Impact Factor (SJIF): 5.301

International Journal of Advance Research in Engineering, Science & Technology

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

Volume 5, Issue 3, March-2018

FEASIBILITY & ANALYSIS OF TIDAL FLOW TRAFFIC OPERATION ON POTENTIAL URBAN ROAD LINKS

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ABSTRACT

Road transportation being very important network system for any country. Facing manifold problems due to increase in population and so vehicle expansion. As the vehicular growth in urban area is fact so the facility to transportation should be adequate for road users but there is limitation to expansion further road due to less availability of extra land. In that kind of condition the traffic management can be done by reversible traffic lane. The study involves of an implementation of reversible lane as a method by which traffic flow carrying capacity is increased and traffic jam density is decreased. For that various type of data are needed which are as: Traffic volume, Delay time, Accidents survey, Spot speed study, Traffic conflicts, Fuel consumption & Environment factor too are needed to study about it. Reversible roadways most commonly are used for accommodating the directionally imbalanced traffic associated with daily commuter periods. Reversible lanes also have been used regularly in construction work zones, during major events and, more recently, for the evacuation of major metropolitan regions threatened by hurricanes. The history of reversible lane systems (RLS) dates back more than 75 years and includes applications on all roadway classifications, from local city streets to freeways. By applying the reversible traffic flow lanes resulted in a significant saving in travel time in the peak-hour time period. Easy traffic flow is maintained and due to that the traffic congestion is reduce. By reducing the congestion vehicle user going to get smooth traffic flow hence the fuel cost and environment can be save. The city is facing problems of traffic, Parking and Pedestrians" safety on certain stretches of roads scope of the study includes the literature review and applying the tidal flow technique to overcome this situation.

Keywords: *Reversible lane systems, Congestion, PCU, Tidal flow*

INTRODUCTION

A reversible lane (British English: tidal flow) is a lane in which traffic may travel in either direction, depending on certain conditions. Typically, it is meant to improve traffic flow during rush hours, by having overhead traffic lights and lighted street signs notify drivers which lane are open or closed to driving or turning. Reversible lanes are also commonly found in tunnels and on bridges, and on the surrounding roadways – even where the lanes are not regularly reversed to handle normal changes in traffic flow. The presence of lane control allows authorities to close or reverse lanes when unusual Circumstances (such as construction or a traffic mishap) require use of fewer or more lanes to maintain orderly flow of traffic. The Institute of Transportation Engineers (ITE) describes the reverse lining of roadways as "potentially one of the most effective methods of increasing rush-hour capacity of existing streets under the proper conditions. A reversible roadway is one in which the direction of traffic flow in one or more lanes or shoulders is reversed to the opposing direction for some period of time. Its utility is derived by taking advantage of the unused capacity of the minor flow direction to increase capacity in the major flow direction, neglecting the need to construct additional lane. Reversible roadways most commonly are used for accommodating the directionally imbalanced traffic associated with daily commuter periods. Reversible lanes also have been used regularly in construction work zones, during major events and, more recently, for the evacuation of major metropolitan regions threatened by hurricanes. RLS, is practices that guide its practices of traffic management though it is not well defined. A review of RLS applications has revealed that the broad, occasionally vague guidelines for reversible roadways actually may be beneficial because they have allowed agencies a wide leeway to apply and adapt practices to fit local roadways. However, it also is thought that the limited evaluation of the operational and safety benefits and costs of RLS may limit full potential. Some agencies have openly stated their reluctance to implement seemingly unconventional strategies without a quantifiably established record of success. The obvious reason for using RLS is to add (or in the case of construction zones, maintain) capacity. It affords the flexibility of changing lane use to fit changing demand patterns and is best suited to routes in which it is not economically practical to add lanes, particularly on bridges and in tunnels. Preferably, capacity gains should be without degrading the operational quality of the opposing direction. This is not always feasible, particularly when full reversals eliminate all opposing traffic lanes. RLS typically is described using a ratio notation designating of the number lanes flowing in one direction versus the other. The area to be covered in the study of above transportation problem should be West zone of Ahmedabad and its surrounding urban areas. The study area is "Namaste circle Shahibaug to Paldi cross road via Delhi Darwaja and Bata circle Income Tax. This stretch is flow from urban area to CBD area of Ahmedabad. Due to that the vehicle volume is very high and the existing road having limitation and that stretch having 2 lane road on both side with various right of way.The aim of this study is to overcome the traffic congestion, travel time and improve LOS such that it allows smooth flow to vehicle, reduce the delay time with safety.

The Objective of this study is

1. To conduct CVC surveys for all links,
2. To minimize Congestion & travel time at study area
3. To analyze traffic capacity and level of service
4. To Justify the extra lane in required direction for easy flow of traffic
5. To calculate side friction of selected stretch and its analysis

II. LITERATURE REVIEW

We are going to talk about "Tidal Traffic Flow or Reversible Traffic Flow" which is one of the most important aspect of transportation planning. A reversible lane (British English: tidal flow) is a lane in which traffic may travel in either direction, depending on certain conditions. Typically, it is meant to improve traffic flow during rush hours, by having overhead traffic lights and lighted street signs notify drivers which lanes are open or closed to driving or turning. Reversible traffic lanes add capacity to a road and decrease congestion by borrowing capacity from the other (off-peak) direction. It reduces congestion during morning and evening commutes, when there is an incident blocking a lane of traffic, or when construction or maintenance is being done on the road.

Helen Waleczek, Justin Geistefeldt, Dijana Cindric-Middendorf, Gerd Riegelhuth, used The effects of a reversible lane system installed in a work zone on freeway A 3 south-west of Frankfurt, Germany, on traffic flow and road safety were analysed. Based on video measurements, a high frequency of lane changes directly upstream of the lane separation was observed in both directions. Radar measurements revealed a maximum traffic volume of roughly 1500 veh/h on the reversible lane. Less than 10% of vehicle speeds measured on the reversible lane exceeded the speed limit of 80 km/h.

S. M. Sohel Mahmud, Md. Shamsul Hoque used Transportation System Management (TSM) is a package of short term measures to make the most productive and cost-effective use of existing transportation facilities, services and modes. For the implementation of such well recognized, cost-effective management tools in a city area demand assessment of the potentiality and the fulfilment of implementation pre-requirements.

Matthew Hausknecht, Peter Stone Dynamic used Contraflow lane reversal the reversal of lanes in order to temporarily increase the capacity of congested roads can effectively mitigate traffic congestion during rush hour and emergency evacuation. However, contraflow lane reversal deployed in several cities are designed for specific traffic patterns at specific hours, and do not adapt to fluctuations in actual traffic. Motivated by recent advances in autonomous vehicle technology, we propose a framework for dynamic lane reversal in which the lane directionality is updated quickly and automatically in response to instantaneous traffic conditions recorded by traffic sensors. We analyse the conditions under which dynamic lane reversal is effective and propose an integer linear programming formulation and a bi-level programming formulation to compute the optimal lane reversal configuration that maximizes the traffic flow. In our experiments, active contraflow increases network efficiency by 72%.

III. STUDY AREA

The Ahmedabad city having lot number of vehicle traffic and this traffic is heterogonous traffic which carry mostly 2-wheeler (motor bike, cycle and scooter) three-wheeler as most common type of para transportation mode (auto rickshaw, shuttles) four wheelers such as (car, cart) and at last multi axial vehicle are also there in heterogonous traffic. The study area stretch from **"Namaste circle Shahibaug to Paldi cross road via Delhi Darwaja and Bata circle Income Tax.** The total length of the study area is approx. 5.9 kms.

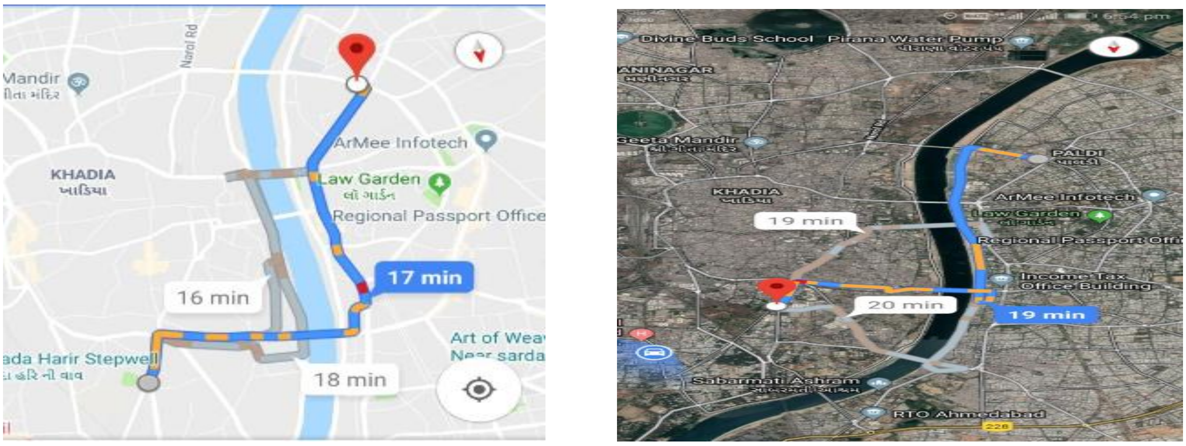


Fig: 3.1 & 3.2 - Study area (Ahmedabad source: google map)

IV. METHODOLOGY FLOW CHART

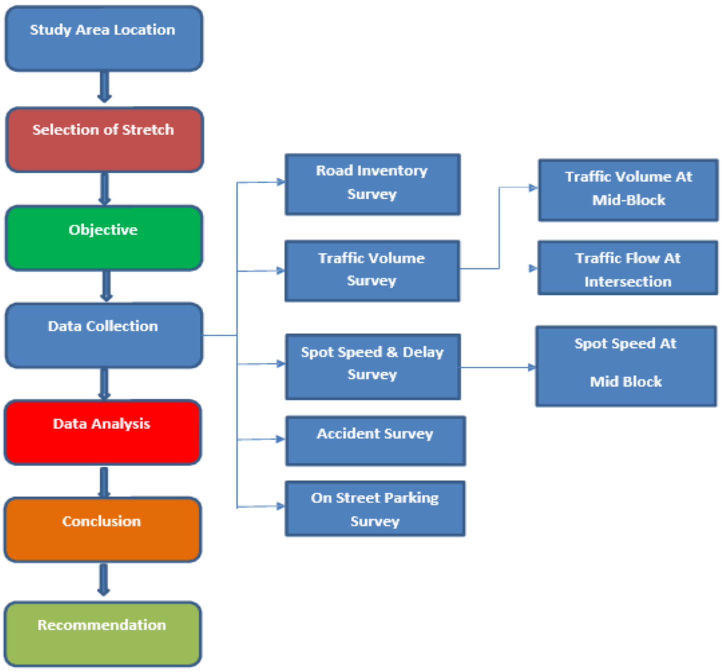


Figure: 4.1 Methodology of Working

V. DATA COLLECTION

"Table 5.1 Inventory survey Data:"

COMPONENT	DELHI DARWAJA	INCOME TAX
Vehicle movement	Two way	Two way
lane	Double lane	Double lane
Median available	Yes	Yes
Width	6.50 m	6.00
Type of intersection	Five leg intersection	Four leg intersection
Intersection	Signalised	Signalised
Sidewalk	Available	Available
Parking facility	Not Available	Not Available
Zebra crossing	Available	Available
Road side friction	On street parking and vendors	On street parking

"Table 5.2 Inventory ward wise Survey Data:"

Sr.	Zone Name	Ward No.	Ward Name	Area (sq. km.)
1	West	30	Paldi	4.55
2	West	31	Vasna	6.05
3	West	18	Navrangpura	7.16
4	West	10	S.P.Stadium	3.33
5	West	9	Naranpura	3.21
6	West	6	Wadaj	5.56
7	West	3	Chandkheda	16.0
8	West	4	Sabarmati	5.34
9	West	5	Ranip	6.33
		Total		57.53

"Table 5.3 & 5.4 showing CVC data"

CLASSIFIED TRAFFIC VOLUME COUNTS				
Location – Delhi Darwaja				Date: 01/02/2018
Time	Type of Vehicle			
	2-Wheeler	3-Wheeler	4-Wheeler	Bus/Truck/Tractor
	Bike/Scooty	Auto	Car	Lorries Trailers
9:00	262	41	58	1
9.05	284	49	71	3
9.10	331	56	63	2
9.15	321	47	75	3
9.20	263	61	93	3
9.25	325	64	64	4
9.30	252	45	84	2
9.35	329	53	81	3
9.40	341	64	95	3
9.45	339	68	83	4
9.50	327	57	86	3
9.55	258	46	74	2
10:00	337	57	71	0
TOTAL NO OF VEHICLES	3969	708	998	33
TOTAL VEHICLES	5728			
PCU FACTOR	0.5	1	1	3
TOTAL PCU	1984.5	708	998	159
TOTAL PCU / HR	3849.5			

CLASSIFIED TRAFFIC VOLUME COUNTS				
Location – Ashram Road				Date: 02/02/2018
Time	Type of Vehicle			
	2-Wheeler	3-Wheeler	4-Wheeler	Bus/Truck/Tractor
	Bike/Scooty	Auto	Car	Lorries Trailers
9.00	242	45	57	1
9.05	281	44	52	2
9.10	334	37	65	2
9.15	308	41	68	3
9.20	281	55	87	1
9.25	205	60	82	4
9.30	264	61	75	3
9.35	355	49	94	2
9.40	308	56	87	3
9.45	381	47	96	1
9.50	372	52	110	2
9.55	401	62	121	1
10.00	325	48	82	2
TOTAL NO OF VEHICLES	4057	657	1076	27
TOTAL VEHICLES	5817			
PCU FACTOR	0.5	1	1	3
TOTAL PCU	2028.5	657	1076	81
TOTAL PCU / HR	3842.5			

"Table 5.5 showing CVC data"

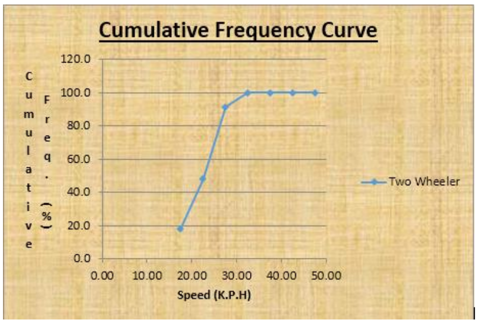
CLASSIFIED TRAFFIC VOLUME COUNTS				
Location - Shahibaug				Date: 03/02/2018
Time	Type of Vehicle			
	2-Wheeler	3-Wheeler	4-Wheeler	Bus/Truck/Tractor
	Bike/Scooty	Auto	Car	Lorries Trailers
9.00	129	25	43	1
9.05	145	19	39	0
9.10	162	30	58	3
9.15	121	28	51	3
9.20	157	17	39	3
9.25	130	14	35	1
9.30	145	16	44	1
9.35	123	26	52	3
9.40	152	31	43	4
9.45	167	24	72	2
9.50	153	21	77	4
9.55	167	27	82	1
10.00	148	32	87	0
TOTAL NO OF VEHICLES	1899	310	722	26
TOTAL VEHICLES	2957			
PCU FACTOR	0.5	1	1	3
TOTAL PCU	949.5	310	722	78
TOTAL PCU / HR	2059.5			

"Figure 5.1: Traffic and Parking Issues in Delhi Darwaja & Income tax Ahmedabad"

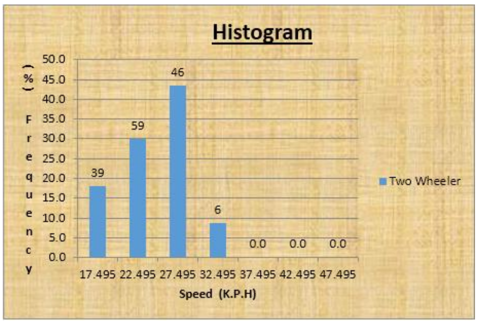
"Table 5.6 & 5.7 showing frequency of two wheelers"

Serial No.	Class Limit	Mid-Point	Frequency	Relative Frequency	Percentage Frequency	Cumulative Frequency
1	15.00 - 19.99	17.495	27	0.180	18.0	18.0
2	20.00 - 24.99	22.495	45	0.300	30.0	48.0
3	25.00 - 29.99	27.495	65	0.433	43.3	91.3
4	30.00 - 34.99	32.495	13	0.087	8.7	100.0
5	35.00 - 39.99	37.495	0	0.000	0.0	100.0
6	40.00 - 44.99	42.495	0	0.000	0.0	100.0
7	45.00 - 49.99	47.495	0	0.000	0.0	100.0
Total			150			

Serial No.	Class Limit	Mid-Point	Frequency	Relative Frequency	Percentage Frequency	Cumulative Frequency
1	15.00 - 19.99	17.495	39	0.260	26.0	26.0
2	20.00 - 24.99	22.495	59	0.393	39.3	65.3
3	25.00 - 29.99	27.495	46	0.307	30.7	96.0
4	30.00 - 34.99	32.495	6	0.040	4.0	100.0
5	35.00 - 39.99	37.495	0	0.000	0.0	100.0
6	40.00 - 44.99	42.495	0	0.000	0.0	100.0
7	45.00 - 49.99	47.495	0	0.000	0.0	100.0
Total			150			



"Graph 5.1 Cumulative Frequency Curve"



"Graph 5.2 Percentage Frequency Curve"

"Table: 5.8 Vehicle distribution speed wise at common table"

NO	LOCATION	AVE. SPEED	LEVEL OF (HCM Manual)
1	DELHI DARWAJA	36.06	C
2	ASHRAM ROAD	36.83	C
3	SHAHIBAUG	35.25	C

VI. DATA ANALYSIS

Theoretical equation for capacity:

C = 1000 V/S

Where, C = Capacity in vehicle per hour per lane. V = Speed in K.P.H

S = Average spacing in meter of moving vehicles.

The following formula is generally used for determining S

$S = L + tV.1000 / 3600 + [V. 1000 / 3600]^2 * 1/2\ g\ f$

$S = L + 0.278V.t + V2 / 254\ f$

The relation obtained by him connecting S and V was:

$S = 21 + 1.1\ V$

Where, S = Spacing in feet V = Speed in M.P.H.

The Road Research Laboratory, U.K., measured the headway between vehicles at various speeds and found the following relation to hold good in practice.

$S = 17.5 + 0.8\ v + 0.004\ v2$ Where, S = Headway in feet. And v = Speed in feet/sec.

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