Study of Economical & Social Impact of BRTS & Feeder System on Aundh Ravet Road

Mr.Pradip D.Shinkar[1], Prof.MrsS.V.Pataskar[2]
[1]Dept of Civil Engineering
[2]Professor, Dept of Civil Engineering
[1, 2] D.Y Patil College of Engineering, Akurdi, Pune -411035, Maharashtra, India

Abstract- *BRTS (Bus Rapid Transit System) is the new upcoming transportation system in Pune. But BRT can only be successful if it is time saving and cost saving to the people using it. In the Vehicle Routing Problem (VRP) a fleet of vehicles with limited capacity has to be routed in order to visit a set of customers at a minimum cost. Feeder System is one of the major part of BRTS. Without a proper feeder the BRT is not going to be a successful one. A feeder should be such that it becomes time and money saver for the passengers using it. Feeder can operate the exclusive rights of ways, quieter and cleaner vehicles, rapid off board fare collection correct and attractive infrastructure and short dwell time. In a particular area there may be more than one feeder routes, but we need to choose the best route so that maximum people in that area can use the feeder with minimum cost and maximum comfort. This Paper investigates the application of real survey at Aundh Ravet road. The area surrounding the Aundh Ravet road is taken in to consideration. The area is provided with the best feeder route and the calculation is done with comparing the cost incurred with own vehicle Vs Feeder and BRTS. The study of economy and social impact of BRTS in comparison with conventional transport system. The result shows that the Feeder and BRTS option is more economical then using private vehicle.*

Keywords- To facilitate the people using BRTS ,Save Time, Save Money, Control the Pollution level

I. INTRODUCTION

Road traffic conditions in India are getting worse day by day. About 65% of freight and 80% passenger traffic is carried by the roads. The average number of vehicles in India is growing at the annual rate of 10.16% since last five years. Spending hours in traffic jam has become part of metropolitan life style, leading to health and environmental hazards. Unpredictable travel-time delays in Indian road networks due to traffic problems like congestion, road- accidents etc., are becoming a serious concern.Bus Rapid Transit has been seen as a creative, emerging public transit solution which can be cost effective in addressing urban congestion. The development of new BRTS in Pune has been promoted as cost effective means of providing quality service for the City. In many Indian developing cities transportation development is too rapid and uncontrolled, causing various problems to the environment and human welfare. Many developing cities in India therefore have considered a sustainable and ecologically friendly transport mode as one of the most important issues, including low emissions, fewer traffic accidents and less congestion. Transportation projects encounter many hindrances during implementation and huge investment also. In identifying the projects for implementation it is essential to examine the technical, economical and social viability and is also required to justify importance of investment in the project in terms of need as well as benefit to the people using it. This dissertation studied the economic and social impact of the BRTS and feeder against Own vehicle used.

In the Vehicle Routing Problem (VRP) a fleet of vehicles with limited capacity has to be routed in order to visit a set of customers at a minimum cost (generally the total travel time). In the static VRP all the orders are known a priori. Dynamic Vehicle Routing Problems (DVRP), sometimes referred to as Online Vehicle Routing Problems, have recently arisen thanks to the advances in communication and information technologies that allow information to be obtained and processed in real time. In this case, some of the orders are known in advance before the start of the working day, but as the day progresses, new orders arrive and the system has to incorporate the min to an evolving schedule. The existence of a communication system between the dispatcher and the drivers is assumed. The dispatcher can periodically communicate to the drivers the new visits assigned to them. In this way, during the day, each driver always has knowledge about the next customers assigned to her/him.

II. OBJECTIVE

1. To Analysis the feeder distance to destination
2. To Analysis the area covered by the feeder
3. To Study the feeder route and find the best feeder route
4. To comparison between own vehicle and BRTS
5. To Study of economy and social impact of BRTS in comparison with conventional transportation system.

III. LITERATURE REVIEW ON BRTS

Koichi Mera (1970) this paper is a product of the continuing investigation of the Economics of Urbanization Division into methods for approaching urban development and, in particular, for appraising urban projects. After previous works on the interrelationship between land use and transportation are examined, an urban transport study method is proposed. On the project analysis level, the quantification of benefits is discussed.

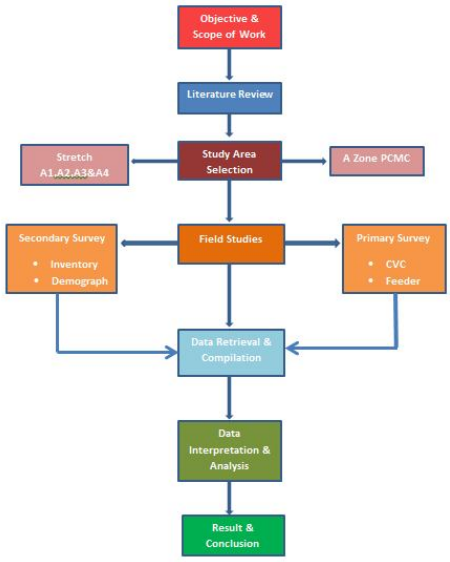
Professor Graham Currie (2006) this paper presents a review of Bus Rapid Transit (BRT) systems in Australasia. It describes the major systems operating in Adelaide, Brisbane and Sydney, outlining their infrastructure, operations and development characteristics. The performance of these systems in terms of patronage, markets, operations and overall urban development impacts is described. Lessons learned in their implementation and operation is also reviewed. The paper concludes with an outline of future prospects for BRT development in Australasia and a discussion of the major findings of this review.

Rathore Kanishka Raj, Dhawankar Aditi and Gungun (2012) EIA includes assessing the present status of air, water, land, noise, biological and socio-economic components of environment based on secondary data collected from various respective departments. Centrally located, Bhopal, capital city of Madhya Pradesh, is located on a hilly terrain within the Malwa Plateau. With an estimated population of 25 lakhs for the year 2011, it mainly relies on public transport with 48% share of passenger trips; this includes standard buses, mini buses and tempos (magic). Bus rapid transit (BRT) is a high-quality, high-capacity bus service that travels on exclusive lanes along designated routes, often compared with the speediness and comforts of a streetcar. BRT buses reducing travel time by 15 to 30 percent and with proper passenger facilities will surely revolutionize the public transport in Bhopal. While, time saving benefits, fuel savings, reduction in air pollution and in traffic congestion and noise and vibration reduction fall under the positive impacts, there are some negative impacts on environmental components of this project; which can be seen on three stages: the Design Stage, construction stage and operational stage. This paper predicts possible impacts on different component of environment during different phases of BRTS Bhopal and suggests possible mitigation measures for prevention as well as reduction.

M. Shafiq-Ur Rahmana, Paul Timmsb, Francis Montgomeryb (2012) Rickshaws are 'green vehicles' and might be able to act as feeder services to public transport if planned properly. Many cities have implemented BRT systems, while others are planning to do so. Several modern BRT systems (i.e. Bogota, Guangzhou) have modal integration with bicycles; however, there is no BRT system in the world yet which demonstrates integration with rickshaws. With the case study of Dhaka City, the research explores: if rickshaws can act as a feeder service to BRT systems; what type of BRT station design would best support such an arrangement; whether fare integration between rickshaws and BRT systems is possible. A total of 11 focus group discussions (FGDs) of different stakeholders and 25 interviews of the key informants were conducted. The outcome of research could be helpful for other cities having rickshaws that have (or are planning for) BRT systems.

I. A. Farhat (2013) The problem of optimal planning of multiple sources of distributed generation (DG) in distribution networks is treated in this paper using an improved Ant Colony Optimization algorithm (ACO). This objective of this problem is to determine the DG optimal size and location that in order to minimize the network real power losses. Considering the multiple sources of DG, both size and location are simultaneously optimized in a single run of the proposed ACO algorithm. The various practical constraints of the problem are taken into consideration by the problem formulation and the algorithm implementation. A radial power flow algorithm for distribution networks is adopted and applied to satisfy these constraints. To validate the proposed technique and demonstrate its effectiveness, the well-know 69-bus feeder standard test system is employed.

IV.METHODOLOGY



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Methodology Flow Chart

V. STUDY STRETCH DETAILS

The corridor considered in the analysis is located in the Pimpri Chinchwad metropolitan area along Aundh Ravet road, A1-Ashosk Nagar to Aundh Ravetroad,A2-Mangal Nagar to Aundh Ravet road, A3-Padwal Nagar to Aundh Ravet Road & A4- Sambhaji Nagar to Aundh Ravet road radial corridor of Pimpri chinchwad.

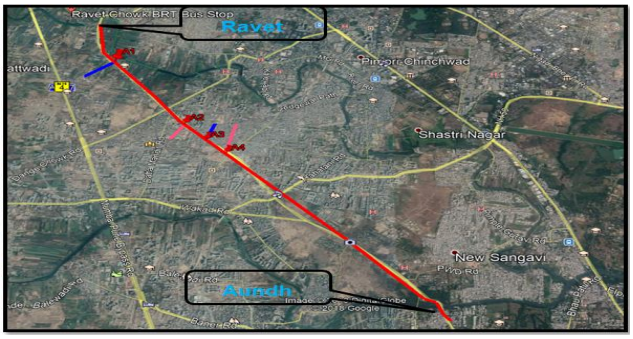

Figure 2: Study Stretch Details

Table 1: Detail Study Segments

Segments	Length (m)
A1	700
A2	500
A3	500
A4	850

VI. STUDY ANALYSIS AND RESULTS

The below table shows the different values of walking time based on percentile values. The 25th percentile value is 2 minutes while that of 50th and 75th percentile values are 3 minutes and 4 minutes respectively

Table 2: Percentile of walking time

Percentile	Walking Time(min.)
$_{25}$th	2
50th	3
$_{75}$th	4

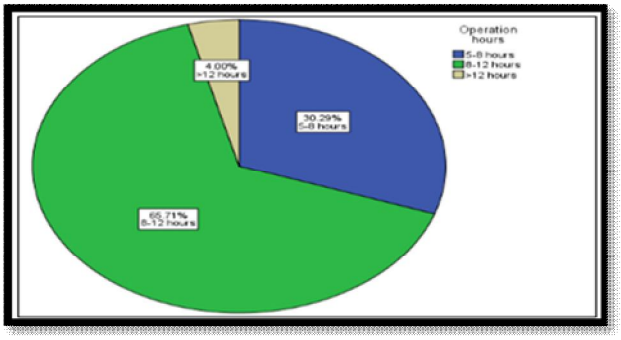

Figure 3: Operation Hours of paratransit operator

This above pie chart shows the percentagewise distribution of the operation hours of paratransit operator throughout the day and night. The maximum i.e. 66% operators work 8-12 hours per day. Only 4% operators work more than 12 hours per day.

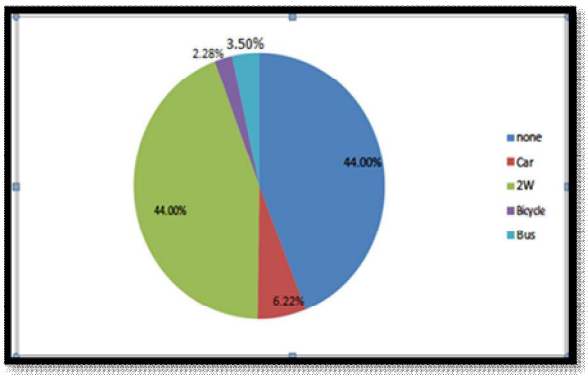

Figure4: Mode wise classification of paratransit passengers

The above pie chart shows the mode wise distribution of the passengers of paratransit. In case when the paratransit passengers are making trips by mode other than paratransit, then pie chart shows that maximum percentage share is of two wheeler. However, the minimum share is of city bus. Following table shows the value of various operational parameters

The dedicated parking is the another issue discussed with the paratransit operator and the provision of dedicated parking gives the following result:

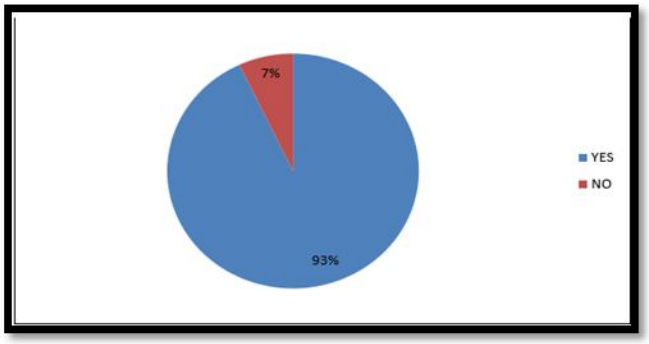

Figure5: Dedicated Parking

93% respondents say yes to dedicated parking and 7% respondents say no to dedicated parking.

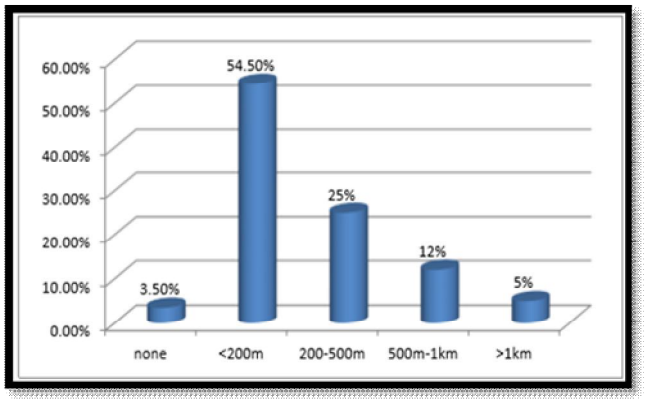

Figure 6: Paratransit User Walking Distance

The above bar diagram shows the frequency distribution of the paratransit users walking (access) distance to the present paratransit service from their trip origin. The none category indicates those respondents who have never used paratransit

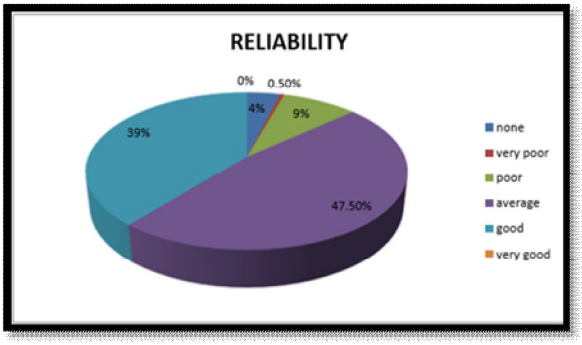

Figure 7: Paratransit Reliability

The schedule reliability of paratransit service is measured on a scale of 1 to 5 where 1 is very poor,2 is poor,3 is average, 4 is good and 5 is very good. Maximum percent (47.5%) of respondents replied that the reliability is average. 39% respondents said that the reliability is good whereas 0.5% replies fall in the very poor reliability category.

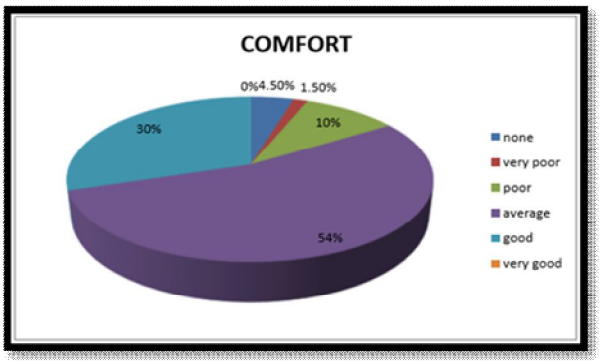

Figure 8: Paratransit Comfort

The above pie chart shows the distribution of paratransit service comfort among different comfort attributes viz. very poor, poor, average, good and very good. Maximum (54%) respondents said the paratransit comfort as average whereas 30% respondents said the comfort level as good while 1.5% respondents like the comfort as very poor.

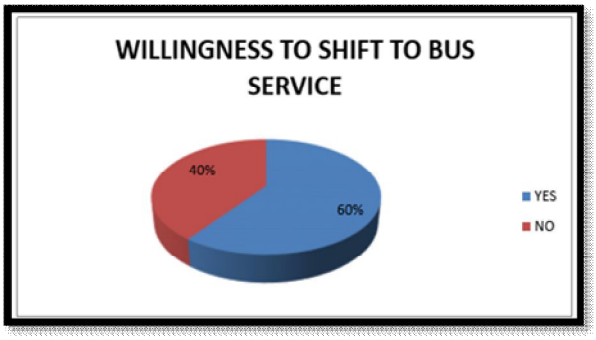

Figure9: Willingness to Shift to Bus service using Paratransit as Feeder

The very important factor regarding the perception of passengers of paratransit to shift to city bus service using paratransit as a feeder is captured in the above pie diagram. 60% respondents show a willingness to shift to bus service using paratransit as a feeder whereas remaining 40% respondents are unwilling to shift to bus service using paratransit as a feeder.

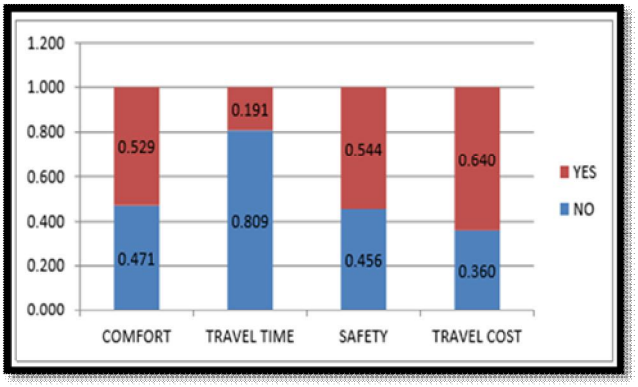

Figure 10:Proportion of Different Factors of Paratransit Service as a Feeder

The histogram shows the proportion of different factors regarding paratransit service as a feeder. The different factors are comfort, travel time, safety and travel cost. The above factors are asked only after the respondents say yes for the willingness to shift to bus service using paratransit as a feeder. Out of the 60% respondents showing willingness to shift to bus service using paratransit as a feeder, the reason(s) to choose paratransit as a feeder has various factors mentioned above. Maximum respondents (64%) choose travel cost, 54% choose safety and security, 52% respondents choose comfort whereas 19% respondents choose paratransit as a feeder due to travel time.

The following pie chart shows the percentage of respondents (who are willing to shift to bus service using paratransit as a feeder) that like to pay the bus travel fare in comparison with that of paratransit.

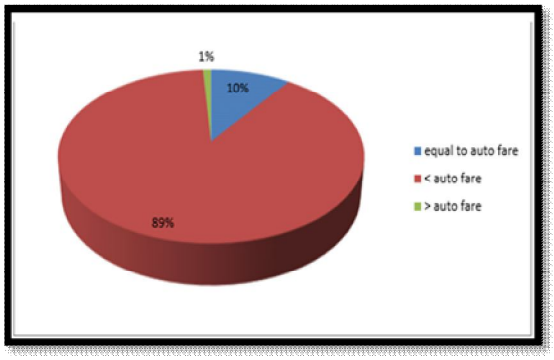

Figure 11: Fare per Trip

It is seen that 89% respondents like to pay the bus fare as lesser than the paratransit travel fare whereas only 1% respondents like to pay bus fare more than that of paratransit while 10% would like to pay equal to that of paratransit.

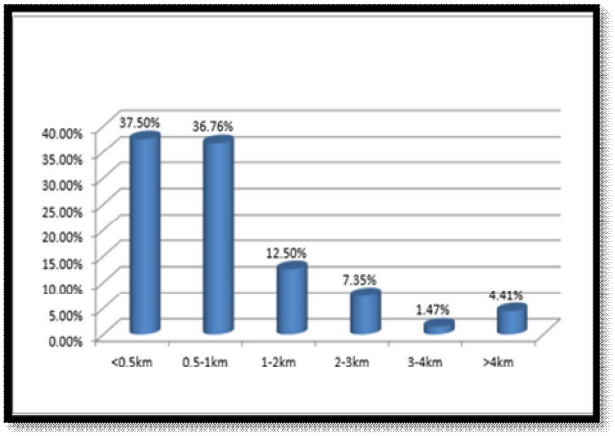

Figure 12: Access Distance to Bus Service Using Paratransit as Feeder

The above histogram shows a very important frequency distribution of access distance to bus service using paratransit as a feeder. It is seen that maximum percentage of respondents(37.5%) like to access at a distance less than or equal to 500m and 36% users like to access from 500m-1km. Therefore within the access distance of 0-1km, about 74% respondents like to use paratransit as a feeder. This is a very important statistic from further analysis point of view.

Traffic data is collected at Aundh Ravet road, A1-Ashosk Nagar to Aundh Ravetroad,A2-Mangal Nagar to Aundh Ravet road, A3-Padwal Nagar to Aundh Ravet Road & A4- Sambhaji Nagar to Aundh Ravet road is selected and the traffic data is taken manually.

Table 3: Occupancy detail

Occupancy Details								
Fast / Power Driven Vehicle								
	Cars\ jeeps\ taxies\ vans	Lcv (light commercial vehicles e.g. Mini truck)	Bus / mini bus	Two axle truck/tanker	Multi axle truck trailer/tanker	Three wheeler (auto rickshaw)	Two wheeler (motor cycle/ scooters etc.)	Cycle/ cycle rickshaw/ other human powered
Avg. no of people per vehicle	3	3	35	2	2	3	1.5	1
Fuel required for 1 hour delay period in litre	1	1	1.5	1.5	1.5	0.63	0.2	7.33

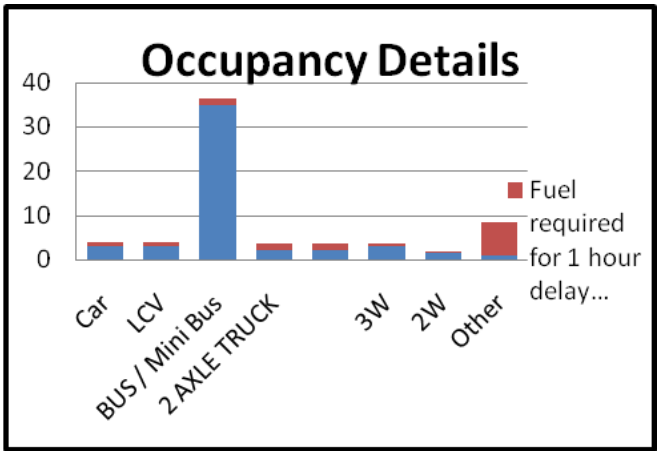

Figure 13: Occupancy Details

As told before the area is divided into 4 parts A1, A2, A3, and A4. The population calculation is done on the basis that per 10000 sqm there are 250 houses and each house occupies 5 members. So the total count is 250X5=1250

Table 4: General detail

Total Count	1250.00					
Population Density	**750.00**	**Per**	**10000.00**	**Sqm**		
Area name	**In Percentage**		**Total Area**	**Area for feeder System**	**Population under feeder system**	**Population Under Bus System**
For A-1	25.00	%	1090927.28	818195.46	61364.66	81819.55
For A-2	15.00	%	1540115.58	1309098.24	98182.37	115508.67
For A-3	15.00	%	724011.94	615410.15	46155.76	54300.90
For A-4	15.00	%	1430066.39	1215556.43	91166.73	107254.98

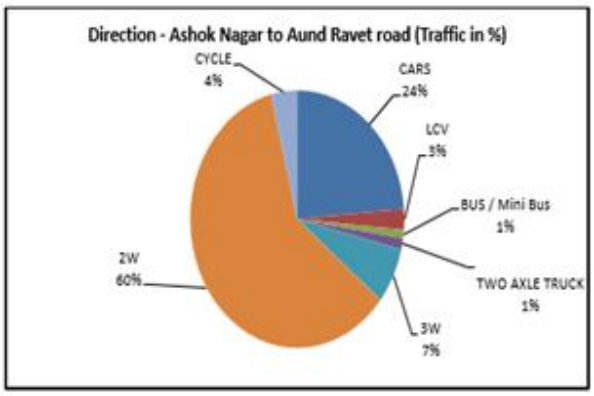

Figure14: Ashok Nagar to AundRavet road (Traffic in %)

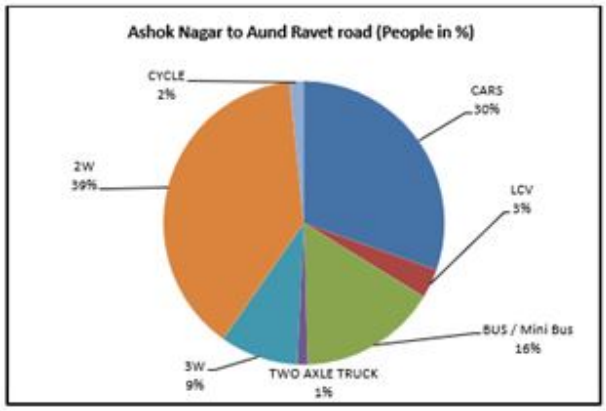

Figure 15: Ashok Nagar to AundRavet road (People in %)

The most important and vital role playing parameter in Economical and social impact study is traffic data. Now traffic data along each network is essential to do technical as well as economic analysis. For this project traffic data along existing routes is taken as actual. This study is done with analysis of delay in signal time i.e. 8 AM to 8PM.

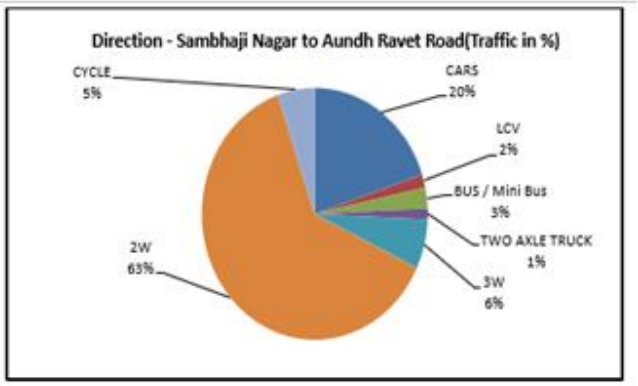

Figure16: Ashok Nagar to AundRavet road (Traffic in %)

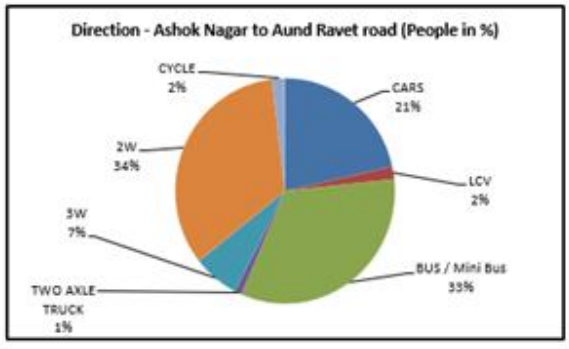

Figure17: Ashok Nagar to AundRavet road (People in %)

Total Up and down traffic

Table5: Total Traffic Calculation of Up & Down

Fast / power driven vehicles							Slow vehicles	Total traffic count
Period	Cars\ jeeps\ taxies\ vans	LCV (light commercial vehicles eg. Mini truck)	Bus / mini bus	Two axle truck/ tanker	Three wheeler (auto rickshaw)	Two wheeler (motor cycle/ scooters etc.)	Cycle/ cycle rickshaw/other human powered	
	Nos	Nos	Nos	Nos	Nos	Nos	Nos	Nos/Hr
	25431	16970	0.00	1668	20206	42759	140008	

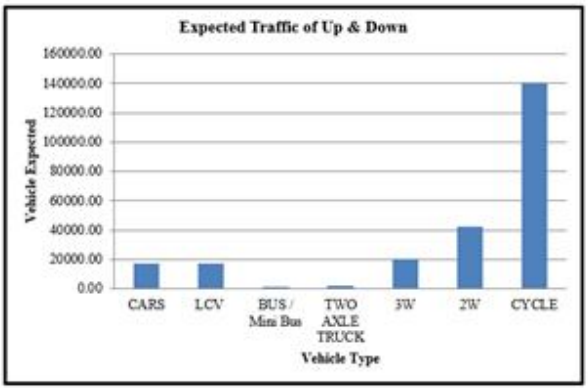

Figure 18: Expected Total Traffic of Route Up & Down

Cost loss with reference to Time, Fuel, Fare, Air & VOC

With the construction of planned road infrastructure project, the main benefits to the road users will be:

a) Savings in time due to decrease in conjunction.
b) Savings in fuel of the vehicles due to decrease in conjunction.
c) Saving in Commodity Holding Cost [CHC]:
d) Saving in Economic cost of pollution:
e) Saving in Vehicular operating cost[VOC]

Finally the result comes and shows that the Alternative-1 (Private Vehicle) is costlier then Alternative -2 (Public Vehicle). So using of public vehicle is more economical than private vehicle. Nation will gain profit if people use the BRTS and Feeder than Private vehicle.

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	Cost loss with reference to									
	Time Loss		Fuel Loss		Fare Collection		Air Pollution		VOC	
Alternative-1	281106.97	Rs./ day	13692 5.03	Cost of fuel in Lacs required for delay period due to conjunction for 1 year Rs. in lac	0.00	Money gain through fare in BRTS System	1864 70.86	Medical cost because of pollution per day in this case in Rs.	193781 9.49	VOC in Alt-1 per day in Rs
Alternative-2	562213.93	Rs./ day	10676 9.25		402105 4.73		1455 81.62		230310 1.61	VOC in Alt-2 per day in Rs

Now if we add all the component of alternative -1 it will be Rs 2542322.34 where as for alternative -2 will give a result of Rs -905388.33. The difference of these two alternatives will give a positive result which is Rs1636934.01. This indicates that the output of using public vehicle is profitable.

VII. CONCLUSION

1. BRTS and Feeder transport can be economical than private vehicle.
2. The whole area is divided into 4 areas A1, A2, A3, and A4. Alt A1, A2 Best Feeder route.
3. If people use BRT and feeder it not only saves their own but also saves nation wise.
4. Pollution level can be controlled.
5. Feeder and BRT can generate job opportunity for local people
6. we provide proper feeder to the BRT user then only people will use the BRT System and BRTS will be a successful one.

REFERENCES

[1] Reddy T.S., Velmurugan S., Madhu E., Ramalingaiah, Updation of Road User Cost and Revised Software for Evaluation of Highway Projects, Vol. I & II, Paper no-493, CRRI, New Delhi, 2003.
[2] B. Maitra, M. Azmi, N. Kumar and J. R. Sarkar, Modeling Traffic Impact of Flyover at an Urban Intersection Under Mixed Traffic Environment, European Transport \ TrasportiEuropei n. 27 (2004): 57-68.
[3] NantaratTangvitoontham, PapussonChaiwat, Economic Feasibility Evaluation of Government Investment Project by Using CostBenefit Analysis: A Case Study of Domestic Port Port A), Laem-Chabang Port, Chonburi Province, Procedia Economics and Finance 2 (2012) 307 – 314, 2012

[4] S.P. Banwait (Adg, C.P.W.D. (Retd.), New Delhi), S.S. Mondal (Member (Water), Delhi Jal Board, Arunalyay, New Delhi-110005) & Rajeev Singhal(Executive Engineer, Amritsar Central Division, C.P.W.D., Amritsar (Punjab)), Construction Of Grade Separators At The Intersection Of Ring Road And AurobindoMarg, New Delhi – A Success Story, Paper No. 504.
[5] Ant Colony system for a dynamic vehicle routing Problem by R.Montemanni, A.V.Donati.
[6] Geoffrey Kingston, Cost Benefit Analysis in Theory and Practice, The Australian Economic Review, vol. 34, no. 4, pp. 478–87, December 2001.
[7] Ant colony optimisation for optimal distributed generation in distribution system by I.A.Farhat.
[8] An overview on Bus Rapid Transit System by Agarwal P K, Sharma Anupama, Singh A.P.
[9] Bus Rapid Transit in Australasia performance, Lessons Learned and Futures by Professor Graham Currie , Monash University
[10] Bus Rapid Transit System: An effective and economical way to reduce urban air pollution By Prof Mrs. SnehalPopli& Prof Bhaumik Shah