Behavior of traffic composition in Urban Area

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Abstract--- The traffic of an urban roads increases rapidly due to the growth in prosperity and vehicle ownership of urban population. The problems occurred due to this increased traffic have also become more and more complex. The urban roads of India generally carry the heterogeneous traffic which is the combination of various vehicles like Cars, Buses, Trucks, Motor cycles, Light goods vehicles, Auto Rickshaws, Pedal Cycles, Hand drawn carts, Animal drawn carts etc. These all vehicles have different speeds, size, Load carrying capacities or passenger capacities etc. which affect the urban heterogeneous traffic flow. The non-uniform **carriageway width** along the road is common especially in developing countries. Due to change in carriageway width, the traffic stream speed also encounters more congestion level along the length of link. Traffic composition is most important factor which directly affects the traffic stream behavior (i.e., speed, flow and density). In case of homogeneous traffic the characteristics of traffic does not change abruptly, as the traffic composition mainly consisting of same types of vehicle. When the traffic composition has maximum number of two wheelers it gives higher speed value and higher flow values. This is due to the reason that two wheelers occupy less space as compare to car and bus and trucks. Also standstill distance required is very less, as two wheelers can be easily stopped with compare to bus and heavy trucks. Speed is also more when two wheelers are driven on urban streets.

Keyward:- Heterogeneous traffic, C.V.C ,Capacity curve, Space mean speed, capacity modal

I. INTRODUCTION

The problem is more in case of mixed traffic flow when speed differential among different categories of vehicles is quite substantial. It increases the desired number of overtaking considerably with limited opportunities to overtake. Prediction and knowledge of capacity is fundamental in design, planning, operation and layout of road network sections. Roadway factors that influence capacity of a various-lane road include lane width, gradient and type of shoulder.

For heterogeneous traffic which is the combination of various vehicles like Cars, Buses, Trucks, Motor cycles, Light goods vehicles, Auto Rickshaws, Pedal Cycles, Hand drawn carts, Animal drawn carts etc. These all vehicles have different speeds, size, Load carrying capacities or passenger capacities etc. which affect the urban heterogeneous traffic flow. The following are some basic definitions of traffic flow parameters.

A. *Objectives Of The Study:* The main objectives of present study are:

- To compare obtain capacity with IRC Recomandade
- To find the space mean speed of Urban street
- To find the time mean speed of Urban street

B. *Capacity:* The maximum number of vehicles that can pass as given point on a lane or roadway during one hour without the traffic density being so great as the cause unreasonable delay ,hazards or restriction to the drivers' freedom to man oeuvre under prevailing roadway and traffic conditions. This term is frequently referred to as the design capacity.

C. *Speed-Flow (Vs-Q) Relationship:* At very low speeds the traffic volume would also below. 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 (U_m) at which the flow is maximum (q_m).

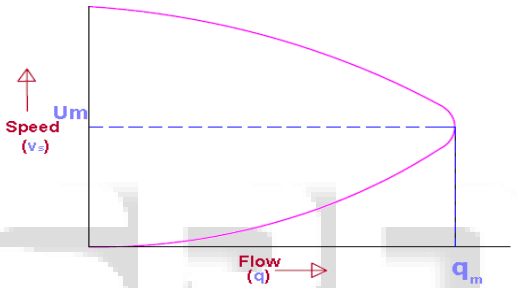


Fig. 1:

II. SELECTION OF STUDY AREA:

The area to be selected for this study is two lane/four lane urban road of Ahmedabad city. For this study the Mid-block section of each road has been selected. The first traffic survey work has been carried on jodhpur to torrent power. This road has two lanes on each direction of traffic flow. Presently the traffic survey was carried out on two stretches of the same traffic flow direction. Both the stretches have two lanes, same widths. The width of stretch is 9.5m .

III. DATA COLLECTION:

- Traffic Flow (q) and CVC count,
- Traffic stream speed at operating traffic volume (qs) ,
- Traffic composition at various stretch of urban roads
- Cumulative frequency curve at various stretch of urban roads
- Estimated the capacity of various stretch of urban roads

Table. 1: C.V.C For Jodhpur to Torrent power Time:9:00 to 10.00

Time (min)	T.W (0.75)	CAR (1.0)	THW (2.0)	BUS (2.20)	LCM (1.4)	CYCLE (0.4)	Vehicle /5min	Vehicle /hr	PCU/ 5min	PCU/ 15min	PCU/hr
5	93	54	12			2	161	1932	149		1783
10	97	56	14	1	2	1	171	2052	162		1946
15	103	64	18	2	2	3	192	2304	186	496	2228
20	123	78	22	1	2	4	230	2760	221	569	2650
25	158	87	24	2	3	2	276	3312	263	669	3155
30	176	91	23		2	3	295	3540	273	757	3276
35	183	89	32	4	2	2	312	3744	303	839	3632
40	185	84	37		2	3	311	3732	301	876	3609
45	189	83	43	2	3	1	321	3852	320	923	3837
50	179	78	38		1	2	298	3576	290	911	3485
55	174	73	32	2		4	285	3420	274	884	3282
60	168	70	29	1	2	3	273	3276	260	824	3122

Table. 2: C.V.C For Torrent power to Jodhpur Time:5:00 to 6:00

Time (min)	T.W (0.75)	CAR (1.0)	THW (2.0)	BUS (2.20)	LCM (1.4)	CYCLE (0.4)	Vehicle /5min	Vehicle/hr	PCU/ 5min	PCU/15 min	PCU/ hr
5	87	56	14	2	2	3	164	1968	158		1891
10	64	61	9	1	1	4	140	1680	132		1586
15	83	47	18	2	3		153	1836	154		1846
20	98	59	21		2	3	183	2196	179		2142
25	123	62	25	2			212	2544	209		2504
30	154	76	22	1	1	1	255	3060	240		2874
35	178	78	32	2		3	293	3516	281		3103
40	184	83	35		2	2	306	3672	295		3106
45	186	89	40	3	4	6	328	3936	323		3877
50	174	78	35	3	2	3	295	3540	289		3469
55	168	71	30		1		270	3240	258		2756
60	167	69	24	1	1	1	263	3156	246		2955

Table. 3: Polytechnic to Uremila circle

Time (min)	T.W (0.75)	CAR (1.0)	THW (2.0)	BUS (2.20)	LCM (1.4)	CYCLE (0.4)	Vehicle /5min	Vehicle /hr	PCU/ 5min	PCU/15 min	PCU/ hr
5	86	67	23	2	2	2	182	2184	186		2226
10	82	61	22	1	3	3	172	2064	174		2089
15	91	65	21	3	1	2	183	2196	184		2209
20	89	59	25	2	1		176	2112	182		2179
25	120	68	24		2	3	217	2604	210		2520
30	126	78	31	1	2	1	239	2868	240		2879
35	132	81	28	2	3	3	249	2988	246		2950
40	142	76	32	3			253	3036	253		3037
45	154	82	34		1	2	273	3276	268		3212
50	173	89	43	4	6		315	3780	322		3863
55	167	82	36	1		3	289	3468	283		3392
60	165	87	32	2	2	1	289	3468	282		3388

Table. 4: Urmila circle to polytechnic

Time (min)	T.W (0.75)	CAR (1.0)	THW (2.0)	BUS (2.20)	LCM (1.40)	CYCLE (0.4)	Vehicle/5 min	Vehicle/ hr	PCU/5 min	PCU/15 min	PCU/ hr
5	84	48	23	2	2	3	162	1944	165		1985
10	79	49	21	1	1	2	153	1836	155		1856
15	89	51	22		2	4	168	2016	166		1994
20	95	53	32	2			182	2184	193		2312
25	132	59	24	3	3	2	223	2676	218		2611
30	139	54	28	2	1	3	227	2724	221		2655
35	143	74	31	1	2		251	3012	248		2979
40	157	84	35	3		3	282	3384	280		3355
45	176	87	43	3	5	3	317	3804	320		3838
50	172	74	25	2	2	2	277	3324	261		3132
55	165	79	24			3	271	3252	252		3023
60	173	85	31	1	1	2	293	3516	281		3374

IV. CUMULATIVE FREQUENCY CURVE

The cumulative frequency curve is used for determining the number of vehicles travel above or below given speed. It is plotted between cumulative percentage and upper limit of each group of each speed group columns From these curves, the speed characteristics of traffic stream are described by several significant values

A. *Time Mean Speed :* Arithmetic mean speed is just the average speed of all observed vehicles.

B. *Median Speed:* The median speed is the middle value one baff of the observed values are hgher than the median and one half are lower

C. *Modal Speed:* The mode or modal speed is the most frequently occurring value in a distribution. It is the speed in which maximum number of vehicles lies.

D. *85^{th},$98^{th}$and 15^{th} Percentile Speed:* For the cumulative frequency curve 85^{th} 98^{th} and 15^{th} percentile speed can be determined , 98^{th} percentile speed is used in Geometric design. It is 120 km/hr 85^{th} percentile speed is used for traffic regulations. It is 90km/hr 15^{th} percentile speed slower vehicles whose speed may caused interference with traffic stream

Table. 5: Cumulative Frequency Curve Jodhpur to Torrent Power

Speed class		mid class	Frequency	cum %	f(x)
20	24	22	263	9	5786
25	29	27	350	21	9450
30	34	32	438	36	14016
35	39	37	496	53	18352
40	44	42	438	68	18396
45	49	47	496	85	23312
50	54	52	321	95	16692
55	59	57	117	100	6669

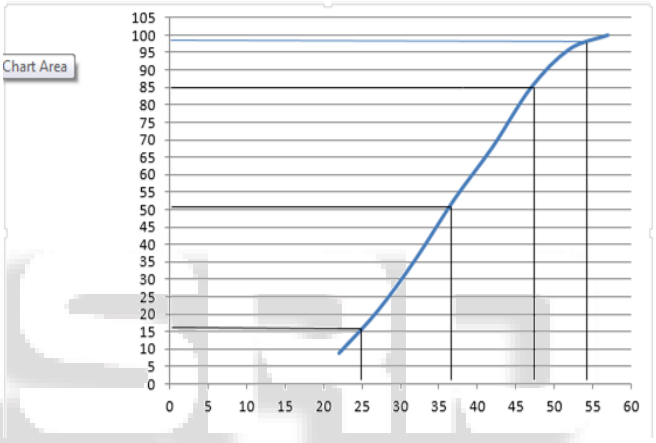


Fig. 1: Cumulative Frequency Curve Jodhpur to Torrent Power

- Modal speed=37km/hr
- Median speed (50%) =36km/hr
- Time mean speed = 38.59km/hr
- Speed to be used in geometric design (98%) =54km/hr
- Speed of traffic regulation(85%)=46km/hr
- Standard deviation (S)= 10.62km/h
- Co-efficient of variation = 27.54%

Table :-6 Cumulative Frequency Curve Torrent power to Jodhpur

speed class		mid class	frequency	cum%	f(x)
20	24	22	330	12	7260
25	29	27	412	27	11124
30	34	32	569	47.77	18208
35	39	37	612	70	22644
40	44	42	504	88.44	21168
45	49	47	222	96.53	10434
50	54	52	54	98.5	2808
55	59	57	41	100	2337
			2744		95983

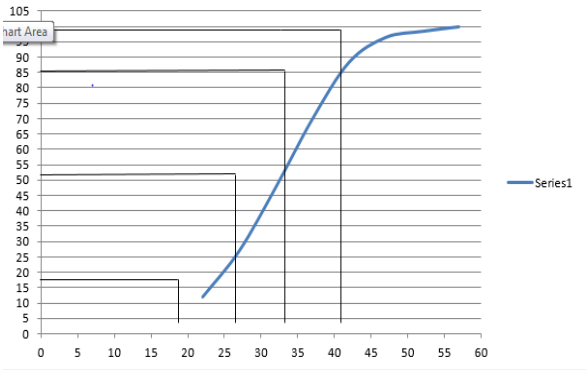


Fig. 2: Cumulative Frequency Curve Torrent power to Jodhpur

- Modal speed=37km/hr
- Median speed (50%) =32km/hr
- Time mean speed = 34.97km/hr
- Speed to be used in geometric design (98%) =50.35km/hr
- Speed of traffic regulation(85%)=41km/hr
- Standard deviation (S)= 8.21km/hr
- Co-efficient of variation = 23.48%

Table. 7: Cumulative Frequency Curve Polytechnic to Urmilacircle

speed class		mid class	frequency	cum%	f(x)
20	24	22	289	10	6358
25	29	27	492	27	13284
30	34	32	636	49	20352
35	39	37	550	68	20350
40	44	42	607	89	25494
45	49	47	184	95.36	8648
50	54	52	90	98.47	4680
55	59	57	44	100	2508
			2892		101674

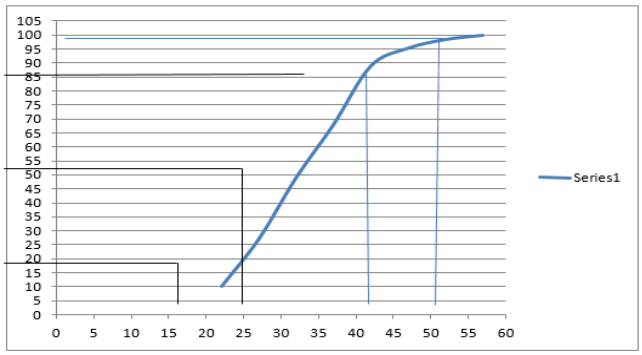


Fig. 3: Cumulative Frequency Curve Polytechnic to Urmilacircle

- Modal speed=32km/hr
- Median speed (50%) =31km/hr
- Time mean speed = 35.15km/hr
- Speed to be used in geometric design (98%) =50.54km/hr
- Speed of traffic regulation(85%)=41km/hr
- Standard deviation (S)= 7.72km/hr
- Co-efficient of variation = 21.98%

Table:-8 Cumulative Frequency Curve Urmilacircle to polytechnic

speed class		mid class	frequency	cum%	f(x)
20	24	22	365	13	8030
25	29	27	480	30	12960
30	34	32	618	52	19776
35	39	37	646	77.93	23902
40	44	42	421	90	17682
45	49	47	186	96.65	8742
50	54	52	52	98.5	2704
55	59	57	42	100	2394
			2810		96190

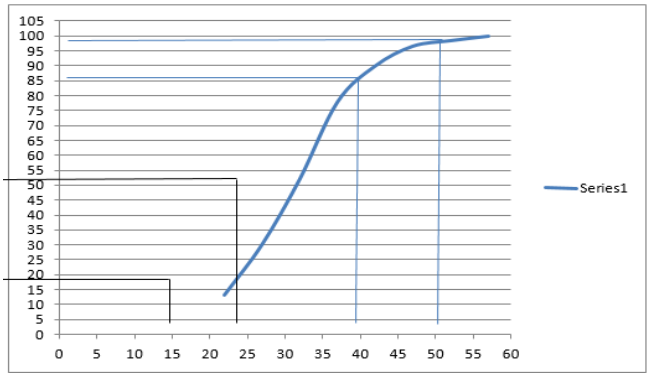


Fig. 4: Cumulative Frequency Curve Urmilacircle to polytechni

- Modal speed=37km/hr
- Median speed (50%) =31.5km/hr
- Time mean speed = 34.23km/hr
- Speed to be used in geometric design (98%) =45.5km/hr
- Speed of traffic regulation(85%)=39km/hr
- Standard deviation (S)= 7.97km/hr
- Co-efficient of variation = 23.28%

V. Overall Transportation Scenario:

Traffic in Ahmadabad is characterized by significant presence of inter city traffic and its composition. The city is presently suffering from several transport problems like traffic congestion, parking difficulties, insufficient road width, and higher use of personalized mode of transportation, high delay at signalized intersection, proliferating intermediate passenger transport vehicles, road accidents and inadequate mass transit facilities

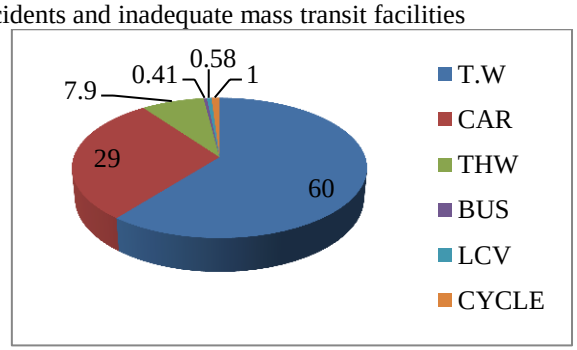


Fig. 5: Traffic Composition Jodhpur to Torrent Power

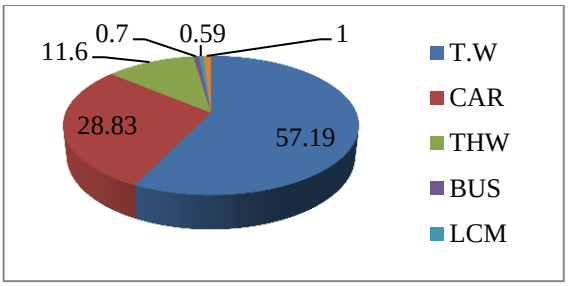


Fig. 6: Traffic Composition Torrent power to Jodhpur

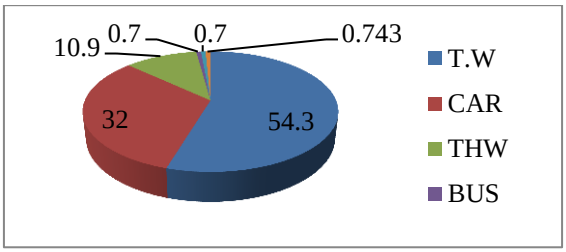


Fig. 7: Traffic Composition Polytechnic to Uremila circle

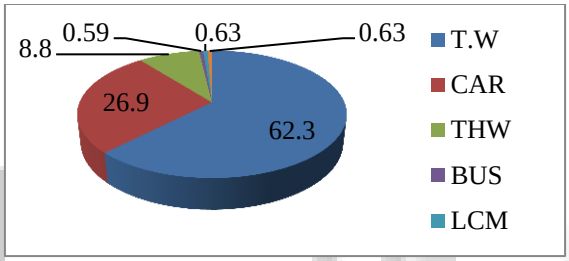


Fig. 8: Traffic Composition Urmila circle to polytechnic

VI. PASSENGER CAR UNITS:

Urban roads are characterized by mixed traffic conditions resulting in complex interaction between various kinds of vehicles to cater to this it is usual to express the capacity of urban roads in terms of common unit the unit general employed is the passenger car unit and each vehicle type is converted into equivalent PCUs based on their relative interference value

Table:-9 Compression of Capacity PCU/hr Urban road with IRC (106-1990)

	3 lane (10.5m) (Traffic flow in one direction)
Capacity in PCU/h for roads with no standing vehicles and no frontage access (IRC 106-1990)	3600
Actual flow in PCU/h (jodhpur to torrent power) (9.5m wide) (W=3.25+3.25++3.0)	3837
Actual flow in PCU/h (polytechnic to Urmilacircle) (10.5m wide) (W=3.25+3.25++3.0)	3863
Actual flow in PCU/h (Urmilacircle to Polytechnic) (10.5m wide) (W=3.25+3.25++3.0)	3838
Actual flow in PCU/h (Torrent power toJodhpur) (9.5m wide) (W=3.25+3.25++3.0)	3877

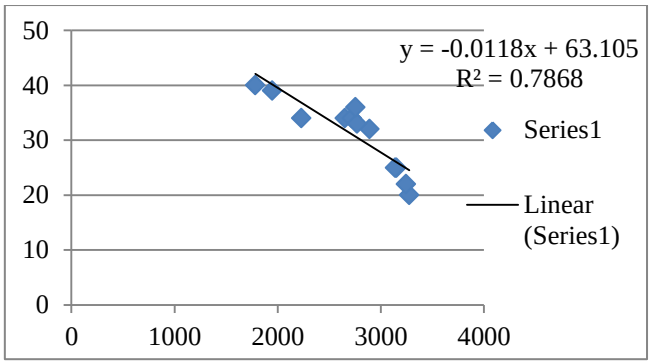


Fig. 9: Capacity Curve Jodhpur to Torrent Power

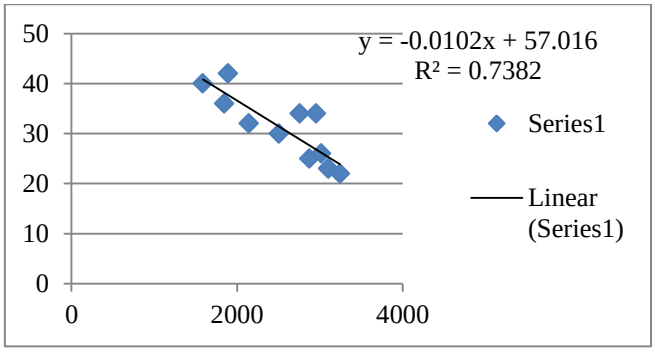


Fig. 10: Capacity Curve Torrent power to Jodhpur

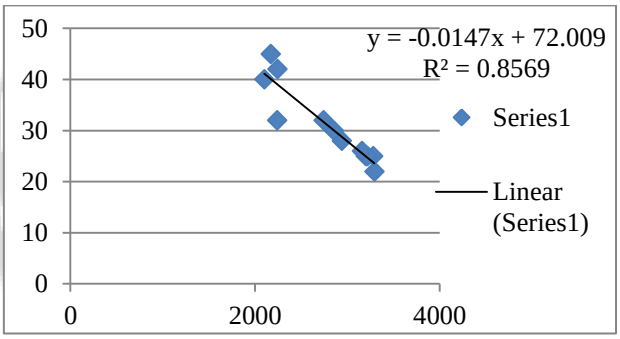
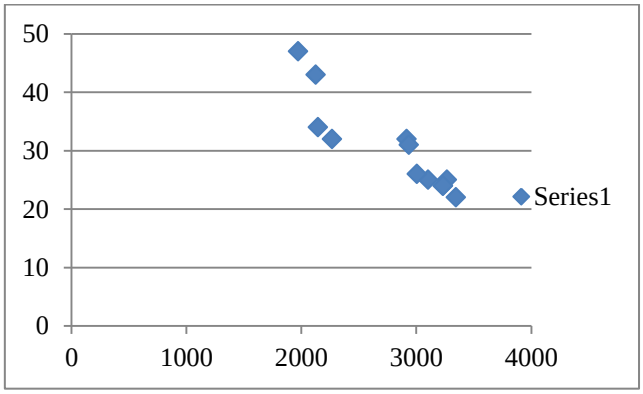


Fig. 11: Capacity Curve Polytechnic to Uremila circle



Capacity Curve Urmila circle to polytechnic

VII. CONCLUSIONS

Capacity Model is very useful for future traffic estimation, traffic planning and designing, testing different alternatives and evaluating traffic management schemes. When the traffic composition has maximum number of two wheelers it gives higher speed value but in S.G.Highway which is the state highway width of road is 12.6 and higher flow values in traffic composition number of two wheeler and car all most same and speed of car more compare to two

wheeler.

- Increase the width of the road
- Mass transportation facility provide
- Restriction of on street parking
- Construct fly over bridge

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