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## PERSONAL RAPID TRANSIT (PRT) SYSTEMS

### **Description:**

Across the United States and in other countries, there is growing interest in developing community-based Personal Rapid Transit (PRT) Systems as an alternative to the use of personal cars and other traditional mass transit methods. Also known as Personal Automated Transport, this innovative option consists of small, pod-like vehicles that transport between two and six passengers at a time. Pods operate on a track built specifically for their use, the system is powered by electricity, and pods are computer-automated with no human drivers or conductors. Tracks can be at ground level, elevated above ground, or located underground; however, the preference is for an elevated track.

The creation of a PRT system enhances a community's ability to be accessible and livable for all residents, including those populations with additional travel needs such as frail older people, people with disabilities, and pregnant mothers. Stations and the pod cars themselves can be made to ADA standards, and the individualized nature of a PRT travel plan will reduce the time spent in transit, as well as the confusion associated with changing lines and locating the correct stops. The individual cars provide privacy and a guaranteed place to sit down. In addition, PRTs will improve the overall environment by reducing traffic congestion and carbon emissions.

Prior to 1964, PRT research occurred independently in small-scale efforts. Following the 1964 passage of the Urban Mass Transportation Act, the federal government began to support comprehensive research and development of PRT systems in the United States. One example was a collaboration between the federal Urban Mass Transportation Administration (UMTA) and the U. S. Department of Housing and Urban Development, which resulted in published studies assessing the viability of PRT. From such research stemmed the Aerospace Corporation research program and the Morgantown PRT system. Between 1968 and 1976 the Aerospace Corporation, a not-for-profit corporation established by the U. S. Air Force to support missile systems development, developed a PRT prototype; however, it did not have sufficient funding to continue development.

The Morgantown System at West Virginia University (WVU) is one of five automated urban "people mover" systems that have been built in the United States since the late 1970s. Others are in Detroit, Michigan; Irving, Texas; Jacksonville, Florida; and Miami, Florida. WVU's system offers the closest example to a functioning PRT system in the United States. It has been in operation for over 30 years and connects the University's various campuses through 8.2 miles of track and 5 stations, with each vehicle carrying eight to 20 people. The WVU PRT receives funding from the Federal Transit Administration and serves approximately 15,000 people a day during the school year.

The Raytheon Corporation and the Chicago Regional Transportation Authority joined together in the largest effort thus far aimed at creating a traditional PRT in the United States. Their PRT design would connect the suburb of Rosemont, Illinois, with the area's main rail transit line. Despite a functioning prototype and favorable projected outcomes, the project was never constructed due to escalating costs.

Currently, Heathrow International Airport in London, England, will open a fully functioning PRT system in the Fall of 2009. When completed, the ULTra design (Urban Light Transit) will provide service throughout the airport with 18 individual pods, which will provide space for up to four travelers and their luggage. The proposed plan will generate no emissions and is 50 per cent more energy-efficient than traditional travel. Masdar, a carbon-neutral city being developed in the United Arab Emirates, will use a hybrid light-rail and PRT system as its form of mass transit. Interest in PRT has been sparked in Germany, Sweden, and Canada, and in as many as 21 different communities around the United States, including Ithaca, New York, where Connect Ithaca, a volunteer community group, convened a conference on Pod Car Systems and applied for a grant to study how such a system could reduce the number of vehicle miles traveled in the City of Ithaca.

Where PRT systems are implemented or being developed, there is no standardized model as to who would own or operate a PRT system; however, a partnership between a developer with the capacity and the technology and the town or city with the zoning, political, and monetary support would be the most ideal. Additionally, although PRT systems were initially conceived as an alternative for urban centers, their successful implementation in defined areas such as airports and college campuses suggest that these systems would be particularly effective in rural villages and towns. Rural systems could create adaptations to include several extensions from town centers to defined destinations in the wider countryside.

A variety of model designs for PRT systems exist, which vary in their propulsion engineering and physical composition; but all are composed of similar, specific elements of design that qualify a transit model as a PRT system:

- Stations are located off-line, meaning that the pod travels from one location to the next directly, without making stops on the line.
- Vehicles are available to consumers 24 hours a day, as needed, with empty pods moving to locations with increased demand.
- To use the PRT, a consumer buys a ticket from an ATM-like machine with their end location identified, inserts the ticket into the pod's slot to open the door, and the vehicle automatically transports the rider to the end location.
- The distance between stations is approximately 500 meters or less.
- The capacity for each line is 1,500-8,000 passengers per hour, each way.

- Individual pods travel throughout the grid of tracks, in response to demand, and are not specifically designated to a specific area or line.

### **Benefits:**

- For older people, people with disabilities, and other users:
  - PRT systems are an excellent personal-use alternative to the automobile for the many community residents who no longer drive or have no access to personal transportation.
  - Pods can be designed or outfitted to meet the standards of the Americans with Disabilities (ADA) Act, as well as additionally designed to include universal design features to further enhance rider usability.
  - Consumers are not restricted to a pre-determined schedule, but can use the system on an “as-needed” basis.
  - The system is available 24 hrs a day, 7 days a week.
  - Because consumers choose where to go and arrive directly, they are freed from having to understand complex schedules or routes, and are not subjected to unknown schedule or route changes.
  - Multiple stations mean less walking and waiting time.
  - Travel time is shorter.
  - Pods are easily kept clean.
  - Consumers can choose to travel alone or in self-determined groups.
  - PRT can be used to transport directly to shopping centers, medical appointments, civic buildings, schools, churches, etc.
- For the wider community:
  - A “mass transit” alternative with “personal transit” characteristics.
  - Reduce the use of personal cars and commercial vans, thus reducing the use of gasoline and reducing carbon emissions.
  - A “green-energy” option—there are no carbon emissions.
  - Smaller-sized vehicles (pods), so less energy use.
  - Ability to travel at higher speeds because of smaller vehicles and no stops.
  - Fewer “human errors” because systems are computer-automated.
  - Can be used to haul freight, mail, supplies, etc.
  - System operates independently of other transit lines and streets, so avoids the congestion of those transit lanes, as well as reduces congestion in those lanes.
  - Pods can be designed to match aesthetically with surrounding buildings.
  - Reduces parking needs, traffic jams, and traffic accidents.

### **Impediments to development and implementation:**

- In the United States, there is not a tested example of a large-scale operating PRT system that can be used for replication or adaptation.
- At this point, start-up and maintenance costs are only forecast because a large-scale system is yet to be implemented.

- Developing a pilot program will take substantial financial support over an extended period of time, a risk many cities and companies are unwilling to take.
- Pilot programs have ended before permanent implementation because of escalating costs.
- There is a lack of awareness of the concept and, therefore, support from the general public.
- Unions and advocates for current mass transit alternatives often oppose PRT systems because of the low number of employees that are employed.
- Currently, only a small number of engineers and researchers are dedicated to developing a PRT system.
- Duplicative research is being done in separate locations because the development is not public.
- Additional costs associated with manipulating already existing architecture have the potential to be substantial.
- PRT may attract vandalism and there is some fear that the pods could be a target for crime.
- The concept of PRT is seen by many as far reaching and without realistic expectations.
- In outlying rural areas (outside of village or town centers), where travel time between stations would be longer, implementation of PRT may not be feasible. The PRT concept was developed as an alternative to address urban traffic problems, with many stations so that travel time is individualized and short. However, creative design adaptations can address issues identified in rural locations.

**Resource—examples:**

- Brief descriptions and many photos:
  - Personal Rapid Transit System, Morgantown, West Virginia, connecting several university campuses:  
<http://web.presby.edu/~jtbell/transit/morgantown/>.
  - Downtown People Mover, Detroit Michigan, urban downtown system:  
<http://web.presby.edu/~jtbell/transit/Detroit/DPM/>.
  - Las Colinas People Mover, Irving Texas, central business district of a planned community:  
<http://web.presby.edu/~jtbell/transit/Irving/>.
  - Metromover, Miami, Florida, serves downtown Miami, with branches north to a shopping center and south to the financial district:  
<http://web.presby.edu/~jtbell/transit/Miami/Metromover/>.

- The Skyway, Jacksonville, Florida, connecting Florida Community College of Jacksonville, Convention Center Station, and the Southbank area across the St. Johns River:  
<http://web.presby.edu/~jtbell/transit/Jacksonville/>.
- ULTra Personal Rapid Transit System, Heathrow Airport, London, England:  
<http://www.ultraglobalprt.com/>.
  - (October 20, 2009), ULTra PRT comprehensive system specifications:  
<http://www.ultraprt.com/uploads/Documents/ULTraDescriptionOct09.pdf>;  
document is large—wait for downloading to complete.
  - Ultra PRT Station Design guidelines:  
[http://www.ultraprt.com/uploads/DesignContest/Station\\_modular\\_design.pdf](http://www.ultraprt.com/uploads/DesignContest/Station_modular_design.pdf).

#### Resource—written and web:

- Ithaca, New York: Grant awarded to Advanced Transport Systems Ltd. in 2009 by the New York State Energy Research and Development Authority (NYSERDA) for a research study, currently underway, of a PRT system for Ithaca, NY. Proposed is a 12-station, 7.7 mi (one-way guide way), Phase I system, which would connect downtown Ithaca to Cornell University and Ithaca College, with a capital cost range of \$58M to \$116M:  
<http://www.ultraprt.com/applications/proposed-systems/ithaca/>.
  - Ithaca PRT feasibility study:  
[http://issuu.com/simplylovelife/docs/final\\_report\\_with\\_endnotes](http://issuu.com/simplylovelife/docs/final_report_with_endnotes).
- Website resource, providing links to PRT information, including overviews, cost comparisons, reports, feasibility studies, PRT publications, and **links to 21 PRT systems** under development in the United States and many foreign countries. Washington University: <http://faculty.washington.edu/jbs/itrans/prtquick.htm>.
- Steve Raney (Cities 21) and Stanley Young (Kansas Department of Transportation) (2005). Paper presented at the Transportation Research Board Annual Meeting, Washington, DC. Describes the Morgantown People Mover Group Rapid Transit System, including history, operating principles, depiction of complex station design and station operations, GIS alignment map, description of moving point synchronous control, three operational modes, as well as demand, schedule, and circulation, with a special emphasis on peak period operations. [http://www.cities21.org/morgantown\\_TRB\\_111504.pdf](http://www.cities21.org/morgantown_TRB_111504.pdf).
  - Information about the Morgantown People Mover GRT system is also available at: (304) 293-5011;  
<http://faculty.washington.edu/jbs/itrans/morg.htm>.
- Alain L. Kornhauser, et al (2004-2005). *Personal Rapid Transit for New Jersey: P.R.T.—The New Mass Transit*. Princeton, NJ: Princeton University.  
<http://www.princeton.edu/~alaink/Orf467F04/NJ%20PRT%20Final%20Small.pdf>
- Bob Dunning, et al (Ian Ford, Editor) (January, 2003). *Personal Automated Transportation: Status and Potential of PRT*. A 36-page publication by the

Advanced Transit Association, an association of international professionals that promotes investigation and development of advanced, cost-effective, service-oriented transit technologies and strategies. Publication includes PRT information on service characteristics, technology details, physical facilities, control systems, and answers to cost, efficiency, and feasibility questions, as well as comparisons of PRT to other transit systems.

<http://innotrans.net/docx/Atra/tech6.pdf>.

- J. E. Anderson (1998). *Personal Rapid Transit: Matching Capacity to Demand*. [http://www.advancedtransit.net/files/PRT-Matching\\_Capacity\\_to\\_Demand.pdf](http://www.advancedtransit.net/files/PRT-Matching_Capacity_to_Demand.pdf).
- BRW, Inc., et al (August, 1997). *City of Sea Tac Personal Rapid Transit Feasibility Project: Technical Appendices*. A 22-page document containing nine Technical Memoranda developed during the analysis and evaluation of transportation alternatives to service the area around the Sea-Tac Airport in Sea Tac, Washington. The 13-member professional project team concluded that PRT was the recommended locally preferred transportation investment strategy. [http://www.advancedtransit.net/files/SeaTac\\_PRT\\_Feasibility\\_Project\\_A\\_Intro\\_small.pdf](http://www.advancedtransit.net/files/SeaTac_PRT_Feasibility_Project_A_Intro_small.pdf).