Impact Factor (SJIF): 4.542

International Journal of Advance Research in Engineering, Science & Technology

e-ISSN: 2393-9877, p-ISSN: 2394-2444

Volume 4, Issue 3, March-2017

FEASIBILITY STUDY OF FLYOVER BRIDGE AT INTERSECTION OF RINGROAD IN URBAN CITY: A CASE STUDY OF VRUNDAVAN INTERSECTION,VADODARA

Panchal Chetan[1], Mauni Modi[2], Hardik Sukhadia[3]

[1]*PG Student, M.E. Civil-Infrastructure Engineering, L.D.R.P. Institute of Technology & Research, Gandhinagar,*
[2]*Faculty, Civil Department, L.D.R.P. Institute of Technology & Research, Gandhinagar,*
[3]*Faculty, Civil Department, Sigma Group Institute, Matar-Bharuch.*

Abstract — ***Rapid urbanization and industrialization have caused an unprecedented growth of vehicles in the world. The urban traffic congestion has a global phenomenon. Environmental pollution problems are also faced by humanity on these days. Due to fast growing vehicular traffic, old planned cities become congested road links, intersection become saturated, busy and supply service is above its capacity. Therefore, it requires effective controls to regulate the traffic and optimize delay and congestion of the traffic at the intersection. This problem can be eliminated by providing Flyover Bridge at intersection.***

This research is mainly focused on feasibility of Flyover Bridge at highly congested intersection. This research is consider the traffic survey like classified volume count survey, speed and delay survey and also collect the data like accident data, population and vehicle growth data of study area. Economic evaluation will be carried out for the Vrundavan intersection. From this research it revealed that for better & efficient transportation infrastructure in urban area at highly congested intersection should gave the facilities if Flyover Bridge may be satisfy the needs.

Keywords- component: transportation problems, traffic congestion at intersections, Flyover Bridge, traffic surveys, economic evaluation

I. INTRODUCTION

Transport is an important part of India's economy. The urban population in India has increased significantly India is a developing country and its cities are undergoing rapid urbanization and modernization as a result there is rapid growth in the road traffic. Traffic movement in India is very complex due to the heterogeneous traffic stream sharing the same carriageway. Cities play a vital role in generating economic growth and prosperity. The sustainable development of cities largely depends upon their physical, social and institutional infrastructure. In this context, the importance of transport infrastructure is paramount.

Urban Transport systems in large developing cities face major challenges due to the continuous growth of urban population, private vehicle ownership, congestion, and the fragility of public transportation systems. When the urban transport system experiences major difficulties, consequences are felt by households, by businesses, and by the urban community at large. Transport may become a binding constraint on both economic growth and social development and inclusion, along with increased negative impacts on health and on the environment. The rapid growth of large cities due to the growth in population coupled with increase in urbanization has posed serious challenges in developing adequate infrastructure facilities. Travel demand has risen sharply exceeding the available supply in transportation infrastructure and services. All the Indian cities irrespective of their sizes and forms are suffering from severe traffic and transportation problems.

Due to fluctuation of vehicle population in the city it is not possible to stop traffic and it is very difficult to provide extra land as per traffic demand. At the intersection traffic jam problem may causes delay time and fuel consumption due to frequently stoppage of vehicles at different intersection. Many conflict points at intersections the rate of accident will be increase. Due to fast growing vehicular traffic, cities become congested and road links, intersection become saturated, busy and supply service is above its capacity. Therefore, it requires effective controls to regulate the traffic and optimize delay and congestion of the traffic at the intersection. Space sharing intersection e.g. rotaries and pre timed signals are widely used to control the intersections. Space sharing intersections are intended to give equal priority and permit continuous movement of all intersecting vehicle flows. For higher traffic volumes, space sharing intersections such as rotary is not preferable due to increase in congestion and overall intersection delay and conflicts. In pre timed signal, green times for the phases remain constant for the particular period of the day, although demand fluctuates during that period. This problem can be eliminated by providing flyover at intersection. The flyover construction need very massive amount of investment and it also effect the economy of the country so before construction we have to check feasibility of the flyover so that we can come to know that from this project we can achieving our desire goal or not, and it will overcome the transportation problem and beneficial in future or not.

1.1 Objectives of study

- To study the present situation of traffic at Vrundavan intersection.
- To carry out the different traffic surveys at study area.

- To find out the benefits of flyover at particular intersection.
- To check construction of flyover at particular location will economically feasible or not.
- To calculate fuel consumption saving, user travel time saving and Vehicle operating cost (VOC) saving due to construction of flyover at intersection.

1.2 Scope of study

- Various types of field surveys like traffic classified volume count survey, traffic speed and delay survey, occupancy survey will be carried out at particular location.
- Fuel consumption, passenger travel time of the vehicle due to traffic delay will be calculated after traffic data collection.
- User travel time saving, Vehicle operating cost (VOC) saving due to construction of flyover at intersection will be calculated.
- To carry out economic analysis for checking the viability of project.

II. STUDY AREA

Vadodara is third largest city of Gujarat and eighteenth largest city of India. It is situated on banks of river Vishwamitri. It has an area of 159.95 sq.km and urban population of 1.8 million (Census 2011). It is known as 'cultural city' and the city shows rapid growth in the sectors of Education, Industrial, Infrastructural and Urbanization.

Vadodara city is located at Delhi-Mumbai corridor. Vadodara city is well connected by an expressway, several national and state highways, the broad-gauge and meter-gauge railways and international airport. The city transportation is mainly dependent on roadway system. Vehicle growth has been rapid. The network is expressing heavy congestion. Consequently air pollution has become severe.

Vrundavan intersection is located at 40mt ring road in Vadodara city. It is the outer ring road of the city. Perpendicular to ring road one phase is Panigate road which is connected with CBD area of Vadodara city and another phase is Wagodia road which is connected with NH-8.

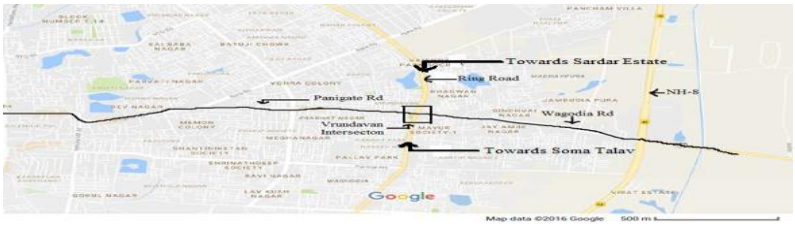


Figure 1:- Location of study area

III. IDENTYFYING THE PROBLEM

For Increase in urban traffic congestion has become a serious matter in urban cities. In urban road networks, the intersections are very large and very close to each other. More traffic congestion is observed especially during peak hours. In fact, in urban areas exciting roads or the scope of improvement of intersection at-grade is very limited. So, due to the unavailability of land in urban city improvement is requiring for fast, safe and smooth movement of vehicle. It's achieved by constructing flyover at intersection.

Study area Vrundavan intersection is having poor geometry and poor road surface. Now Vrundavan intersection faced heavy traffic congestion. Efficiency of signal is decrease due to increase in vehicle growth. Due to low efficiency of signal number of Traffic police is required at intersection for managing traffic situation. Autorickshow is stay on carriageway so decrease the space of carriageway for moving vehicles.

Due to this:-

- Increase travel time.
- Increase air and noise pollution.
- Increase in fuel consumption.
- Increase the chances of accident.

Figure 2:- Traffic at intersection

Impact Factor (SJIF): 4.542

International Journal of Advance Research in Engineering, Science & Technology

e-ISSN: 2393-9877, p-ISSN: 2394-2444

Volume 4, Issue 3, March-2017

IV. METHODOLOGY

It is required to frame the methodology to be followed before starting the actual research work. For the feasibility study of Flyover Bridge, data works as raw material for analysis, planner and design maker. Without qualitative and detail data, Scientific analysis becomes difficult.

To achieve the objectives a methodology is framed. Complete flowchart of each activity showing various stages involved is shown in fig. For this work study area is identified for collecting data. Main stretches of the study area identify the problems, such as delay in travel time, loss of fuel consumption, air pollution, and noise pollution. Traffic data are collected from the field survey at location and is used for analysis purpose. Economic evaluation is carried out for justification of Flyover Bridge.

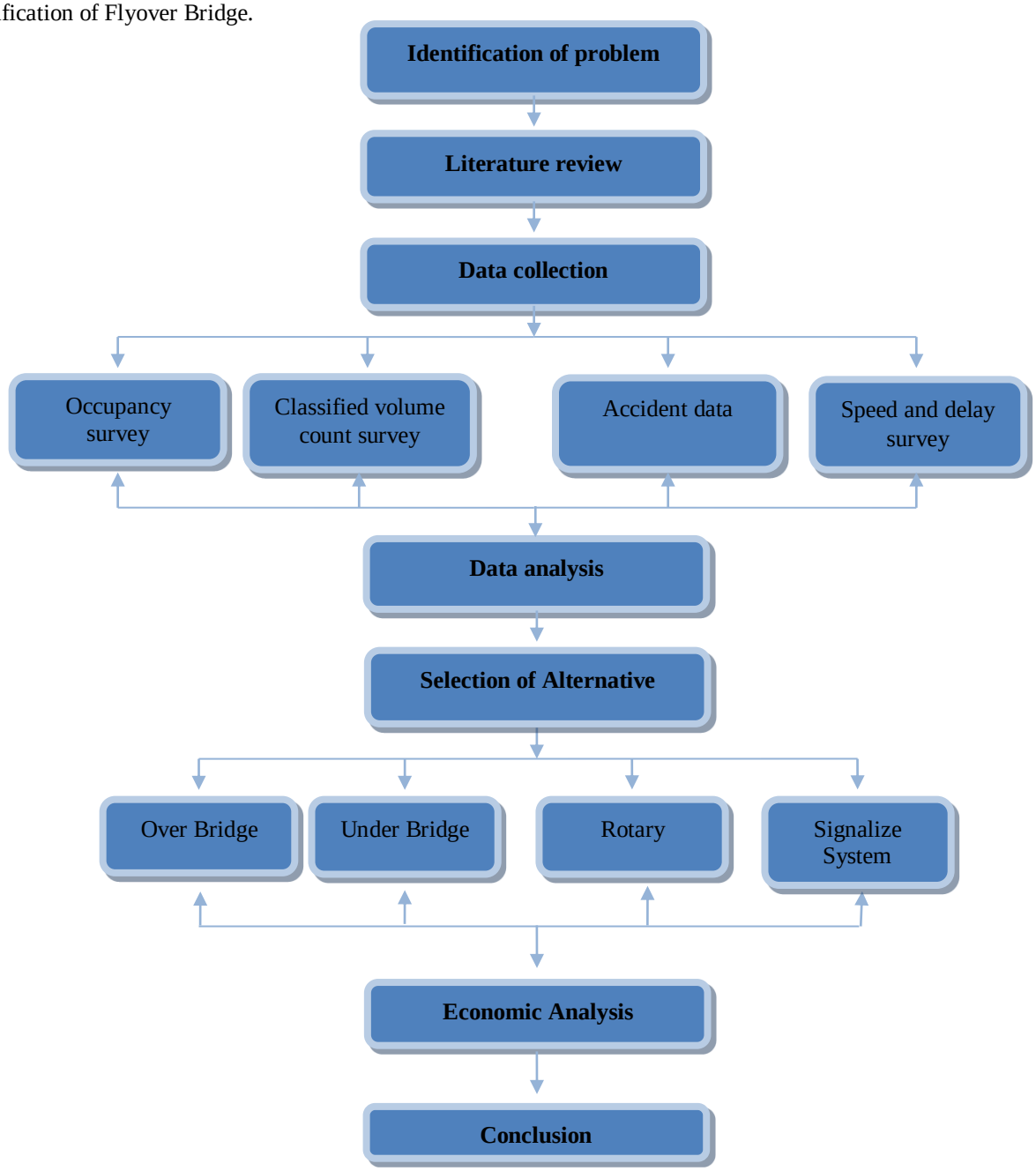


Figure 3:- Methodology flow chart

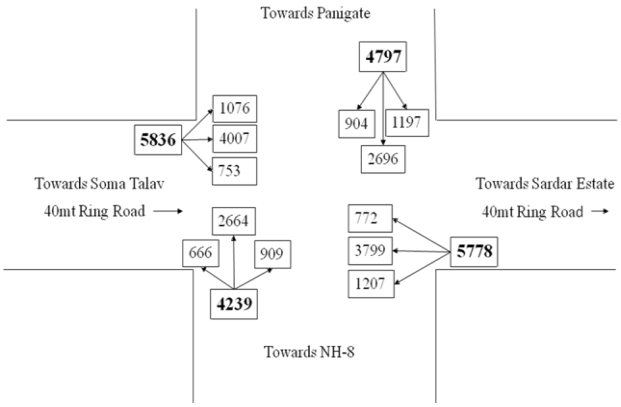
IV. DATA COLLECTION AND ANALYSIS

1. Classified volume count data

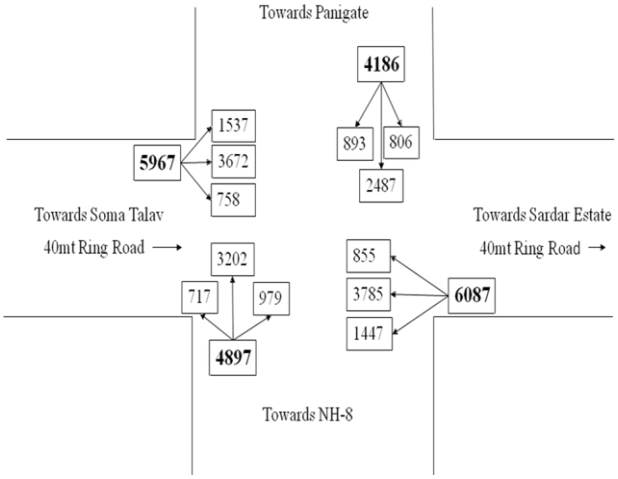
The hourly Traffic data was collected by using Video-graphic technique a high mega pixel (20.0 MP) video camera was used for accurate data collection, which was installed at an elevated point so that it is possible to covers the Traffic movements on the entire intersection. The Traffic movement was recorded during morning peak hours (9:00am to 12:00pm) and evening peak hours (6:00pm to 9:00pm) on Saturday, Monday, and Tuesday. The required Traffic data were later extracted from the recorded videos by using video player operating at normal speed. Turning movement counts should be conducted manually and recorded in 15 minutes interval according to lane movement and by vehicle classification. Peak hours (morning and evening) are sufficient for most of the situations.

Type of vehicle	Towards sardar-estate	Towards Somatalav	Towards Panigate	Towards NH-8	Total
2W	7937	8360	6450	5946	28693
3W	1382	1216	1222	1458	5278
CAR	1819	1631	921	1235	5606
BUS	62	61	17	42	182
LCV	161	132	41	97	431
HCV	55	33	15	24	127
CYCLE	448	390	317	336	1491
Total	11864	11823	8983	9138	41808

2. Turning Movement count



Morning Turning Movement



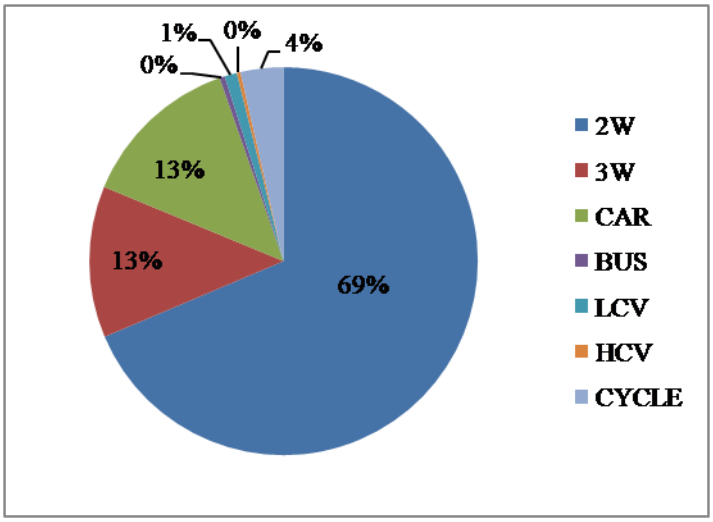
Evening Turning Movement

3. Accident data

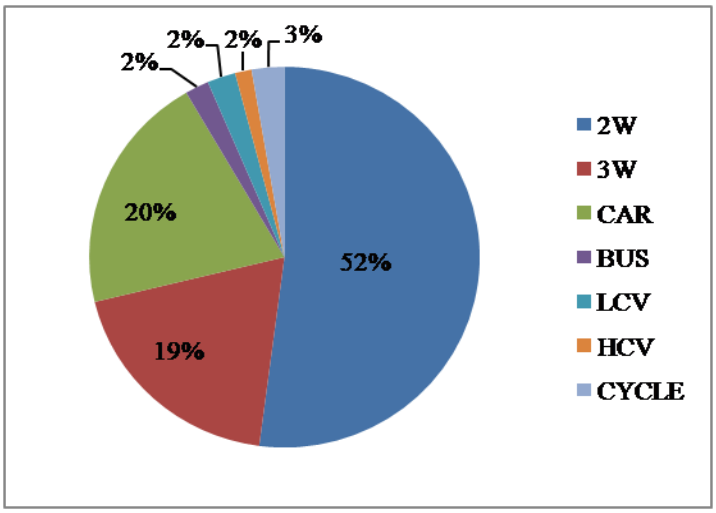
Year	Minor	Major	Fatal	Total
2013	7	2	0	9
2014	11	5	1	17
2015	9	3	0	12

Source: - Police station

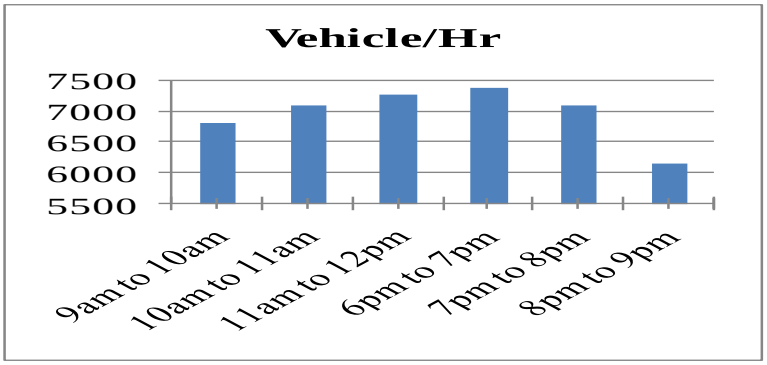
4. Vehicle Composition (%)



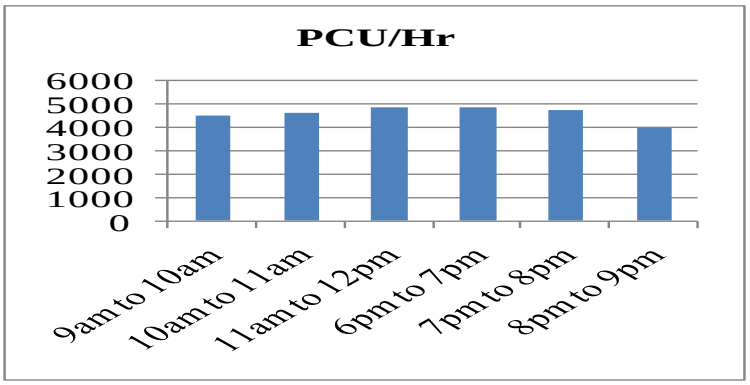
5. Vehicle Composition (In % PCU)



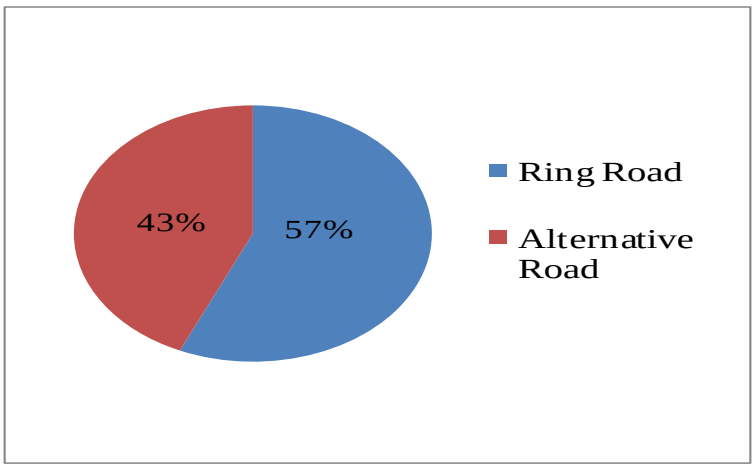
4. Vehicles/hour at Vrundavan intersection



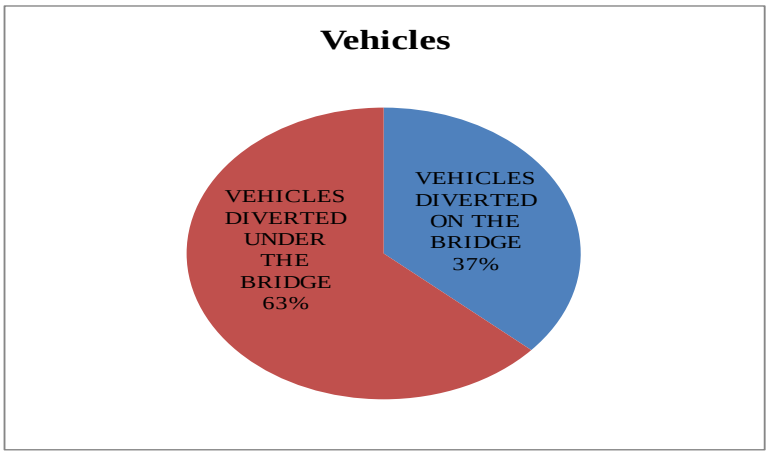
5. PCU/hour at vrundavan intersection



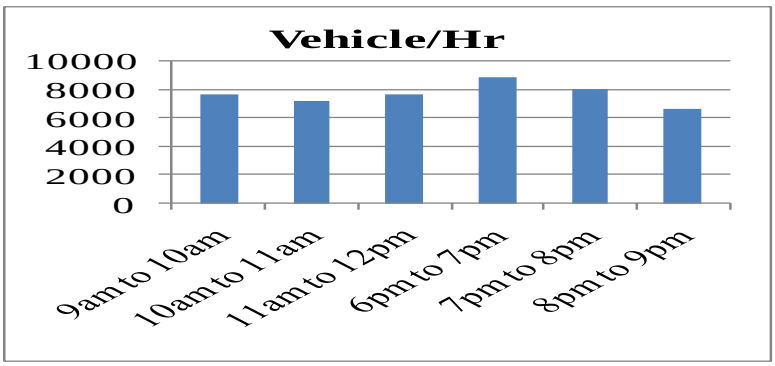
6. Vehicles/day at vrundavan intersection



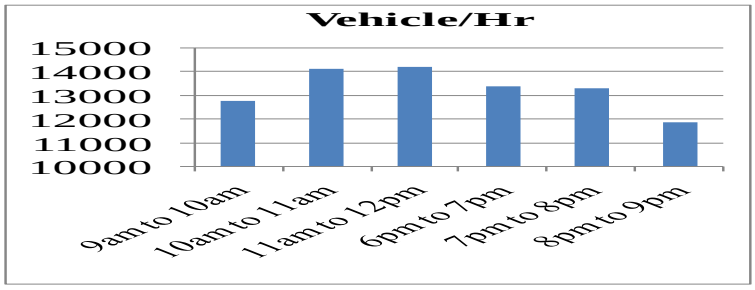
7. Diversion of vehicles on proposed flyover



8. Vehicles/hr on the proposed flyover



9. Vehicles/hr under the proposed flyover



10. Delay survey

Delay survey is carried by observing journey time of different type of vehicles. It is helpful to find out consumption of fuel at intersection in the idle condition of the vehicle.

Direction	Morning	Evening
Toward Soma Talav	14.01	28.47
Toward Sardar Estate	17.83	27.03
Average	15.92	27.75
Average delay per vehicle		**22**

11. Speed survey

Speed survey is carried out by counting journey time of different type of vehicles. Stopped watch is used for counting a journey time. Running speed is determined by journey time divided by length.

Speed in km/hr		
Vehicle	**Towards Soma Talav**	**Towards Sardar Estate**
2w	14	12
3w	11	9
Car	9	8
Bus	7	6
LCV	9	7
HCV	6	6
Average	**9**	**8**

12. Passenger occupancy survey

Vehicle occupancy survey determines by observing the no of passengers in each vehicle. This survey establishes the traffic volume in terms of number of persons by different types of vehicle crossing at a given point. The analysis of vehicle occupancy survey data and junction delay survey data provide valuable inputs in economic analysis of the project.

Vehicle type	Passenger Occupancy
2w	1.4
3w	2.4
car	2.4
Bus	48

V. ECONOMIC ANALYSIS

1. No of vehicles gets benefited by flyover bridge

Vehicle type	Soma Talav	Sardar Estate	Total
2w	5416	4936	10352
3w	852	1040	1892
Car	1061	1131	2192
Bus	42	46	88
LCV	69	103	172
HCV	28	36	64
Total	7468	7292	14760

2. Saving in vehicle time in hours /day

It was estimated by using value of delay per vehicles.

Vehicle	No of vehicle	Saving in vehicle time in second	Saving in vehicle time in hours/day
2W	10352	1366464	380
3W	1892	249744	69
CAR	2192	289344	80
BUS	88	11616	3
LCV	172	22704	6
HCV	64	8448	2

3. Saving in vehicle time passenger hours /day

It was estimated by multiplying saving in vehicle time in hr/day with Passenger occupancy data.

Vehicle	Saving in vehicle time in hr/day	Passenger occupancy	Saving in vehicle time in passenger hours/day
2W	380	1.4	532
3W	69	2.4	166
CAR	80	2.4	192
BUS	3	48	144
LCV	6	-	6
HCV	2	-	2

4. Travel time saving Rs./year

It was estimated by multiplying saving in vehicle time in hr/day with Travel time saving in Rs. / passenger-hr.

Type of vehicle	Savings in vehicle time in passenger hr/year	Travel time saving in Rs/passenger-hours	Travel time saving in Rs./year
2W	194180	67.48	13103266
3W	60444	10.23	618342
CAR	70080	34.81	2439485
BUS	52560	10.23	537689
LCV	2190	10.23	22404
HCV	730	-	-
TOTAL			**16721186**

Source: - DMRC 1996 study

5. Fuel consumption Rs./year

Fuel consumption was estimated by Idle fuel consumption of delayed vehicles is analyzed by taking total delay vehicles per hour of each vehicle group multiplied by corresponding PCRA Idle fuel consumption coefficients.

Type of vehicle	Idle fuel consumption liter/hour
2W	0.34
3W	0.42
Car	0.54
LCV	0.69
Bus	0.86
HCV	0.89

Source: - PCRA 1996 study

From the analysis of classified volume count survey data can see that the vehicles run on diverse kind of fuel (Petrol, Diesel and CNG). Proposition of vehicles according to fuel usage is shown in below table.

Type of vehicle	Petrol	Diesel	CNG
2w	100%	0%	0%
3w	0%	7%	93%
car	36%	23%	41%
Bus/LCV/HCV	0%	95%	5%

To find out money saving due to fuel consumption saving, from the idle fuel consumption liter/hour and saving in vehicle time in hours/day fuel consumption saving is calculated.

Type of vehicle	Fuel saving during 1 day in liters	Saving in Petrol (liter)	Saving in Diesel (liter)	Saving in CNG (kg)
2W	129	129.00	0.00	0.00
3W	29	0.00	2.03	26.97
CAR	43	31.32	20.01	35.67
LCV	4	0.00	4.00	0.00
BUS/HCV	4	0.00	3.80	0.20

Money saving is calculated by multiplying the price of fuel with fuel saving during 1 day in liter or kg. Current fuel price (March 2017) is 78.48/liter for Petrol, 65.29/liter for Diesel, 48.09/Kg for CNG.

Type of vehicle	Money saving in 1 day as per respective fuel price	Money saving in 1 year
2W	9364	3418012
3W	1716	626200
CAR	2748	1003160
LCV	261	95323
BUS/HCV	261	95323
TOTAL		**5238019**

6. Accident cost

Accident cost is estimated by multiplying no of accident with economic cost of accident as per Clause 6.8 Accident cost saving from Table 8 IRC-SP 030:2009

Type of accident	Economic cost of accident (Rs)	No of accident	Monetary loss(Rs)
Fatal	864350	0	0
Major	172650	3	517950
Minor	30450	9	274050
Total			**792000**

Source: - IRC-SP 030:2009

7. Total cost of saving

Summation of Travel time savings, Fuel savings, Accident cost savings during 1 year.

Sr no.	Saving	Amount in Rs.
1	**Travel Time Savings**	16,721,186
2	**Fuel Savings**	5,238,019
3	**Accident Savings**	792,000
	Total	**22,751,204**

8. Calculation for various method of Economic Evaluation

Method	Value	Result
NPV	**-31.98**	**Negative, Project is not justified**
B/C	**0.5**	**<1,Project is not justified**

VI. CONCLUSION

In this research paper I conclude that after studying the all data and taking all the required surveys. From traffic volume count survey total traffic of 37% vehicles will be diverted on flyover and 63% under the flyover. Average delay per vehicle was 22sec and average speed of vehicles is 9kmph.

From economic analysis, Total Saving in travel time Rs. /year is 16,721,186, Fuel saving cost is 5,238,019 and accident cost saving was 792,000. This is a benefit of the flyover at vrundavan intersection. As per this benefits and cost of construction I was findout the NPV and B/C ratio.

Vadodara mahanagar seva sadan (VMSS) was planning the flyover at vrundavan intersection and VMSS estimated the cost of flyover construction at vrundavan intersection is 45cr. As per this cost of construction the economic evaluation was carried out,

- NPV value is -31.98, which is negative. Hence project is not justified.
- B/C value is 0.50, which is less than 1, Hence project is not justified

Flyover and underpass is not beneficial for vrundavan intersection for next few years because of high construction cost. So another alternative are Rotary or signalize system. Rotary is not preferred because of low space at intersection. Signalize system is available at vrundavan intersection but its efficiency is very low, it is work only at 6pm to 7pm. So I suggest improve the efficiency of signalize system for reduce the congestion and achieve smooth flow of traffic and to making proper Transportation management strategies. It will helpful to reduce the traffic congestion at intersection. Transportation management strategies like:

- Improve the geometry of intersection
- Increase the space of carriageway by removing the hawkers and vendors from near the intersection
- Implementing proper parking system
- Improve pedestrian environment

From this we can achieve the sustainable infrastructure at the vrundavan intersection.

REFERENCES

[1] Ankit Patel, "Economic Evaluation for proposed highway Rail Over Bridge - A case study of Naroda rail crossing",M.E (Transportation Engineering), L.D Engineering College, GRA - Global Research Analysis, 2003.

[2] Jani Krupa P "Economic Evaluation of Flyover - A case study Rail Over Bridge at Ahmedabad -Botad M.G Railway line at Shreyas crossing Ahmedabad" M.E(Civil) Transportation Engineering, L.D College of Engineering, Ahmedabad (2008)

[3] S. K. Goyal "Assessment of environmental benefits of flyover construction over signalized junctions: a case study" National Environmental Engineering Research Institute (NEERI), Nehru Marg, Nagpur, India (2008)

[4] Ronak N Modi "Pre-Feasibility study of transportation in infrastructure: A case study of chappi Railway crossing" M.E. (Civil) Infrastructure Engineering, LDRP Institute of Technology and Research, Gandhinagar (2015).

[5] Tarun Patel "Feasibility Study and Rapid Construction of Flyover at Sahakari Zin Intersection on NH-8, Himmatnagar"M. E. Student LDRP-ITR, Gandhinagar.(2015)

[6] Parthkumar Patel "Before and After Study of an Over Bridge - A Case Study of IIM-A Intersection"L.D Engineering College(2015)

[7] Raba Jayeshkumar "Feasibility Study of Flyover on Bopal Junction along Sardar Patel Ring Road, Ahmadabad"L.D Engineering College(2016)

[8] CityNihal D. Chhatbar "Economic Assessment of Flyover – A Case Study of Rajkot" Atmiya Institute of Technology and Science, Rajkot (2016)

[9] PravinHadiyal "Assessment of Flyover in Terms of Saving in Travel Time and fuel Consumption– A Case Study"L.D College of Engineering, Ahmedabad.(2016)

[10] Patel Ravi "Justification of Rail-Over-Bridge with Economic Evaluation a Case Study of Vastrapur Rail Crossing at Vejalpur" M.E. (Civil) Infrastructure Engineering, L.D.R.P. Institute of Technology & Research, Gandhinagar (2016)

[11] IRC : SP : 30-1993, Manual on Economic Evaluation of Highway Project in India, Indian Road Congress, Delhi

Book: Dr. L.R.Kadiyali "Traffic engineerng and Transport planning"

Websites: www.pcra.org
www.delhimetrorail.com