

## **Influence on the Capacity of Thruway by Bus Stops in Pampore, Jammu and Kashmir-192121**

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**ABSTRACT:** *Traffic characteristics of roadway are influenced by various characteristics like base-way condition, roadway condition, traffic condition, operating condition, driver skills, side friction or side activities, road maintenance, technology etc. One of the major problems facing motorists in Pampore town in present time is congestion. The total number of vehicles travelling in Pampore and its adjoining areas has rapidly increased now a days resulting in an increase in traffic congestion and a decrease in the operational integrity of the transportation system. Traffic congestion particularly at bus stops in the area is on rise with increasing private automobiles on the roadways competing with public transports for the limited roadway spaces. The efficiency of public transportation buses are declining considerably. Commuters have to waste a lot of time at bus stops and also in the bus in order to get their destination. The purpose of this project is to determine the loss in traffic capacity at bus stops due to limited road width and later, after observing the situation by proper analysis of the collected data, solution and proper measures for the said cause is recommended for the smooth flow to the traffic.*

*Field data are collected for urban road of Pampore and its nearby areas like Kadlbal, Namblabal and Drangbal areas are taken into consideration in this thesis . The roadway was divided into two sections (A - Before bus stops, B - At bus stops). Based on bus arriving frequency bus stop capacity has been defined. Results & analyzed data show a significant loss in roadway capacity for on-street bus stops at the two bus terminals of Pampore.*

**KEY WORDS:** *Speed, Traffic volume, Traffic density, Side friction, Bus stop.*

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### **I. INTRODUCTION**

Transportation is the important factor for the economic performance of any country, it also affects the living standard and style of the people living in the area. For sustainable development, an economy has to ensure proper supply of transportation facilities. Traffic congestion significantly affects both the economic performance as well as the living standards of the people. In majority of urban areas, travel demand exceeds highway capacity occasionally during peak periods. In addition, events such as crashes, vehicle breakdowns, adverse weather, etc. cause temporary losses in capacity, often deteriorating the situations on already congested road networks. These temporary capacity losses have significant impact on delay, reduced mobility, and reduced reliability of the roadway network. The traffic characteristics of a road section can be influenced by various factors such as surface type, base-way condition, roadway width, side friction or road maintenance, etc. However among all the factors, side frictions like bus stops, on-street parking, encroachments and frontage access significantly reduce the performance of an urban road. Bus stop has a significant influence on the capacity and speed on the roads because they have to interfere with the passing vehicle and buses have to pull into or out of the bus stops causing the turbulence and congestion on the roads. Road way capacity is defined as the maximum hourly rate at which vehicles can traverse a point or uniform section of a lane per time period under prevailing roadway. In this project, the main problem is bus stop locations on the on the roads and the consequences for traffic properties. The number and type of bus stops on the road significantly affect the flow characteristics of traffic on the roads. A bus stop is a designated place where buses are either located on or off the road carriageway lane. Activities which usually include bus stops, on-street parking, encroachments etc. are often treated as detrimental to the capacity of roads.

Traffic congestion at bus stops in JAMMU and KASHMIR particularly in Pampore town & its nearby areas like Kadlbal, Drangbal, Namblabal is on rise with increasing private automobiles on the roadways competing with public transports for the limited roadway spaces. Due to above considerations, efficiency of public transportation buses are declining considerably.

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Roadway capacity is a quantitative assessment of traffic stream properties. It is based on relationship between:

- Flow,
- Speed and
- Density

Vehicle flow interaction, speed and density is determined at the bus stops of Pampore as PAMPORE T-1 and PAMPORE T-2.

## **II. RESEARCH SIGNIFICANCE AND OBJECTIVES**

In this project, the main concern is bus stop locations on the highways and the corollary for traffic stream properties. The location of bus stops along a road carriageway lane is therefore the main aim in this study. A bus stop is a designated place where buses stop for passengers to board or leave a bus. The number and type of bus stops provided on a road significantly influence the flow characteristics of traffic on the road. So it can be suggested that any change in prevailing location of bus stop could trigger a change in the capacity of roadway.

The main objectives of the proposed study is to determine:

- Roadway capacity
- Capacity loss at bus stops
- Spot speed measurement at both sections i.e., before bus stop & at bus stop.

## **III. GOALS OF STUDY**

- Climatic Protection.
- Healthy and Safe Communities.
- Transportation System effectiveness.
- Improved traffic flow by avoiding collisions and blocking congestion delays.
- Attenuates or reduces disturbing noise generated by vehicle horn and automatic warning devices.

## **IV. NEED FOR STUDY**

The road traffic on JAMMU and KASHMIR particularly Pampore and its adjoining areas like Kadlbal, Drangbal and Namblabal is highly heterogeneous comprising vehicles of wide ranging static and dynamic characteristics. Under the heterogeneous traffic flow conditions, the buses being relatively larger vehicles, find it difficult to maneuver through the mixed traffic. Due to the pull out or in of the buses in the carriageway leads the serious problems of congestion in the form of bottle necks, leading to the shrinkage of the of the road width. The congestion in the roads ultimately lead to the reduction of the traffic capacity and gives birth to serious problems of traffic jams, accidents, time delay, fuel consumption, noise pollution etc. With the case of in- adequate and in efficient bus transit, the potential bus users shift to personal vehicles, this further increases the traffic flow on the roads leading to traffic jams.



**Fig.(1)** Traffic congestion at Pampore T-1 due to bus stop

In order to have a good quality of bus transit system, effective measures should be taken for the encouraging the bus transport service as well as supply side management measures. This can be achieved by encouraging the bus transport and to give more priority to it. One of the better treatments to the bus stops on the carriage way is to provide the proper bus bays on high capacity roads, to facilitate fast movement of buses, which also makes the mode better to service.

## V. METHODOLOGY, DATA COLLECTION, ANALYSIS

The traffic data was collected by observing the traffic flow at bus stop. The collected data was utilized to determine the capacity and level of service of the roads. Various parameters that are utilized for analysis like dwell time, clearance time, traffic speed, traffic volume were collected and calculated for the analysis of capacity of bus stops.

### V-1 Methodology

The methodology used to determine the impact on the capacity due to bus stops will be based on technical sound information for collecting and analyzing the data. The methodology used for the analysis of the data includes various stages like road inventory survey, traffic survey, spot speed and traffic volume counts. In road inventory survey proper information of the road is observed like road width, obstruction etc for collecting the data. For the case of traffic survey, road section is divided into two phases as Before Bus Stop and After Bus Stop for calculating the data utilized for the analysis part. Bus arrival frequency was also studied at the same bus stops and same time. This was done by counting the buses that arrived within 15 min period. Spot speed and traffic volume studies carried at both sections and compared.

### V-2 Analysis

Analysis was done by calculating PCU and LOS for different class of vehicles, LOS base on speed data and with determining the important factor used for calculating the impact on flow of vehicles on roadways by stoppage of the buses that is bus stop capacity.

## VI. SLECTION OF STUDY AREA

Study area selected for the analysis is Pampore town. Pampore which is also called the gate way to the city is taken into consideration because wide spread of commercial, industrial, government, private and other activities and having a good road network .In Pampore area two bus terminals as ‘Pampore T-1’ lies in Kadlabal vicinity and ‘Pampore T-2’ which is in Namblabal area having the distance gap of 1000m is taken for study analysis. All the above two bus stops come under the important national highway, which have the huge traffic flow through out whole year as it connects two ends of the country and has been named on the basis of it. This national highway is popularly known as **Srinagar-Knyakumari Hwy.(NH 44) India.**



**Fig. 2-** Bus stop at Pampore T-1 Area



**Fig. 3 -**Bus stops at Pampore T-1 Area

## VII. CALCULATIONS AND RESULTS

### PAMPORE T-1 BUS STOP

BASIC CAPACITY: 2700

LANE WIDTH : 7.5M

**Table 1** level of service based on traffic count

Description	Day	Before Bus Stop		At Bus Stop		LOS	Capacity Loss (%)
		V (PCU/hr)	V/C	V (PCU/hr)	V/C		
(NH 44) road with frontage access with side	<b>01</b>	892	0.33	1100	0.41	B	18.90
	<b>02</b>	866	0.32	1018	0.38	B	14.93

roads, connecting Pampore T-1 with Pulwama.	<b>03</b>	862	0.32	994	0.37	B	13.27
	<b>04</b>	750	0.28	1006	0.37	B	25.44
	<b>05</b>	664	0.25	794	0.29	A	16.37
	<b>06</b>	908	0.34	1064	0.39	B	14.66
	<b>07</b>	702	0.26	814	0.30	A	13.75

**PAMPORE T-2 BUS STOP**

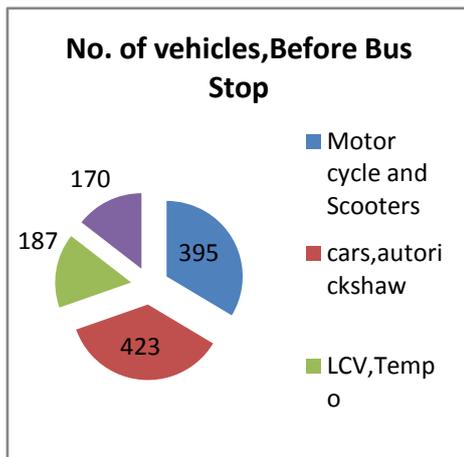
BASIC CAPACITY: 2600

Lane Width :7.5 m

Description	Day	Before Bus Stop		At Bus Stop		LOS	Capacity Loss (%)
		V (PCU/hr)	V/C	V (PCU/hr)	V/C		
(NH 44) road with frontage access with side roads, connecting Pampore T-2 with Dal-Gate .	<b>01</b>	902	0.35	992	0.38	B	9.07
	<b>02</b>	862	0.33	912	0.35	B	5.48
	<b>03</b>	828	0.32	1002	0.39	B	17.36
	<b>04</b>	860	0.33	1036	0.40	B	16.98
	<b>05</b>	518	0.20	692	0.27	A	25.14
	<b>06</b>	910	0.35	1098	0.42	B	17.12
	<b>07</b>	746	0.29	844	0.32	A	11.61

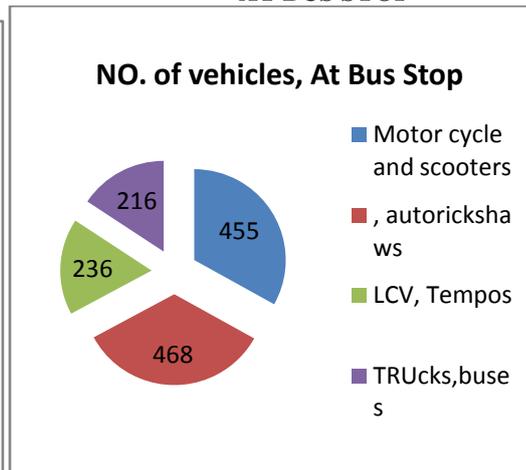
**Table 2** -level of service based on traffic count

**Traffic Volume Calculations for Bus Stop PAMPORE T-1  
BERORE BUS STOP**



**Fig. 4-** No. Of vehicles BBS

**AT BUS STOP**



**Fig. 5-** No. Of vehicles ABS

**Traffic Volume Calculations for Bus Stop PAMPORE T-2  
BERORE BUS STOP**

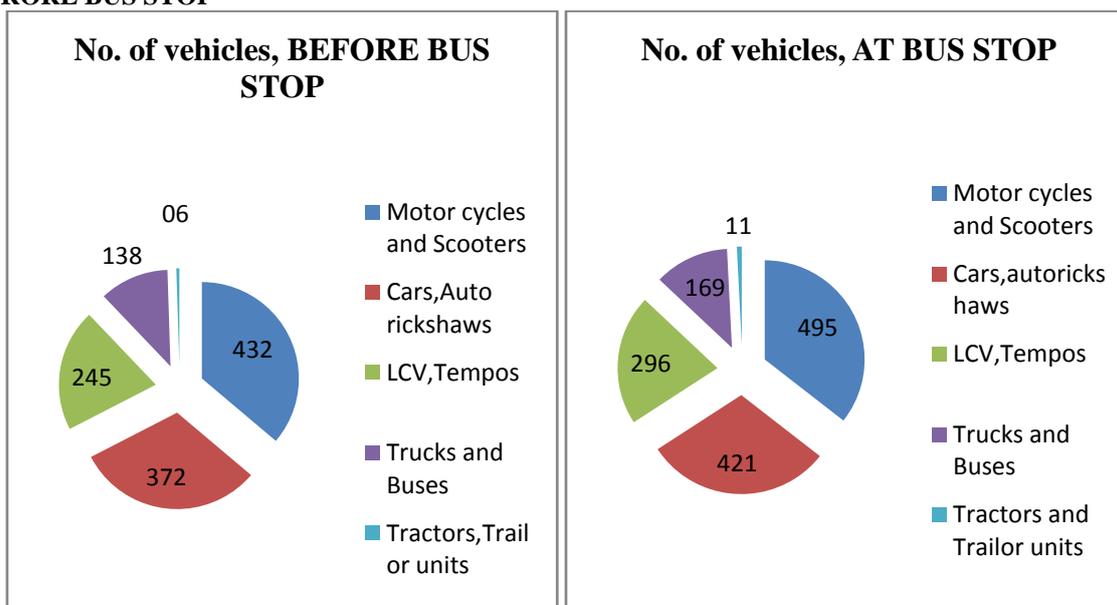


Fig.6- No. Of vehicles BBS

Fig.7- No. Of vehicles ABS

**SPOT SPEED**

LOS Based on Speed Data

Location	Section	2 Wheeler	3 Wheeler	Car/Jeep	L.C.V	Truck	Bus	Tractor	Avg. Speed	LOS
PAMPORE -1	Before	43	29	45	40	28	21	-	34.3	C
	At	34	20	33	26	19	14	-	24.3	D
PAMPORE-2	Before	47	31	43	40	33	27.5	26	35.3	C
	At	36	25	32	30.5	20.5	17	15.5	25.2	E

Table 3 - Level of Service Based on Speed Data.

**Variation of speed at PAMPORE T-1  
Before Bus stop and At Bu S**

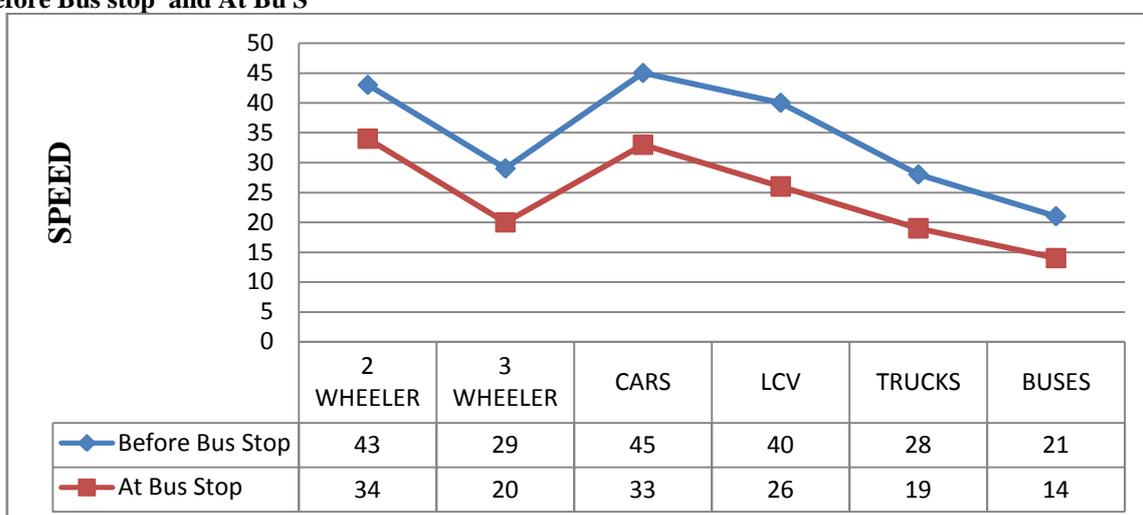
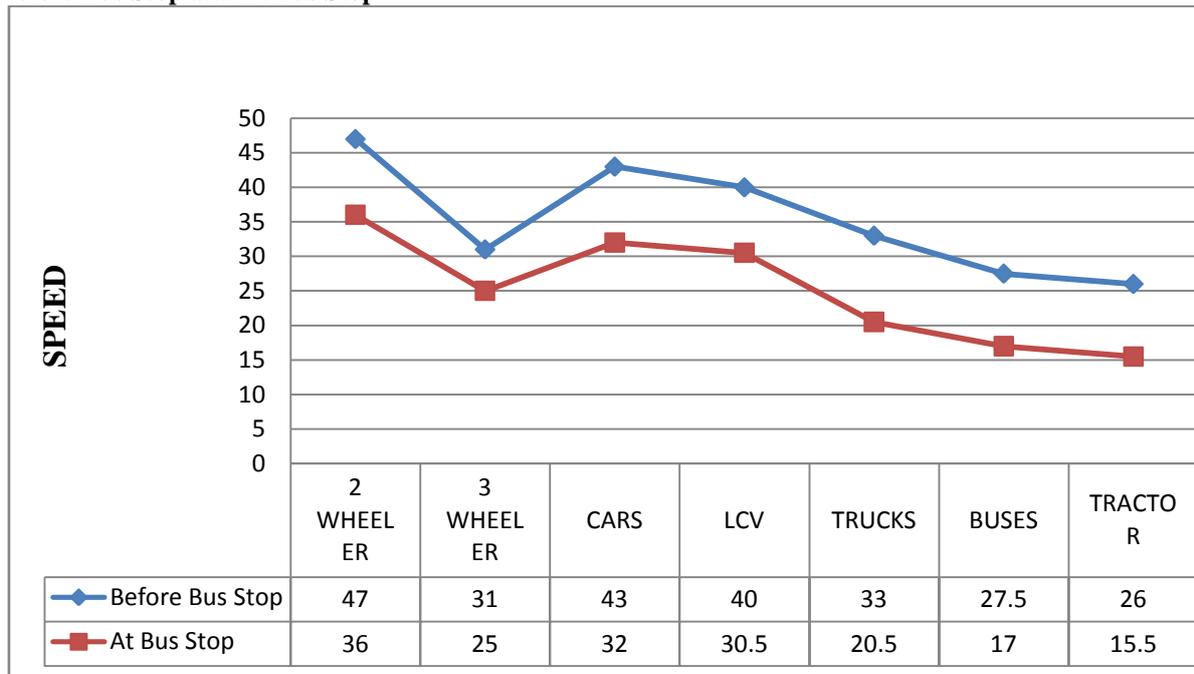


Fig. 8 -Variation of speed at Pampore T-1 BBS and ABS

**Variation of speed at Pampore T-2  
Before Bus Stop and At Bus Stop**



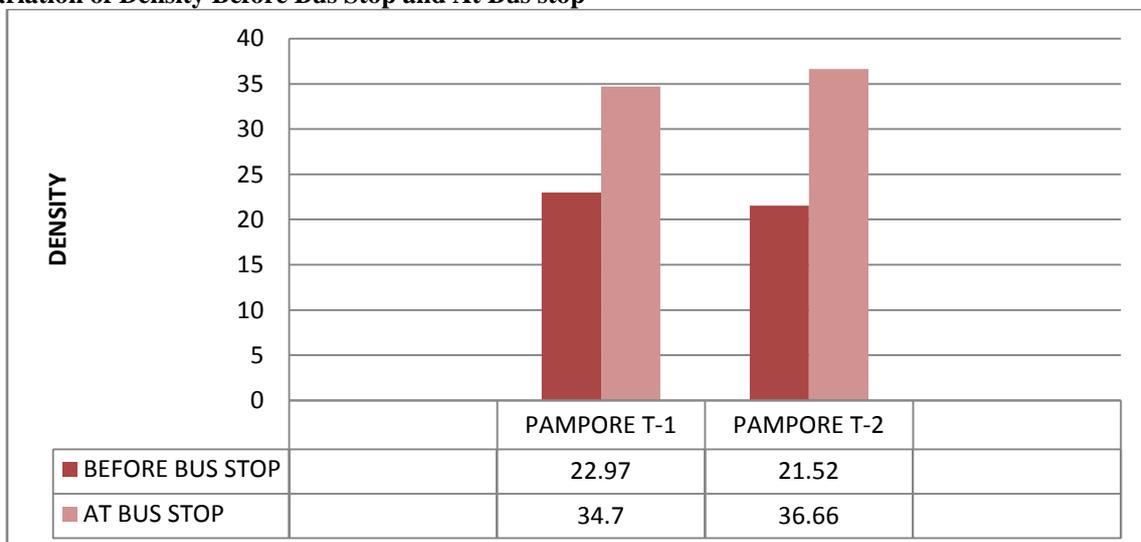
**Fig. 9** -Variation of speed at Pampore T-2 BBS and ABS

**DENSITY**

BUS STOPS	SECTION	TIME INTERVAL	DAY	FLOW Veh/15min	FLOW Veh/hr	SPEED (kmph)	DENSITY K	DENSITY Km/h/l	LOS
PAMPORE T1	BEFORE	15 min.	06	197	788	34.3	22.97	11	C
	AT	15 min.	01	211	844	24.3	34.7	17	D
PAMPORE T2	BEFORE	15 min.	06	190	760	35.3	21.52	11	C
	AT	15 min.	06	231	924	25.2	36.66	18	E

**Table 4** - Tabulated Density and LOS as per HCM 2000

**Variation of Density Before Bus Stop and At Bus stop**



**Fig. 10-** variation of density BBS and ABS

**BUS STOP CAPACITY**

PARAMETERS	LOCATION	
	PAMPORE T-1	PAMPORE T-2
Dwell Time(s)	47	50
Coefficient of Variation of dwell time	60%	60%
Failure Rate	15%	15%
Z <sub>a</sub>	1.040	1.040
g/c ratio	1	1
On Line / Off Line	On line	On line
Clearance Time (s)	31	43
Loading Area/ Bus Berth	2	2
No. Of Cumulative effective berth	1.75	1.75
Bus Stop Capacity (bus/hr)	34	29
<b>Max./Actual bus stop capacity(bus/hr)</b>	<b>56</b>	<b>51</b>

**Table 5-BUS STOP CAPACIT**

**VIII. CONCLUSION AND DISCUSSION**

The data calculated and analyzed from the field at bus stops shows decrease in the traffic parameters like speed, volume, density and capacity. This situation prevails due to the various factors of side friction either in the form of bottlenecks or the usage of lane width by the bus stoppage, which leads to traffic jam condition at the bus stop points. The condition of bottleneck occurs on the roadways due to exit or entry of bus from curb side to the lane causing shrinkage of the actual lane width to small extent. This small road width leads to decrease of the traffic parameters. Other factor of the bus stoppage on the curb side or on the pavement lane is synonyms to the above factor as it also causes the reduction of the lane width which leads to hindrance for free movement of vehicles. For movement of vehicles proper measures should be utilized and rigorously adopted for free flow. Measures like bus bays with suitable design should be provided, no structures other than passenger shed should be permitted at bus stops, bus stops should provided on both sides of road for each direction of travel, pavement marking on road with word "BUS" written on pavement, parking for other vehicles should be restricted on both side of bus stops etc. All these measures would pave for smooth flow of traffic and would lead to usage of bus transit service because of less time consumption than by using the personal vehicles. It would not lead to the benefits for traffic system but also helps to save the fuel used during the stagnant phase of vehicles. However it is also observed that traffic jam at bus stops is also caused by erratic behavior of drivers and other road users. Drivers at bus stops interfere with through traffic on the curb side resulting unnecessarily increase in dwell time and congestion. It is therefore recommended that, for better operation, strict enforcement measures should be stepped up accompanied with stiff penalties to defaulters. Obedience for that stopped vehicles are parked appropriately to allow smooth movement of through traffic. This measure should be undertaken while educating the bus drivers on the proper and safe use. Over all if the above measures are properly, obediently and acquiescently adopted by both the bus drivers as well as the general road users, the negative and the miserable impact of bus stoppage on the capacity of road traffic at both the Pampore bus terminals will be either negligible or less than that calculated and analyzed from field data.

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