Impact Assessment of Priority Measures under Heterogeneous Traffic Conditions

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ABSTRACT: Movement and transportation in creating nations are additionally altogether different to created nations since activity structure and level of street side exercises are rather than created nations. The objective of the thesis is to study the movement execution at un-signalized convergences under blended traffic-conditions, e.g. speed, stream and convergence inhabitance. The traffic volume at heterogeneous traffic condition at Six selected sites indicated that there is a high volume of traffic at all the sites during the morning and evening hours usually during opening and closing of the offices. The data revealed that at Lal Chowk during 9:00 a.m. to 10:00 a.m. the total number of vehicles per hour was calculated as 3380 vehicles and at 4:00 to 5:00 p.m. the no of vehicles was 4032. At the heterogeneous site of Pantha Chowk during 9:00 a.m. to 10:00 a.m. the total number of vehicles per hour was calculated as 2497 vehicles and at 4:00 to 5:00 p.m. the no of vehicles was 1734. Very limited concerted efforts have been made earlier to analyze actual traffic flow at four leg uncontrolled intersection under mixed traffic situations. The critical gap suggested here are for three categories of vehicles only and a particular geometry of the intersection. Further research may be conducted for estimation of the impact of various parameters (like occupancy, age of the driver, sex of the driver, speed of on-coming traffic, size of on-coming vehicles, number of rejections etc.) on critical gap parameter, especially in the case of mixed traffic conditions.

Keywords: Impact Assessment, Measures, Heterogeneous Traffic

I. INTRODUCTION

The Traffic and Safety Impact Assessment examines the vehicle movement and bike and walker well-being effects of Bikeways. The proposed postulation would not bring about any vehicular movement impacts, as characterized by the Significance Thresholds for Traffic Impacts (Ashalatha *et al*, 1996) [1]. The proposed would likewise chip away at various negative bike or person on foot well-being impacts. Bike and person on foot well-being conditions are depicted utilizing a "level of traffic stretch" (LTS) philosophy, which utilizes a numbered framework from 1 to 4 to describe the real and saw security of boulevards for individuals strolling and on bicycles utilizing the accompanying criteria: (a) speed restrict, (b) number of vehicle paths and nearness or nonappearance of a middle, (c) review or incline, and (d) normal day by day activity (ADT) volumes (Brilon *et al*, 1999) [2]. LTS 1 speaks to the most secure roads on which individuals are the most happy with riding a bicycle and strolling, while LTS 4 speaks to the minimum safe boulevards on which individuals are the slightest open to riding a bicycle and strolling. Bike and passerby security conditions

likewise are surveyed utilizing chronicled contemplate territory information about crashes, fatalities, and wounds including individuals strolling or on bicycles (Berlin, 2006) [3].

Numerous analysts have considered the execution of two-path intercity parkways with the assistance of various measures. In the present investigation, the execution of such parkways under heterogeneous movement conditions was analyzed by utilizing a few speed and adherents related measures (Gattis, 1999) [4]. The information was gathered from five examination locales situated in various districts of India. Another approach will be proposed where supporters were recognized by utilizing a speed contrast (between two back to back vehicles) scope of - 4 to + 10 km/h and gap edge esteem (lower than a specific gap esteem) of 10s. By utilizing acknowledgment bend strategy, distinctive basic gap esteems were proposed for each site to distinguish the adherents (HCM, 2000) [5]. Out of all the execution measures, the quantity of supporters as an extent of limit (NFPC) and adherent thickness were observed to be the best and second best parameters.

At last, extraordinary level of administration ranges was proposed in view of NFPC utilizing group investigation. Movement and transportation in creating nations are additionally altogether different to created nations since activity structure and level of street side exercises are rather than created nations. Movement rules, for illustrations, similar to give way or path train and so on are neglected much of the time. Drivers are more forceful so a gap acknowledgment conduct is fairly phenomenal. If there should arise an occurrence of un-signalized convergences, very nearly two third (2/3) of vehicles did not sit tight for a gap. In the event that there is any basic gap which is probably going to be acknowledged, at that point this is little with around 2 seconds (Raff *et al* 1950) [6]. Vehicle composes in creating nations demonstrate a substantial fluctuation which influences activity to stream rather heterogeneous. This activity stream comprises of transport methods of changing dynamic attributes having a similar street space. In this view, vehicles add to variety in speed conduct extending from ease back vehicles to rather fast– moving autos. Run of the mill for creating nations, is there is additionally an extraordinary number of exercises happening at the edge of the street, both on the roadway and shoulders and walkways (Troutbeck 1988) [7]. The greater part of these exercises makes quantities of contentions called "side grating". The Indian manual gave much regard for such angles like "side grindings" which have awesome effect on limit and execution are walkers, stops by transport vehicles and stopping moves, engine vehicles sections and exits into and out of roadside properties and side streets, and slow– moving vehicles (bikes, rickshaw, and so forth.). Side erosion is estimated subjectively as for movement designing thought as high, medium and low (Wu, 2006) [8]. The principle destinations of the investigation are the research the movement execution at un-signalized convergences under blended traffic-conditions, e.g. speed, stream and convergence inhabitance and research parameters that can be utilized to depict most extreme stream (limit).

II. MATERIALS AND METHOD

A. Traffic Volume count

The most important data are generated through the modern survey techniques like traffic volume count at different links. Knowledge of the vehicular volume using a road network is important for understanding the efficiency at which the system works at the present and the general quality of service offered to the road users. Knowing the flow characteristics one can easily determine whether a particular section of the road is handling traffic much above or below its capacity. If the traffic is heavy, the road suffers from congestion with consequent loss in journey speed.

The traffic volume survey is carried out for twelve hour (8:00 to 20:00) on working days at six links such as Lal Chowk, Pantha Chowk, Dal gate, Jahangir Chowk, Qamarwari, Bemina Crossing. By analyzing the twelve hours traffic volumes, the period of peak flow are assessed. The traffic volume is expressed car unit per hour (PCU/h).

II. RESULTS AND ANALYSIS

The empirical study of traffic operation at un-signalized intersections as it is described in the previous paragraphs showed that the traditional methodologies for capacity analysis, as they have been established for developed countries, are not applicable for countries like India. Current behavior such as of very short gaps acceptance (less than 2 seconds), a large number of non–motorized vehicles which have many different speeds, no lane discipline where many conflicts must be expected. Current investigations found that within a flow of 4900 veh/h–7200 veh/h, the number of vehicle stops is only 0.4% – 0.5%. Therefore, in such a case of mixed traffic flow at un-signalized intersections the capacity is difficult to measure, when the flow is not saturated. Two methods (gap acceptance and empirical approach) of capacity are used in the saturated traffic. They are difficult to apply in such a mixed traffic.

Table 1: Characteristics of vehicles of the heterogeneous traffic.

Vehicle type	Dimensions in m[a]		Lateral-clearance allowance in m		Free speed in km/h
	Length	**Breadth**	**Minimum**[b]	**Maximum**[c]	**Mean**
Bus	10.3	2.5	0.3	0.6	57
Truck	7.5	2.5	0.3	0.6	58
LCV	5.0	2.0	0.3	0.5	64
Car	4.0	1.6	0.3	0.5	75
M.Th.W.	2.6	1.4	0.2	0.4	45
M.T.W.	1.8	0.6	0.1	0.3	62
Bicycle	1.9	0.5	0.1	0.3[d]	10

LCV: Light Commercial Vehicle
M.Th.W.: Motorised Three Wheelers
M.T.W.: Motorised Two Wheelers
[a]Averages of the dimensions of different makes within a vehicle type
[b]At zero speed
[c]At speeds 60 km/h and more
[d]Maximum clearance at 20 km/h

Table 1 reveals the heterogeneous characteristics of light commercial vehicles, motorized three wheelers and motorized two wheelers, buses, trucks and Bicycles at the different heterogeneous crossing in Srinagar city. The mean free speed in km/hr was 57, 64, 75, 45, 62, 10, respectively for Buses, trucks, LCV, Car, motorized three wheelers, motorized two wheelers and Bicycles, respectively.

Table 2: Traffic volume data count at heterogeneous traffic condition at Lal Chowk.

Time/ Vehicle type	8 am to 9 am	9 am to 10 am	10 am to 11 am	11 am to 12 pm	12 pm to 1 pm	1 pm to 2 pm	2 pm to 3 pm	3 pm to 4 pm	4 pm to 5 pm	5 pm to 6 pm
Trucks	54	16	38	23	18	19	16	11	10	12
Mini buses	280	148	198	121	98	102	70	64	74	75
Large buses	108	42	56	8	16	38	54	52	28	28
Car, jeep van taxi	1470	1790	1765	1530	1761	1895	1990	2199	2360	2360
3 wheeler, autorickshaw	382	460	440	556	563	469	573	576	463	463
Motorcycle, Scooter	608	862	916	900	824	909	998	970	1045	1045
Cycle	60	68	77	38	36	30	39	50	52	51
Total Vehicles/hr	2962	3386	3490	3176	3316	3462	3740	3922	4032	4034

Traffic volume data count at the heterogeneous site at Lal Chowk shows that most of the vehicles in the traffic stream were private owned vehicles Like Jeaps Cars, 3 wheelers and Motorcycle scooters. The high concentration of the vehicles was present during the office hours as can be shown by the data of Table 2. The reason for high proportion of light vehicle at Lal Chowk is the proximity of different business centers and offices in the area.3386 and 4032 vehicles per hour were recorded during the morning hours (9:00 a.m. to 10:00 a.m.) and evening hours (4:00 p. m. to 5:00 p.m.), respectively. Traffic volume data count at the heterogeneous site at Pantha Chowk shows that most of the vehicles in the traffic stream were cars, jeeps, vans and Taxi's and there were minimum use of bicycles during the all hours of the day. The high concentration (2497 vehicles/hr at 9:00 a.m to 10:00 a.m. & 2141 vehicles at 3:00 to 4:00 p.m.) of the vehicles was present during the office hours as can be shown by the data of Table 3.

Cars, jeeps, vans and Taxi's are the maximum number of vehicles among all others forms of traffic at Dal Lake. The data from table 4 indicated that there was minimum number of bicycles running along the roads of Srinagar city. Most of the traffic density was observed during peak hours i.e. morning and evening hours.

Table 3: Traffic volume data count at heterogeneous traffic condition at Pantha chowk.

Time/ Vehicle type	8 am to 9 am	9 am to 10 am	10 am to 11 am	11 am to 12 pm	12 pm to 1 pm	1 pm to 2 pm	2 pm to 3 pm	3 pm to 4 pm	4 pm to 5 pm	5 pm to 6 pm
Trucks	16	16	13	14	13	14	13	13	14	13
Mini buses	61	69	60	64	58	59	71	82	84	21
Large buses	120	50	60	10	19	19	77	54	36	18
Car, jeep van taxi	1092	1385	610	1222	1090	1178	1074	1073	745	822
3 wheeler, autorickshaw	382	460	440	556	563	469	573	576	463	463
Motorcycle, Scooter	248	439	318	232	262	238	286	285	336	300
Cycle	40	78	87	78	46	30	30	58	56	53
Total Vehicles/hr	1959	2497	1588	2176	2051	2007	2124	2141	1734	1690

Table 4: Traffic volume data count at heterogeneous traffic condition at Dal Gate.

Time/ Vehicle type	8 am to 9 am	9 am to 10 am	10 am to 11 am	11 am to 12 pm	12 pm to 1 pm	1 pm to 2 pm	2 pm to 3 pm	3 pm to 4 pm	4 pm to 5 pm	5 pm to 6 pm
Trucks	6	5	6	7	4	3	7	3	2	1
Mini buses	50	40	56	64	58	59	71	82	84	21
Large buses	54	30	20	10	13	9	8	15	4	3
Car, jeep van taxi	925	828	920	701	630	591	693	714	558	442
3 wheeler, autorickshaw	430	320	323	241	245	229	203	234	106	62
Motorcycle, Scooter	675	620	698	460	412	373	360	470	252	160
Cycle	22	32	32	24	22	28	24	30	30	10
Total Vehicles/hr	2162	1875	2055	1505	1384	1292	1366	1548	1036	699

Table 5: Traffic volume data count at heterogeneous traffic condition at Jahangir Chowk.

Time/ Vehicle type	8 am to 9 am	9 am to 10 am	10 am to 11 am	11 am to 12 pm	12 pm to 1 pm	1 pm to 2 pm	2 pm to 3 pm	3 pm to 4 pm	4 pm to 5 pm	5 pm to 6 pm
Trucks	230	219	274	190	223	222	210	178	178	100
Mini buses	60	34	38	65	54	52	54	43	43	44
Large buses	28	17	13	16	11	76	90	10	19	19
Car, jeep van taxi	600	817	711	876	897	765	865	655	321	617
3 wheeler, autorickshaw	110	111	111	90	99	76	87	109	76	93
Motorcycle, Scooter	319	232	262	238	281	285	336	300	332	257
Cycle	6	-	4	8	10	8	10	11	8	1
Total Vehicles/hr	1355	1430	1413	1483	1575	1484	1652	1306	977	1131

1430 vehicles at Jahangir chowk were counted at 9:00 am to 10:00 a.m. as most of the employees and business man come to their offices during this period. The number of vehicles may increase or decrease during the period of time as it depends on number of factors that may include festival season, holidays, religious gatherings and others. The number 1575 can be attributed to the same (Table 5). But buses were almost fully occupied and people were travelling by standing due to lack of seat in them. It can be assumed that, more people were travelling by bus though their occurrences were low.

Table 6: Traffic volume data count at heterogeneous traffic condition at Qamarwari.

Time/ Vehicle type	8 am to 9 am	9 am to 10 am	10 am to 11 am	11 am to 12 pm	12 pm to 1 pm	1 pm to 2 pm	2 pm to 3 pm	3 pm to 4 pm	4 pm to 5 pm	5 pm to 6 pm
Trucks	79	38	23	18	23	18	10	178	78	100
Mini buses	43	198	121	98	121	98	54	43	43	44
Large buses	28	17	13	16	11	76	90	10	19	19
Car, jeep van taxi	1167	1765	1530	1761	1530	1761	1865	1655	1321	1617
3 wheeler, autorickshaw	110	440	556	563	556	563	87	109	76	93
Motorcycle, Scooter	302	916	900	824	900	824	836	800	800	754
Cycle	198	77	38	36	38	36	30	11	8	6
Total Vehicles/hr	1909	3490	3176	3316	3176	3316	2393	2806	2378	2636

Traffic volume data count at the heterogeneous site at Qamarwari shows that most of the vehicles in the traffic stream were private owned vehicles Like Jeaps Cars, 3 wheelers and Motorcycle scooters. The high concentration of the vehicles was present during the office hours as can be shown by the data of Table 6.

The reason for high proportion of light vehicle at Qamarwari is the proximity of different residential houses and shops in the area.1909, 3490, 3176, 3316, 3176, 3316, 1393, 2806, 2378, 2636 were counted from morning 9:00 a.m. to 10:00 a.m. and evening hours (5:00 p. m. to 6:00 p.m.), respectively.

Table 7: Traffic volume data count at heterogeneous traffic condition at Bemina Crossing.

Time/ Vehicle type	8 am to 9 am	9 am to 10 am	10 am to 11 am	11 am to 12 pm	12 pm to 1 pm	1 pm to 2 pm	2 pm to 3 pm	3 pm to 4 pm	4 pm to 5 pm	5 pm to 6 pm
Trucks	60	48	34	45	55	54	16	19	178	100
Mini buses	65	87	100	96	120	90	67	54	54	56
Large buses	38	27	23	18	11	76	90	10	19	19
Car, jeep van taxi	1324	2765	1530	1761	1530	1761	1324	1765	1843	1765
3 wheeler , autorickshaw	114	555	652	675	541	765	887	765	654	432
Motorcycle, Scooter	302	916	900	824	900	824	987	876	654	654
Cycle	543	453	432	654	432	654	543	432	432	543
Total Vehicles/hr	2446	4851	3671	4073	3589	4224	3914	3921	3834	3569

Traffic volume data count at the heterogeneous site at Bemina Crossing shows that most of the vehicles in the traffic stream were cars, jeeps, vans and Taxi's and there were minimum use of bicycles during the all hours of the day. The high concentration (4851 vehicles/hr at 9:00 a.m to 10:00 a.m. & 3921 vehicles at 3:00 to 4:00 p.m.) of the vehicles was present during the office hours as can be shown by the data of Table 7.

IV. CONCLUSIONS AND FUTURE SCOPE

This paper presented a detailed review of studies carried out in the past related to estimation of the critical gap under heterogeneous conditions. Further, this study also highlighted the difficulty in measuring critical gap on uncontrolled with heterogeneous and weak lane discipline traffic which is observed in India. In order to demonstrate the inefficiency of developed methodologies for critical gap estimation at Indian uncontrolled intersection, traffic movement data is collected from an uncontrolled four-legged intersection located in semi-urban area. The critical gaps are calculated for three different vehicle types and two different maneuvers using nine different methodologies developed in the past. Estimated critical gaps are found to be relatively low with a wide deviation among the results obtained by these nine different approaches. This is due to the inborn fault of these methodologies to account for the heterogeneous traffic conditions as they evolved under fully homogeneity. However, concept of clearing behavior approach which has been evolved for

mixed traffic conditions produces quite reasonable results for both movements. This approach takes the concept of clearing time to incorporate the actual driving behavior of drivers. This estimation procedure is quite simple, and it is applicable for mixed traffic condition as well as homogeneous traffic and similarly it is applicable for both over-saturated as well as under-saturated traffic conditions.

The present study was taken up with the objective of initiating research on uncontrolled intersections in Srinagar India. Very limited concerted efforts have been made earlier to analyze actual traffic flow at four leg uncontrolled intersection under mixed traffic situations. The critical gap suggested here are for three categories of vehicles only and a particular geometry of the intersection. Further research may be conducted for estimation of the impact of various parameters (like occupancy, age of the driver, sex of the driver, speed of on-coming traffic, size of on-coming vehicles, number of rejections etc.) on critical gap parameter, especially in the case of mixed traffic conditions.

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