International Journal of Civil Engineering and Technology (IJCIET)
Volume 8, Issue 7, July 2017, pp. 774–779, Article ID: IJCIET_08_07_083
Available online at http://www.iaeme.com/IJCIET/issues.asp?JType=IJCIET&VType=8&IType=7
ISSN Print: 0976-6308 and ISSN Online: 0976-6316

STUDY ON TRAFFIC CONGESTION COST – A CASE STUDY

K. S. B. Prasad
Assistant Professor, Department of Civil Engineering,
GMR Institute of Technology, Rajam, Andhra Pradesh, India

Dr. G. Venkata Rao
Professor and Head, Department of Civil Engineering,
GMR Institute of Technology, Rajam, Andhra Pradesh, India

S. Venkatesh
P.G Student, Department of Civil Engineering,
GMR Institute of Technology, Rajam, Andhra Pradesh, India

ABSTRACT

Traffic congestion in metro cities and also developing towns is a common phenomenon for developing countries. The impact of traffic congestion on national economy. A study conducted to quantify the congestion problem. It describes the complete methodological process from data collection to cost per minute. Traffic congestions are frequently observed where road facilities operate at capacity limits. To estimate the congestion cost an arterial route was selected that has significant importance due to Industrial & port associated activity. The amount is a composition of opportunity cost & Fuel consumption cost caused due to excessive delays in congestion. Additionally, it describes the complete methodological process from data collection to cost per minute delay. Traffic congestion issues are frequently observed in cities and also in developing towns of the world. Traffic congestion issues in developing towns at preliminary stage give a better understanding for future accommodation of traffic. In present study 1.1 kilometer congested stretch of rajam town populated with more than one lakh located in srikakulam district Andhra Pradesh is selected. The cost loss is a composition of opportunity and fuel consumption costs caused due to excessive delays in congestion, which is Analyzed the selected stretch.

Key words: Traffic Congestion, arterial, congestion cost, value of time, delay.

Cite this Article: K. S. B. Prasad, Dr. G. Venkata Rao and S. Venkatesh. Study on Traffic Congestion Cost – A Case Study. *International Journal of Civil Engineering and Technology*, 8(7), 2017, pp. 774–779.
http://www.iaeme.com/IJCIET/issues.asp?JType=IJCIET&VType=8&IType=7

1. INTRODUCTION

From the last two decades, rapid growth and urbanization brings precarious issues to the under developing countries. Mainly all these issues are classify as public issues which leads towards drastic impact to the settlements. One of the eminent problem faces by all classes of population is road transportation related problem. The incompetent and inefficient transportation infrastructure was the main restraint for the development [1] Numerous studies on congestion cost estimation, that aim to quantify their monetary losses, have been conducted. Value of Time (VOT) assessment through utility maximizing theory and choice models are abundantly applied in transport literature. The concept of VOT was introduced by Becker when he proposed the conversion of time into money by assigning more time to work[2]. A combination of population growth, urbanization and increasing economic prosperity has led to significant congestion problems in many parts of the world, particularly in the urban areas. Congestion has many negative impacts such as delays, higher transportation costs, increased travel time etc. All these undesirable traffic characteristics increase the level of air pollution and noise, wear and tear of vehicles, and poor operational efficiencies.. [3]. Congestion pricing charges motorists a toll for using a particular stretch of highway or bridge or for entering a particular area. It is a market or demand based strategy designed to encourage a shift of peak period trips a. off-peak periods; b. to routes away from congested facilities or c. to alternative modes – high occupancy vehicles or public transit during the peak demand periods. Congestion pricing proposes to guide and internalize the transportation and environmental costs – delay, pollution, accidents – associated with congestion, costs that are largely unaccounted for in the current transportation system[4]. Motorization in urban India is growing faster than the population; automobile ownership growth rates are of the order of 15% - 20% per annum in most cities As the urban population undertakes its daily mobility by a variety of transportation modes (local train, bus, car, etc.), the in dividable modal choice is governed by a complex set of factors, viz., physical, human, economic and social. Even though public transport offers a competitive service, its market-share is constantly declining[5].Traffic congestion extends the travel time leading to increased cost for most people especially business men and stakeholders. More fuel is consumed, which reduces the air quality, decreases the people's health and increases the emissions. In addition, the noise level is increased due to the traffic congestion.[6].

Not only in cities and also developing towns of India face similar types of congestion problems. Although, there are number of efforts made to accommodate and facilitate the increasing traffic in future for the developing town areas, but congestion seems to be an unresolved issue. Keeping this in view, this research was conducted to investigate the quantity of congestion and then quantify in term of cost. For this, one of the busiest and significantly important road stretch of rajam were selected. Rajam is a developing town in district of Srikakulam, Andhra Pradesh. Rajam is enclosed by educational institutions, Industries, Market yard Recreational centers etc.., The Rajam has population of more than one lakh according to Census India. The research was design to ascertain the traffic congestion with Various traffic parameter were collected through field surveys. This paper contains the description about study area, type of data collected for this study and obtained findings followed by the concluding remarks.

2. STUDY AREA

The study area selected in Rajam i.e. having significant importance to provide service to the business area. This is a long stretch of road in which one end is located in the residential houses and other end sited in the urban area. Two stretches are selected in Rajam, where the length of two road stretches are 1.1 km serving to the heterogeneous traffic which includes

light and heavy traffic from bike to truck. The study area was divided into 2 observation points which are green in colour. The figure 1 shows the map of road stretch which segmented into urban and industrial area and the points identifies the observation spots in the stretch.

Figure 1(a) Showing upstream traffic towards rajam

Figure 1(b) Showing downstream traffic from rajam

3. DATA COLLECTION

Data was collected in from morning 6.00 am to evening 8.00 pm respectively. In selected stretch two observation points are selected. One observation point at Rajam panchayat office and another one at rajam market road. In study stretch, it is observed that the volume of Two Wheeler vehicle is more than other type of vehicle volume. The delay study conducted on the road stretch 1 and road stretch 2 (from Satya complex to Bobbili junction & Bobbili junction to Satya Complex) at free flow period and congestion period. Delay time was calculated with reference speed 30Km/Hr. Value of time (VOT) is also estimated different attributes of the travel modes such as travel cost, travel time. VOT values are used to calculate opportunity cost component of traffic congestion cost. Fuel efficiency and fuel consumption data for different types of modes which are travelling on that road stretch was gathered to estimate vehicle operating cost component of traffic congestion cost. Equation (1) and (2) represents the expressions utilized to compute opportunity and vehicle operating costs.

$$OC = \Sigma^{m}_{m=1} (VOTm * Delay_m * V_m * Vocc_m) \quad (1)$$

Where, OC= Opportunity Cost of traffic congestion, VOTm = Value of time for specific mode m,

$Delay_m$ =travel delay in time units observed for mode m(estimated at some reference speed),

V_m =number of vehicles of type m per day, $Vocc_m$ = Average vehicle occupancy for specific mode m.

VOT=(ß1/ß2)

β_1=coefficient of travel time[1/min]

β_2=cpefficient of travel cost[1/Rs]

$VOC=L*\Sigma^{m}_{m1}$ (Fcm*Delaym *vm) (2)

Where, VOC= Vehicle operating Cost, Fcm= Fuel cost in Rs/hr for specific mode m, and have the same meaning mentioned earlier and L= length of stretch in Km. Where, is calculated using equation (3).

$Fc_m = \Sigma 3Ft=1 (Fcq_m^{ft} * fp^{ft} * \mu^{ft})$ (3)

Where, Fcq_m^{ft}= Fuel consumption quantity in litres/km or Kg/km of specific mode m, fp^{ft} = fuel price of specific fuel types Ft = 1, 2 and 3 such as CNG, Gasoline and Diesel, respectively in Rs. /litres. µft =proportion of specific mode type m using a particular fuel type for travelling on that road stretch.

4. RESULTS AND DISCUSSION

The collected data was compiled according to the parameters described in equations (1), (2) and (3).The average values of the volume collected at two different locations were given in Table 1. As the survey data was gathered only for fourteen hours of the day. In addition to this, table 1 also provides observed values of vehicle occupancy as per IRC SP 30. Various industries are located nearby and also this road provides access to those industries. It is interesting to note that the average vehicle occupancy of Two wheeler obtained as low compared to its seating capacity.

Table 1 Classified volume and vehicle occupancy

Stretch	Mode	Veh\day	Vehicle occupancy
Stretch 1	Motorcycle	8536	1.5
Stretch 2	Motorcycle	7183	1.5

Table 2 describes the average speed of classified modes on that road stretch & also shows estimated travel delays for each representative travel mode at two reference speeds (i.e. 30km/hr)

Table 2 Average speed and average delay under reference speed.

Stretch	Mode	Average speed (km\hr)	Average delay (min\veh)
Stretch 1	Motorcycle	30	0.83 (50 sec)
Stretch 2	Motorcycle	30	0.83 (50 sec)

VOT values are shown with respect to mode usersin table3. Average fuel consumption quantity of classified modes and their proportions (i.e.µ1,µ2, µ3)are also shown in same table. By using same running vehlicles fuel consumption quantities are estimated

Table 3 Vehicle classified VOT with μ-factor and fuel consumption quantity.

Mode	VOT(Rs\Hr)	μ2	FcqGasoline (km/lt)
Motorcycle	137	1	55

The results shown in table 1, 2 and 3 are utilized in quantifying the level of congestion and traffic congestion cost using equations (1), (2) and (3). As shown in table2 above, time loss for average vehicle type is approximately 0.83 minutes/trip using conservative definition of delay (i.e. 30km/hr reference speed) along with the volume of traffic which is15719 vehicles/day. The Level of Service (LOS) for this stretch was fond out to be D. The free flow travel time for the stretch, was 3.21 minutes, but in actual circumstances average travel time per average vehicle is found to be 4.11 minutesfor the complete stretch of road which is around 1.1km.

Table 4 Total Cost of direct traffic congestion per day in Indian Rupees

Sections	Opportunity Cost(Rs\day)	Vehicle operating cost(Rs/day)
Section 1	17592	180
Section 2	22629	152
Total	40221	332
Wear and tear (10% of voc)	-	33
GRAND TOTAL = 40221+332+33 =40586.		

Table 4 shows results that total direct traffic congestion cost as around rs.40,586 per day for the road stretch under study using conservative definition of travel delay (i.e. 30 km/hr reference speed). The traffic congestion cost for whole arterial network of Rajam can be done by calculating per km cost for the stretch under study.

5. CONCLUSIONS

The main aim of this study is to determine the congestion cost. Congestion cost is calculated as Opportunity cost and Vehicle Operating Cost Equations. Those Equations are modeled for all type of vehicles with Delay count and Traffic volume count. This research study estimated the traffic congestion cost of Rajam town of India. Field data were collected on traffic volumes, and traffic speeds during peaks and off-peaks were conducted. The policy making institutions needs to take serious actions to deal with it. Furthermore, this is the loss incurred directly due to traffic congestion not included the cost associated with it like environmental degradation cost. A congestion performance measure named travel time index was estimated for the existing traffic of selected road corridors and the congestion level of these study stretch were identified. Congestion pricing also helps to increase the ride sharing and public transport system.

REFERENCES

[1] Mir Shabbar Alia, Muhammad Adnana, Syed Muhammad Nomana, Syed Fazal Abbas Baqueria Estimation of Traffic Congestion Cost-A Case Study of a Major Arterial in Karachi.

[2] Syed Fazal Abbas Baqueria,, Wim Ectorsa, Mir Shabbar Alib, Luk Knapena, Davy Janssensa, Ansar Yasara Estimation of Value of Time for a Congested Network – A case study of the National Highway, Karachi .

[3] Tina Maria Sunny1, Jomy Thomas, Determination of congestion for car users in CBD area of thiruvananthapuram city.

[4] Mr. Milan A. Patel Mr. H. K. DaveDevelopment of congestion Pricing for Selected Arterial Road in Ahmedabad City.

[5] Aparajita Chakrabartty, Sudakshina Gupta Estimation of Congestion Cost in the City of Kolkata—A Case Study.

[6] A.Shoaeb,S.EI-Badaway and A.Gabir Direct Costs Of Urban Traffic Congestion Case Study:Main Corridors in Mansoura City.

[7] Goulias, K. G., 2003. Transportation system and Planning, Methods and Application.

[8] Arnott, R., Small, K.A., 1994. The economics of traffic congestion. American Scientist 82, p. 446.

[9] McKinnon, A., 1999. The effect of traffic congestion on the efficiency of logistical operations. International Journal of Logistics: Research and Applications 2 (2), p. 111.

[10] Goodwin, P.B. and Dargay, J., 1999. Traffic congestion in Europe. Paris: OECD, ECMT Round Table 110.

[11] Thomson, I. and Bull, A., 2001. La congestion deltra´nsitourbano: causas y consecuenciasecono´micas y sociales [Urban traffic congestion: economic and social causes and consequences]. Serie de Recursos Naturales e Infraestructura. Cepal. No. 25.

[12] Australian Government, Department of Transport and Regional service, Estimating urban traffic and congestion cost trends for Australian cities, work paper 71.

[13] Khan, T., and Islam, R. M., 2013. Estimating Costs of Traffic Congestion in Dhaka City, International Journal of Engineering Science and Innovative Technology (IJESIT), 2(3).

[14] Goodwin, P.B., 2004. The economic costs of road traffic congestion. London: University College London, ESRC Transport Studies Unit, Discussion Paper.

[15] Garrido, N. 2012. Computing the cost of traffic congestion: a micro simulation exercise of the City of Antofagasta, Chile, Transportation Planning and Technology.

[16] Samar Patni, V. S. Landge and Sanket Gupta, Motor Vehicle Traffic Congestion Costing in Nagpur City, International Journal of Civil Engineering and Technology, 8(4), 2017, pp. 100–106.

[17] Akshay Jadhav, Deepak Anchule, Shekhar Bade and Prof. Anuradha Pansare, Optimized Solutions for Resolving Traffic congestion At University Circle, International Journal of Civil Engineering and Technology, 7(2), 2016, pp. 278–289.