



Feasibility of Personal rapid transit system for connecting Sardar Vallabhbhai Patel international airport to Kalupur railway station in Ahmedabad

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Abstract — An ever-increasing growth in the urban areas has put up a new challenge in the domain of urban transportation. The complexity of the problem is enhanced by the limitations in the option available, space available, their inter-relationships and also the ease with which these options serve to cater to the present requirements. Meanwhile as the world is becoming smaller and smaller, the urgency to communicate, travel and transport faster is growing by leaps and bounds. Technology on one hand is acting as a catalyst in this process and on the other hand is providing with solutions to cater to this process. Urban transportation with all its complexities and challenges has attracted the interest of planners and engineers to seek solutions. One such solution is PRT (i.e. Personal Rapid Transit) which has proved promising as a solution to the problem stated above. This Study PRTS which is development in technology and prospect in developing nation like India provide feasibility to city like Ahmadabad

Keywords: P.R.T .System, , Pod taxes, Public Transport Accessibility Level, Ahmedabad

I. INTRODUCTION

The Advanced Transit Association (ATRA) convened a Technical Committee on Personal Rapid Transit (PRT) in late winter 1987. Its assignment was to revisit PRT and update public Knowledge about it by:

- Assessing the feasibility and developmental status of the transportation technology called Personal Rapid Transit (PRT);
- Presenting findings and conclusions as to whether PRT can someday provide economical and high quality transit service in urban areas, especially where today's transit technology is often not capable of offering service economically; that is, in locations where residential or job populations range from medium to low density.



The defining characteristic of a PRT system is a small-sized driverless vehicle that operates on demand. A PRT system aspires to combine the on-demand and private space advantages of a personal car with the convenience and efficiency of a transit system. PRT operating models can span the spectrum from a purely public system with stations, to car sharing pods (a zip car with no driver that picks you up at your door through prior arrangement and delivers you at your destination) to privately owned automatic cars. The PRT vehicles operate at the same level of separation as roads and trams from pedestrians and non-motorized traffic.

The nature and complexity of the software systems had changed significantly in the last 30 years. The previous applications run on single processor and produce fixed output .But with the advancement in the technology application are having the complex user interface and these applications run on the various systems simultaneous like applications which support client server architecture.

Aim of the Study

To Study feasibility of personal rapid transit system connecting Sardar Vallabhbhai Patel international airport via Kalupur railway station and Gita mandir to Paldi.

Objectives

1. To determine the appropriate PRT system Route between S.V.P International Airport via Kalupur railway station and Gita mandir S.T Station to Paldi S.T Station.
2. To collect the road inventory survey details and origin and destination survey detail of the air transport traveler.

3. To conduct SP (Stated Preference) survey for willing to shift & willing to pay for the proposed PRT system
4. To propose a tentative design of PRT system, cabs, guide/carriage way, station, fare collection and to carry out the economic analysis.

Personal rapid transit system

Most mass transit systems move people in groups over scheduled routes. This has inherent inefficiencies. For passengers, time is wasted by waiting for the next vehicle to arrive, indirect routes to their destination, stopping for passengers with other destinations, and often confusing or inconsistent schedules. Slowing and accelerating large weights can undermine public transport's benefit to the environment while slowing other traffic.

Personal rapid transit systems attempt to eliminate these wastes by moving small groups nonstop in automated vehicles on fixed tracks. Passengers can ideally board a pod immediately upon arriving at a station, and can — with a sufficiently extensive network of tracks — take relatively direct routes to their destination without stops. The low weight of PRT's small vehicles allows smaller guide ways and support structures than mass transit systems like PRTs the smaller structures translate into lower construction costs, smaller easements, and less visually obtrusive infrastructure.

II. Literature Review

Srivastav & Nigam et al They had studied significantly remarkable that they had a requirement of an alternative transportation medium that can meet the increasing population trends. The technical specifications of Personal Rapid Transit Systems make it clearly visible that these systems can prove to be an efficient transportation model for lucknow city that too without affecting the environment. They systems can be an effective and strong public mass transit that can function not only as a major means of transportation in dense areas as well as it can be employed as a feeder network for the proposed metro service for the city of lucknow.

Udit Jain and Anupam Vibhuti had studied Personal Rapid Transit is one of the emerging transportation modes and has the potential to provide the last mile connectivity to the users. Introducing a PRT system in an area ensures high levels of accessibility in the area. With the increase in the accessibility levels, a higher usage of public transport and reduction in private modes of transportation can be expected. The case study sectors of Dwarka are served by the Delhi Transport Corporation Buses and Delhi Metro Rail at present. Still the PTALs of study area sectors fall in the range of 1b and 2 which indicate a poor level of accessibility. After the introduction of PRT in Dwarka, significant improvement can be observed in the accessibility levels of the sectors. The PTALs of the study area sectors shoot up to 5 and 6a which indicates excellent levels of accessibility. Thus PRT can be used as a feeder system to the existing public transport systems to provide the last mile connectivity to the users. A multimodal seamless integration of PRT with other public transport modes like MRTS and buses has the potential to meet the urban transport deficit and increase the share of public transport users in the area. The implementation of PRT as a standalone network to serve the transportation needs of an urban area is yet to be explored.

Hargraves & Vandebona had studied The methodology followed in this paper has provided an effective platform for concluding on the feasibility of implementing String Transport Systems for Passenger Rail in New South Wales. Analysis of needs before designing of the route allowed for the most appropriate route to be designed, and with the detailed information of this route, estimated costing could be undertaken. This coupled with skills in civil engineering and project management to undertake the feasibility study, have allowed for a report to be completed, similar to the style of that prepared in industry.

Moradi, Ismail and Rahma et.al. Public transport system for a particular urban area is a system which meets all the social, technical and economical criteria and is in higher position in the ranking tables of three mentioned models. PRT as a choice would be compared to the other conventional systems and its efficiency would be determined according to the results and outputs of social, technical and economical models and it provides a clear picture for public transport planners and decision makers.

Pengjun Zheng & David Jeffery have studied simulation study of traffic management opportunities with an extended Personal Rapid Transit (PRT) network at Heathrow airport. The investigation was based on the Citymobil reference scenario of the Heathrow airport PRT Demonstrator between Terminal 5 and a car park, but modified to allow investigation of a wider area including links to Terminal 1 to 3 and car parks. A predictive demand management strategy was identified to be incorporated in both local vehicle dispatching and wide network operation. The impacts of the proposed management strategy were evaluated using a microscopic PRT simulation model – Hermes which was specially modified for this research by the developer. Simulation results suggested a significant reduction in average waiting time across all stations in the test network as a result of the implementation of the proposed traffic management strategy. Despite the fact that PRT is a demand responsive

service with its operation optimised through a control algorithm, this investigation has shown that the service level can be further improved by incorporating traffic management measures such as demand prediction.

III. RESEARCH METHODOLOGY

This chapter outlines the methodology developed for sustainable transportation for PRT system and how it has been set up for this study. Methodology has divided in three key steps. In first step, methodology including data selection and collection. However, the scope of the dissertation and man power constraints, only the most relevant surveys were conducted like road inventory survey, willingness to pay & shift survey and stated preference survey .in second step, data analysis and model development between existing public transit mode and proposed PRTS mode. In third part selection of techniques to create an economic analysis and develop elementary design of PRTS for selected corridor.

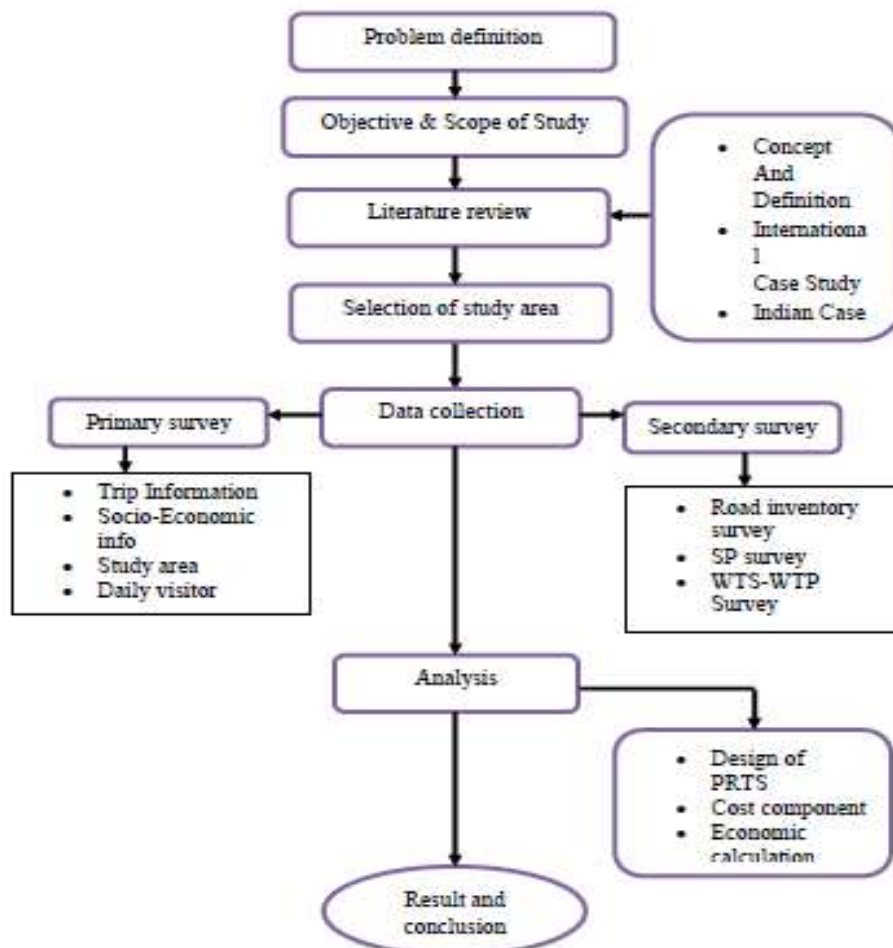


Figure: Methodology Chart

IV. Study area & Data Collection

Due to the rapid urbanization people migrate from rural area to Ahmadabad city. Day by day the traffic condition deteriorates in Ahmadabad city. The study location was taken based on following criteria corresponding to the purpose of study

The study area should have a transit system.

- The study area have more working trips.
- The study areas have maximum commuters flow, especially student flow.
- There should be heavy traffic congestion problem faced by existing transit and transport system.

Ahmadabad is highly urbanized and industrialized city of Gujarat State. Ahmadabad has become the localized attraction for the people due to better job opportunities and living standards. Due to rapid urbanization and increase in the growth of vehicles have resulted in bad conditions and poor mass transit condition in Ahmadabad city area

Willingness to pay/willingness to shift

During the survey, the interviewees were given a general idea of the PRTs and asked whether they would like to adopt such a mode that would be elevated in nature, and hence give them a relief from the congestion they face every day, has advantages such as comfort, safety, reliability, nominal waiting time, public yet personal in nature and quick, without any intermediate stops. People were assured that system would be for the common man, and the cost of travel would be between that of a bus and an auto. People were asked how much they would pay for the same journey by PRT, rather than their usual modal availability. The survey attracted different queries from the people, along with enthusiastic inputs regarding the expectations from a new system that had the potential to address the mobility issues in Ahmadabad. In the Ahmadabad project, questions pertaining to the willingness to shift and willingness to pay surveys were integrated with socio-economic survey

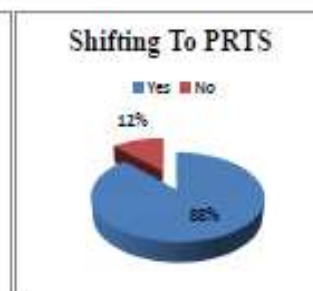
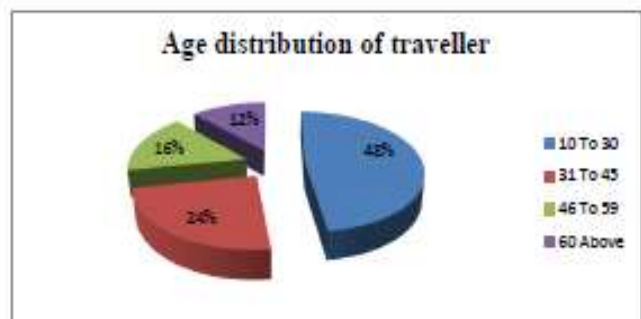
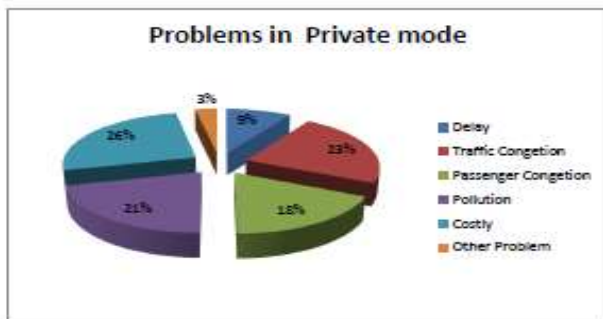
Road inventory survey

Technical feasibility to implement PRTS treatment includes road width, corridor/road length, shoulder width, and nature of bottlenecks. Road inventory survey has been carried out for entire length of selected corridor. In road inventory survey the inventory and physical features like bus stops, intersection, trees, platform etc. Was gathered..

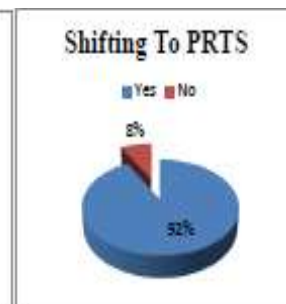
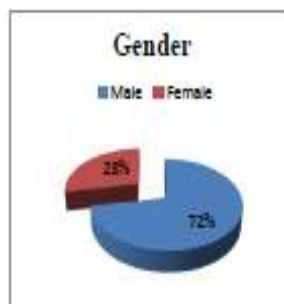
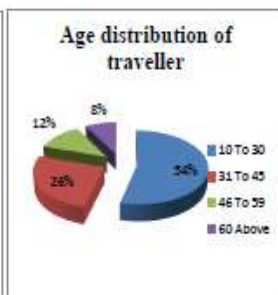
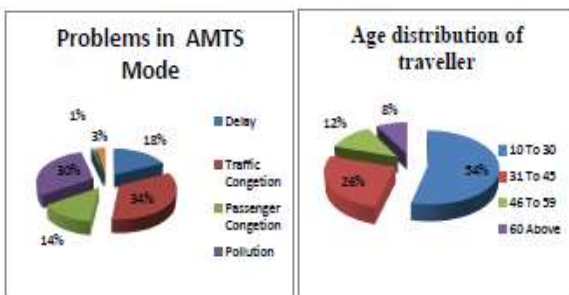
V. Data Analysis

• **Willingness to pay survey analysis**

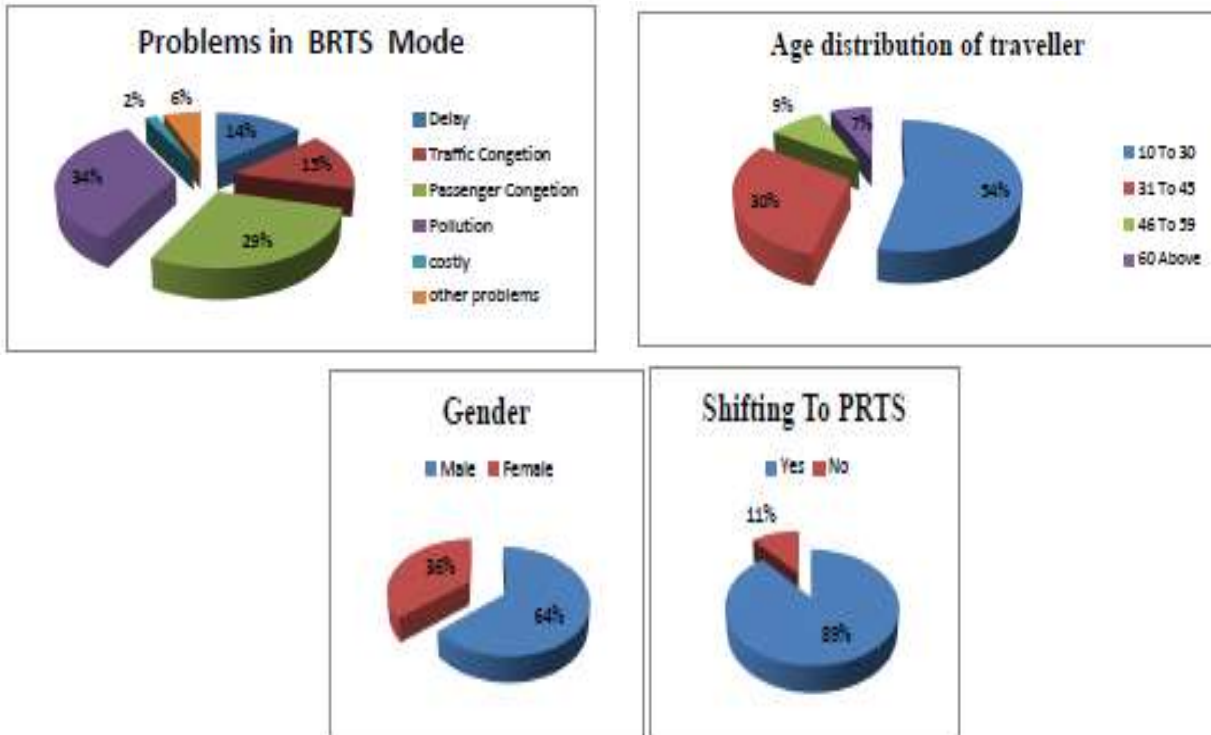
Private Mode



AMTS Mode



BRTS Mode



• **Road Inventory survey analysis**

Table : Road inventory data (Ahmadabad stretch)

Name of corridor	Length of corridor	lane	Right of way	Width of carriage way (Both side)	Shoulder (Both side)
Paladi to Gitamandir ST Stand	3.6 km	6	22.58 m	9 m	1.4 m
Gitamandir ST to Kalupur railway station	2.0 km	6	25.57 m	9 m	1.2 m
Kalupur railway station to Sahibag underpass	3.7 km	6	23.40 m	9 m	1.2 m
Sahibag underpass to S.V.P.I Airport	5.5 km	6	26.6 m	10.4	0.42 m

Table : Travel time and travel cost data from S.V.P.I Airport to Paldi

Paladi to S.V.P.I Airport Travel Stretch	AMTS		BRTS		Private Vehicle		PRTS	
	Travel time (min)	Travel cost (INR)	Travel time (min)	Travel cost (INR)	Travel time (min)	Travel cost (INR)	Travel time (min)	Travel cost (INR)
S.V.P.I Airport to Sahibag underpass	-	-	-	-	10 to 15	80 To 150	7 to 10	10 to 20
Sahibag underpass to Kalupur railway station	13 to 25	5 to 10	-	-	7 to 20	40 To 70	5 to 7	10 to 20
Kalupur railway station to Gitamandir ST bus Station	11 to 20	8 to 20	5 to 30	10 to 15	5 to 20	10 To 30	3 to 4	10 to 20
Gitamandir ST bus Station to Paldi	10 to 15	5 to 10	-	-	5 to 8	10 to 20	4 to 5	10 to 20

• **Economical Evaluation**

Table : Benefits Cost Ratio Method

Year	Benefits	Maintenance cost	Total cost	B - C	Interest Rate 8 % (B-C)/(1+i) ⁿ
0	-	-	765.12	-765.12	-765.12
1	89.68	5.72	5.72	83.96	77.74
2	95.95	6.29	6.29	89.66	77.29
3	102.66	6.91	6.91	95.75	76.6
4	109.84	7.6	7.6	102.24	75.73
5	117.52	8.36	8.36	109.16	75.28
6	125.74	9.19	9.19	116.55	74.71
7	134.54	10.1	10.1	124.44	74.07
8	143.95	11.11	11.11	132.84	73.39
9	154.02	12.22	12.22	141.80	72.71
10	164.80	13.44	13.44	151.36	72.07
11	176.33	14.78	14.78	161.55	71.48
Net present value					55.95 crore

Conclusions

The major results and findings achieved from the study can be pointed out in brief as follows

- The proposed development is well located on S.V.P.I Airport which is main route linking Kalupur railway station along with Gita mandir S.T stand and Paladi. This will allow safe and efficient movement of vehicles between the main road and major road network, and minimize the environmental impact of traffic, on the surrounding areas. Local and national Transport Policy requires new developments that generate large numbers of trips to be accessible by public transport and other sustainable modes.
- These proposals will provide a sustainable development which aims to minimize car journeys and encourage the use of public transport including, in addition to Super tram, improved bus services and provisions to encourage walking and cycling.
- It concludes from Corridor analysis that the complete S.V.P.I Airport to Paladi and the other major corridors as priority are preliminary suitable for PRTS Implementation.
- From Public Transport Survey, it can judged that existing public transport demand along corridor is very much higher than capacity throughout the corridor.
- The Surveys concludes that the route selected is having one of the highest mobility on daily basis. It also serves many regular work trips. The selected corridor is one of the most feasible routes for the Personal Rapid Transportation System. People will adopt the system which is environment friendly, cheap, time saving and comfort level of service.
- Stated Preference and Willingness to pay Survey carried out on existing three mode public transit user. Like GSRTC, PRTS and Private Shuttle in which develop utility function for PRT with Binary Logit Model.
- From the Economic analysis carried out on the corridor the cost and benefit streams for 11 year period in the economic prices have been worked out. The calculated benefit – cost ratio is 1.07, which is greater than 1. Hence the project is economically justified.
- Personal Rapid Transit System is most efficient, faster, safe, reliable, and cost effective and Environment friendly and by the figures which are achieved from the study can make it feasible in year 2040.

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