# Automated People Movers


## What is it?

Automated People Movers (APM) are mass transit systems designed primarily to serve relatively small areas such as airports or theme parks. They come in varying sizes and are guided by various ground based systems. This note concentrates on the smaller 2-6-person systems generally referred to as Personal Rapid Transit (PRT).

PRT systems are designed to move small groups nonstop in automated vehicles. The vision is for passengers to board a pod immediately upon arrival at a station and take a direct route to their destination, without stops.

The low weight of PRT's small vehicles allows small guideways and support structures translating to low construction costs, smaller easements and less visually obtrusive infrastructure.

It is envisaged PRT may:

- Provide future cities "a highly accessible, user-responsive, environmentally friendly transport system which offers a sustainable and economic solution."
- "cover its operating costs, and provide a return which could pay for most, if not all, of its capital costs."
- provide "a level of service which is superior to that available from conventional public transport."
- be "well received by the public, both public transport and car users."

On the flip side, despite the advantages, public authorities will not commit to PRT systems due to the risks associated with being the first public implementation.

## Manufacturers

There are many manufacturers of PRT systems such as:

- Parry People Movers
- ULTra Global PRT
- Boeing
- 2getthere
- Vectus

to name a few.


*Figure 1 Heathrow Airports Carpark Shuttle PRT nicknamed 'Pod'*

## Vehicle Design

When designing a PRT system consideration should be given to:

- Vehicle weight - this influences the size and cost of the system's guideways (a major part of the capital cost)
- Production costs - Larger vehicles are more expensive to produce, require larger and more expensive guideways and use more energy to start and stop.
- Operational speed - Smaller vehicles have more surface area per passenger resulting in high air resistance. This in turn favours larger motors for efficiency.
- Passengers - The number of passengers who will share a vehicle is a key unknown. The average car in most industrialised countries average below two passengers per trip. Not having to share a vehicle with strangers is a key advantage of PRT systems.
- Size of Car – Studies have suggested two passengers per vehicle, or even one to be the optimum. Some designs use a car for a model, and choose larger vehicles, making it possible to accommodate families with small children, riders with bicycles, disabled passengers with wheelchairs, etc.

## Propulsion

Most current designs are powered by electricity. To reduce vehicle weight, power is generally transmitted via lineside conductors rather than using 'on-board' batteries. To achieve a lightweight system, linear induction motors are commonly used on the car which is propelled/braked via a stationary conductive rail. Other designs utilise rotary motors. Battery back-up to reach the next station stop in case of power failure should be considered.

Alternative systems with 'on-board' battery propulsion like 'ULTra' are available. These generally recharge at stops. This method increases safety and reduces the complexity, cost and maintenance of the guideway.

## Track Steering

Systems with conventional steering are available permitting simpler 'track' design as only a road surface is required along with a form of reference for the vehicle's steering sensors, such as embedded magnets and proximity sensors.

## Guideways

There are numerous guideway systems available, such as:

- beams similar to monorails
- bridge-like trusses supporting internal tracks
- Cables embedded in a roadway

*Figure 2 2getthere POD for Masdar city*

Most designs use the guideway to distribute power and data communications, including to the vehicles.

## Stations

Stations will usually be close together, and located on side tracks so that through traffic can bypass vehicles picking up or dropping off passengers.

When user demand is low, surplus vehicles can be configured to stop at empty stations at strategically placed points around the network. This enables empty vehicles to quickly be despatched to wherever required, with minimal waiting time for the passenger.

## Capacity

Generally PRT vehicles seat fewer passengers than trains and buses, and must offset this by combining higher average speeds, diverse routes, and shorter headways. Proponents assert that equivalent or higher overall capacity can be achieved by these means.

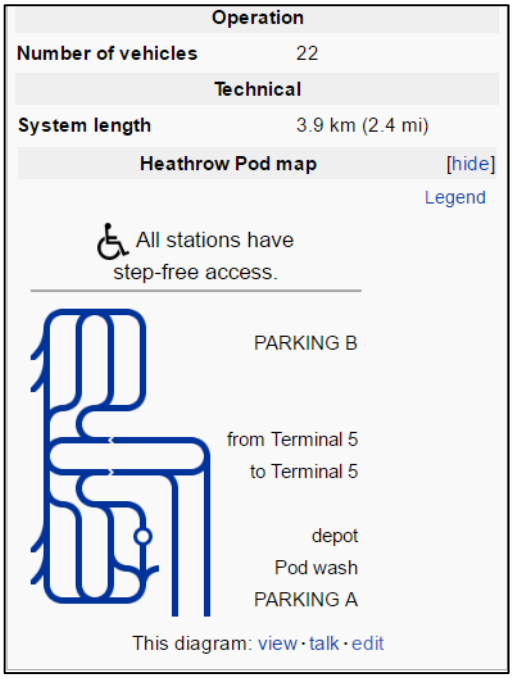


*Figure 3 Heathrow Airport POD track layout*

A single PRT line can achieve theoretical maximum capacity of 7,200 passengers per hour. However, most estimates assume that vehicles will not generally be filled to capacity, due to the point-to-point nature of PRT. At a more typical average vehicle occupancy of 1.5 persons per vehicle, the maximum capacity is 2,700 passengers per hour.

PRT systems should require much less horizontal space than existing metro systems, with individual cars being typically around 50% as wide for side-by-side seating configurations, and less than 33% as wide for single-file configurations. This is an important factor in densely populated, high-traffic areas.

## Safety

Computer control eliminates errors from human drivers, so PRT designs in a controlled environment should be much safer than private motoring on roads. Grade-separated guideways would prevent conflict with pedestrians or manually controlled vehicles. Other public transit safety engineering approaches, such as redundancy and self-diagnosis of critical systems, are also included in designs.

Recent research by ULTra PRT reported that automated guideway transit (AGT) systems have a better safety than more conventional, non-automated modes.

As with many current transit systems, personal passenger safety concerns are likely to be addressed through CCTV monitoring and communication with a central command centre from which engineering or other assistance may be dispatched.

## Energy efficiency

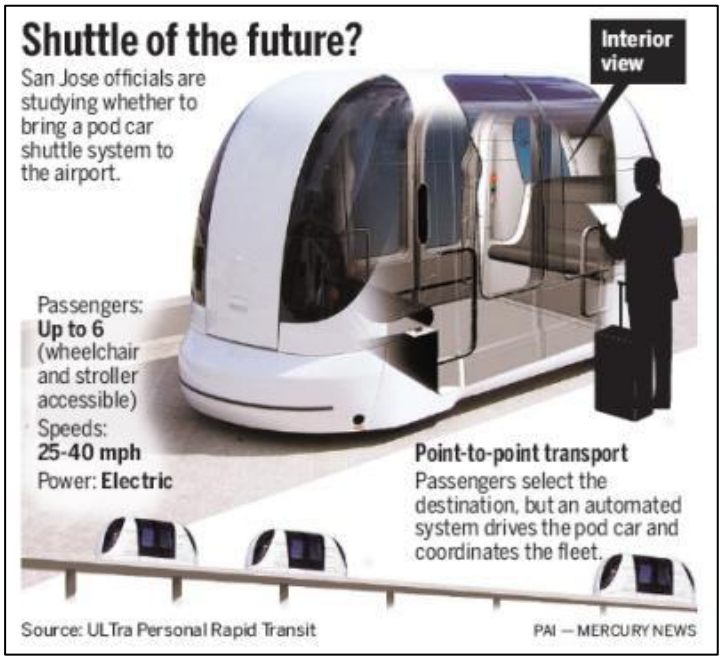


*Figure 4 ULTra Marketing Poster*

The energy efficiency advantages claimed by PRT proponents include two basic operational characteristics of PRT: an increased average load factor; and the elimination of intermediate starting and stopping.

PRT vehicles only move in response to demand. This allows 24-hour service without many of the costs of scheduled mass transit.

ULTra PRT estimates its system will consume 839 British thermal units (BTU) per passenger mile (0.55 MJ per passenger km). By comparison, cars consume 3,496 BTU per passenger mile.

Due to PRT's efficiency, some proponents say solar becomes a viable power source.[67] PRT elevated structures provide a ready platform for solar collectors, therefore some proposed designs include solar power as a characteristic of their networks.

## Comparison of PRT with Existing Transport Systems

| Comparison With | PRT |
|---|---|
| Cars | • Vehicles are small—typically two to six passengers<br>• Vehicles are individually hired, like taxis, and shared only with the passengers of one's choosing<br>• Vehicles travel along a network of guideways, much like a network of streets. Travel is point-to-point, with no intermediate stops or transfers<br>• Potential for on-demand, around-the-clock availability<br>• Stops are designed to be off the main guideway, allowing through traffic to bypass stations unimpeded |
| Trams<br>Buses<br>Monorails | • A public amenity (although not necessarily publicly owned), shared by multiple users<br>• Reduced local pollution (electric powered)<br>• Passengers embark and disembark at discrete stations, comparable to bus stops or taxi ranks |
| APM | • Fully automated, including vehicle control, routing, and collection of fares<br>• Usually above the street—typically elevated—reducing land usage and congestion |
| Distinct Features | • Vehicle movements may be coordinated, unlike the autonomous human control of cars and bikes<br>• Small vehicle size allows infrastructure to be smaller than other transit modes<br>• Automated vehicles can travel close together. Possibilities include dynamically combined "trains" of vehicles, separated by a few inches, to reduce drag and increase speed, energy efficiency and passenger density |

## Example of PRT in Operation

The link below shows an example of a PRT system in operation at Heathrow Airport, London:

https://www.youtube.com/watch?v=F5Knmgr2Ge8