



Advice Note for Promoters Considering Personal Rapid Transit (PRT)

Version 1: July 2012

Chapter 1 - Introduction

1.1 Purpose of Advice Note

This Advice Note is intended to provide practical help to promoters considering Personal Rapid Transit or PRT and highlights those matters they will need to consider.

We recommend that promoters first should refer to the ***Guidance Note for Light Rail, Ultra Light Rail and Personal Rapid Transit*** which provides general guidance on the preparation and evaluation of major scheme business cases. This is the first important step to be taken in seeking funding for any scheme.

This Advice Note is also aimed at encouraging more local authorities becoming aware of the advantages of PRT and therefore helping them to come forward with proposals to suit their communities.

This Advice Note is intended for promoters in England outside London. However, much of its contents may also be of interest to potential promoters of schemes in London, Scotland, Wales and Northern Ireland.

This Advice Note focuses on Personal Rapid Transit. Other Advice Notes are available for light rail and ultra light rail transit modes.

We would also recommend that promoters should consult UK Tram as to the most effective ways of developing local transport proposals

1.2 What is Personal Rapid Transit?

Personal Rapid Transit (PRT) is a new form of transport, based on the use of small (typically 4-6 passenger) vehicles operating on a dedicated small scale guideway network. It offers passengers trips with no waiting and no stopping, direct to any point served by the system. This contrasts with all existing forms of public transport, which involve both waiting and multiple stops during the trip. PRT provides public transport which is designed to compete with the car in urban areas and to offer major attractions in sustainability, passenger convenience and cost. PRT is particularly attractive when used in conjunction with existing modes of transport (see fuller discussion in Section 4.2).

PRT is now in operation at Heathrow airport and Masdar City Abu Dhabi and a system is also under construction for operation in Suncheon, South Korea. Practical demonstration of its effectiveness, reliability and reduced cost and, in particular, the exceptionally positive response of passengers, has led to a recognition that PRT can offer a valuable new contribution to transport infrastructure.

The three established PRT manufacturers are Ultra Global PRT Ltd, based in Bristol, England, 2getthere based in Utrecht, Holland, and Vectus based in Uppsala, Sweden. Ultra supplied the Heathrow pod system operating at London Heathrow Airport between Terminal 5 and its Business car park. The 2getthere system is operating at Masdar City in Abu Dhabi. Vectus is implementing a system at Suncheon Bay, South Korea, planned to open in 2013.

1.3 Structure of this Document

- **Chapter 2: Characteristics of PRT** - Summary of the general attributes of PRT
- **Chapter 3: Comparative Description of Current Systems** – including detailed comparative specifications and contact details for vendors
- **Chapter 4: Exploiting the benefits of PRT**- setting out how the benefits of PRT are revealed through existing applications and studies.
- **Chapter 5 PRT Costs** - general guidance on costs
- **Chapter 6 Procurement** - comment on special issues in PRT procurement
- **Chapter 7 Regulatory Issues** - as a new form of transport PRT is subject to special regulation

Chapter 2 – Characteristics of PRT

PRT is a type of small automated guided transit (AGT), a class of system which also includes larger vehicles such as driverless metros and airport automatic people movers, and smaller systems such as group rapid transit (GRT). Worldwide there are over 150 fully driverless AGT systems in operation. These carry over 2 billion passengers per year and have a record of no fatality or serious injury in the past 10 years.

In PRT designs, vehicles are sized for individual or small group travel, typically carrying 4-6 passengers per vehicle. Guideways are arranged in a network topology and, importantly, all stations are located off line. This approach allows for nonstop, point-to-point travel, bypassing all intermediate stations. The point-to-point service has been compared to a driverless taxi or a horizontal lift (elevator).

2.1 User Benefits

From the user's perspective, PRT offers many benefits:

- Immediate service: passengers rarely need to wait for a vehicle, since the empty vehicle management system ensures that one will usually already be available at the station.
- Practical operations have demonstrated that the average passenger waiting time is around 10 seconds.
- Nonstop travel: due to off-line stations, the journey is nonstop from start to destination, anywhere on the network.
- Travel is reliable, predictable and congestion free, affording passengers greater certainty in their journeys. There is no need to plan trips, consider schedules, or transfer between vehicles.
- Personal transport: passengers only share with desired companions.
- Faster than other urban transport, typically by a factor of two. Although average speeds are modest (around 25 mph), non-stop service and low waiting ensures short trip times.
- Travel is safe: PRT systems are certified to safety levels at least as good as trains, approximately 10 times higher than automotive safety. Segregation implies less conflict with non-users.
- Accessibility: The system is available to all, including the young, the old, and those with disabilities.

2.2 Community Benefits

In addition to user benefits, PRT provides sustainable urban transport with major benefits to non-users and to the community as a whole.

- PRT is energy efficient: light, small, efficient vehicles traveling non-stop and only on demand result in significant energy savings. PRT uses less than half of the energy of a car, and is more energy efficient than conventional public transport.
- PRT meets sustainability targets; satisfying the requirement for reduced carbon emissions. There are no emissions at point of use.
- PRT is exceptionally quiet, routinely below background noise levels.
- Lightweight vehicles permit light infrastructure. Small vehicles and guideways imply less land take and less visual intrusion.
- PRT reduces congestion: studies indicate significant modal shifts away from the car, freeing up both road capacity and parking space and allowing greater pedestrianisation.
- Installation flexibility: small scale infrastructure may be readily integrated into buildings. Small turn radii (~5m) and high gradients (up to 10%) are readily achievable
- PRT is complementary to other transport modes. Links to PRT can attract passengers to existing public transport (see Section 4.2)

2.3 Business Benefits

PRT systems can also offer a greater overall return on investment at local level than other forms of transport, especially when the opportunities for capturing land value uplift through integrated planning are realised.

- Much lower capital cost than conventional modes (see Chapter 5 for more details).
- Reduced operating costs (see Chapter 5 for more details)
- Rapid construction: the small scale of the infrastructure, typically prefabricated off site, gives low infrastructure build times.
- Less disruption: due to the small scale of the infrastructure compared to conventional modes
- Increased usage of conventional modes (see Section 4.2)
- Increased land values due to improved accessibility
- Opportunities for advertising and sponsorship revenue
- Excellent first and last impression for city or campus applications

Chapter 3: Current Systems

3.1 Overall Descriptions

Listed below are the PRT systems currently operating. All offer the key features of PRT described in this document. For each system, details of a lead contact person are provided. These people have said that they would be happy to discuss the characteristics of their system with promoters considering whether to develop a new scheme.



Ultra PRT

Location: Heathrow Airport
Opened: April 2011
Track length (km): 3.8
Vehicles: 21
Stations: 3
Passenger journeys (millions): 0.5
Contact: Fraser Brown
Fraser.Brown@ultraglobalprt.com
www.ultraglobalprt.com +44 (0)1454 414700



2Getthere

Location: Masdar City Abu Dhabi
Opened: Nov 2010
Track length (km): 1.7
Vehicles: 13
Stations: 5
Passenger journeys (millions): 0.5
Contact: Robbert Lohmann
Robbert@2getthere.eu
www.2getthere.eu +31 30 2383570









Vectus

Location: Suncheon Bay, South Korea
Opened: Due 2013
Track length (km): 10
Vehicles: 40
Stations: 2
Passenger journeys (millions): - NA
Contact: Martin Pemberton
martin.pemberton@vectusprt.com
www.vectusprt.com +44 (0)1789 205011

3.2 Comparative PRT Specifications

These details have been brought together by ATRA IG, the PRT Industry group.

Important Note: Stated characteristics reflect systems as designed for current applications; there is much scope for tailoring parameters and performance of each system as required for future applications.

| | |  |  |  |
|--|------------------|---|---|---|
| | |  |  |  |
| | Data Basis | Masdar Application | Heathrow Application | Suncheon Application |
| Key system design aspects | | | | |
| Vehicle Power principle | | Battery stored electric | Battery stored electric | Electrical |
| Power Transfer method | | Automatic charging via automated connection at berths and in maintenance facility | Automatic opportunity charging via automatic connection at berths and in charging lanes | Current collection |
| Drive principle | | Electric motor driving vehicle wheels | Electric motor driving vehicle wheels | Linear motor and /or electric motor driving vehicle wheels |
| Vehicle Support Method | | Semi-solid tyres on level road surface | Pneumatic tyres on level road surface | Proprietary low friction solid polymer wheels on steel track |
| Vehicle Guidance Method | | Dead reckoning with magnetic markers | Kerb referenced electronic steering | Captive to steel track |
| Vehicle Emergency Evacuation | - | Both sides | Front hatch (onto passive guideway) | Both sides |
| Vehicle Size & Accessibility | | | | |
| Dimensions LxWxH | mm | 3920x1460x2010 | 3700x1470x1800 | 37360x20100x2500 |
| Floor Space | m ² | 1.7 | ≥1.7 | 3.4 |
| Door opening area (HxW) | mm | 1750x1050 | ≥1500x900 | 1950x900 |
| Level entry | | Yes | Yes | Yes |
| Number of passengers per vehicle | - | 4 adults, 2 children | 4 adults, 2 children | 4 adults, 4 children |
| Wheelchair accommodation capability | - | Yes (ADA compliant) | Yes (RVAR/ADA compliant) | Yes (RVAR compliant) |
| Luggage | - | Between seats | Between seats | Between seats |
| Weight - empty and (maximum) | kg | 1400 (2050) | 850 (1300) | 1500 (2500) |
| Payload | kg | 650 | 450 | 1000 |
| Performance characteristics | | | | |
| Maximum Speed | km/hr | 40 | 40 | 70 |
| Maximum speed in curve (with radius: 20/50/100m) | km/hr | 16/26/36 | 18/28/40 | 16/26/36 |
| Typical Acceleration and Deceleration | m/s ² | 0.8 | 1.25 | 1.2 |
| Maximum Emergency Deceleration (current/projected) | m/s ² | 4.7 | 2.5 / 5 | 5 |
| Maximum Range (at maximum payload) | km | 60 | 20 | Not applicable |
| Platform Gap | mm | < 30 | < 20 | < 30 |
| Platform Step | mm | <10 | 5 | < 10 |
| Energy Usage | | | | |
| Energy Consumption @ 30 km/h (empty) | kWh/km | 0.17 | 0.09 | 0.23 |

| | | | | |
|---|-------------------|--|---|---|
| vehicle) | | | | |
| Energy Consumption @ 30 km/h (full vehicle) | kWh/km | 0.19 | 0.13 | 0.24 |
| Equivalent Carbon usage (full vehicle @30km/h, and 0.545kgCO2/kWh) | gCO2/passenger km | 0.023 | 0.018 | 0.022 |
| Control System | | | | |
| Controls concept | | Asynchronous / Synchronous | Synchronous-based, asynchronous aspects | Asynchronous |
| Controls Topography | | Distributed | Distributed | Distributed |
| Automatic Vehicle Protection system | | Fixed Block in combination with obstacle detection | Fixed block system | Radio based Dynamic Moving Block |
| Obstacle Detection | - | Front and Rear | Operator monitored CCTV | Optional front |
| Dynamic rerouting | | Not currently | In stations | Yes |
| Emergency recovery | | Manual drive (joystick) + tow bar | Low speed recovery mode + dedicated tow vehicle if necessary | Reverse operation + Push/Tow with other vehicles |
| Current application headway | seconds | 5 | 6 | 4 |
| Infrastructure | | | | |
| Max. Track Gradient | % | 10 | 10 | 10 |
| Minimum Radius (centre line) | m | 5.5 | 5 | 5 |
| Track Width (at grade / elevated) | mm | 1750 / 1850 without walkway | 1750 / 2100 | 1400/1400 |
| Typical system (track and vehicle) square clearance envelope (W*H) | mm | 1750 - 1850 / 2300 without walkway | 1750 / 2100*2000 | 2100 * 2500 |
| Berth concept(s) | | Angled independent or straight in-line | Angled independent or straight in-line | In-line |
| Maximum throughput 1 berth/hour | Vehicles | ~120 | ~120 | 160-200 |
| Minimum multi berth station length per independent berth | m | Depends on berth angle: @Masdar: 4.3 at 30degrees | 3.2 | 4.5 |
| Minimum multi berth station width per independent berth (inc vehicle and passenger areas) | m | Depending on angle of the berth | 4 | NA |
| Interaction with passengers | | | | |
| Information | | Touch Screen with audio and custom defined content | Automated interactive display and audio at berths and in vehicles. | A/V passenger information displays in vehicles and stations |
| Communication initiation | | CCTV, Intercom, Medical Assistance request button, Emergency Stop button | Information and Emergency Assistance request buttons in vehicles and stations | Information and Emergency Assistance request buttons in vehicles and stations |
| Communication | | 2 way audio intercom and CCTV monitoring at berths and in vehicles | 2 way audio intercom and CCTV monitoring at berths and in vehicles | 2 way audio intercom and CCTV monitoring at stations and in vehicles |
| Destination Selection | | Application Dependent | Application Dependent | Application Dependent |
| Facility for ride sharing | | Yes | Yes | Yes |
| Emergency response | | | | |
| CCTV | | Yes | Yes | Yes |
| Intercom | | Yes | Yes | Yes |
| Operator | | Yes | Yes | Yes |

Chapter 4 – Exploiting the benefits of PRT

4.1 Introduction

This chapter offers advice to promoters on how best to exploit the attributes of PRT and the type of application where it is best suited. In deciding whether PRT is the most appropriate mode, promoters will need to think about how to best use its particular attributes to optimise the scheme they intend to consider. Promoters should talk to those who have already developed and delivered PRT systems and look at the measures they have taken to make their projects successful. Promoters should take note of the published and anticipated work of UKTram.

As discussed in Chapter 2, PRT offers a series of major potential benefits. In the right circumstances it is

- Highly flexible
- Attractive to users
- Sustainable
- Lower cost, both capital and operating
- Efficient - compared to other modes with equivalent capacity

4.2 PRT as a part of the Transport System

It is widely recognised that, despite high levels of subsidy, consumer satisfaction with present public transport services is low. Private cars have intrinsic advantages over collective modes, deriving from their greater flexibility of use. A key issue is the “last mile” problem. Current public transport only delivers passengers to the nearest stop, which can be some distance from the final destination desired. PRT can connect effectively to conventional public transport systems to solve this problem, thus attracting passengers to existing public transport. Independent studies by Arup and the University of Leeds have shown that using PRT to provide a network link to conventional transport can increase the take up of conventional public transport by factors of between 2 and more than 3 (Ref 1). PRT offers a new approach to meeting a core objective of Transport policy, attracting more users onto public transit.

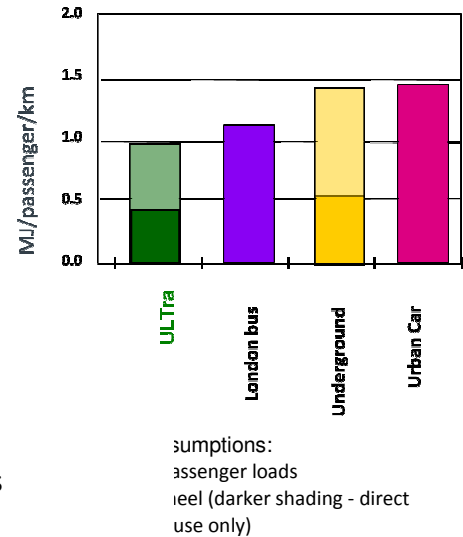
PRT has the capability of adding major value to new developments by providing quicker links to major activity centres. It can also support satellite offices or parking locations or locations that might be difficult to access by private car. Integration of PRT into Master Plans to maximise the land-use and value added is a critical aspect of developing a satisfactory business case. PRT may be seen as a key ingredient in the creation of truly integrated transport solutions.

4.3 PRT as Sustainable Transport

PRT provides

- Light-weight low speed electric vehicles
- Movement only when there is user demand
- Regenerative braking avoids 'stop & go' waste
- No on-site emissions
- Low external noise (below background levels)
- Low resource use

This means that PRT, as well as having no emissions at point of use, uses lower energy than all other modes, including mass transit modes, meaning lower carbon emissions. (see diagram)



Thus PRT offers a new approach to meeting a core objective of energy policy, ie the introduction of sustainable transport.

4.4 PRT Issues

PRT is not necessarily the best solution for all transport problems. For example, heavy commuter loads, such as those in the biggest cities like London, require much higher capacity systems. As noted above, PRT can help the heavy modes to do their job better by taking passengers to and from the major stations served by such modes. In more modest size cities PRT may be justified for a 'feeder' role in delivering city centre commuters.

Long point to point links are another application where PRT may not necessarily be the best solution. PRT will normally offer cost benefits over rail modes, but long corridor routes do not exploit the anywhere to anywhere capability which is a key attraction of PRT. Also PRT may not have high enough speed to deliver acceptable trip times on longer routes. However, PRT has very little waiting, while for conventional transport it is necessary to add a wait time. This time is a function of frequency, but could well be 10 minutes or more for a conventional mode. It will be a matter of judgement whether the combined times from arrival at the station to leaving the vehicle at the destination would be more attractive by conventional transport or PRT.

PRT deals with high demand by using many small vehicles rather than single large vehicles. This is the key to providing low waiting times. Where large demand is expected, stations must be sized with sufficient berths to permit the demand to be dealt with satisfactorily. Operating experience has shown that during peak periods passengers are very prepared to share vehicles. Thus PRT capacity automatically increases when it is needed. Maximum capacity depends on system details (see specifications in Section 3.2). It has been demonstrated that a 5 berth station can deal with up to 40 passengers per minute i.e. 2400 per hour. For comparison, a 40 passenger bus is projected to take 100 seconds to fully load (Ref 2). If clearance of large

passenger numbers is a key operational requirement, it will be necessary to examine the various commercial systems available to determine which technology best satisfies the need.

4.5 Project Risks

PRT is a new system. Any such system must involve elements of project risk. Experience from operations has been very positive, demonstrating excellent reliability. Technology risks for modest scale systems can be considered as low. Risks associated with PRT can reasonably be regarded as being manageable. An objective evaluation of risk and reward will be a necessary part of a procurement action.

In the opinion of the suppliers, PRT is a “hard target” from the security point of view due to the extensive use of actively monitored CCTV, in Stations, Guideway and Vehicle. Experience to date has revealed zero security problems in current operations. However a review of the most suitable approach to security is recommended as part of the operational design process.

Chapter 5 PRT Costs

5.1 Introduction

Many of the costs for a Promoter establishing a new transport system are associated with the planning and approval process, as described in the wider **Guidance Note for Light Rail, Ultra Light Rail and Personal Rapid Transit** covering the preparation and evaluation of major scheme business cases. This Chapter is intended to provide broad guidance on the likely level of Capital and operating costs involved, which are a critical part of establishing a business case for any scheme.

Given the flexibility of PRT, there is not a "one size fits all" cost calculator, and the unique characteristics of a site will determine the overall capital cost requirements for a particular application. Costs are particularly influenced by system ridership. Guideway and control system costs will remain fairly constant once a route has been established, but station capacity (berths and locations) and number of vehicles (with attendant maintenance and maintenance facility costs) can all vary significantly dependent on the volume of passenger movements required.

Capital costs are therefore a function of the ease or difficulty in installation, expressed as cost per km, and the anticipated demand on the system, expressed as vehicles per km on the peak route. Figure 1 shows a typical cost envelope for low capacity/high capacity, easy installation/difficult installation. This is a total cost per km of one way track including all infrastructure, systems and vehicles. Figure 2 gives the approximate breakdown by price of a medium capacity system.

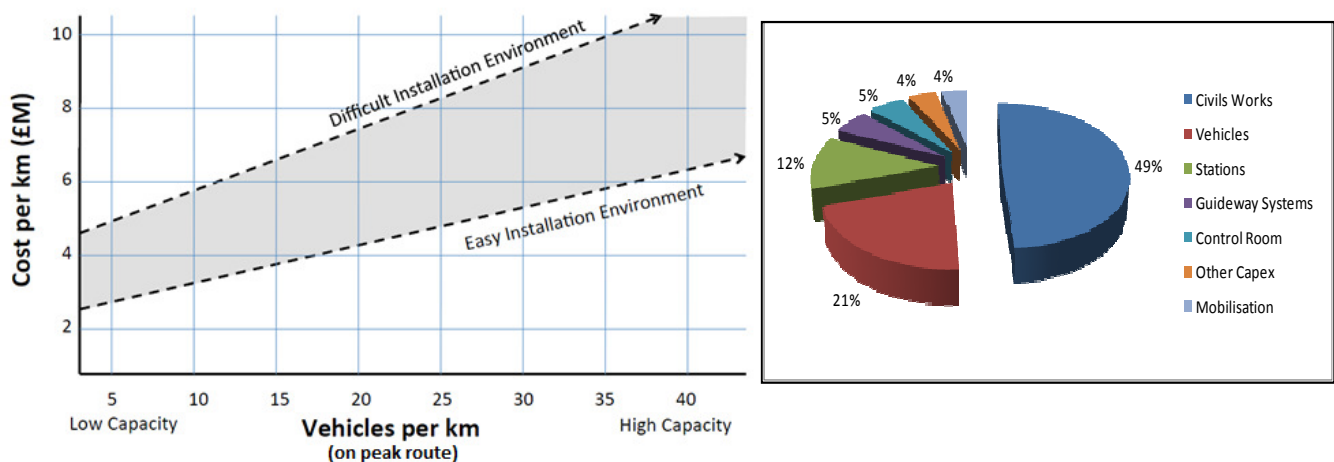


Figure 1 Capital Cost Trends for PRT

Figure 2 Typical PRT Cost Breakdown

5.2 Primary Capital Cost Drivers

The primary cost drivers for a PRT system application are as follows:

- System size (particularly if custom elements are required);
- Station Density - stations required per guideway-km;
- Peak system loading, average journey length, and desired average passenger wait time;
- Average vehicle occupancy during peak, and tidality of flow (# empty vehicle movements);
- Amount of single versus bi-directional guideway;
- Amount of elevated/at-grade/tunnel/culvert/cantilever guideway;
- Proportion of standardized components (e.g. guideway curve sections)
- Deployment context (urban/public areas or semi open/closed, controlled access such as airports & private campus areas), and associated security requirements;
- Integration with other site facilities/roads/pedestrian areas etc;
- Customer's aspirations for station design;
- Customer requirements for custom vehicle appearances and characteristics.

As a simple example, an application of PRT in which all of the guideway and stations are at grade will have a significantly reduced base cost due to the large contribution of the elevated guideway. However, other factors (e.g. extra security requirements, severance issues, land costs) may lessen the benefits of this reduction, and increase costs elsewhere.

5.2 Cost comparison to other rail and other systems

The basic cost drivers for automated transport systems, including PRT, are common engineering issues rather than specific features of the technology. The high cost of line haul systems, is primarily associated with their (comparatively) large size.

An automated system can be divided into three main parts: the infrastructure, control system and vehicles. Typically the infrastructure costs for both traditional and PRT systems dominate the cost comparisons, with the (elevated) guideway being the largest cost of the infrastructure. Comparable results for the weight of the elevated superstructure of three examples shown below are as follows:

- | | | |
|---------------------|--------------------------|--------------------------|
| • PRT (ULTra) | Combined weight guideway | 4.6kN/m (0.46tonnes/m) |
| • Monorail (Sydney) | Steel guideway beam | 13.5kN/m (1.35tonnes/m) |
| • LRT (KL) | Combined weight guideway | 45.3kN/m (4.53 tonnes/m) |
- Data from Ref 3



Ultra Heathrow

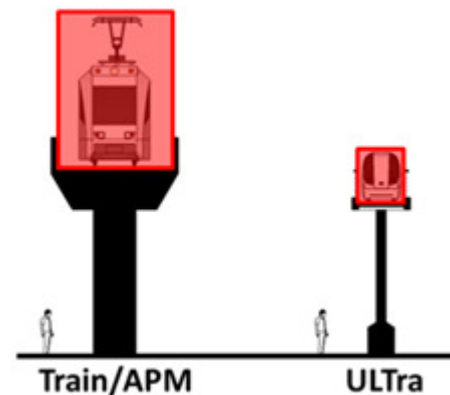


Kuala Lumpur LRT



(Right) Sydney monorail

PRT is a transport facility of a considerably smaller mass and scale than rail and other systems, and as such offers potential for lower capital cost projects in comparison with conventional systems of the same overall passenger capacity, combined with additional benefits described in section 2.



5.3 Operating and Maintenance Costs

The level of automation provided by a PRT system eliminates drivers and reduces operator work load in the control room. Automatic control and management of vehicle operations with respect to demand levels ensures that the system uses energy to move passengers in the most economical way. Computerized demand management systems ensure that operational planning is matched with expected demand levels, feeding performance data back into the system to provide continual improvements to service levels and customer experience.

The O&M costs for a PRT system range from 3% - 5% of capital cost per annum. Much of this cost is fixed by the requirement to man the control room on a full time basis. The number of staff required only varies modestly with system size. This means that the O&M cost of a small system (<50 vehicles) will be towards the high end of this range, while the cost for a larger system (say >100 vehicles) will be towards the lower end of the range. Specific cost estimates will require detailed consideration of the details of the system planned.

Capital Replacement Costs: Using the typical breakdown figures given in 5.1, assuming the design infrastructure life of 50 years and vehicles/systems replacement life of 8 years, gives a projected Capital Replacement cost of about 5%.

Chapter 6 - Procurement Strategy

Chapter 4 of the 'Guidance Note for Light Rail, Ultra Light Rail and Personal Rapid Transit' provides general advice and guidance on the procurement of these transport systems.

PRT is a new technology and many independent consultants, traditionally used by promoters for advice on specifications and procurement will be unfamiliar with the specific features and characteristics of PRT. It is therefore recommended that the technology supplier is selected early in the procurement process to work alongside the chosen transport planner and infrastructure designer during the design stages. Bringing these experts together at an early stage in the definition of the scheme is likely to provide a more cost effective system, fully exploiting PRT capabilities, while also reducing both interface risks and subsequent integration risks.

Chapter 7 - Regulatory Issues

7.1. Introduction

Specific clearance of any new PRT system under the UK regulations is a formal requirement. As a minimum the PRT systems must comply with the UK Disability Discrimination Act (DDA) 2005 and the safety regulations enforced by the Office of the Rail Regulator (ORR). These two aspects are amplified below.

All current operating PRT systems have passed through an extensive regulatory approval process based on existing standards and norms. It is believed by the vendors that all systems are broadly comparable in their ability to deliver a system which is satisfactory under the various National regulations. However, at present there are currently no UK or European PRT specific design standards. The US continues to develop the ASCE APM standards to cover PRT. However, if these US design standards are used it will be necessary to introduce variations to comply with UK legislation and some specific design features of the European PRT systems.



7.2 Physical Accessibility

The design of all new PRT vehicles will need to comply with the 'The Rail Vehicle Accessibility (Non-Interoperable Rail System) Regulations 2010', referred to as RVAR 10 which came into force on 6th April 2010. The infrastructure elements would be expected to follow the principles laid down in the DfT's publication, "Inclusive Mobility", as far as reasonably practicable. In addition, under the Disability Discrimination Act (DDA) 2005, suppliers of transport services have a duty, as far as reasonably practicable, not to discriminate against disabled people and must design their policies and procedures to comply with this requirement.

Early contact with the DfT's Rail Vehicle Accessibility Group and the Disability Policy Unit is advisable. Early input can help to ensure that all accessibility issues are addressed for the whole scheme. Whilst the above Acts and Regulations set the minimum framework standards for access to public transport, the promoter will need to pay careful consideration to determine the full extent of the DDA provision for each scheme.

7.3 Safety Regulation

PRT systems come within 'The Railways and Other Guided Transport Systems (Safety) Regulations 2006' (ROGS), enforced by the Office of Rail Regulation (ORR). The Regulation differentiates between main line rail and other guided transport systems that operate at speeds

below 40km/h. As most PRT systems typically operate at speeds below 40km/h the transport operator can put the system into use provided that the safety of the system is verified by an independent competent person (or persons). Should a PRT scheme with vehicle speeds greater than 40km/h be considered, early discussion with the ORR is essential.

The promoter should consider carefully the contractual arrangements and responsibilities for compliance with ROGS when selecting the PRT system supplier, the infrastructure provider and the transport operator. Early discussions with ORR and HMRI on the safety responsibilities of the various Duty Holders are advisable.

7.3.1 Safety Management System

Before bringing the PRT system into service, the transport operator must establish a satisfactory Safety Management System (SMS). The general requirements of the SMS are defined (within ROGS) but there is no requirement for it to be approved and no certificate is required.

One of the requirements of the SMS is that, before any new or altered vehicles or infrastructure are placed into service, the transport operator must establish a written safety verification scheme (compliant with Schedule 4 of the ROGS), appoint a competent person and the competent person must undertake that safety verification.

The 'competent person' must have sufficient skills, knowledge, experience and resources to undertake the safety verification and be independent of the management or operation of the scheme. In practise the 'competent person' may be a small team of experts.

7.3.2 Guidance on ROGS

Guidance on ROGS can be found on the ORR website www.rail-reg.gov.uk. HMRI encourages promoters of new systems to contact them as early as possible in the development process and then maintain regular dialogue throughout this process so that they can discuss relevant safety issues before designs become fixed.

References

1. "An Assessment of City-Wide Applications of New Automated Transport Technologies" May, A.D, et al, TRB 12-0504
2. "Transit Capacity and Quality of Service Manual" TCRP Report 100
3. "Infrastructure Cost Comparisons for PRT and APM" A.D. Kerr ASCE APM05