Traffic Signal Design and Co-Ordination between Two Intersections Of Dhansura-Shamlaji Road-A Case Study Of Modasa City

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Abstract— There are two objectives for this research. One is to develop an effective procedure to optimize intersection signal timing by minimizing total delay for both vehicles and pedestrians. The second objective is to establish guidance for pedestrian crossing phase selection and the length of WALK phase when scramble crossing is used. An optimization procedure for signal plans on intersections is developed. The object of this report is to give traffic engineers or technicians in the cities of the emerging world a brief introduction to traffic signals, together with some practical guidelines on how to use them to obtain good and safe results. The lack of traffic signal conspicuity is often cited as a contributing factor by drivers who are involved in accidents at intersections. As such, increasing the conspicuity of traffic signals should lead to improved safety performance. This paper describes a project to determine the road safety effectiveness associated with improved signal design and better co-ordination between two intersections. A time-series evaluation was completed to investigate the effectiveness of the improvements to the traffic signal on road safety performance. Anecdotal information concerning the effectiveness of the improved traffic signals were also collected and evaluated.

Keywords: Traffic Signal, transportation, road safety.

I. INTRODUCTION

Modasa is situated in the northeast portion of the Gujarat State (INDIA), with latitude of 23.47N and longitude of 73.30E. Population in Modasa city is 94 thousands (2011). Density of population is 5300 per sq.Km.

Traffic and transportation problems in Modasa City have not been commensurate with the increasing demands for its usage. The city expanded dynamically without any planning and control due to the rapid socioeconomic changes. Modasa City is the nucleus of the greater Modasa regions and all of the divisional head office of corporate offices, the higher educational facilities (Two Pharmacy college, Two public engineering college, three private College, thirty industrial Courses, private hospitals and clinics, government colleges and schools), so many business and shopping complexes are located in or around the Modasa city. Thus, the city plays a big role in controlling the economic development of not only Modasa region but also the entire Gujarat.[Ref.4]

II. BASIC FORM OF SPEED-FLOW-DENSITY RELATIONSHIP

Knowledge of relationship between speed, volume and density is very important in traffic studies. In this Study speed-flow relationship is used to signal design and co-ordination.

A. Speed-density relationship:

With increase in density the speed decreases. When there is no vehicle (density=0), the speed is maximum. This speed is called "Free speed". At very high density, the vehicles approach zero speed. This density is called "Jam density".

B. Speed-Flow relationship:

At very low speeds the volume would also be low. With increasing speed, traffic volume also increases up to a certain limit, as headway initially decreases. But as the speed further increases the spacing between the vehicles increases and becomes so large that volume decreases. There is an optimum speed at which the flow is maximum.

C. Flow-density relationships:

As the density increases from zero, volume increases up to the point of critical density, the density corresponding to maximum flow. It is called "Optimum density". There after volume decreases as density continues to increases to a maximum value known as "Jam density" when all vehicles are stopped. As density increases the speed of vehicle is reduced, reducing the flow, till it reaches jam density when there is no movement or flow.[Ref.4]

III. METHODOLOGY & DATA COLLECTION

The study has been conducted by the Department of Civil Engineering, GOVT. Engineering College, Modasa. For assessing the existing traffic condition in Modasa City

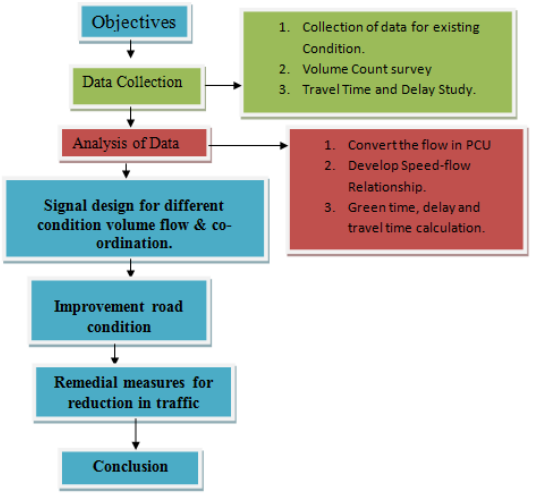

Fig. 1: Flow diagram of whole methodology

A. Traffic Volume Survey

The most important data are generated through the modern survey techniques like traffic volume count at Malpur Cross Road to Bus-Station Link road. The extent of variation of traffic flow was ascertained by carrying out twelve hour (7:30 to 19:30) weekday counts on Study road. By analyzing

the twelve-hour traffic volumes, the period of peak flows are assessed. The traffic volume is expressed as passenger car unit per hour (PCU/h)

IV. DATA COLLECTION AND ANALYSIS

Hourly traffic volumes and average daily volumes are those commonly used in planning, design, and operation of highway facilities. Traffic demand in vehicle per hour per lane is of great significance in dealing with practical traffic problems.

Methods of traffic volume counts are manual counting, mechanical methods (electric contact device, photo electric device, radar device, ultrasonic device, magnetic device, infra-red device, and pneumatic detector), photographic method, moving observer methods.[Ref.5]

Data collecting from volume count survey are Analysis and measure Space mean speed on selected 27 m Long Street through 10 min Flow count in Peak hour and Flow is measured through the pcu value. The 10 min flow of different direction from both corridors is calculated as shown in below table.

				BUS STAND CORRIDOR									
Sr no.	TIME	A to B				A to C				A to D			
		2 wlr	3wlr	4wlr	6wlr	2wlr	3wlr	4wlr	6wlr	2wlr	3wlr	4wlr	6wlr
1	10:30 to 10:40	6	0	3	0	5	0	0	0	6	0	5	1
2	10:40to 10:50	5	0	4	0	6	0	0	0	5	0	4	1
3	10:50to11:00	8	0	2	0	5	0	0	0	7	0	3	1
4	11:00to11:10	4	0	2	0	4	0	0	0	4	0	6	0
5	11:10to11:20	7	0	3	0	3	0	0	0	5	0	4	1
6	11:20to11:30	5	0	1	0	3	0	0	0	3	0	3	0
total		35	0	15	0	26	0	0	0	30	0	25	8
PCU		54	0	33	0	39.8	0	0	0	44.3	0	54	28.8
total pcu		87				39.8				127			

Table. 1: traffic volume flow and pcu calculation at bus stand corridor

As per above table the remaining whole calculations of all corridors at both intersections are done.

		Bus stand			**Village**			**Dhansura**			**Malpur cross**	
Turn	left	Straight	right	left	straight	right	left	straight	right	Left	straight	Right
	84	0	44	200	0	383	0	1025	142	196	939	0
	21			50		0	0		106	49		0
	105	0	44	250	0	383	0	1025	248	245	327	0
q		149			633			1273			572	
q+8%		161			684			1375			618	
w(m)		5			6			9			9	
s= 525*w		2625			3150			4725			4725	
y=q/s		0.061			0.217			0.291			0.1308	

Table. 2: flow factor calculation at bus stand corridor

		Green time for separate lane of diff.			**cycle time**
bus stand	village	dhansura	malpur cross	pedestrian	Total cycle time (sec)
20	20	25	20	20	105
20	25	30	20	20	115
20	25	35	25	20	125

Table. 3: Green time for separate lane at bus stand inter section.

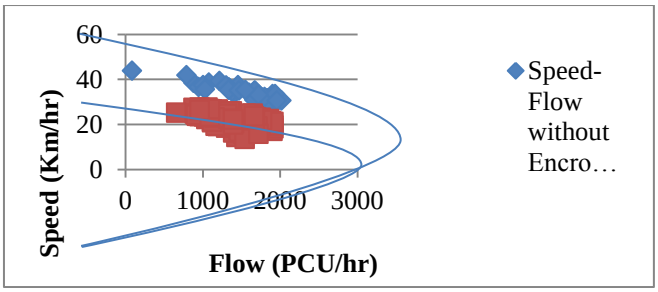

Fig. 1: Speed-flow diagram at bus stand to malpur cross road.[Ref.4]

Sr.No	pcu/cycle	Arrival X cycle	pcu/sec	Departure pcu/sec	Green time	Departure in green
1	4.875	125	0.039	0.729166667	20	14.58333333
2	5.3625	125	0.0429	0.729166667	20	14.58333333
3	5.85	125	0.0468	0.729166667	20	14.58333333
4	6.3375	125	0.0507	0.729166667	20	14.58333333

Table. 3(a): Delay calculations at bus stand inter section.

red time	pcu waiting in red	total delay	delay sec/pcu	queue length
105	4.095	214.9875	44.1	20.475
105	4.5045	236.48625	44.1	22.5225
105	4.914	257.985	44.1	24.57
105	5.3235	279.48375	44.1	26.6175

Table. 3(b): Delay calculations at bus stand inter section.

bus stand	right+ left flow	Vol.1 pcu/hr	Vol.2 pcu/hr	speed 1 kmph	speed 2 kmph	diff.	K1=q/v	K2=q/v
1375	427	1372.952	1047.619	24	25	1	57.20635	41.90476
		1510.248	1152.381	22	24	2	68.64762	48.01587
		1647.543	1257.143	20	24	4	82.37714	52.38095
		1784.838	1361.905	18	23	5	99.15767	59.21325

Table. 4(a): For Speed 1&2 density-space-time-travel time variation

K1=q/v	K2=q/v	diff.	time head way1 1/q	time head way2 1/q	diff.	travel time 1 d/v*3600	travel time 2	diff.
57.206	41.904	-15.30	0.000728	0.000955	0.000226	90	86.4	-3.6
68.647	48.015	-20.63	0.000662	0.000868	0.000206	98.18182	90	-8.181
82.37714	52.380	-29.99	0.000607	0.000795	0.000188	108	90	-18
99.15767	59.213	-39.94	0.00056	0.000734	0.000174	120	93.91304	-26.087

Table. 4(b): For Speed 1&2 density-space-time-travel time variation.

V. CONCLUSION

- Speed-flow relations for with encroachment and without encroachments were developed, which clearly shows the influence of Encroachment on travel speed.
- Traffic volume count data is used to calculate pcu value and flow factor of two intersections.
- There are no very high traffic on their two intersections, and the straight flow is more and no more right movement so the signal design is not highly necessary but for the smoothen flow and traffic management it is developed.
- Effects of road Parking and pedestrians on Traffic Flow were studied which indicated reduction in average speed of vehicle between two intersection.
- Average travel time on Study Street indicated an increment of 32 sec for Bus-station to Malpur cross link Road and 28 sec for Malpur cross to Bus-station link Road due to road side encroachment. For co-ordination the travel time is used.
- L.O.S of D to E was observed under prevailing condition, which could be improved to B by designing proper Parking facility, change in road geometry and taking regulatory enforcement measures.

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