

NICHES+ Champion City Daventry

Implementing Personal Rapid Transit (PRT)



The Region and NICHEs+

The project

NICHES+ is a FP7 co-ordination action aiming to network key actors actively engaged in developing **innovative urban transport concepts** and to facilitate the co-ordination of their activities across Europe. The project duration is from 2008-2011.

Daventry is a Champion City within the project that aims to implement a system of Personal Rapid Transit (PRT). This document summarises an **implementation scenario** that gives advice on how to realise the given concept in the specific context of the city. This also provides an example to other cities interested in the uptake of the measure.

The City

Daventry is a market town situated in a rural ie green environment, although it lies in the midlands area of the UK where car manufacturing in nearby towns and cities such as Longbridge, Birmingham and Coventry, has traditionally been a major industry.

The town of Daventry is **expected to grow from 23,000 to 40,000 by 2021**. The District Council are looking for a new sustainable public transportation system to facilitate this expansion and to provide improved connections to the local main line trains and motorways.



Daventry

Photo: Daventry District Council

The innovative concept

Significant new roads building will not be possible so the new system will need to provide **flexible transport** between the existing and new residential, business, retail and leisure areas and at the same time help reduce the need to travel, especially by car; support the development of sustainable communities; reduce social exclusion and improve intermodality.

Daventry has investigated the use of **Personal Rapid Transit (PRT)** as the means of public transport to meet these requirements. PRT is clean, green, quiet, and potentially sustainable, and in particular, appears to have high potential for attracting car users and so reducing private car usage.



Photo montage of PRT in Sodertalje, Sweden

Courtesy: WSP Sweden

The Challenge

The Milton Keynes and South Midlands Study undertaken for the Department of Communities and Local Government designated **Daventry as an area for future development**; this was supported by Daventry District council (DDC) in 2003.

However, mobility in the City is heavily focused on the use of the private car (59% modal share). **Public transport is only used for 2% of all trips**. Currently the public transport services are based almost exclusively on a bus network. But the size of the City and the passenger numbers are too small to allow an economic service with a sufficiently high frequency to be attractive to users.



The PRT test track in Uppsala,
Photo: courtesy of Vectus Ltd

Personal Rapid Transit (PRT)

a state-of-the-art form of public transport (PT) using small automated (driverless) electric 'podcars' to:

- provide a taxi-like service for individuals or small groups of travellers
- provide demand responsive feeder and shuttle services

The podcars run on a segregated guideway to ensure unhindered direct trips between origin and destination. They provide clean, safe, efficient and sustainable transportation. With high vehicle speeds and very small headways, PRT provides fast, individual, on-demand and point-to-point PT with very short waiting times.

Benefits of PRT

- Highly efficient "on-demand" operation
- Low operating costs as drivers are not required
- Personal public transport
- Pollution reduction as vehicles are automated, electric and quiet
- Direct origin to destination stop services, ie no intermediate stops
- Simple, accessible services similar to a lift
- Very short waiting time
- Congestion-free transport due to operating on a segregated guideway

The Vision

The vision for Daventry was set out in the **Master Plan (2006)** produced for DDC by Marchini Curran Associates. This provides a plan for the development required to accommodate the proposed growth in population and associated business, retail and leisure activities by 2021.

The plan stated that there was a transport opportunity and **PRT was suggested as an option**. This was the brainchild of a spatial town planner. It was not based on any formal analysis of PRT, but appeared well suited to serve the requirements for mobility. The possibilities have been further explored by DDC.

In addition to the Master Plan, Daventry has completed two **feasibility studies**: one (DDTS, 2007) to confirm that PRT offers a viable solution; and a second (DPRTSS, 2008) to confirm that it offers the preferred solution (compared with a bus based alternative), and to specify and evaluate a proposed pilot scheme. The results show the pilot scheme is potentially economically viable and performs better than a high quality bus option.

The Good Examples

There are **not many examples of operational PRT systems yet**. The technology is very new. However, there are two systems that have been influential in developing Daventry's thinking and ideas, these are the Parkshuttle at Rivium and the PRT at Heathrow Airport.

The Parkshuttle at Rivium, Rotterdam/Capelle aan den IJssel, the Netherlands

ParkShuttle is an automated system of **driverless electric mini-buses** connecting the Kralingse Zoom metro station and car park with the Rivium business park about 2km away. The system was built by the '2getthere' company and is operated by the Netherlands PT operating company Connexxion. The system was fully operational in early 2006. It uses six buses, each with seats for 12 and a maximum capacity (including standing passengers) for 24.

The vehicles are electric and provide **clean, green, efficient and sustainable** public transport with low waiting times (1.5 to 3 minutes on average).



The Parkshuttle at Rivium

Photo: 2getthere

This system is not strictly a PRT. It is a **GRT (Group Rapid Transit)** which must stop to pick up and set down passengers on route. It does not offer the higher speed and direct to destination trips provided by PRT, but it does demonstrate the automated vehicle technology working and the user's acceptance of the system.

Start up costs of the Parkshuttle are reckoned to be more expensive than for a conventional bus scheme, but the operating costs are less.

Contact: Robbert Lohmann, 2getthere, email: robbert@2getthere.eu

PRT at London's Heathrow Airport

The **pilot PRT scheme** at Heathrow Airport (UK) which is scheduled to open in the spring of 2011, is the first implementation of a real PRT system in the world. It provides transport for travellers between the business car park and the new Terminal 5, about 2 km away.

21 automatic electric podcars, each with room for 4 persons and their luggage, transport users along a segregated guideway at up to 40kph. The trip takes about 5 mins, the podcars operate on-demand, but are usually waiting so that waiting times are zero for 70% of users and very low for the others.

The capital cost is estimated to be about half that of an equivalent tram scheme and with the potential to provide a similar passenger carrying capacity.

If the pilot is successful, it is planned to extend it eventually, to interconnect all the car parks and terminals with the bus, rail and metro stations, car rentals and hotels on the airport site.

Contact: David Holdcroft, Heathrow, email: david_holdcroft@baa.com

"PRT is a potential form of Public Transport that could offer a travel experience sufficiently close to using a private car (eg personal space, on-demand) that it should be able to compete directly in a wide range of implementations."

Richard Caple, PRT Project Manager, Daventry District Council, UK

The user needs

There are essentially two classes of users for PRT systems: the end users i.e. **passengers**, and the **buyers** of the systems.

Passengers include all classes of travellers on trips for all purposes e.g.:

- Leisure
- Commuting
- Business
- People with individual requirements, such as:
 - Mothers with pushchairs
 - Travellers with heavy luggage
 - Wheelchair users and other physically disabled travellers
 - Visually impaired travellers

Their main expectations and needs include accessibility, information, ease of use, comfort, low cost, high reliability, safety and security.

Buyers: as the system buyer DDC must recognise the needs of passengers, and for this purpose has established a Public Advisory Panel as a means to inform and learn the opinions of the local community. DDC also have additional concerns relating to factors such as operations, maintenance, costs and financial viability.

The key stakeholders for implementation

DDC propose to procure a PRT system through a **Private Finance initiative (PFI)** or other form of public-private partnership. The main actors will be:

- **DDC** as the scheme promoter together with **Northamptonshire County Council (NCC)** who are the Regional Transport Authority with responsibility for planning and owners of the infrastructure on which the scheme will run.

- A **PT operating company**, to be determined by tender, as the operator of the PRT system.
- A **Technology supplier** and system integrator, also to be determined by tender, who will provide the podcars, the control centre and communications systems.
- An **Infrastructure supplier** and contractor, also to be determined by tender, to implement the necessary civil engineering facilities, including the guideway and stops, and buildings for the control centre and depot.
- **Managing consultant**, also to be determined by tender, to act as project manager to oversee the overall implementation and ensure co-ordination between the technology and infrastructure suppliers.
- **National government** for certification and funding support.
- Other **Funding partners** eg banks, and the developers of the sites served by the PRT scheme.

Other groups that will need to be consulted will include:

- Neighbouring local and regional authorities
- Emergency services
- Local community
- Passenger interest groups
- Special needs groups
- Media

Several models for PFIs are possible, such as the DBFO (Design, Build, Finance, and Operate). They involve establishing a formal legal 'consortium' agreement between the public and private sector partners involved to clarify their respective roles, responsibilities and liabilities.

The Transferability Potential

The transferability to Daventry

The example case of the **PRT scheme at Heathrow has been the key reference** for the transferability analysis that has supported the development of a tailored approach for Daventry.

Supportive factors are:

- **Cost benefits**, studies show that unlike most public transport systems, PRT systems should cover their costs.
- **System efficiency**, the system is on-demand so vehicles are only used when there is a demand, waiting times are low, and vehicles go direct to the destination without stopping.
- **System attractiveness**, the high quality on-demand personal service is expected to be highly attractive to users and to have a substantial effect on modal split.
- **High degree of compatibility** with prevailing transport policies and strategies, including pollution reduction, increased use of public transport, accessibility, sustainability and land use.

Major constraints are:

- **Funding**, start-up costs are significantly higher than for an equivalent bus (though not for a tram) scheme, even though operational and whole life costs are expected to be significantly lower.
- **Legal and contractual requirements**, where national government is the ultimate authority for the necessary safety certification of a scheme.
- **Organisational and institutional aspects**, where national and regional government need to be involved to establish the planning and procedures required to obtain necessary approvals.

- **Technical requirements**, mainly in terms of the infrastructure required, which must be segregated (where the guideway is elevated, there are possible problems of visual intrusion, where the guideway is at ground level, there are possible problems of severance).
- **Awareness and communications**, because the system is so radically different from existing services that it will require greater effort to educate and familiarise potential users/stakeholders.

Also worth mentioning are:

- **Stakeholders**, because of the effort required to involve the users and businesses likely to be affected by implementation from the outset, and get them on-side; and, if necessary for funding, to involve national government as a partner.
- **Human resource issues**, in terms of the skills and training required for the operators of the system.
- **Technology risk and safety and security**, even though it is recognised that these are satisfactorily dealt with in existing automated systems such as Metros in cities and Transits at airports.

It can be concluded that **transferring PRT into Daventry will be difficult**. Nevertheless, the **benefits are very persuasive and the numerous problems have been overcome in examples** such as Morgantown (USA) and Rivium (NL), and are being overcome currently at Heathrow (UK), in Rome (I), in Masdar (UAE), and in one of Uppsala or Stockholm (S), to be decided imminently. The FP7 CityMobil project (www.citymobil-project.eu) is helping to show the way, and NICHES+ is helping to promote the concept locally.

The measure justification

The main justification for implementing a PRT scheme in Daventry has been shown from the feasibility study commissioned from Colin Buchanan Ltd (DDTS 2007) which showed a **Benefit/Cost Ratio (BCR)** in the range 5.3 – 7.6 for a city wide system, and the detailed study for a pilot scheme (first city phase) commissioned from Sinclair Knight Mertz (DPSS 2008) which showed a BCR in the range 1.84 – 2.74. The BCR figure for the pilot has been separately confirmed at about 2.12 using the Business Case Tool produced by the CityMobil project (CityMobil 2008) which also included a **multi-criteria analysis** showing that PRT was substantially preferred over an alternative High Quality Bus scheme.

The implementable measure

An outline specification produced for DDC by Sinclair Knight Mertz, sets out the route and high level requirements of a pilot scheme of PRT for Daventry. The general requirement is for the design of all elements of the PRT system to conform to relevant standards for safety.

The specification covers:

Access Requirements including:

- stations to conform with requirements of the Disability Discrimination Act 1995
- requirements for lighting, public announcement system, information displays and means of communicating with control
- means of requesting vehicles
- means of fare collection

Quality of Service including:

- maximum and average waiting times
- station capacity
- passenger and luggage capacity of podcars
- vehicle headways
- the passenger carrying capacity of the system

- requirements for wheelchair access
- ride quality
- journey times
- system availability
- operations

Safety

- procedures in the event of problems
- walkways and amenity areas lighting for night use
- requirements for fire protection
- requirements for collision protection
- secure two way voice communication between control and all podcars
- the guideway designed to minimise the risk of damage from road vehicle collisions
- CCTV for supervision of all station platforms and cars

Guideway, including design requirements to:

- support and contain vehicles and cope with weather conditions
- provide support for and escape of passengers in stranded podcars
- provide a means of safe access for maintenance staff
- incorporate suitably insulated and protected traction power and other supplies
- provide alternative routeing in the event of a failure or blockage at any point

The report concludes:

The PRT pilot scheme performs well at this stage, confirms the range of potential benefits indicated in phase 1 (of the study) and is preferred to the High Quality Bus option. Daventry DC should develop the implementation strategy.

The Implementable Measure

The implementation strategy

It is expected that DDC supported by NCC as the regional highway authority and a key stakeholder, will be the main players in the **PFI procurement process** to select the successful tender. They will then transfer responsibility to the successful tenderer which is expected to be a Special Purpose Vehicle (SPV) or similar company that will oversee the project and finances, and will sub-contract the various different aspect of the work eg for the design, build, operate and communications work.

The programme of activities and timeline to implementation are:

Determine procurement model and performance spec.	2011
Procurement	2011 – 2012
Establish SPV	2012
Prepare full business case and detailed design	2012 - 2013
Prepare and submit a full grant application	2013 – 2014
Prepare TWA (transport and works act) Order application	2015
Construction of infrastructure	2015 – 2017
Procurement of vehicles	2015 – 2016
Staffing and training	2016 - 2017
Acceptance testing	2017
Operations	2017 on

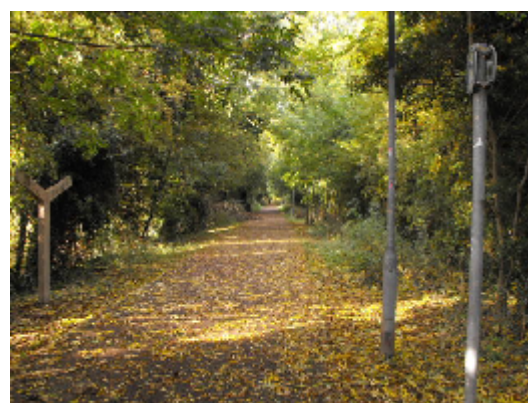
The **capital costs** are estimated to be £28.5M (EUR 33.9M) made up from £22M (EUR 26.1M) for infrastructure and £2.5M (EUR 3M) for vehicles.

The operating costs are estimated at £1.2M (EUR 1.4M) per year plus about 1.5 persons full time equivalent from DDC to monitor scheme operations and communications on behalf of the community.

The long-term perspective

Unfortunately the proposed pilot scheme cannot be self-funding. It is a necessary first phase to test the technology and user acceptance, but is almost certainly too limited in scope to attract sufficient passengers and revenue to pay its way. The evidence suggests it should do so when it is extended to cover a proper network, but initially some **pump priming money** will be required to get a pilot operational.

It is therefore hoped that some funding to support a pilot will be found from **community eg national or European funds**. PRT is a new technology. It is clean and green, and looks to offer real potential for paying its way and realising a significant mode shift away from private cars. It is therefore **potentially sustainable in both economic and environmental terms**. At the same time it will offer new opportunities for developing local skills and industries that should in turn lead to new jobs and wealth creation.



Daventry: the proposed route of the pilot scheme would use a section of old railway line, now a public foot and cycle path, to connect a residential area with the town centre.

Photo: Daventry District Council

PRT is an **exciting new technology** which appears to have very real potential to provide future public transport systems that are both **economically and environmentally sustainable**.

Studies suggest that in a comprehensive network, PRT should be very nearly as attractive to use as the private car for local journeys. As a result PRT can expect to **attract high levels of patronage** which should in turn produce revenues that are more than sufficient to cover their capital and operating costs.

In addition they are **easy to use**, like a lift, and consequently easily accessible to all classes of users including the young, the elderly and the disabled.

The main worries appear to centre on **technology risk and user acceptance**. Both have been effectively allayed in existing systems, including automated metro systems which are now commonplace in many large cities, and in the more closely related Parkshuttle and Heathrow example systems.

Nevertheless, problems remain and private funding will continue to be hard to find until a pilot scheme is available to prove the facts. At the same time this pilot will need to address the difficult procedures needed to get **planning approvals and safety certification**.



Photo montage of PRT in the setting of a new development
Courtesy BAA

Check list

The following check-list summarises **key aspects for implementing PRT** and intends to give the reader advice on whether the concept is suitable for their own context.

Check list	
City size	Best suited to smaller cities where trams and metros are uneconomic. Also useful for widening catchment areas e.g. for stations etc. and serving new &/or dispersed sites.
Key conditions for implementation	Dedicated will and motivated team to improve accessibility and provide sustainable transport for the future. Kick-off funding to get a scheme started and long-term commitment to keep it running.
Resources	Less than for a tram and less than the full life costs for an equivalent bus scheme using drivers. Capital costs are needed to procure the podcars; provide the control system/centre and a depot for vehicle maintenance and charging; and also to provide and equip the guideway, stations and security measures.
Implementation time	Medium term, 5 years or more may be needed to plan and implement a scheme in a city environment.
Stakeholders involved	Operating company, local authority as the infrastructure owner, national government for safety certification. Local community and users.
Undesirable secondary effects	Possible visual intrusion caused by elevated sections of guideway, and of severance caused by sections at-grade.

Postscript

Following a conference to present the NICHES+ findings and identify future actions, the way forward could be via a GRT system as a first step. It would be cheaper to implement initially and at the same time provide a means for investigating the options and procedures for both types of systems. It would also substantially avoid the visual intrusion and severance issues identified as a problem by the local community.



For further details on how to implement Personal and Group Rapid Transit (PRT and GRT) schemes please see the **NICHES+ Guidelines for implementers** (available from www.niches-transport.org).

The more detailed **full version of the Implementation Scenario** for PRT in Daventry is also available on the NICHES+ website.

Photo on title page

PRT at Heathrow airport, courtesy BAA, and Daventry High Street, courtesy Daventry District Council

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