American Journal of Engineering Research (AJER)
e-ISSN : 2320-0847 p-ISSN : 2320-0936
Volume-03, Issue-06, pp-242-246
www.ajer.org

Research Paper Open Access

Introduction to corridor selection & assessment for Bus Rapid Transit System (BRTS) in Hyderabad

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***ABSTRACT**: Bus rapid transit system is an innovation and it is up gradation to the present transport system. BRT is affordable, adaptable and cost effective. The term of rapid transit system means a form of high speed urban passenger transportation. Here, the mode of transportation is bus hence it is called as bus rapid transit system (BRTS). Transportation facilities and the system will be different form different countries. Especially for the developing countries, transportation is a problem and BRT is the best way to overcome it. If a country gets richer the development will be seen in different aspects like education, industry, science and technology etc., except transport which will get worse. There are many ways to get rid of these traffic issues and transport problems. What attracted the countries to install BRT is the bus way concept as that it can cover whole city and is cheaper than the rail. BRT is a high speed rapid transit system using high capacity vehicles, physically separated bus ways, modern station with electronic fare collection, rapid boarding and high service frequency which result more passengers and less congestion. This paper presents an overview of BRTS and corridor selection & assessment for it in Hyderabad through surveys etc.*

***Keywords:** BRTS, PCU, Traffic congestion, Transportation, Level of Service, LRT, ITS, SPS.*

I. INTRODUCTION

Bus Rapid Transit System (BRTS) takes part of its name from "Rapid Transit", which describes a high-capacity transport system with its own right-of-way, implemented using buses through infrastructural and scheduling improvements, to provide a high level of service [1]. Normally BRT includes the following features like dedicated lanes, off board fare collection, intersection treatment, platform level boarding. The Bus Rapid Transit system is expected to revolutionize public transport with new buses, special lanes and new routes, all at a low cost. When compared to regular mode of transportation, the operation of BRTS is a bit challenging. That is because there will be some frequency between the buses, at the time of traffic jams the buses will give the estimated time of arrival to the signals using the intelligent transport system (ITS). This sort of operation leads to delay the red signal or extending the green signal. This operation can be technically termed as signal priority system (SPS). In India, roads are often designed to take a particular number of users, say 30,000 persons per hour per direction. A single dedicated lane BRTS is known to carry 20,000 passengers per hour per direction. A well implemented efficiently-run BRTS will also cause citizens to switch travel modes from car to bus, which will further alleviate the traffic situation. The Selection of a corridor is done by conducting various number of surveys in Hyderabad by which the BRTS can be easily implemented in it.

II. INDENTATIONS AND EQUATIONS

2.1 How BRTS is applicable for Hyderabad???

Hyderabad has a well developed ring radial structure, high density development and dispersed travel pattern. No Single mode is adequate to meet with the mobility needs in cities. Improvements in existing bus system alone are not adequate to bring about significant modal shifts [2]. Literally BRTS is new sort of transportation system to Hyderabad city. Recently it has been proposed in Vijayawada, India.Primarily the corridor selection is made on the basis of the traffic volume in the city and especially the particular corridor is selected because currently there is a facility i.e. construction of metro rail is under progress. So that the traffic volume count will be drastically change after operation of Hyderabad metro rail in the other areas. Hence, the

people in the corridor suffering from the heavy traffic, traffic jams and traffic congestions may make use of BRTS. In order to make sure the survival of the BRTS in Hyderabad, a survey was started with the specific route or corridor. Some of the interesting facts and values are discovered in the surveys. This paper describes the surveys conducted in the corridor and the related values and the effects for the values obtained and the graphical representation of the values for a better idea.The Selected corridor is from Prashanth Nagar to Secunderabad (via bowenpally).The traffic volume in this corridor is fairly high because it connects to the educational centre like Kukatpally, industrial hub like Balanagar, business centre like Paradise and Patny center and the most crowded area like Secunderabad which is one of the important railway junctions in country and headquarters for railways South Central Division (SCR-South Central Railway).

The corridor consists of 5 junctions they are,
1.Balanagar 2.Bowenpally 3.Tarbund 4.Paradise 5.Patny.

The different surveys done in the specific corridor are like Reconnaissance survey, dividing the corridor and studying in to homogeneous sections, survey on passenger car unit, annual daily traffic survey and survey on level of service.

Reconnaissance survey
Before selecting the BRTS corridor the visual surveys are done and the corridor is selected [4] shown in Fig.1.

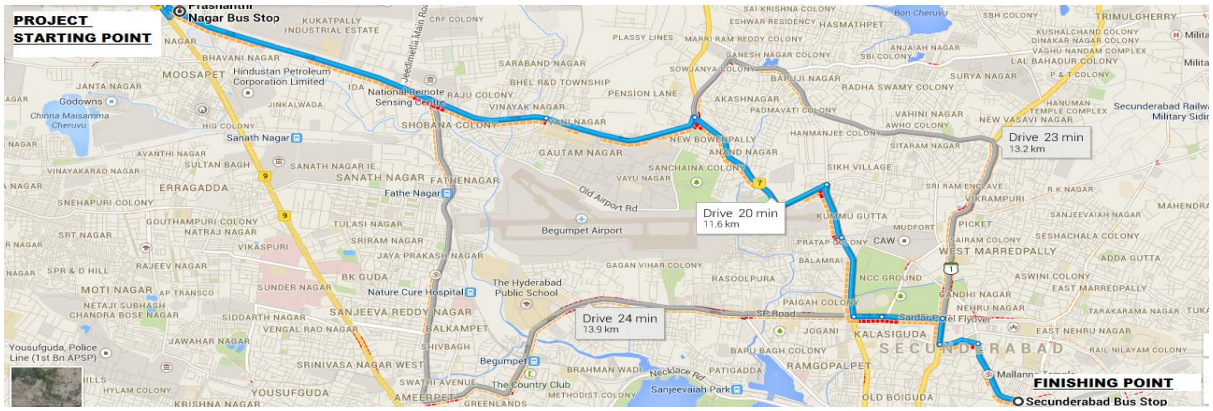

Fig.1 : Map of selected corridor

By the reconnaissance survey the orientation of the corridor can be obtained and the rough assessment of the project can be done easily, even the length of corridor can be identified. As per survey it is observed that the length of the corridor is 12.24km.

2.3 Dividing the corridor and studying in to homogeneous sections

With a view to capture section-wise traffic flow characteristics, the total project stretch has been segmented into four traffic-homogeneous sections, based upon the locations of major intersections/ urban settlements. These acts as main collectors or distributors of traffic along the project corridor; i.e. sections of more or less similar traffic characteristics would form one homogeneous section. The homogeneous sections identified are given in Table 1.

Table 1: Identified homogeneous sections.

Homogeneous section	Length (Km)
Prashanth nagar to Balanagar (HS-1)	2.3
Balanagar to Bowenpally (HS-2)	4.02
Bowenpally to Paradise (HS-3)	3.72
Paradise to Secunderabad (HS-4)	2.2

Survey on passenger car unit

The traffic flow is measured in terms of number of vehicles per unit time. Since Indian traffic is heterogeneous in nature, it is common practice to convert the traffic in terms of Passenger car units (PCUs). Table 2 gives PCU factors mentioned in IRC : 106-1990.

Table 2:Equivalent PCU factors.

Vehicle type	Equivalent PCU factors with percentage composition	
	5%	10% and above
2 wheelers scooter (or) motor cycle	0.5	0.75
Passenger car and pick van	1	1
Auto rickshaw	1.2	2
Light commercial vehicles	1.4	2
Truck or bus	2.2	3.7
Agricultural tractor	4	5
Cycle	0.4	0.5
Cycle rickshaw	1.5	2
Tonga	1.5	2
Hand cart	2	3

By using the above PCU values the traffic volume count is converted in to per passenger car unit at every homogeneous section the survey is done. The number distribution of vehicles is given in Table 3.

Table 3: Number distribution of different types of vehicles.

Vehicle composition	section 1	section 2	section 3	section 4
2-wheeler	1888	1049	2073	1827
Car	465	406	1045	276
Auto	177	123	133	99
Bus	206	229	137	158
Cycle	10	2	2	16
Light commercial vehicles	41	98	33	26
2-Axle truck	61	65	43	38
3-Axle truck	12	28	22	19
Multi axle truck	1	8	5	7

The histogram representation of the different number of vehicles is given in Fig.2.

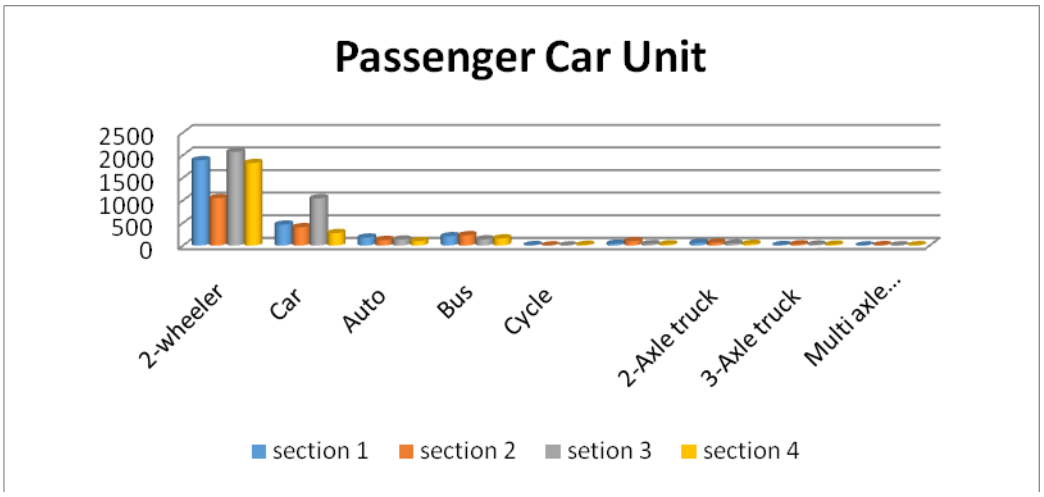

Fig.2 : Frequency distribution of different types of vehicles.

From the above values and graphs it is clear that the 2-wheelers are the majority number of the vehicles in the traffic composition. The surveys done on the peak hours to identify the maximum traffic volume, that leads to the absence of the multi axle and 2 axle trucks.

Annual daily traffic survey

The classified traffic volume count data collected in between March and April 2014 is analyzed to assess the traffic intensity along the project corridor. The detailed analysis of data is given in Table 4.

Table 4: Traffic volume data.

Vehicle Type	Km. 2.3		Km. 4.02		Km. 3.72		Km. 2.2	
	To Balanagar	To Prashanth nagar	To Bowenpally	To Balanagar	To Paradise	To Bowenpally	To Secunderabad	To Paradise
Two Wheelers	17809	17153	9634	14046	18915	20325	18323	18255
Auto	539	439	398	390	596	794	821	1008
Car	3514	3240	2614	2989	5132	6108	2074	3859
Bus	757	685	719	747	507	616	797	800
LCV	245	199	269	299	70	63	42	62
2-Axle Truck	91	48	85	24	11	8	5	3
3-Axle Truck	10	14	21	2	2	4	0	0
Multi Axle Truck	9	5	16	4	0	5	0	0
Cycle	151	216	196	80	277	343	372	397

Survey on level of service

Level of service is defined as the qualitative measure describing the operational conditions within a traffic stream, and their perception by drivers/ passengers. Level of service generally describes the factors such as speed and travel time, freedom to manoeuvre, traffic interruptions, comfort, convenience and safety.
A level of service chart taken from IRC: 106-1990 is given in Fig.3.

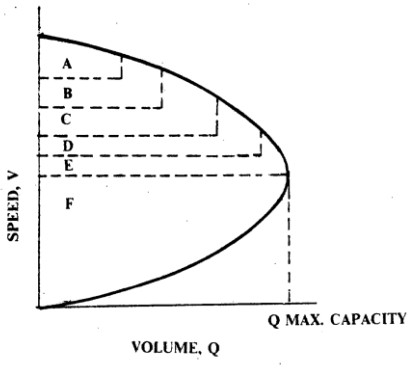

Fig.3: Level of Service chart [3].

Six levels of service are recognized commonly ,designated from A to F , with level of service “A” representing the best operating condition(i.e.., free flow) and Level of Service “F” the worst (i.e.., forced or break down flow).

Level of service for homogeneous section 1

Over all PCU values at mid block 1 = 2777 PCU/hour
Total design service volume = 2900
2777/2900= 0.957 => 95.7%(which is greater than 80%)
So, level of service for mid block 1 falls under category ‘E’.

Level of service for homogeneous section 2

Over all PCU values at mid block 2 = 2625 PCU/hour
Total design service volume = 2900
2625/2900= 0.905 => 90.5%(which is greater than 80%)
So, level of service for mid block 2 falls under category ‘E’.

Level of service for homogeneous section 3
Over all PCU values at mid block 3 = 2829 PCU/hour
Total design service volume = 2900
2829/2900= 0.975 => 97.5%(which is greater than 80%)
So, level of service for mid block 3 falls under category 'E'.

Level of service for homogeneous section 4
Over all PCU values at mid block 4 = 2433.6 PCU/hour
Total design service volume = 2900
2433.6/2900= 0.839 => 83.9%(which is greater than 80%)
So, level of service for mid block 4 falls under category 'E'.

Level of Service E : It represents operating conditions when traffic volumes are at or close to the capacity level. The speeds are reduced to a low, but relatively uniform value, average value being 1/3rd the free flow speed. Freedom to manoeuvre within the traffic stream is extremely difficlt, and is generally accomplished by forcing a vehicle to give way to accommodate such manoeuvres. Comfort and convinience are extremely poor, and driver frustration is generally high. Operations at this level are usually unstable, because small increases in flow or minor disturbances within the traffic stream will cause breakdowns.By this level of service the inconvinience range for the driver will be increased and it would lead to discomfort for the traffic [3].

III. CONCLUSION

The above surveys state that, we cannot trust the current mode of transportion completely and it may not be able to bear if traffic volume increases. It is necessary to upgrade the current system of transportation in case of increase in traffic volume. In this context BRTS would be the best choice, as it is cheaper compared to other systems and it can be easily adaptable, flexible, requires no special faclites, needs lower capital costs can serve a larger geographical area.The capital costs of implementing BRT are lower than for light rail transit (LRT). A study by the United States government accountability office from 2000 found that the average capital cost per mile for bus ways was $13.5 million while light rail average costs were $34.8 million [5].By the Surveys done on the selected corridor in Hyderabad states clearly that the upgradation of the current transportation system should be done with BRTS.

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