

## Traffic problems due to the side friction at Bapunagar

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**Abstract** - Land use pattern always have a significant impact on performance of highways of developing countries like India. In recent past Government of India invested substantial amount of money to improve the service level of various categories of roads in India. Several projects for widening and strengthening of roads have been taken up, surface condition has been improved but capacity and LOS has not been improved as expected because of abutting land use along the road alignment. One of the factors for not improving the LOS is the presence of side friction along rural highways. In developing countries like India presence of road-side markets at regular interval along rural roads is very common phenomenon. These road side market areas function as a pseudo bottleneck points to the fast moving traffic of highways. Road users have to incur indirectly the additional cost due to side friction in the form of vehicle operating and travel time cost. In literature review it is found that very few works have been carried out to understand effect of side friction on travel speed and Road User Cost.

**Key Words:** Road side friction, market areas, friction elements, travel speed, vehicle operating cost, road user cost

### 1. INTRODUCTION

Most Asian countries have heterogeneous traffic and India as one of the developing country has the characteristic. The characteristics of heterogeneous traffic are many kinds of vehicles in every road side, dynamic characteristic of vehicle composition, and complex behavior of indisciplined road users unfortunately; none of the official guidelines on highway construction include the effect of grade in the geometric design of horizontal curves. For instance, the Green Book (AASHTO 2011) considers a point-mass model for the basic curve equation. However, the point-mass model is not adequate for obtaining comprehensive results for the side friction factor, and an alternative model must be used. Activity road side factor affecting side friction is one of the traffic characteristic in urban area in India aside from mix

traffic, public transportation condition and indisciplined driving behavior.

### 2. Factors Affecting Traffic Delay

- 1) Too many cars for the roadway due to inadequate mass transit options or other reasons.
- 2) Obstacles in the road causing a blockage and merger. These can be any of the following:
  - Double parking
  - Road work
  - Lane closure due to utility work
  - Road narrowing down
  - An accident
- 3) Too many pedestrians crossing not permitting cars to turn.
- 4) Too many trucks on the road due to inadequate rail freight opportunities.

### 3. Problem definition for side friction

Road narrowing as the impact of side activities of society which causes high number of side friction, for instance

- Illegal parking in the road side in front of the market because of the lack of parking area.
- Street vendors in the road side and the sidewalk.
- Pedestrians in the road side because of the lack of sidewalk and pavement conversion for trading activities.
- Non - motorized vehicle deceleration in the road side.
- Bad habit of public transportation which picking up and setting down passengers in the side of the road because of the lack number of public transport stops.

#### 4. Aim of the study

Comparing time delay during traffic with and without side friction.

#### 5. Objective of the study

- To find width loss due to side friction.
- To compute descriptive statistics.
- To obtain basic calibration for the simulation of traffic condition.

#### 6. Need of the study

- To rectify side friction problem in a particular area.
- To provide free flow of vehicles in that area.
- Thus to observe the major difference without side friction in that area.

#### 7. Study area

Ahmedabad is seventh largest metropolis in India and the largest city in Gujarat. It is also very close to the State capital Gandhinagar. The Ahmedabad Urban Agglomeration (AUA) population has increased from 3.4 million in 1991 to 6.9 million in 2011. Ahmedabad is the commercial capital of the State and is also known as the textile capital of India. It lies in the cotton belt of Gujarat, 23 km south of Capital Gandhinagar, 552 km north of Mumbai and 96 km from the Gulf of Cambay. It has excellent connectivity through air, road and rail links with Mumbai and Delhi.

The population density of the city is 9900 persons per square kilometer. The enumeration done in 1871 demonstrated a population of 116,900. By 1911 there were over a fourth of a million people and over a half million by the 1941 registration. The city passed the 1 million inhabitant mark by the 1961 evaluation with more than 1.1 million occupants. The city has developed by around one and a half million individuals by the last statistics in 2011. An adjacent army base and government establishments bring individuals from all over India to Ahmedabad and fuel the city development. By 2021, there could be almost 9 million individuals living in Ahmedabad.

Thaltej had a population of 42,699. 1Males constitute 53% of the population; females 47% of the population and 10% of the population is under 6 years of age. Pakwan intersection is not only connecting point of Sarkhej - Gandhinagr highway but also is a prime center of S G Highway as it has hospital, college and commercial complex. Pakwan intersection is at grade manually operated four phase intersection. Among these four leg Sarkhej - Gandhinager approach consist heavy traffic movements. People tend to travel either by their own vehicles (Motor Cycle / Car) or by Public

Transports (Bus / Auto Rickshaw). Frequency of passing Ambulances and VIP vehicles are high due its location surrounding. As this is NH – 8C Interstate connecting Buses, Taxies, Loading trucks and other heavy vehicles are also passing through during the day.

#### 8. Modes share in Ahmedabad

In Ahmedabad, the number of trips by walk accounts for 32% of the person trips made daily. Two-wheeler has a share of 26% followed by public transport (11%) and car (8%) respectively. It is clearly seen that two-wheelers are the predominant mode of transportation in Ahmedabad. Public transport share is less than walk, cycle and two-wheeler based mode of transportation, whereas the Intermediate Public Transport (IPT) in the form of auto rickshaws has the lowest share among all the modes of transportation in Ahmedabad. The modal share of Ahmedabad (2007) has been presented in the Table.

##### 8.1 different types of modes

| Mode             | % Share |
|------------------|---------|
| Walk             | 32      |
| Cycle            | 15      |
| Two wheelers     | 26      |
| Public transport | 11      |
| Car              | 8       |
| Auto             | 7       |

#### 9. Road inventory survey

Road (network) inventory studies serve to collect data describing the road network in terms of the actual cross-sectional elements and the vertical and horizontal alignment. Here the stretch is taken from rajpath to s g highway. The survey is carried out by 5 people at every 200m distance in 3.1km road. Field workers complete inventory sheets describing the cross-section, the alignment, roadside furniture, condition of road surface, markings and signs, condition of verges and clear roadside area, visibility and any other data required by the road authority. Intersections are inventoried separately and each intersection approach is described (number of lanes, lane widths, configuration etc.).

### 9.1 road inventory survey

| Road Area                                  | Number of lanes | Carriageway |           |           | Median (m) | Side walk (m) |
|--------------------------------------------|-----------------|-------------|-----------|-----------|------------|---------------|
|                                            |                 | Type        | Width (m) | condition |            |               |
| Shubhlaxmi complex to Bapunagar char rasta | 1               | BT- Bitumen | 15        | Good      | Nil        | 1             |
| Bapunagar char rasta to Bhidhanjan hanuman | 1               |             | 15        |           | 0.8        | 1.5           |
|                                            | 2               |             | 12        |           |            | 1             |
| Bhidhanjan hanuman to Amber cinema         | 1               |             | 15        |           | Nil        | 1.7           |
| Amber cinema to Saraspur                   | 1               |             | 9         |           | 0.9        | 1.9           |
|                                            | 2               |             | 10        |           |            | 1.8           |

the road research laboratory in U.K. The main advantage of Moving Car Observer Method is that flow, Average journey speed, Average running speed and Average delay can be obtained from the calculation. It has the advantage of obtaining the complete state with just three observers and a vehicle. Moving Car Observer technique is one in which both speed and traffic flow data are obtained by a single experiment.

A 10 test runs are made along the study stretch of rajpath club to S.g highway high and a group of observer records various parameters. One is having two stop watches in which one stop watch is used to find the total journey time and the another watch used to measure the various delay occurred on the stretch. These details are recorded by the observers in a suitable tabular form. The number of vehicles overtaken and Number of vehicle overtaking noted down by the other two observers during the study.

| Morning Peak Hour ( 10 am To 12 pm ) |                   |                         |                |            |
|--------------------------------------|-------------------|-------------------------|----------------|------------|
| Sr No                                | Time Delay        |                         | No Of Vehicles |            |
| Laps                                 | Fixed Delay       | Operational Delay       | Over Taking    | Over Taken |
| 1                                    | 62                | 170                     | 18             | 65         |
| 2                                    | 70                | 128                     | 16             | 55         |
| 3                                    | 120               | 166                     | 47             | 59         |
| 4                                    | 84                | 156                     | 26             | 62         |
| 5                                    | 118               | 164                     | 23             | 43         |
| Evening Peak Hour ( 5 pm To 7 pm )   |                   |                         |                |            |
| Sr No                                | Time Delay        |                         | No Of Vehicles |            |
| Laps                                 | Fixed Delay (sec) | Operational Delay (sec) | Over Taking    | Over Taken |
| 1                                    | 64                | 114                     | 20             | 62         |
| 2                                    | 48                | 126                     | 17             | 81         |

### 10. Travel time delay

Moving car observer method is a procedure commonly used to estimate the average flow and journey time of traffic on a road link through collected data of moving vehicle. The method was first described in a paper by Wardrop and Charlesworth (1954) and developed by



|   |    |     |    |    |
|---|----|-----|----|----|
| 3 | 68 | 174 | 15 | 68 |
| 4 | 80 | 222 | 44 | 55 |
| 5 | 64 | 212 | 25 | 66 |

Spot speed studies are vital for measuring different variables and factors needed in the design and analysis of the highway system. The Radar gun method is quicker than other methods but expensive method for collecting speed data.

For doing the study 4 spots were chosen from thaltej to Sindhu bhawan. The two members of the team were selected to record the data, with one member having Radar Gun and the other one with the reading sheet. Reading was taken at the afternoon time around 01:00 pm that off peak hour condition can be satisfied. Total 520 numbers of observations were taken during the survey, 130 observations on each spot.

### 11.1 spot speed study



## 12. Classified volume count

One of the fundamental measures of traffic on a road system is the volume of traffic using the road in a given interval of time. It is also termed as a flow and expressed in vehicle per hour or vehicle per day. Volume is important for understanding the efficiency at which the system works at present and the general quality of service offered to the road users. Method used for vehicle count here is named as video photography method.

Vehicles are classified comprising of smaller vehicles: Motorised two-wheeler and motorised three-wheeler. Various type of four wheelers considered as a single unit i.e. car, jeep & van, while all types of trucks & tractors whether they are single axle, double axle or three axle & tractor trailer unit are considered as a single classified volume category.

In order to study traffic operation at mid block, both side movement count is done to quantify the movement of vehicle through the defined way. Movement count is done for each leg separately. Traffic flow condition at the study area in the morning peak hour was vast and vice-versa at the evening peak hours. Although number of direction changing vehicles is less, it creates very unpleasant environment for the other road users and affects the moving traffic flow



## 11. Spot speed study

Speed is an important transportation consideration because it relates to safety, time, comfort, convenience and economics. Spot speed studies are used to determine the speed distribution of a traffic stream at a specific location. The data gathered in spot speed studies are used to determine vehicle speed percentiles, which are useful in making many speed-related decisions. Spot speed data have number of safety applications, for a spot speed study at a selected location, a sample size of at least 30 and preferably more vehicles. Traffic counts during the peak period may show exceptionally high volumes and are not normally used in the analysis: therefore, counts are usually conducted on the other times. Spot speed data are gathered using one of three methods: (1) Stopwatch method, (2) Radar gun method, (3) Pneumatic road tube method. Here Radar Gun method is used for surveying.

| Spot Speed Study                                                |            |               |                           |            |               |
|-----------------------------------------------------------------|------------|---------------|---------------------------|------------|---------------|
| Project: traffic problems due to the side friction at bapunagar |            |               |                           |            |               |
| Name of Road:                                                   |            |               | Date : 03 Nov. 2018       |            |               |
| Curve Length: 22 meters                                         |            |               | Time : 03:00 pm           |            |               |
| Morning                                                         |            |               | Evening                   |            |               |
| Vehicle no.(asc)                                                | Time (Sec) | Speed (km/ph) | Vehicle no                | Time (Sec) | Speed (km/ph) |
| 1                                                               | 2.59       | 30.58         | 1                         | 2.45       | 32.33         |
| 2                                                               | 2.16       | 36.67         | 2                         | 2.21       | 35.84         |
| 3                                                               | 2.61       | 30.34         | 3                         | 2.34       | 33.85         |
| 4                                                               | 2.06       | 38.45         | 4                         | 2.14       | 37.01         |
| 5                                                               | 2.01       | 39.40         | 5                         | 2.17       | 36.50         |
| 6                                                               | 1.69       | 46.86         | 6                         | 2.16       | 36.67         |
| 7                                                               | 1.68       | 47.14         | 7                         | 2.46       | 32.20         |
| 8                                                               | 1.98       | 40            | 8                         | 2.64       | 30            |
| 9                                                               | 1.89       | 41.90         | 9                         | 2.07       | 38.26         |
| 10                                                              | 2.08       | 38.08         | 10                        | 1.89       | 41.90         |
| 11                                                              | 2.16       | 36.67         | 11                        | 1.69       | 40.41         |
| 12                                                              | 2.24       | 35.36         | 12                        | 1.99       | 39.80         |
| 13                                                              | 2.36       | 33.56         | 13                        | 2.07       | 38.26         |
| 14                                                              | 2.45       | 32.33         | 14                        | 2.11       | 37.54         |
| 15                                                              | 2.65       | 29.88         | 15                        | 2.27       | 34.89         |
| 16                                                              | 2.55       | 31.06         | 16                        | 2.35       | 33.70         |
| 17                                                              | 2.32       | 34.14         | 17                        | 2.14       | 37.01         |
| 18                                                              | 2.04       | 38.82         | 18                        | 2.17       | 36.50         |
| 19                                                              | 1.98       | 40            | 19                        | 2.16       | 36.67         |
| 20                                                              | 1.98       | 40            | 20                        | 2.45       | 32.33         |
| 21                                                              | 1.96       | 40.41         | 21                        | 2.21       | 35.84         |
| 22                                                              | 1.78       | 44.49         | 22                        | 2.34       | 33.85         |
| 23                                                              | 1.87       | 42.35         | 23                        | 2.14       | 37.01         |
| 24                                                              | 2.09       | 37.89         | 24                        | 2.17       | 36.50         |
| 25                                                              | 2.18       | 36.33         | 25                        | 2.16       | 36.57         |
| 26                                                              | 2.26       | 35.04         | 26                        | 2.46       | 32.20         |
| 27                                                              | 2.45       | 32.33         | 27                        | 2.07       | 38.26         |
| 28                                                              | 2.59       | 30.58         | 28                        | 1.89       | 41.90         |
| 29                                                              | 2.16       | 36.67         | 29                        | 2.45       | 32.33         |
| 30                                                              | 2.61       | 30.34         | 30                        | 2.21       | 35.84         |
| 31                                                              | 2.06       | 38.45         | 31                        | 2.34       | 33.85         |
| 32                                                              | 2.01       | 39.40         | 32                        | 2.14       | 37.01         |
| 33                                                              | 1.69       | 46.86         | 33                        | 2.64       | 30.00         |
| Average Speed                                                   |            | 37.33         | Average Speed             |            | 31.63         |
| 85th percentile Speed                                           |            | 36.67         | 85th percentile Speed     |            | 32.33         |
| 95th percentile Speed                                           |            | 38.45         | 95th percentile Speed     |            | 33.85         |
| Median (50th perc. Speed)                                       |            | 34.14         | Median (50th perc. Speed) |            | 37.01         |

resulting in conflicts between vehicles and road users at the section.

### 13. Conclusion

road side markets on performance of two-lane rural roads. A Road Side Friction Index (RSFI) is developed to quantify the side friction and its relationship with travel speed has been demonstrated. It is demonstrated that road user cost incurred by different vehicles increased substantially while travelling through a road section having road side market areas in between. This additional amount is not directly paid by the road user but indirectly incurred by them due to presence of road side markets with various side friction levels along the sections. This additional cost is not only loss to individual road users but also huge loss of society at large. Typical example has been demonstrated with the help of 40km study section considering three types of vehicles only. Thousands of such road side markets exist along almost all national/state highways of developing countries like India. Presence of this side friction also restricts the benefit of investment in road infrastructure for improvement in level of service of road section. Findings of the study would certainly justify the implementation of policy measures to keep away such market activities from the carriageway.

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