International Journal of Engineering & Technology, 7 (2.1) (2018) 63-68

International Journal of Engineering & Technology

Website: www.sciencepubco.com/index.php/IJET

Research Paper

Optimization of Urban Public Transportation System in Vijayawada - A Case Study

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Abstract

The recent scenario of Public transportation in most of the Indian cities shows only 20% to 30% of the total passengers utilizing any public transit as their mode of travel. Rapid growth in vehicles population has put enormous strains in all urban roads in Vijayawada, due to high vehicle ownership and poor supporting public transport facilities specially in the cities where the population is between 1 to 2 million. With more private vehicles on roads, pollution as well as congestion levels in the cities are also expected to increase. The major factor is very low ridership in public transport due to poor service quality and more travelling time. Hence there is a need to make the public transit a favorable mode of transport for the passengers. This study is concerned of assessment of public transport demand for Vijayawada and identifies the major factors for poor ridership with estimation of the probable shift of personal vehicle users to bus due to the increase in its level of service also identifies ways to account qualitative factors in the public transport project evaluation by adjusting travel time values to reflect comfort and convenience.

Keywords: *Public, Transportation, Urban, Vehicles, Vijayawada*

1. Introduction

India's having largest transport system which serves 1.1 billion people. According to a World Bank report (2007), the transport sector contributed about 5.5 percent to India's GDP, with road transportation contributing the lion's share. From 1990s onwards the economy of transport services and infrastructure demands more. However, the sector has not been able to meet this growing demand [1]. Good physical connectivity in urban and rural areas is essential for economic growth. The international and national markets may get down due to poor transport system facilities which leads to loss of competitiveness. Cities and towns play a vital role in promoting economic growth and prosperity. The two third of the country's income generates from one third of India's people live in cities and towns which account for 90% of government revenue. In the coming years, as India becomes more and more urbanized, urban areas will play a critical role in sustaining high rates of economic growth [2].

Public transportation plays a significant role in finding solutions to the numerous challenges of today's world. As per the American public transportation Association (APTA), public transportation helps conserving energy , reduces oil dependence , relieves congestion , protects the environment , improves air quality and health , provides mobility for small urban and rural areas and builds a strong economy as investments in public transportation generates significant economic benefits. Improvement of Public Transport, to reduce the growth of individual motorized traffic, is one of the highlighted measures when it comes to reduction of negative impacts of traffic and the improvement of the energy-efficiency of a transport system [3]. Hence the National Urban Transport Policy of India and the Climate Change Action Plan likewise stress this measure (MoUD 2006, GoI without date). Which is right since the existence of an attractive public transport system is a prerequisite to keep people from using cars or motorcycles [4].

2. Study Area

Vijayawada is the second largest metropolitan city of Andhra Pradesh. The city forms with capital and head quarters of Andhra Pradesh. The city is one of the major trading and business centres of the state and hence, it is also known as "The Business Capital of Andhra Pradesh". The city is well connected to other regions by road, rail and air. Vijayawada urban agglomeration had a population of 1,491,202 as per the provisional data of 2011 census. Vijayawada Municipal Corporation had a population of 1,048,240. The city spreads over an extent of with an area of 261.88 km^2. The Bus operations and route directional are given in Table 1 and Figure 1.

Table 1: Vijayawada city operations

S. No	Type	Total No. of Routes	Total No. of Buses	Total No .of Trips
1	City	50	245	3615
2	Sub-Urban	38	98	997
3	Metro Express	12	99	844
	Total	100	442	5456

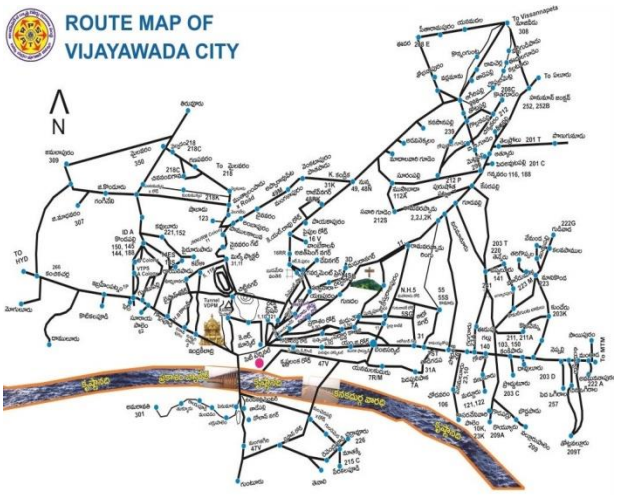

Figure 1: Vijayawada city Bus Route Map

3. Vehicular growth in Vijayawada

Table 2: Total number of registered Transport vehicles in Vijayawada: 2011-2016

S. No	Class of Vehicle	2011	2012	2013	2014	2015	2016
1	Auto rickshaw	16872	18014	19645	21121	24728	27471
2	Contract Carriages	390	403	419	427	446	472
3	Educational Institute Buses	1294	1362	1443	1504	1605	1731
4	Goods Carriages	27649	29528	31325	33207	35833	38946
5	Maxi Cab	880	968	1069	1183	1315	1390
6	Motor Cab	5409	5596	5704	5978	6267	6569
7	Others	354	378	431	495	670	934
8	Private service vehicles	136	141	149	159	163	178
9	Stage Carriages	1289	1348	1421	1505	1620	1805
10	Tractor Trailers	10591	11080	11853	12512	13391	14763
	Total	**64864**	**68818**	**73459**	**78091**	**86038**	**94259**

Table 3: Total number of registered Non Transport vehicles in Vijayawada: 2011-2016

S. No	Class of Vehicle	2011	2012	2013	2014	2015	2016
1	Motor Car	34144	39764	43817	49161	55983	61422
2	Motor Cycle	331424	367640	403911	440492	477923	507427
3	Others	3196	3342	3503	3768	4105	4392
4	Tractor Trailer	8948	9848	10641	11376	12071	13094
	Total	**377712**	**420594**	**461872**	**504797**	**550082**	**586335**

Public transport is a critical element of urban transport system. A great emphasis needs to be given to the public transport system because it offers the most efficient utilization of limited resources – energy and land. Bus transport is the most important system from societal perspective. A well planned bus system can provide a high level of mobility to a large section of the population with least cost [5]. However, a poorly planned system causes inconvenience to the users, loses ridership, encourages use of private vehicles and imposes financial burden on the operator [6]. The transport and non transport vehicles details for the year 2011 to 2016 is presented in Table 2 and 3.

4. Selection of Route

Bus transport is the only Public transportation system was present in the Vijayawada city . In Vijayawda city there are many routes out of those, the study considered two routes. The major reason for selecting these two routes are they have more travelling demand along these routes & many Educational institutions, Commercial activities takes place along these routes .Various studies have been carried out along these routes.

Route 1 - PNBS Bus Terminal to Poranki

Route 2 - PNBS Bus Terminal to Nidamanuru

5. Parameters for Public Transport Assessment

The parameters selected are Journey time, trip length, travel cost & Bus stop location & its facilities. Journey time is an important factor in the mode choice analysis. It includes access time, waiting time, and travel time. The project evaluation considered the travel time and travel time cost. More accurate analysis tends to increase the relative value of transit improvements over a period of time [7]. The comparision of Journey time was conducted between two modes of transport system

they are private mode (Bike) & public transport (Bus). Trip length study it basically means identifying the minimum trip length above which the traveller will opt public transport over the private mode. Study of Travel cost it bascilly represents the willingness of the potential user to pay for the journey as compared to what he will pay for the private mode [8]. As such , this is general perception that if travel cost will increase in any of the mode, the demand foe that mode will decrease.

5.1 Route - 1 (Pnbs to Poranki)

The total length of Route 1 is 10.2 kilometers. Route 1 is from Pnbs bus terminal to Poranki There are totally 26 bus stops along this Route in each direction .

5.1.1 Bike Journey Time

The Bike Journey Time was calculated along this route for 3 days with 8 trips per day during peak hours. The maximum speed was maintained at 40kmph along the route for calculating the journey time as shown in the Figure 2. Travel time it is the time excluding all the stopping time due to traffic signals etc

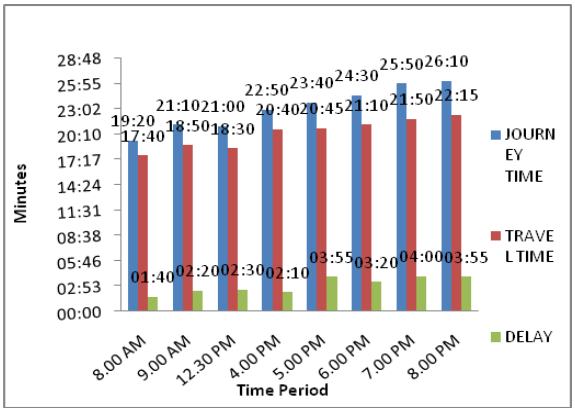

Figure 2: Bike journey time from Pnbs to Poranki

From figure 2 it is observed that the maximum journey time is observed in the evening peak hour timings & the maximum travel time is nearly 22:15 minutes at 8 PM .

5.1.2 Bus Journey Time

The Bus Journey Time was calculated along this route for 7 days with 8 trips per day during peak hours as shown in the Figure 3. Travel time it is the time excluding all the stopping time at each bus stop for passengers getting in and out ,and also due to traffic signals etc. The enumerators travelled in the bus from starting point Pnbs to destination point Poranki and noted the journey time ,travel time, delay at each stop, number of persons getting in & out.

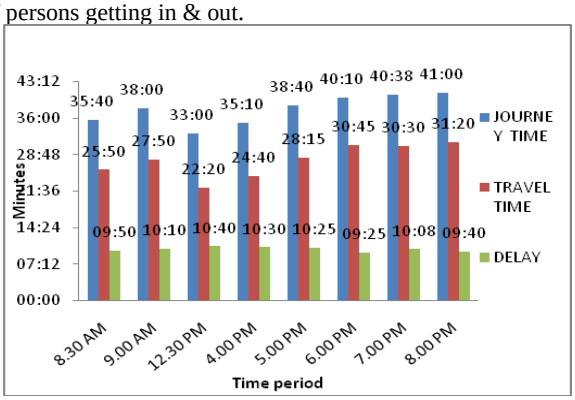

Figure 3: Bus journey time from Pnbs to Poranki

5.2 Route – 2

The total length of Route 2 is 13.4 kilometers .Route 2 is from Pnbs bus terminal to Nidamanuru .There are totally 25 bus stops along this Route in each direction. In this Route the road length of nearly 5 kilometers which runs on NH-5 Chennai to Kolkatta.This route has many Intersections like 4 junctioned , 3 junctioned .

5.2.1 Bike Journey Time

The Bike Journey Time was calculated along this route for 3 days with 8 trips per day during peak hours. The maximum speed was maintained at 40kmph along the route for calculating the journey time as shown in the Figure 4. Travel time it is the time excluding all the stopping time due to traffic signals etc.

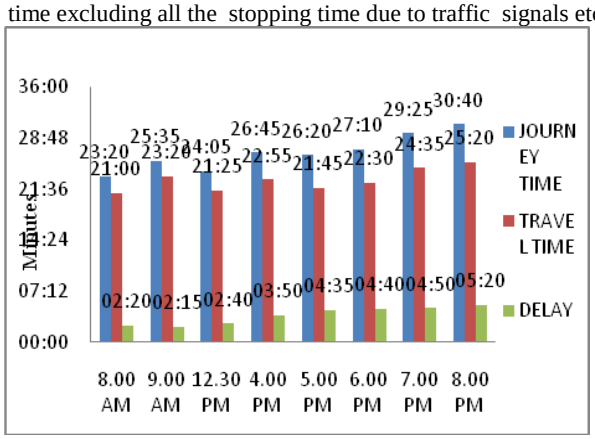

Figure 4: Bike journey time from Pnbs to Nidamanuru day

From figure 4, the maximum journey time is observed in the evening peak hour timings & the maximum travel time is nearly 25:20 minutes at 8 PM .

5.2.2 Bus Journey Time

The Bus Journey Time was calculated along this route for 7 days with 8 trips per day during peak hours as shown in the Figure 5. Travel time it is the time excluding all the stopping time at each bus stop for passengers getting in and out ,and also due to traffic signals etc. The enumerators travelled in the bus from starting point Pnbs to destination point Nidamanuru and noted the journey time, travel time, delay at each stop, number of persons getting in & out .

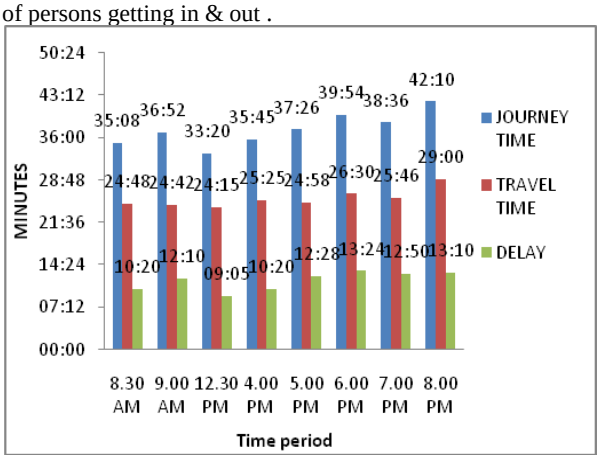

Figure 5: Bus journey time from Pnbs to Nidamanuru

From figure 5, the maximum journey time is observed in the evening peak hour timings & the maximum journey time is nearly 42:10 minutes at 8 PM.The journey time is minimum at the afternoon it is 33:20 minuttes at 12:30PM.

6. Bus Stop Location

The location and physical configuration of transit stops has a large impact on transit speed. Transit travel times can be improved significantly by relocating stops to places with better traffic conditions (for example, to the near or far side of an intersection, as appropriate). The stops physical configuration matters because pulling into and out of a bus stop can take a significant amount of time particularly on busy streets. Finally eliminating stops reduces travel time but it leads to accessibility, so this must be carefully evaluated however, many transit routes probably have more stops than really necessary as shown in the Table 4 and 5 for both the routes.

Naturally Bus stops should be located close to the origins and destinations of users. Often the best locations for Bus stops are near pedestrian crossing facilities such as intersections. This provides passengers with the ability to easily continue their journey on sidewalks or on connecting Bus services [9]. The pedestrian safety is the most important parameter to consider in locating the bus stop which leads to the shortest path street crossing may not be protected. Driver and prospective passengers are clearly visible to each other

- Where there is adequate footway width
- Away from sites likely to be obstructed
- Close to pedestrian crossings
- Where there is space for shelter
- Sites to minimize walking distance between interchange stops
- Close to main junctions without affecting road safety or junction operation

Generally there are Three types of Bus stop Locations .

1) Mid block - stop is located between intersections.
2) Near side - stop is located just before intersection.
3) Far side - stop is located just after intersection.

Table 4: Facilities at bus stops from Pnbs to Poranki

Bus stop Name	Route map & Time Board	Bus stop shelter	Real time info	Kerb Ht.	Bay Length	Station placement distance	Seat no	Railing
PNBS	Yes	Yes	Yes	15cms	6m	No	18	Yes
Bandar Locks	Yes	Yes	Yes	30cm	6m	10m	No	No
Raghavayya park	Only timing board	No	No	No	No	20m	No	No
Collector office	Yes	Yes	Yes	45cm	12m	10m	15	No
Pwd grounds	Yes	Yes	Yes	15cm	18m	20m	25	Yes
Radio station	Yes	Yes	Yes	45cm	8m	25m	12	Yes
Veterinary hospital	Yes	Yes	Yes		6m	10m	12	Yes
Pvp	Yes	Yes	Yes	10cm	15m	10m	30	No
Kandari	No	No	No	No	No	No	No	No
Benz circle	Yes	Yes	Yes	No	12m	10m	16	Yes
Eenadu	No	No	No	No	No	10m	No	No
Ntr circle	No	No	No	No	No	5m	No	No
Patamata	Yes	No	No	No	No	No`	No	No
High school road	Yes	Yes	No	No	6m	5m	10	No
Auto nagar gate	Yes	Yes	No	15cms	5m	6m	10	No
Auto nagar terminal	Yes	Yes	Yes	No	15m	No	25	No
Siris	No	No	No	No	No	No	N0	No
Time hospital	Tes	No	No	No	No	No	No	No
Papula mill	No	No	No	No	No	No	No	No
Kamaya Thopu	Yes	Yes	No	No	4m	No(10m)	No	No
Vrsec	Yes	Yes	Yes	10cm	6m	Yes	No	No
Tadigadapa	Yes	No	No	No	No	Yes	No	No
Poranki center	Yes	No	No	No	No	Yes	No	No
Poranki	Yes	Yes	Yes	No	6m	Yes	30	No

Table 5: Facilities at bus stops from Pnbs to Nidamanuru

Bus stop name	Route map & timing board	Bus stop shelter	Real time information system	Kerb height	Bus bay length	Station placement distance from intersection	Seating in number	Railing faciility
Pnbs	Yes	Yes	Yes	15cms	6m	No		Yes
Old bus stand	No	No	No	No	No	No	No	No
Challapalli bungalow	No	Yes	No	15cms	6m	20m	8	No
Lenin centre	Yes	Yes	Yes	10cm	10m	Yes	12	No
Vijaya talkies	Yes	Yes	Yes	15cms	6m	10m	8	No
Kotha vanthena	Yes	Yes	No	15cms	6m	20m	8	Yes
Bsnl	Yes	Yes	No	10cm	6m	25m	12	No
Maruthi nagar	Yes	Yes	No	15cms	6m	10m	8	No
Srr college	Yes	Yes	No	5cms	6m	50m	8	Yes
Machavaram temple	Yes	Yes	No	No	6m	Yes	8	Yes
Machavaram down	No	No	No	No	No	No	No	No
Gunadala church	Yes	Yes	Yes	20cm	8m	Yes	12	Yes
Gunadala center	No	No	No	No	No	No	No	No
Gunadala vanthena	Yes	No	No	No	No	No`	No	No
ESI	Yes	Yes	Yes	15cms	10m	Yes	12	Yes
Power office	Yes	Yes	No	5cm	10m	6m	12	No
Ring	Yes	Yes	Yes	10cm	15m	Yes	16	Yes
Ramavarapadu	No	No	No	No	No	No	N0	No
Prasadam padu	No	No	No	No	No	No	No	No
Prasadampadu center	Yes	Yes	No	10cm	6m	No	10	No
Srk college	No	No	No	No	No	No(10m)	No	No
Enekepadu	No	No	No	No	No	No	No	No
Ramanagar	Yes	Yes	No	10cm	4m	No	6	No
Nh5 c/s road	No	No	No	No	No	Yes	No	No
Nidamanuru	Yes	Yes	Yes	No	6m	Yes	10	No

On the present Urban Bus Public transportation system a stated public feedback survey was conducted from more than 1000 people at 8 locations spread all over the city of Vijayawada on major nodes or hubs of transportation activities mainly to understand the reason for not using public transport system and also to identify the requirements at which they will ready to shift their mode [10]. The study also concentrated on utilization of Google forms for collection of public feedback survey. It is presented in the following web link –
https://goo.gl/forms/zowFkHgDHI3lOLjN2

7. Conclusions

This study identifies the issues like inefficient operation of existing bus system in Vijayawada city and also identifies some solutions for improvement in performance of the urban bus system. By referring different literature papers it is identified that some parameters for evaluation of the present Public transport system and the parameters like travel time, travel cost, real time information, facilities at bus stops. The study also concentrated on travel time survey in the selected routes and compared the difference between the modes. The study identified the reasons for inefficient working of the public transport. With increase in private vehicles all the city roads are constrained with the increased traffic conditions this is because of poor Public transport ridership.

The reasons for poor Public transport ridership are because of more travel time, accessibility, comfort conditions, fares system & convenience. The feedback from public was taken on present Public transport conditions and got some suggestions for improvement of present Public transport system. The solutions for improvement present public transport ridership is minimisation of journey time, increasing service frequency during peak hours to reduce wait times and vehicle crowding, improving the facilities at bus stops by providing the seating the arrangements, display boards, route maps. By improving the Public transport by Intelligent transport system which was used in Mysore city transportation which was very successful and improved the conditions for the public. The shift from private to public transportation can have numerous advantages as Ensures safety eases, Traffic Congestion will be reduced, Improves Air quality, Reduces Energy Consumption.

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