

Assessment of Flyover in Terms of Saving in Travel Time and fuel Consumption– A Case Study

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Abstract— To reduce traffic congestion at an at-grade intersection near a big city, one method is construction a flyover bridge at the old junction in two directions on one of the main highways. The flyover facilitates the traffic flow in the directions of the bridge, but the infrastructure cannot fully solve all of the problems especially on the secondary road. The traffic signal still uses the same control as the “before” situation, that is the fixed time control plan. Ahmedabad is the seventh largest metropolitan and fifth largest city in India. Here in this research paper assessment of flyover is carried out in terms of saving time, saving in fuel and reduction in the accidents.

Key words: Flyover, Signalized intersection, cost-benefit analysis, Vehicle delay, Travel Time Saving. Fuel saving

I. INTRODUCTION

The flyover-bridge intersection is an intersection that has a special bridge constructed over an at-grade intersection to allow for the free flow in two directions on one of the main road and reduce the traffic congestion in both of these directions, but underneath of the bridge, the existing traffic signalization is still used to control traffic as the at the intersection. Sometimes at the end of project of flyover construction, may not get fruitful results.

This research work tries to evaluate flyover performance of Ellis bridge intersection in terms of reduction in traffic as well as economic benefits. For this research work variety of surveys were carried out at the Ellis bridge intersection like stopped delay survey, occupancy survey, spot speed survey and CVC survey. From the analysis of primary and secondary data, impact of flyover on traffic condition and the economic benefits generated by the flyover is calculated. Calculation is carried out in terms decrease in accident and saving in fuel consumption due to the flyover construction.

II. PROBLEM DEFINITION

There was colossal traffic congestion problems at Ellis bridge intersection. Flyover was constructed in the direction of Ellis Bridge to Gujarat College and perpendicular the Ashram road to minimize the traffic problems. This route is one of the busiest route in Ahmedabad city.

Decrease in delay due to the flyover construction was observed. But it seems that traffic is not reducing as per assumptions. So it needs evaluation based on finance as well as engineering perspective, whether the flyover fulfill its presumptions or not.

III. OBJECTIVE OF STUDY

To evaluate and understand the above project, following objectives related to the study is listed as bellow.

- 1) To collect data of traffic on the flyover and at the intersection.
- 2) To determine saving in travel time and fuel consumption due to construction of flyover.
- 3) To compare the accident rate before and after construction of flyover.
- 4) To evaluate viability of flyover constructed.

IV. SCOPE OF STUDY

- 1) To collect classified volume count, delay and speed survey on the flyover and at intersection.
- 2) To collect the data of actual travel time and fuel consumption on the flyover and at intersection.
- 3) To collect the data of all types of accidents before and after flyover construction.
- 4) To carry out analysis for checking of viability of the project.

V. SELECTION OF THE STUDY AREA

The Ashram roads is one of the busiest route in Ahmedabad city. This flyover is running perpendicular to the Ashram road. Every day, during peak hours, much traffic congestion and delay was observed at the Ellis bridge intersection. So to reduce the traffic delay and congestion, flyover was constructed. According to a traffic survey, ashram road get extremely congested with traffic, to cop up with this traffic flyover was provided. Every day, during peak hours, this route faces maximum traffic congestion problem. The BRT corridor simply adds to the woes. According to a traffic survey, Ashram roads get extremely congested with traffic, and so there was much conflict point at the Ellis bridge intersection to cop up with this traffic flyover was provided.



Fig. 1: Google image of study area

The flyover measure 1 km in length, 8.9 meters wide and 2 lane road on each side is provided on the flyover. 30 kmph speed limit is provided on the flyover. Cost of construction of flyover is around 95-100 crore. According to the AMC report, The flyover is beneficial in the future BRT project.

VI. ECONOMIC ANALYSIS

The Traffic volume at Ellis bridge intersection was continuously increasing day by day. Also there was tremendous accident hazard during peak hour. To diminish this problem flyover was constructed. In view of the above an attempt has been made to evaluate the cost and benefits in terms of fuel consumption, travel time saving and decrease in the accident due to the flyover construction. After the collection of data, it converted in to the momentary values. This has been done based on the CVC survey, simultaneous delay survey carried out during total survey time of 2 hours in morning and evening for working 3 day in a week. The vehicle hours computed is converted into passenger hours based on vehicle occupancy. Occupancy survey is carried out manually on the flyover, as given in (Table 1). Accident data is collected from police station. After the collection of primary and secondary data, detailed analysis in different terms.

A. Analysis Of Data Results:

The vehicle hours computed is converted into passenger hours based on vehicle occupancy. Occupancy survey was carried out manually on the flyover by 50 observation of each types of vehicles in peak hours.

Types of vehicles	Occupancy	No. Of vehicles per hours	Person benefited per hour pre vehicles
Tw	1.54	741	1141
Car	3.11	104	324

3W	2.64	415	1096
Lcv	2.2	123	270
Bus	38.12	29	1486
Cycle	1.2	13	15
Total passenger benefited per hour			4332

Table 1: No. of passenger benefited

The total 1425 number of vehicles and 4332 number of passenger benefited per hour due to flyover. If take the 18 hours as working hours per 24 hours, then monthly 23,39,280 passenger uses the flyover.

Fatal	864350
Major	172650
Minor	30150

Table 2: Economic cost of accident (Source: IRC SP: 30,20092nd edition)

Year	Fatal accident		Major accident		Minor accident	
	No.	cost	No.	cost	No.	cost
2008	5	4321750	16	2762400	20	603000
2009	6	5186100	13	2244450	16	482400
2010	4	3457400	16	2762400	19	572850
2011	5	4321750	13	2244450	25	753750
2012	6	5189100	15	2589750	20	603000
2013	4	3457400	17	2935050	14	422100
2014	3	2593050	12	2071800	14	422100
2015	2	1728700	9	1553850	13	391950

Table 3: Evaluation of cost of accidents

Accident records from the year 2008 to 2015 are collected from the police station, and categorized in fatal, major and minor accidents on the basis of injurie and damage to the properties. Decrease in the rate of accident was observed from the year 2008 to 2015 is 41 to 24 respectively, So decrease in the fatal and major accidents was observed.

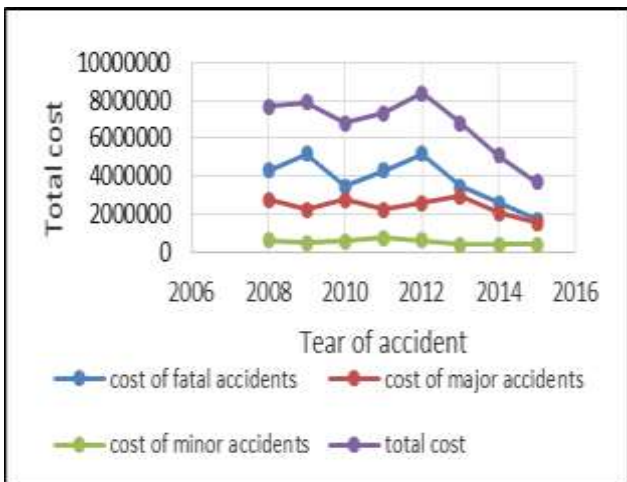


Fig. 2: Graphical representation of accident cost in Ellis bridge area.

(Source: RTI/ELLISBRIDGE/461/16/AHMEDABAD
Note: PIO senior police inspector, Ellis bridge police station, Ahmedabad)

From the graph, curve shows rate of accident is decreasing in succeeding year after the construction of flyover. So there is decrease in the cost of accidents, and ultimately increase the safety of public.



Fig. 3: volume composition on the flyover.

	Speed on the flyover(kmph)	Speed on that stretch in 2012(kmph)
Morning time	41.96	32.58
Evening time	38.08	37.97

Table 4: Speed comparison

(Source : Harshit Patel (Estimation of Delay and Fuel Loss at Signalized Intersection in Ahmedabad City))

Spot speed survey was carried out on the flyover for 2 hours in morning and evening time on working days during the peak hours. Speed on stretch from Gujarat college to Ellis bridge was taken from the thesis work carried out by Mr. Harshit Patel.

Vehicle Type	Fuel Consumption	Remark
Two Wheeler	197	Petrol
Three Wheeler	677	CNG
Car	706	Petrol
Car	649	Diesel
Car	989	CNG

LCV	690	Diesel
HCV	920	Diesel
Bus	930	Diesel
Bus	3610	CNG

Table 5: Idling Fuel consumption rate (in ml/hr, gm/hr)
(Source: Mrs. Purnima Parida, S. Gangopadhyay, 2009)

The price of petrol, diesel and CNG were taken as Rs.61.96/liter, Rs. 49.64/liter and Rs. 45.60/kg respectively in the month of May, 2016 at Ahmedabad city. Fuel consumption rate of TW, 3W and car was carried out at Honda show room near Vijay crossroads in Ahmedabad, by putting the vehicle in idling condition and measuring fuel consumption rates of different vehicles. Total 10 sample are taken to find the fuel consumption rate. Fuel consumption rate for LCV, HCV and bus is taken from the books of Mrs. Purnima Parida, S. Gangopadhyay, 2009.

	Morning delay	Evening delay
Average delay	64.413	65.12

Table 6: Vehicles benefited due to flyover

Types of vehicles	Passenger Occupancy	No. Of vehicles per hours (in peak hour)	No. of vehicle per day (18 hours)
Tw	1.54	741	13338
Car	3.11	104	1872
3W	2.64	415	7470
Lcv	2.2	123	2214
Bus	38.12	29	522
Cycle	1.2	13	234
Total vehicles benefited per hour			25650

Table 7: Vehicles benefited due to flyover

Types of vehicles	No. of vehicles	Savings in vehicle time in second	Savings in vehicle time in hours/ day
Tw	13338	959127.26	266
Car	1872	120584.08	33.43
3W	7470	479163.15	133
Lcv	2214	142105.59	39.73
Bus	522	33483.69	9.301
Cycle	234	15073.11	4.186

Table 8: Saving in vehicle time in hours per day

Vehicles type	Savings in vehicle time in hours/ day	Passenger occupancy	Savings in vehicle time in Passenger hours/day
Tw	266	1.54	409.64
Car	33.43	3.11	103.96
3W	133	2.64	351.12
Lcv	39.73	2.2	874.06
Bus	9.301	38.12	344.26
Cycle	4.186	1.2	5.0232

Table 9: Savings in vehicle time in Passenger hours/day

The saving in vehicle time in Passenger hours per day was carried out by use of occupancy survey data and delay survey.

Type of Vehicle	Travel Time Saving in Rs./ Passenger - hour
Tw	Rs. 67.48
Car	Rs. 34.81

3W	Rs. 10.23
Lcv	Rs. 10.23
Bus	Rs. 10.23

Table 10: Savings in vehicle time in Rs Passenger hours
(Source: DMRC 1996 study)

Veh. type	Savings in vehicle time in Passenger hours/day	Travel time saving in Rs./ Passenger - hour	Travel time saving in Rs. / day	Travel Time Saving in Rs. / year
Tw	409.64	Rs. 67.48	27642.5	10089541.7
Car	103.96	Rs. 34.81	3618.84	1320876.6
3W	351.12	Rs. 10.23	3591.95	1311061.75
Lcv	874.06	Rs. 10.23	8941.63	3263696.33
Bus	344.26	Rs. 10.23	3521.78	1285449.7
Total travel time saving in Rs.				17270626

Table 11: Savings in travel time in momentary value

Veh. type	No. Of vehicles per hours(in peak hours)	Fuel saving during hours in liters/kg	Saving in Petrol (liter)	Saving in Diesel (liter)	Saving in CNG (kg)
Tw	741	52.402	52.402	0	0
Car	104	23.60	11.33	8.41	9.28
3W	415	90.041	1.8	13.506	74.73
Lcv	123	27.41	0.27	26.03	1.09
Bus	29	8.649	0.08	8.21	0.345

Table 12: Fuel consumption of vehicles.

Veh. type	Fuel saving during day in liters/kg	Money saving in 1 day as per respective fuel price	Money saving in Rs. in 1 year
Tw	943.236	58442.9	21331658.5
Car	424.8	25506.05	9309872
3W	1620.73	73905.288	26975427.2
Lcv	493.38	24471.64	8932148.6
Bus	155.68	7727.95	2820701.75
Total fuel saving in momentary value			69369808

Table 13: Savings in fuel consumption due to flyover.

Here the 18 hours per day is taken for the calculation of fuel consumption per day.

VII. CONCLUSION

Following are the important observations from the surveys, study and analysis.

- Total number of passenger benefitted by flyover construction are 77976 per day.
- Average delay time saving per vehicle 64.145 seconds.
- Due to flyover construction saving in travel time cost Rs.1, 72, 70,626.
- Saving in fuel consumption cost Rs.6,93,69,808 per year.
- The decrease in accident economic cost comes down from year 2013(Rs.8381850) to 2014 (Rs.5086950) after the construction of flyover.

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