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Benchmarking of Personal Rapid Transit System (Dynamic Model)

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Abstract

PRT is an efficient rapid transit system which provides the last mile connectivity to the users with a high level of reliability and comfort. There is absence of existing benchmarks for PRT in both India and abroad. Dwarka, New Delhi, in India has been taken as the case study area for carrying out the feasibility study of PRT. Primary and secondary data has been collected for the planning of PRT. The base year trips and logit model outputs have been used for the travel demand estimation.

Different international and Indian case studies have been reviewed to understand the operations and costs associated with PRT systems. A detailed financial analysis has been carried out for the formulation of benchmarks. The analysis results obtained from the dynamic model can be used to predict various parameters including the base year trips for a specified fare to achieve internal rate of return (IRR) of 18\%, which is considered as the optimum IRR for investing in a project.

This dynamic model for benchmarking of PRT systems has been developed using Visual Basic scripting overlay on a standard financial analysis model. The Model works on the inputs of Demand, Operational and Financial Parameters. Each of the seventeen input factors can be tweaked using slider bars in the model to see how a change in any of the variables will impact the financial feasibility of the project. The Model has been validated using the data on PRT studies for Amritsar and Trivandrum. The Model can be used to justify the development of PRT in any other city in India. The Model works on the inputs of Demand, Operational and Financial Parameters.

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1. Introduction

Personal Rapid Transit or PRT is a contemporary form of public transport. It provides a taxi-like demand responsive services for individuals or small groups of travellers (Anderson, 1978 and EDICT Final Report, 2004). It has small automated electric ‘podcars’ which are usually two, four or six passenger vehicles that run on a segregated guide way. PRT is gaining popularity around the world for its uninterrupted (Anderson, 2009), efficient and sustainable journey between origin and destination (Gilbert and Anthony, 2006). It is a lightweight system and it incurs lesser capital cost as compared to other public transport systems (Gilbert and Anthony, 2006). PRT stations are off line stations that ensure non-stop point to point service.

PRT can be introduced in a city or an area in various forms. It works most efficiently in a system of small loops. These loops may be around a mass transit line and PRT may act as a feeder to the mass transit. A feeder system not only provides easy access to the transit users but also induces latent demand to the transit. There have been several studies on integration of feeder modes like bicycle to the transit systems (Castro et al., 2013). PRT can be integrated with the transit directly at the platform level which is not possible with any other mode. PRT can also work as a standalone network to serve the demand in a particular area (Vibhuti, 2009). The stations of a PRT system are usually closely spaced to provide high level of accessibility. It is commonly marketed as a comfortable mode which provides the last mile connectivity to the user with negligible waiting time.

A PRT system is generally conceived as a feeder mode and is not compared to the conventional transit services. Due to absence of any large scale PRT systems in the world, it is difficult for people to imagine a large scale or a city-wide PRT network. Theoretically, in a comparison of line capacity of PRT and other transit modes, PRT has a much higher Passenger-km-per-hour-per-direction (PkmPhPd) capacity (Vibhuti, 2008). Also, the capital cost of constructing a transit service like MRTS is three to five times the capital cost required to build the same length of a PRT system. So, PRT appears to be beneficial in terms of cost as well as capacity, but a large scale implementation of PRT is yet to be seen by the world.

PRT is slowly getting popularity and planning of PRT has started in India. Feasibility studies and detailed project reports have been prepared for PRT systems in Amritsar, Gurgaon and Trivandrum. Some of the critical issues faced while planning a PRT system are travel demand estimation and financial analysis. It is also necessary to develop benchmarks to understand how each of the factors affecting travel demand, operations or financial analysis will have an overall impact on the project. In this study, travel demand assessment has been carried out for the selected case study area. The travel demand has been used to work out the PRT operations and the number of pod cars required to meet the travel demand. Based on the operations and other parameters, a detailed financial analysis has been carried out to assess the viability of the project.

Based on these analysis, a dynamic model has been developed which has been used to develop benchmarks for PRT. The model also assesses the impact of each of the factors used in the analysis, on the operational and financial feasibility of a PRT network. The dynamic model can be used as a quick decision making tool for planning and assessing the viability of a PRT project.

2. Experiences of PRT Systems around the World

The concept of PRT was introduced in 1953 by Don Fichter who conducted a research on alternative transportation methods (Anderson, 1996). An operational PRT system was first introduced in 1975 in West Virginia University in Morgantown, USA (Anderson, 1996). It connects three campuses of West Virginia University. It is also known as Automated Group Rapid Transit system. There is some disagreement whether Morgantown system is a true PRT system or not. This is because it has a capacity to hold 21 person (8 seated & rest standing), which is large in comparison to most PRT concepts. It is also known as Morgantown People mover (MPM). The total length of this system is 13.2 km.

PRT got real momentum only after 2011 when PRT operations began at Heathrow Airport Terminal 5. Since then the world has realized the potentials of PRT system and it is now being considered for public transport planning studies
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