                  | 1.5                  |
| 3   | Incometax – Bata        | 6            | 10.5              | 1.2                | 0.5                  | 1.5                  |
| 4   | Bata showroom – BOB     | 6            | 10.5              | 1.2                | 0.5                  | 1.5                  |
| 5   | BOB – Nehrubridge       | 6            | 10.5              | 1.2                | 0.5                  | 1.5                  |
| 6   | Nehrubridge-VS Hospital | 6            | 10.5              | 1.2                | 0.5                  | 1.5                  |
| 7   | VS Hospital – Paldi     | 6            | 10.5              | 1.2                | 0.5                  | NA                   |

## Traffic Data

Table 4 No. of vehicles and PCU/h

| No. | Peak    | Stretches                       | No. of Vehicles | PCU/h(V) |
|-----|---------|---------------------------------|-----------------|----------|
| 1   | Morning | Vadaj to Usmanpura              | 3449            | 3637.5   |
|     |         | Vadaj to Usmanpura opp.         | 3455            | 3767.95  |
|     | Evening | Vadaj to Usmanpura              | 3531            | 3910.95  |
|     |         | Vadaj to Usmanpura opp.         | 3582            | 3841.6   |
| 2   | Morning | Usmanpura to Incometax          | 2960            | 3340.5   |
|     |         | Usmanpura to Incometax opp.     | 2897            | 3300.3   |
|     | Evening | Usmanpura to Incometax          | 2585            | 3198.7   |
|     |         | Usmanpura to Incometax opp.     | 3062            | 3534.55  |
| 3   | Morning | Incometax to Bata showroom      | 3035            | 3436.85  |
|     |         | Incometax to Bata showroom opp. | 3046            | 3428.75  |
|     | Evening | Incometax to Bata showroom      | 3176            | 3548.65  |
|     |         | Incometax to Bata showroom opp. | 3060            | 3461.2   |
| 4   | Morning | Bata showroom to BOB            | 3220            | 3567.95  |
|     |         | Bata showroom to BOB opp        | 2955            | 3250.45  |
|     | Evening | Bata showroom to BOB            | 2965            | 3287.65  |
|     |         | Bata showroom to BOB opp        | 2988            | 3369.9   |
| 5   | Morning | BOB to Nehrubridge              | 3089            | 3487.6   |
|     |         | BOB to Nehrubridge opp          | 3107            | 3479.55  |
|     | Evening | BOB to Nehrubridge              | 3054            | 3429.3   |
|     |         | BOB to Nehrubridge opp          | 3230            | 3615.85  |
| 6   | Morning | Nehrubridge to VS Hospital      | 3191            | 3653.15  |
|     |         | Nehrubridge to VS Hospital opp  | 3179            | 3507.3   |
|     | Evening | Nehrubridge to VS Hospital      | 3141            | 3522.5   |
|     |         | Nehrubridge to VS Hospital opp  | 3205            | 3499.4   |
| 7   | Morning | VS Hospital to Paldi            | 3823            | 4278.95  |
|     |         | VS Hospital to Paldi opp        | 3815            | 4297     |
|     | Evening | VS Hospital to Paldi            | 3793            | 4296.55  |
|     |         | VS Hospital to Paldi opp        | 3658            | 4099.9   |

Traffic data is analysis for the PCU/h as per the PCU factors given in IRC: 106-1990. Vehicle composition is useful in selection PCU factors to convert in PCU/h. In IRC: 106-1990 5% and 10% vehicle composition factors are given.

## III. RESULTS AND DISCUSSION

### Level of Service

Level of service is determined as per IRC: 106-1990. The level of service is evaluated as 4300 PCU/h for sub-arterial roads.

Table 5 Level of Service

| No. | Peak    | Stretches                       | PCU/h(V) | V/C  | LOS |
|-----|---------|---------------------------------|----------|------|-----|
| 1   | Morning | Vadaj to Usmanpura              | 3637.5   | 0.84 | E   |
|     |         | Vadaj to Usmanpura opp.         | 3767.95  | 0.87 | E   |
|     | Evening | Vadaj to Usmanpura              | 3910.95  | 0.90 | E   |
|     |         | Vadaj to Usmanpura opp.         | 3841.6   | 0.89 | E   |
| 2   | Morning | Usmanpura to Incometax          | 3340.5   | 0.77 | D   |
|     |         | Usmanpura to Incometax opp.     | 3300.3   | 0.76 | D   |
|     | Evening | Usmanpura to Incometax          | 3198.7   | 0.74 | D   |
|     |         | Usmanpura to Incometax opp.     | 3534.55  | 0.82 | E   |
| 3   | Morning | Incometax to Bata showroom      | 3436.85  | 0.79 | D   |
|     |         | Incometax to Bata showroom opp. | 3428.75  | 0.80 | D   |
|     | Evening | Incometax to Bata showroom      | 3548.65  | 0.82 | E   |
|     |         | Incometax to Bata showroom opp. | 3461.2   | 0.80 | D   |
| 4   | Morning | Bata showroom to BOB            | 3567.95  | 0.83 | E   |
|     |         | Bata showroom to BOB opp        | 3250.45  | 0.75 | D   |
|     | Evening | Bata showroom to BOB            | 3287.65  | 0.76 | D   |
|     |         | Bata showroom to BOB opp        | 3369.9   | 0.78 | D   |
| 5   | Morning | BOB to Nehrubridge              | 3487.6   | 0.81 | E   |
|     |         | BOB to Nehrubridge opp          | 3479.55  | 0.81 | E   |
|     | Evening | BOB to Nehrubridge              | 3429.3   | 0.79 | D   |
|     |         | BOB to Nehrubridge opp          | 3615.85  | 0.84 | E   |
| 6   | Morning | Nehrubridge to VS Hospital      | 3653.15  | 0.85 | E   |
|     |         | Nehrubridge to VS Hospital opp  | 3507.3   | 0.81 | E   |
|     | Evening | Nehrubridge to VS Hospital      | 3522.5   | 0.82 | E   |
|     |         | Nehrubridge to VS Hospital opp  | 3499.4   | 0.81 | E   |
| 7   | Morning | VS Hospital to Paldi            | 4278.95  | 0.99 | E   |
|     |         | VS Hospital to Paldi opp        | 4297     | 0.99 | E   |
|     | Evening | VS Hospital to Paldi            | 4296.55  | 0.99 | E   |
|     |         | VS Hospital to Paldi opp        | 4099.9   | 0.95 | E   |

### Public Opinion Survey

#### Public opinion survey:

| No | Questions                      | Answers                             |
|----|--------------------------------|-------------------------------------|
| 1  | Name                           | Annaa Pathan                        |
| 2  | Survey spot                    | V.S. Hospital                       |
| 3  | Peak hour                      | 9:00 to 11:00 AM<br>6:00 to 8:00 PM |
| 4  | Accidents occur on this route? | No                                  |
| 5  | Suggestion of route.           | Sabasmati Riverfront                |
| 6  | Other suggestion               | Bus lane should be provided         |

After providing parallel route for the traffic diversion during peak hour's level of service increased and less of congestion on selected Ashram road stretch.

## Improvement in Level of Service

Table 6 Level of Service after Improvement

| No. | Peak    | Stretches                       | PCU/h(V)<br>Existing<br>condition | PCU/h(V)<br>after<br>Improvement | LOS<br>(New) |
|-----|---------|---------------------------------|-----------------------------------|----------------------------------|--------------|
| 1   | Morning | Vadaj to Usmanpura              | 3637.5                            | 2937.5                           | D            |
|     |         | Vadaj to Usmanpura opp.         | 3767.95                           | 3067.95                          | D            |
|     | Evening | Vadaj to Usmanpura              | 3910.95                           | 3210.95                          | D            |
|     |         | Vadaj to Usmanpura opp.         | 3841.6                            | 3141.6                           | D            |
| 2   | Morning | Usmanpura to Incometax          | 3340.5                            | 2640.5                           | D            |
|     |         | Usmanpura to Incometax opp.     | 3300.3                            | 2600.3                           | D            |
|     | Evening | Usmanpura to Incometax          | 3198.7                            | 2498.7                           | C            |
|     |         | Usmanpura to Incometax opp.     | 3534.55                           | 2834.55                          | D            |
| 3   | Morning | Incometax to Bata showroom      | 3436.85                           | 2736.85                          | D            |
|     |         | Incometax to Bata showroom opp. | 3428.75                           | 2728.75                          | D            |
|     | Evening | Incometax to Bata showroom      | 3548.65                           | 2848.65                          | D            |
|     |         | Incometax to Bata showroom opp. | 3461.2                            | 2761.2                           | D            |
| 4   | Morning | Bata showroom to BOB            | 3567.95                           | 2867.95                          | D            |
|     |         | Bata showroom to BOB opp        | 3250.45                           | 2550.45                          | C            |
|     | Evening | Bata showroom to BOB            | 3287.65                           | 2587.65                          | C            |
|     |         | Bata showroom to BOB opp        | 3369.9                            | 2669.9                           | D            |
| 5   | Morning | BOB to Nehrubridge              | 3487.6                            | 2787.6                           | D            |
|     |         | BOB to Nehrubridge opp          | 3479.55                           | 2779.55                          | D            |
|     | Evening | BOB to Nehrubridge              | 3429.3                            | 2729.3                           | D            |
|     |         | BOB to Nehrubridge opp          | 3615.85                           | 2915.85                          | D            |
| 6   | Morning | Nehrubridge to VS Hospital      | 3653.15                           | 2953.15                          | D            |
|     |         | Nehrubridge to VS Hospital opp  | 3507.3                            | 2807.3                           | D            |
|     | Evening | Nehrubridge to VS Hospital      | 3522.5                            | 2822.5                           | D            |
|     |         | Nehrubridge to VS Hospital opp  | 3499.4                            | 2799.4                           | D            |
| 7   | Morning | VS Hospital to Paldi            | 4278.95                           | 3578.95                          | E            |
|     |         | VS Hospital to Paldi opp        | 4297                              | 3597                             | E            |
|     | Evening | VS Hospital to Paldi            | 4296.55                           | 3596.55                          | E            |
|     |         | VS Hospital to Paldi opp        | 4099.9                            | 3399.9                           | D            |

## IV. CONCLUSION

The present study has been conducted to analyse the traffic characteristics of Ashram road, Ahmedabad. The following main conclusions are drawn from the work:

- Delay calculation by delay survey 9.56-minute delay at selected stretch due to traffic congestion.
- In public and driver opinion survey peak hours determined in morning 9AM to 11AM and in evening it's 6PM to 8PM.
- From data analysis of traffic volume count two-wheeler vehicle composition around 50% and three-wheeler around 20%.
- Study of LOS found out that during existing condition of Level of Service was Level D and E at all stretches.
- After diverting traffic to riverfront road level of serve increases. The level of service is Level C, at Bata showroom to BOB at morning opposite side

and in evening this side. LOS E, at V S Hospital to Paldi and others are improving in level D.

- In public opinion three-wheeler divers are worst diving methods and they don't follow the rule that should be improved.
- In traffic volume count this route is busiest bus route, so bus-lane should be provide for decreasing traffic congestion found to be of E level of service against all the peak hour traffic.

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