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EDICT

Evaluation and Demonstration of Innovative City Transport

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0. EXECUTIVE SUMMARY

0.1 Introduction

EDICT (Evaluation and Demonstration of Innovative City Transport) was established by a consortium of 4 European cities (Cardiff, Ciampino-Rome, Eindhoven and Huddinge) together with 12 research organisations to fulfil the following objectives:

- To demonstrate and evaluate in a European Capital City an innovative form of Personal Rapid Transit (PRT) which can offer effective and sustainable transport;
- To study the opportunities for PRT for practical improvement of both transport and the environment in four European Cities with significantly different characteristics via scenario analysis and pre-planning for full application, including an integrated simulation;
- To assess the environmental impact of PRT systems compared to other forms of transport. This work will include energy, emissions, noise, visual intrusion, separation etc, issues;
- To assess the key social, economic, and cultural issues in the introduction of PRT systems in Europe, via analysis, discussion with potential stakeholders and citizen consultation both informally and via carefully constructed surveys. This will include an examination of institutional barriers to innovation;
- To assess and recommend best practice for the evaluation and introduction of PRT to improve the effectiveness and sustainability of transport systems for the City of Tomorrow.

The Dutch city Almelo joined as a partner city during the course of the project to replace Eindhoven which had to withdraw due to institutional and financial barriers.

The EDICT cities evaluated Personal Rapid Transit as an innovative and sustainable transport solution to the private car, that addresses the problems of congestion, poor air quality and social exclusion in cities, and which complements existing forms of public transport. That is a system of driverless automatic cabs travelling on their own guideway network which can be positioned aboveground, at ground level or underground. PRT vehicles can be made available 24 hours a day on demand at all stations on the network to meet individual travel needs. Vehicles typically take two to six passengers travelling together. From the user's perspective, PRT offers fundamental benefits over existing public transport. The service is available on demand rather than on fixed schedules. In most cases, passengers do not need to wait for a vehicle; one will already be at the station for their personal use. Non-stop travel service ensures short trip times.

Despite these benefits, to date no type of PRT has been demonstrated in service in the world. Thus these benefits remain unproven by practical evaluation. At the beginning of the EDICT project, it was planned to have a full-scale demonstration of a PRT system (ULtra) in Cardiff but due to political and financial barriers this activity was withdrawn and instead the test track that was built before the project was further developed in order to undertake practical assessments, including user trials.

0.2 Demonstration and Case Studies

In EDICT, PRT was evaluated in terms of the local policy contexts of the different cities. In summary, each site has a particular case for PRT, identified as follows:

- the "*transport problem*" case, where there are identified existing problems of increasing traffic congestion and pollution (Ciampino, Huddinge and Almelo);
- the "*sustainable city*" case, where the project is not problem driven, but driven by environmental and lifestyle goals and local development plans which derive from the vision of a sustainable "City of Tomorrow" (Cardiff);
- the "*innovation policy*" case, driven by the goal of creating new opportunities through launching an innovation process (maximising the potential of the university campus) (Eindhoven).

The cities, the characteristics of their PRT schemes, their broad transportation strategies, and their progress in EDICT, are summarised in Table 0.1.

Table 0.1: Synthesis of Local Schemes

	Cardiff	*Ciampino*	*Eindhoven*	*Almelo*	*Huddinge*
Location	New regeneration development area on former dockland adjacent to city centre	Link from sub-regional centre and transport system to secondary airport	Link from University Campus to public transport systems.	Link railway station, city centre and hospital	Links within out of town retail and leisure development
Land-Uses Served	Business, government offices	Airport	Education and business	Retail, Rail, Healthcare, Education, Business	Retail
Scheme Promoter	City Council	City Council	Regional Council	City council	City Council
Main Objective	To provide sustainable, flexible access to regeneration site from city centre	To provide sustainable access to transport system	To provide sustainable access to transport system	To provide sustainable access to the transport system, improve city image	To link low-density retail and leisure facilities to public transport and car parks
Description of Scheme	Phased implementation of PRT scheme	Single scheme	Single scheme	Single scheme	Multiple lines
Summary of Progress	Test-track complete. Evaluation (including passenger trials) on test track and planned future scheme. Dissemination activities ongoing. Produced a video of the ULTra test track.	Routes identified and preferred option selected. Evaluation complete. Dissemination activities ongoing. Produced simulations of the PRT route.	Routes identified for evaluation. Evaluation carried out but not completed. The project was withdrawn from EDICT due to financial and political barriers. Produced PRT simulation.	Route identified for evaluation. Evaluation complete. Dissemination activities ongoing (included the production of videos showing mock-up system). Produced PRT simulation.	Route identified for consultation. Evaluation complete. Dissemination activities ongoing. Produced simulations of the PRT route.
Expected Implementation	Plans for Phase 0 in 2005 delayed due to temporary withdrawal of national funding in 2003. Change of political power in May 2004. Political support continues, but timescale is uncertain.	Depends on financial support from airport operator. PRT will require public funding.	Initial support faded. Process slowed down by tendering regulations. Knowledge, experience and momentum lost. Eindhoven study stopped,transferred to Almelo.	Phased PRT implementation. The first phase of this system was evaluated in EDICT. Preparation for a pilot scheme is planned after EDICT.	Full network in 2015.Potentially funded by 50% state subsidy. Needs political support and be part of the local and regional development plan to obtain funding.

Clearly EDICT offers a wide range of study sites with different needs and land-uses. Each city has evaluated the implications of implementation of a PRT system, with Cardiff having tested a specific PRT system – ULTra. However, full system implementation will, of course, be subject to the usual EC, national and local requirements for procurement.

0.3 Evaluation

A detailed evaluation plan was developed which enabled the assessment of PRT in all partner cities on a comparative basis, and to suit local objectives. Data were collected under the following headings:

1. **Impacts on the policy objectives**
    a. efficiency and quality of the transport system
    b. safety and security
    c. accessibility
    d. environment
    e. economy and
    f. integration with other policies

2. **Practical feasibility analyses**
    a. distribution and equity
    b. public acceptability and stakeholder support
    c. finance and funding
    d. technical and legal
    e. political context and decision making process

0.4 Results

The results of the EDICT project for the demonstration and case study sites are summarised in Table 0.2. Overall, the results may be summarised as follows:

0.4.1 Impacts on Policy Objectives

Transport Efficiency and Quality: A key attraction of PRT over conventional public transport modes is that it eliminates waiting time, and offers direct and comfortable journeys. The stated preference survey findings indicate that these elements of PRT are an attractive factor for all transport users (including car and public transport). Furthermore, implementation of PRT is shown to lead to travel time savings for car and public transport users. Car traffic is also expected to be reduced in all study sites as a result of PRT. The investment and operating costs for the study networks vary by area since each proposed application is of a different scale and will attract different numbers of passengers. The system attracts the greatest number of passengers if it is integrated with the rest of the city's transport system.

The fare proposed is between 1-1.5 in 2006. In Cardiff this fare is per vehicle so when people share a vehicle they share this fare between them. Focus Groups studies with people who have ridden on the ULTra test track say they would be willing to pay two to three times this amount because of the additional benefits it offers over conventional public transport modes.

Safety and Security: PRT is generally regarded as a safer mode of transportation mainly because it is mostly elevated and therefore does not conflict with road traffic and / or pedestrians. The safety case for the ULTra system is also accepted by Her Majesty's Rail Inspectorate (HMRI). However, a key issue of concern emerging from the stated preference surveys and the ULTra user trials related to the system's safety and the personal security of passengers. Because the system does not exist and the public have nothing with which to compare it, respondents had reservations about its technical reliability and efficiency, and how it would cope in severe weather conditions. Also, because the system is driverless respondents raised an element of concern about their personal safety especially using the system alone. To enhance feeling of safety so that more people will use the system, it must be well-lit and be under continuous CCTV coverage, with direct links to the controller from all stations and vehicles. Furthermore the minimal waiting time should reduce the vulnerability of passengers at stations. However, safety and perception of personal security has not been a cause of concern for passengers using the driverless minibuses operating in the Netherlands (in Schiphol and Rotterdam).

Accessibility: The main impact across the EDICT cities on accessibility is improved access to the PRT network areas. With the exception of Eindhoven, the evaluated PRT networks provide a connection within the present transport system. This connection will help to attract more visitors to the study areas, whether it is a retail site, recreational centre or airport. PRT is also proved to be a preferred choice of mode for disabled and elderly people; it is regarded as a means of transport that enhances mobility and independent travel. It is generally felt among the public to be more convenient, comfortable and easier to use than conventional public transport modes. It is also considered to reduce stress which many disabled and elderly people experience while using other modes of travel.

Environment: PRT vehicles are generally electric and lightweight. They use considerably less energy per passenger-km than cars or even conventional public transport. Even allowing for pollution caused by the production of the electricity required to run them there is a net saving in both energy and emissions compared with the modes which their passengers would otherwise use. Furthermore, the expected reduction in car traffic will lead to further reductions in CO_2 emissions. Electric PRT vehicles are also generally quieter than the alternative modes. Also PRT can be run inside buildings thus reducing visual intrusion or habitat destruction. The main issue of concern is when the system runs outside historic buildings or private residences.

Studies in Huddinge also show no threat to habitat destruction. The proposed PRT network that connects Skärholmen residential area, its shopping centre and the metro station to the Kungens Kurva area, would enhance the attractiveness of the entire area. On the other hand, the need for new infrastructure may lead to increased visual impact which could be a problem in historic areas.

Socio-economic: The cost-benefit analysis showed positive net present values. All the proposed PRT networks present positive social benefits which are expected to exceed costs. It should easily cover its operating costs. Such a system is expected to provide citizens with a transport system which saves time, effort and money, which attracts people from their cars, and which will support new developments and regeneration sites. Further social benefits are brought by increased access for all groups in society to services that improve quality of life and employment opportunities. Many of these benefits go wider than the net profit from the system.

The revenue streams from the proposed PRT systems may not quite cover their capital costs on the predicted level of demand. Whilst it is possible that revenues would be sufficient to cover costs at the standard public discount rate, higher returns would be required from the investment if funding is sought from the private sector. Furthermore, if PRT is seen as a tool to facilitate high building densities within city centres, the economic benefits should exceed investment.

Integration with other policies: PRT is shown to make a positive contribution to achievement of local transport and social policy within the demonstration and network study areas. These relate to accessibility, social inclusion, and regeneration in addition to sustainable mobility objectives.

0.4.2 Practical Feasibility Analyses

User Acceptance and Attitudinal: The concept of PRT in all EDICT partner cities was well received by the public. The user trials of the Cardiff demonstration showed that user acceptance and willingness to use ULTra increased considerably after riding the system on the track. There were some common issues of concern raised by the public that included personal security and safety of the vehicle and stations; fares and ticketing; and the system's technical reliability. However these issues were regarded as being easily overcome through the implementation of personal security measures such as CCTV and good communication links between passenger and control centre in the vehicle and at stations; and an area wide information campaign to raise awareness of how the system operates and its features.

Funding and Procurement: Although PRT is certainly an innovation, legal advice insisted that procurement of a pilot scheme must be via competitive bidding, and invitations to potential providers have made several false starts. Procurement of such a system, via the OJEC procedure will be necessary, but the European regulations for public procurement are not well-suited to innovations like PRT.

Risks: The project identified a number of risks to consider in the design and planning of a PRT system. These mainly relate to technical, political, procurement, personal security and legal issues. For the investor, there are technical risks that the system will not ultimately perform as proposed, and that it may cost more and take longer to bring to satisfactory operation than the designers claim. Whether the decision is made by a local authority using public funding, or by a company using private capital (as for example in an airport) there are serious political risks attached to failure.

The perceived risk of innovative solutions such as PRT will remain high, no matter how compelling might be the cost-benefit case, until a fully-operating pilot system is in successful public use. Some form of government support, beyond the normal public transport funding arrangements, seems likely to be necessary to achieve such a demonstration.

Political Context and Decision-making: The experiences of Cardiff and Eindhoven demonstrate the importance of the political context in enabling the development of an innovative project. Both projects were hindered by political problems. Although the proposed PRT networks in both cities received political support and financial backing in the initial stages of the project, it proved difficult to retain this support. Political support for highly innovative schemes may be controversial and subject to rapid change as the electoral cycle proceeds. If there is no political advocate bearing the risks and burdens of the scheme and

willing to reap only a small portion of the short- and long-term benefits, the scheme is likely to fail.

Actor's participation: a number of actors have been identified that offer a key role in the development and operation of PRT. There are a large number of different types of stakeholders involved in the design, operation and use of any PRT system. The project identified the following key stakeholders and their roles in the design, operation and use of any PRT system: national authorities, the European community, regional development authorities, local transport authorities, politicians, neighbouring city authorities, transport operators, other service providers, finance organisations, trade unions, users of the transport system, local community and pressure groups, potential residents, external firms, users, tourists, and the media.

Table 0.2 Summary of findings by city

	CARDIFF	CIAMPINO	EINDHOVEN / ALMELO	HUDDINGE
Impacts on Policy Objectives				
1. Transport efficiency and quality	In 2006 ULtra is predicted to attract 5.67million passenger trips per year. Demand will grow as the commercial and residential development increases, rising to 7.42million trips by 2036. ULTra is predicted to attract 61% of present bus users, and 9% of walkers, and 8% of car commuters. It is also expected to increase the use of rail and bus. Mean wait time is only 0.3minutes.	The number of PRT passengers will be almost 2 million per annum in 2006 and over 4 million in 2036. Within the local area car traffic is expected to reduce by 57 million veh-km, 75 million fewer passenger-km by car and 372,000 hours less travel time. An increase of 11 million passengers-km is estimated on public transport.	A key attraction of PRT over conventional public transport modes is that it enables no waiting time, direct and comfortable journeys – a pulling factor for car users. Expected PRT patronage in Almelo is 6151 passenger trips per day. 35-40 PRT vehicles are required to meet this demand. Average waiting time is estimated at 2 minutes.	The PRT system is estimated to cost 57million (6.9 per km). At 0.79 fare per trip, the annual operating cost is expected to be 3.2million. Travel time between Skärholmen and Kungens Kurva is reduced by 41%. Travel time savings for car and PT users are up to 20 minutes. Car traffic is expected to reduce by 8% with PRT. Without PRT traffic is likely to rise by 40%.
2. Safety and security	HMRI, the body responsible for rail safety in the UK, has accepted the safety case for ULTra and authorised passenger trials. To enhance passengers' feeling of safety the system must be well-lit and be under continuous CCTV coverage, with direct links to the controller at all stations and on all vehicles.	The reduction in car use brings about reductions in accidents, injuries and fatalities. These are estimated as a saving in social costs of 1.8million in 2006 and 3.5 million in 2036.	A predicted reduction in traffic is expected to reduce the risk of accidents and injuries.	Reduced traffic congestion will ultimately reduce the risk of road accidents. PRT is considered to be safer than road transport since it uses an elevated guideway and therefore does not conflict with other modes.
3. Accessibility	Depends on the extent of the network. ULTra will be immediately available to residents of the Bay Area, but most other users will access it via some other mode of transport. Disabled people regard it to be more accessible and convenient than other present forms of public transport.	PRT will provide a much needed link to the airport and ease of transfer with rail services.	PRT would improve access to the hospital, shops and services, and also enable elderly and disabled people to use.	Access between stores at Kungens Kurva is significantly improved with PRT.

	CARDIFF	**CIAMPINO**	**EINDHOVEN / ALMELO**	**HUDDINGE**
4. Environment	There are substantial savings in energy use, equivalent to 2.5million litres of petrol per year and parallel savings in emissions. The saving in energy corresponds to a reduction in CO_2 of 3550 tonnes. There will be a visual impact as a result of elevated tracks.	Reductions in air pollutants stem from a reduction in car traffic. CO_2 emissions savings are substantial: 13,000 tonnes of CO_2 for reduced car traffic against a higher production of 116 tonnes of CO_2 at the generating plants for battery recharging of the PRT electric vehicles. Reductions in CO_2 emissions are valued as 0.6 M pa in 2006, reductions in all other emissions as 2.3M pa in 2006	The reduction in energy usage compared with cars is over 75%. Importantly, in peak periods when cars (and buses) are restricted by congestion this benefit rises to 90%. There is no threat to the habitat but the system's noise levels is slightly higher than legal standards for residential areas at full capacity and maximum speed. The visual impact is below standards unless the track is close to a window.	A total energy saving of 9 % of 162 GJ per day can be achieved. This will correspond to an energy saving of 59,150 GJ per annum. The PRT network between Skärholmen and Kungens Kurva reduces the amount of air pollution exhausts by 8 %. The CO_2 reduction amounts 1,610 tons per annum. The Skärholmen-Kungens Kurva PRT network does not bring any community severance. The PRT system overcomes the physical barrier (Euro route E4) between Skärholmen in Stockholm and Kungens Kurva in Huddinge.
5. Economy	Building the ULTra network (20km guideway) will cost £34.3M (51.5), with an annual operating cost of £2.05M (3.08M). Revenue is estimated at £4.3M (6.5M at the £1 fare per vehicle in 2006 rising to £5.6M (8.4M) in 2036. ULTra is expected to attract 5.67 million passenger trips per year, rising to 7.42 million by 2036. The Net Present Value of the social benefit less costs over 30 years is 200M at a discount rate of 6%, with a Benefit to Cost Ratio of 3.9 and a First year rate of Return of 27%.	At a fare of 0.50, revenue is expected to be 0.9M p.a. and 1.8 p.a. at 1 fare. The operating cost in 2006 is 3,1M. In 2036, at the 0.50 fare, revenue is 2,140,000 and 4.3M at 1 fare. The operating cost is 3.5M.	Investment costs for PRT in Almelo is estimated at 39 million and annual operating costs are 2million. The annual revenue, assuming a flat fare of 1 per passenger will be around 1.9million. The system almost covers its costs.	Investment cost: 57M (6.9 M /km) – including 7% for engineering works Annual operating cost: 3.2M/year (0.8 per passenger)
6. Integration with other policies	The proposed PRT system contributes to various local transport policies by encouraging transfer from car to public transport, and improving the vitality of the city by making facilities and jobs more accessible.	The proposed PRT system contributes to local transport policies in reducing congestion and enhancing the sustainability of public transport modes.	The PRT system is expected to increase land values, attract outward investment, in addition to contributing to sustainable mobility objectives.	Attracts 17% more visitors to Kungens Kurva, rising to 52% over time. 8% of car users will switch to PRT. The use of the light rail transit serving Kungens Kurva is also likely to increase by up to 20%. Land values are likely to increase with PRT in place.

	CARDIFF	CIAMPINO	EINDHOVEN / ALMELO	HUDDINGE
Practical Feasibility Analyses				
7. Distribution and equity	The proposed PRT system will serve residents of the redeveloping Bay area, improve accessibility to jobs and services for low-income residents, and access for disabled and elderly users.		All transport users are expected to benefit from the PRT system including disabled and elderly people. It also improves quality of life by improving access for non-car users to the hospital, shops/services.	The estimated social benefits (129million) exceed costs (95million). The direct costs of PRT make up 89million or 69% of all benefits.
8. User acceptance and stakeholder support	User attitudes are positive with a high level of acceptance and willingness to use. Stakeholder reactions are mixed. Some issues of concern about impacts on city image, visual intrusion.	Attitudes are positive to the proposed PRT route especially among travelers who are male, young, and currently use public transport. Personal security was an issue of concern.	User attitudes are generally positive and many benefits are perceived over conventional public transport modes.	Car and public transport users have a positive view of PRT and a high willingness to use. 57 % of survey respondents were in favour of the PRT system to be built. 1 in 5 believed it would be easer to travel without a car to the Kungens Kurva if PRT with PRT in place.
9. Funding and Procurement	The procurement process has been long and complicated.		Public funding will be very difficult. Options for private funding exist should the profit of higher building density be given to a private investor.	
10. Technical and legal	The ULTra system has minimised many of the technical risks. There are legal risks because as yet, there is not a European regulations or regulatory body for such an innovative transport system.			
11. Risks	These included technical, financial and legal, and political.		As in Einhoven's case, the risk was a political one.	Only political factors present a barrier to a PRT application. Technical and personal security risks do not pose a problem.
12. Political context and decision making processes	Gaining and retaining political support for new and untried systems is difficult. This project was delayed because the Welsh Assembly Government withdrew its funding allocation.	The main barrier relates to the multiplicity of stakeholders. Financial support is required by the low-cost airlines otherwise the system will require public funding.	Political barriers in Eindhoven led to the project's withdrawal.	Gaining and retaining political support for new and untried systems is difficult. To date there has been no political support for PRT.

0.5 Conclusions and Recommendations

The following general conclusions and recommendations are put forward based on the experience of EDICT.

The detailed assessment carried out in the EDICT project suggests that PRT:

- can provide significant benefits and achieve a wide range of needs, policy objectives and land-uses, whether the motivation is transport driven, a sustainability or innovative case;

- can be cheaper to build and operate than conventional forms of guided public transport; for the application of the ULTra system to Cardiff, the assessment indicated that PRT would easily cover its operating costs, and provide a return which could pay for most, if not all, of its capital costs;

- provides a level of service which is superior to that available from conventional public transport, because there is very little waiting time, travel is essentially private, and is non-stop direct from origin station to destination; the mean speed is not high, but PRT is likely to be quicker than road travel, or rail travel with intermediate stops, over distances up to several kilometres in an urban environment;

- is well received by the public, both public transport and car users; attitudinal surveys show a high willingness and enthusiasm to use it for short-distances within city centres and for commuting trips;

- promotes the social inclusion of certain groups especially disabled and elderly persons by increasing their access to cities and key services e.g. retail, recreation, hospitals;

- is regarded as a quiet, safe, convenient and an efficient means of public transport with potential to replace car trips;

- can potentially enhance the image of cities, attract inward investment, and increase the economic value of land and premises; and

- provides positive rates of return from the investment in social cost-benefit terms.

Overall the findings inform us that PRT provides a highly accessible, user-responsive, environmental friendly transport system which offers a sustainable and economic solution for the “Cities of Tomorrow”.

On paper, PRT looks much more attractive than conventional public transport, as proved in all EDICT sites. On the negative side, however, PRT carries a lot of risk because to date, there has been no full practical development for public use, least not in Europe. Although many public authorities are interested in the concept, as found in EDICT, not one has committed to installing such a system. EDICT evaluated the risks and barriers to the implementation of a PRT system from which the following recommendations are put forward:

- It seems essential that the risks should be minimized by first constructing a small pilot scheme, in order to decrease the financial commitment, but also to minimise the public

visibility and inconvenience if the system should have initial problems which take longer than anticipated to solve.

- There may be political differences at local, regional or national levels and winning over a sometimes sceptical public can also prove difficult. Often the support of one key politician can be the difference between acceptance and rejection. However, as proved in Cardiff and Eindhoven, this is a high risk element, as there can be abrupt changes of mind and many of the political aspects are beyond the control of scheme designers and promoters. The technical merits alone of any new proposed innovative system are insufficient to guarantee implementation. The solution would be to attract the private sector and perhaps develop a public-private partnership to promote and develop a scheme to reduce the risk of political uncertainty. Here it would be necessary to identify a means with which the commercial party can benefit and the social benefits can also be served.

- Whilst it is possible that revenues would be sufficient to cover costs at the standard public discount rate, higher returns would be required from the investment if funding is sought from the private sector.

- One of the main issues pertinent to Cardiff was the category in which to place a PRT system when preparing the OJEC notice, since a definitive description applicable to PRT systems could not be found in the Common Procurement Vocabulary (CPV). For example, there are very clear categories for Rail, Bus etc, but nothing for driverless automated Personal Transport. It is important for future procurement purposes, especially those involving OJEC, that a precise CPV category is established for particular innovative modes of transport, and a specific CPV category for this type of product should be created within the European Procurement Categories. Current EC procurement rules are not propitious for innovation, and have led to substantial delay.

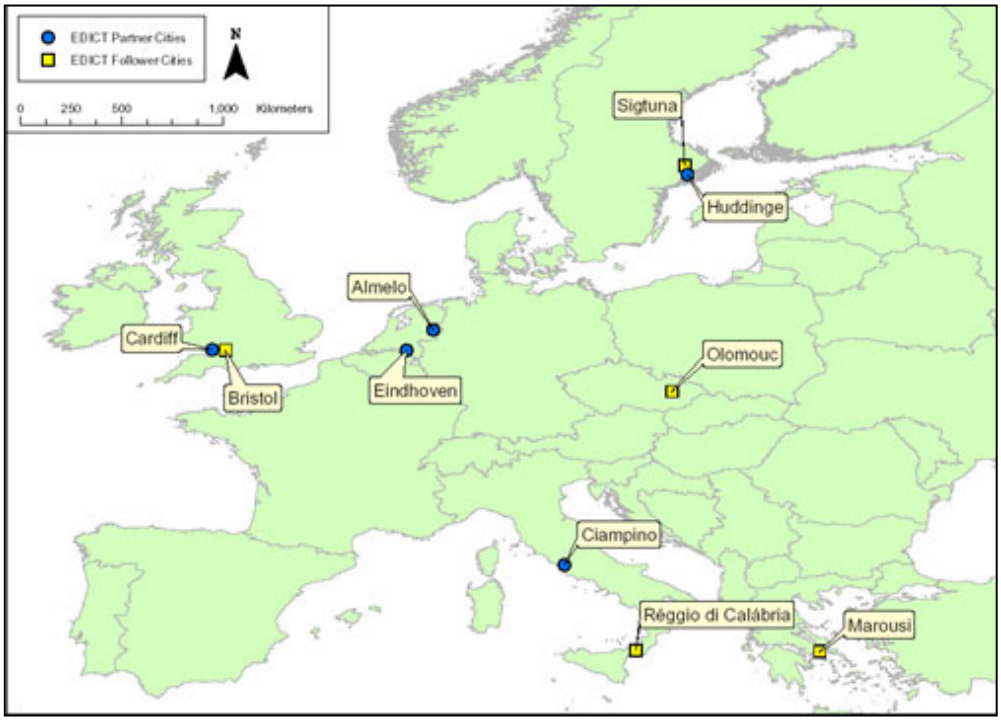
1. INTRODUCTION

1.1 What is EDICT?

EDICT is the acronym for Evaluation and Demonstration of Innovative City Transport commissioned by DG Research of the European Commission (project reference: EVK4-2001-00058). It was a 36-month project which commenced on the 01/12/01 and was completed by 30/11/04. The project is funded under the Energy, Environment and Sustainable Development or EESD subsection of the Fifth Framework Programme (FP5) which addresses the urgent need for sustainable forms of transport in cities in Europe as an alternative to the car and to complement existing forms of public transport. EDICT is situated under the City of Tomorrow Key Action of the programme which aims to develop new technologies and systems to complement what already exists and to help guide decision-making processes.

EDICT was established by and began with four partner cities from Italy, the Netherlands, Sweden and the United Kingdom, together with 12 research organisations. During the course of the project the Dutch city (Eindhoven) was forced to withdraw when it became clear that the planned evaluation of PRT could not be undertaken within the project timescale, due to institutional and political barriers. Three cities remained (Cardiff, Huddinge and Rome Ciampino) and the Dutch city of Almelo (a former follower city in EDICT) joined the project as a partner in place of Eindhoven. Researchers and transport authorities in these cities and five follower cities across Europe (see Figure 1.1) were brought together to evaluate the technical, environmental, social and economic benefits of a novel Personal Rapid Transit (PRT) system. Practical assessment of user and community benefits was accomplished through test track demonstration in Cardiff. The results have been developed to provide information on best practice for assessment and introduction of PRT systems to improve future transport in Europe.

Figure 1.1 EDICT cities



1.2 Project Objectives

The project aimed to produce a full technical, environmental, social and economic evaluation of the demonstration PRT system, together with a systematic and unified appraisal of the potential of PRT in four European cities with very different characteristics. The appraisal covered technical, environmental and socio-economic aspects in each case, and included a direct comparison with existing forms of public transport. This enabled an evaluation of the potential of the ideas for application throughout Europe.

The achievements of the work include full evaluation reports, which cover, in addition to direct technical assessments and assessment methodologies, policy incentives, planning tools, and best practices for reducing car use and encouraging greater use of sustainable public transport. Specific issues covered in the reports also comprise the following RTD priorities: vehicle/transit system modelling, simulation, cost benefit analysis and assessment, life-cycle analysis, concepts for prototype testing, demonstration and validation, real-scale demonstration and assessment of urban transport concepts. The work is especially relevant to the RTD priority to provide user-friendly new vehicle concepts for personal or freight transport and improved vehicle / urban infrastructure compatibility.

The specific objectives of the EDICT project were:

- To demonstrate and evaluate in a European Capital City an innovative form of Personal Rapid Transit (PRT) which can offer effective and sustainable transport.

- To study the opportunities for PRT for practical improvement of both transport and the environment in four European Cities with significantly different characteristics via scenario analysis and pre-planning for full application, including an integrated simulation.

- To assess the environmental impact of PRT systems compared to other forms of transport. This work will include energy, emissions, noise, visual intrusion, separation etc, issues.

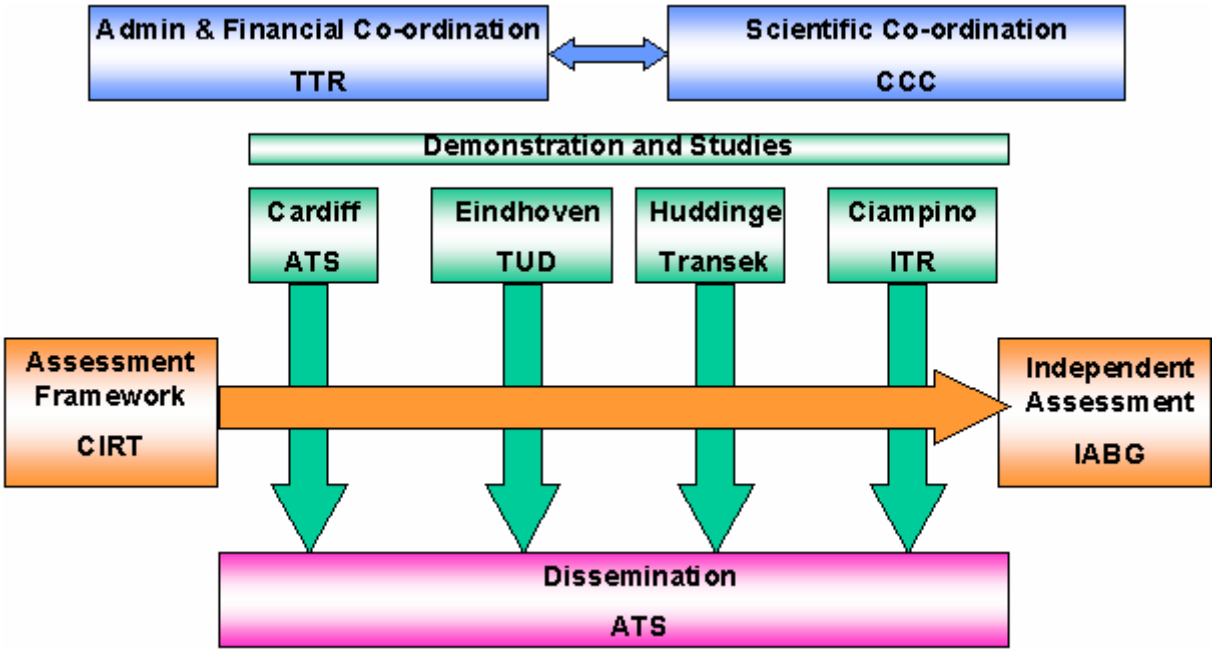
- To assess the key social, economic, and cultural issues in the introduction of PRT systems in Europe, via analysis, discussion with potential stakeholders and citizen consultation both informally and via carefully constructed surveys. This will include an examination of institutional barriers to innovation.

- To assess and recommend best practice for the evaluation and introduction of PRT to improve the effectiveness and sustainability of transport systems for the City of Tomorrow.

With regard to the first objective, at the Project's inception phase, a full-scale demonstration of a PRT system was planned in Cardiff – the first PRT system to be demonstrated in the world. No PRT system has been previously demonstrated. Work was undertaken in several countries in the 1970s, but only reached the stage of full scale engineering testing. Thus prior evaluations and assessments of the merits (or otherwise) of PRT have been unable to take advantage of recent practical experience in PRT operation. For the first time the testing and evaluation work proposed within EDICT would identify the current technical and social issues associated with this highly promising new form of transport. However, during the course of the project it proved impossible to build the planned demonstration because of political and procurement matters. Instead, assessment was carried out based on the existing

PRT test track in Cardiff. Further to this, evaluation of the political and procurement process was undertaken. The overall work structure of EDICT is illustrated in Figure 1.

Figure 1: EDICT Structure



1.2 What is Personal Rapid Transit?

The work undertaken during the EDICT project demonstrated and assessed a new class of urban transport, known as Personal Rapid Transit (PRT). PRT is a system of driverless automatic cabs travelling on their own guideway network. Vehicles are available 24 hours a day on demand at all stations on the network to meet individual travel needs. Vehicles typically take two to six passengers travelling together. The passenger arrives at a station and indicates the required destination station on a terminal, making payment electronically. Generally there will be an empty vehicle waiting in the station for immediate boarding, but if not the system will automatically route the nearest empty vehicle to the caller's station. All stations are off-line, so the vehicle takes the passenger by the most direct route and non-stop to the destination station. If the passenger is travelling in a small group all will share the vehicle, up to its capacity. The case studies take as their model the ULTra PRT system developed by Advanced Transport Systems of Bristol, which uses a four-seater battery-electric rubber-tired vehicle, automatically steered on a passive guideway. The segregated track is 2 metres wide and lightweight, so that elevated sections, which are used to avoid severance, are not visually intrusive. Other versions of PRT are being developed by other companies.

PRT is a type of innovative public transport which takes advantage of recent developments in Intelligent Transport Systems (ITS). The majority of ITS approaches involve the improvement of existing forms of transport, especially the car. Improved driver aids which enhance the effectiveness of the car have already emerged from this work. However, the consensus view among car manufacturers is that any automated device can only be employed as a driver aid, thus excluding the possibility of full automation - this view principally derives

from legal concerns. In many areas, for example the centres of busy cities, it is not conceivable that autonomous vehicles could operate on conventional roads outside driver control. PRT offers an alternative approach for exploiting these technologies. Application of ITS concepts is greatly eased on a PRT guideway, which is separated from other users. Thus the PRT can be regarded as one element of a wider programme to improve transport generally.

However, to date no type of PRT has been demonstrated anywhere in the world. Thus these potential benefits remain unproven by practical evaluation. EDICT offered a unique opportunity for testing and evaluation work. This allowed the development of guidelines for exploiting the potential of PRT in order to obtain benefits in new integrated transport systems throughout Europe.

1.2.1 Key Questions for PRT

The key issues surrounding PRT evaluated in EDICT included:

- Safety & security
- Visual intrusion
- Integration with other modes
- Impact on traffic congestion

and

- Appraisal of PRT

1.3 Structure of the Report

This report summarises the progress and work carried out in the EDICT project. There are 9 sections, as follows:

⇒ The first section introduces the project background, the project objectives, the consortium members and their roles in the project.
⇒ Section 2 provides a description of the project case study sites and PRT scenarios.
⇒ Section 3 outlines the approach adopted to undertake the evaluation of PRT.
⇒ Section 4 presents the scientific and technical description of the results for the whole project and by city.
⇒ Section 5 includes the conclusions and lessons learnt from the project.
⇒ Section 6 provides an overview of the technical progress of the project, including a comparison of the original planned activities and the work actually undertaken.
⇒ Section 7 gives a brief outline of the deliverables produced under the project.

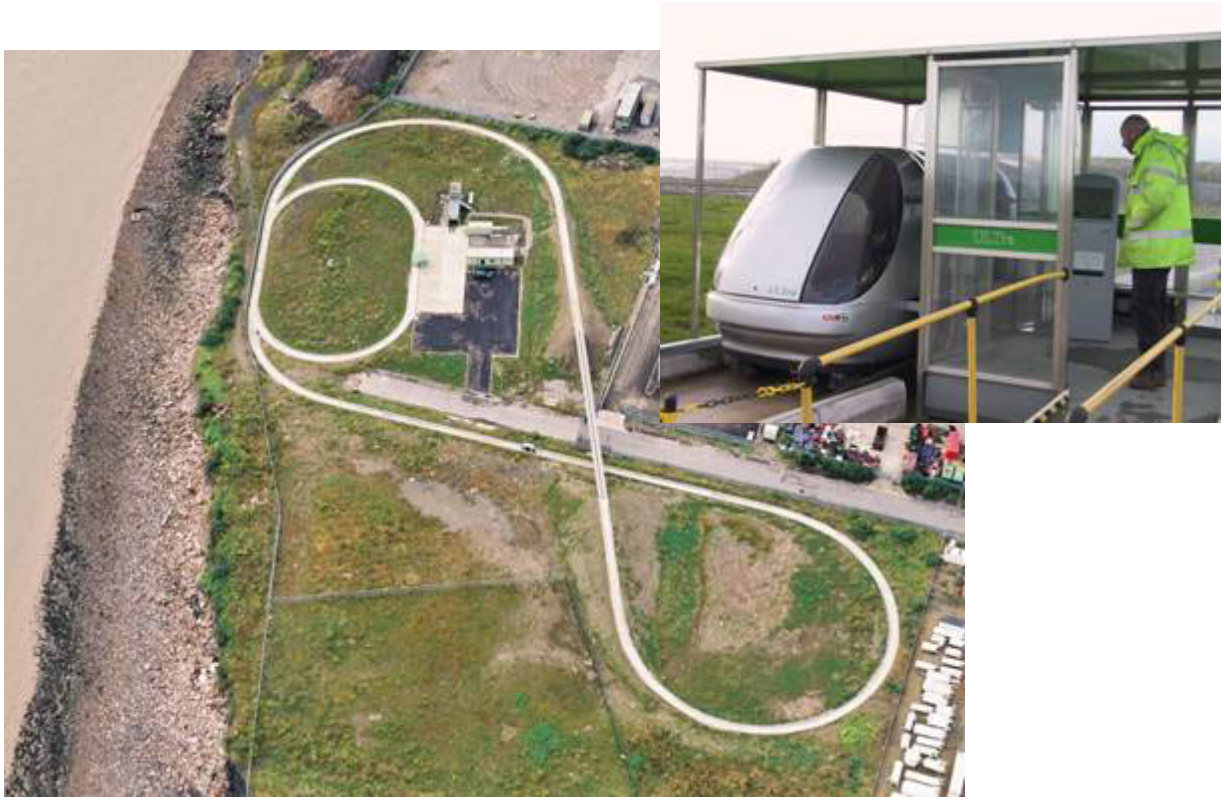
2. THE EDICT DEMONSTRATION AND STUDY SITES

2.1 Cardiff

Cardiff is the capital of Wales and has seen recent regeneration in the Cardiff Bay area, which is in close proximity to the city centre but lacks established public transport access. The development of Personal Rapid Transit (PRT), to provide this access, is more advanced in Cardiff than in any other European city. A test track and station has been constructed and vehicles and ticketing systems are now operational.

The system examined in this Case Study is the ULTra system (shown in Figure 2.1), and it is intended to be developed in three Stages, with the first stage, a single loop in the Bay Area, acting as a Pilot installation to demonstrate the practicality and reliability of the concept. A test track and two prototype vehicles already operate at a site in Cardiff Port (Figure 2.1). The full system will have 15kms of single-track guideway, 70% of it elevated, and 26 stations. However, because the demand surveys made so far were designed for the first two stages only, the EDICT study assesses the "Stage 1" network of 7.7kms of guideway and 12 stations (as illustrated in Figure 2.2).

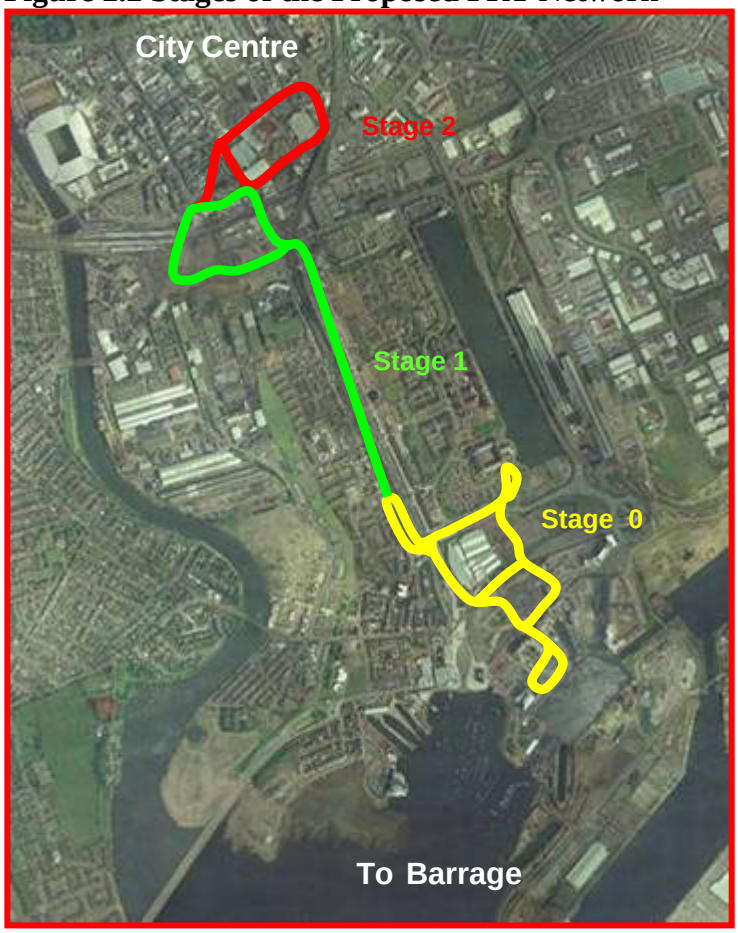
Figure 2.1 ULTra at the Cardiff test track



The test track covers approximately 2ha with a boundary of some 10m to the Severn Estuary (Figure 2.1). The guideway is approximately 600m in length and is laid out in a figure of eight arrangement at both grade and elevation, with inclines and declines, merges and diverges and a station on an inner loop: all the features that would be expected to make up a typical city centre network. The crossover section is elevated, with three spans of 18m length elevated guideway, formed by steel supporting prestressed concrete planks, to provide an

example of the visual impact of implementation and to provide gradient for climbing traction and braking tests. The track includes a short inner circuit and platform where various station layouts can be tested. Prototype cars are running on the track under full computer guidance and control. Tests undertaken to date have enabled valuable lessons to be learnt concerning the interrelationship between ride comfort, car suspension, track surface quality, and level access from the station platform. Development work is ongoing regarding turnout speed, transitions, super-elevation and passenger reaction.

Figure 2.2 Stages of the Proposed PRT Network

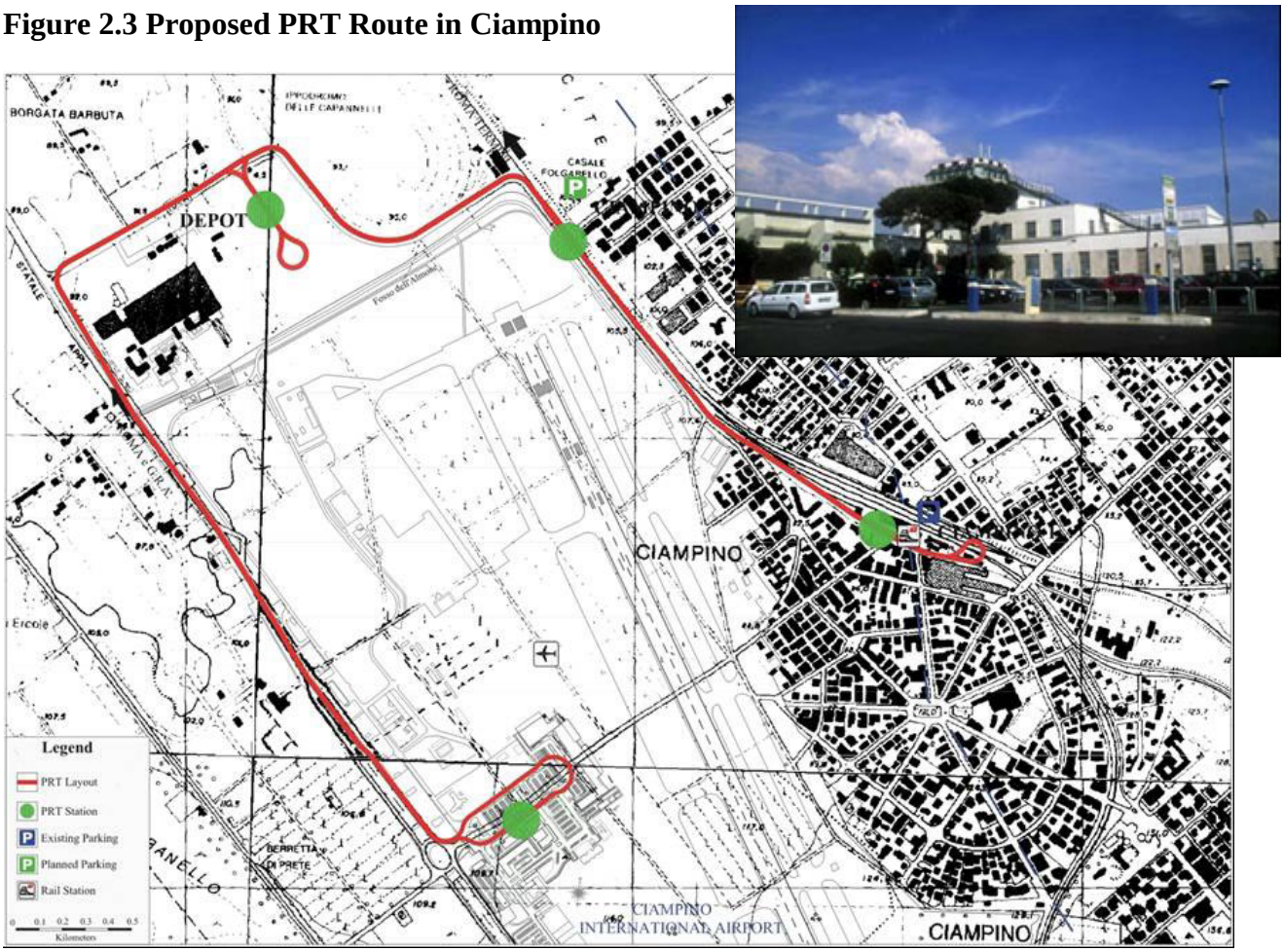


2.2 Ciampino

Ciampino is a buffer zone between the capital and the small towns of the Castelli Romani, making it a strategic node and a potential catchment area for trips between these towns and Rome. As the crow flies Ciampino airport lies less than a kilometre from the town's railway station. The current bus connection, however, is more than 5 km long, since the buses have to take a roundabout route to avoid the runways.

The shortest path for the required rapid connection between the airport, the railway station, and the centre of Ciampino is impeded by the airport runways and, for safety reasons, underground connections are not practical. A PRT system was assessed for providing a new route from the airport to the public transport network (as shown in Figure 2.3).

Figure 2.3 Proposed PRT Route in Ciampino



2.3 Eindhoven / Almelo

Eindhoven is a city situated within the province of Noord-Brabant to the south of Amsterdam in the Netherlands. Within the EDICT project the opportunities for PRT for improving access to the Technical University of Eindhoven (TU/e) by connecting it to a rail/bus station were examined. Local assessment studies were to be carried out to determine the response of potential users of the system, and the effects of the system on land-use planning, the environment, and the social and economic benefits.

The Eindhoven project had to withdraw from the EDICT project due to financial and political reasons. The evaluation therefore was not all completed so some of these issues have not been fully addressed. The city of Almelo joined the project as a full partner to replace Eindhoven and fulfil the assessment objectives.

The city of Almelo is situated in the Twente region to the east of Amsterdam in the Netherlands. The city's objectives are to reduce car travel and encourage sustainable development in which context PRT is seen as a solution. The aim of PRT here is to improve the image of the city centre as a result of an expected reduction in traffic congestion and to improve access to visitors. A good connection between the railway station, city centre and hospital will improve the quality of life and opportunities for people who live in, work in and visit the city (see Figure 2.4).

Figure 2.4 Proposed PRT network in Almelo (© M.Minderhoud 2004)

2.4 Huddinge

Kungens Kurva or King's Curve is one of the largest growing development areas in Huddinge. 5 million people visit it every year and the recent opening of the Heron City entertainment centre is expected to attract a further 3.5 million people. Most of the site's visitors and employees travel to and from the site by car.

The research programme in EDICT involved an in depth analysis of the technical, social and economic impacts of a proposed PRT network (12 km, 18 stations) and remote parking scheme within Kungens Kurva (see Figure 2.5).

Figure 2.5 Proposed PRT network in Huddinge

2.5 Context and Local Project Objectives

The demonstration and study networks that were evaluated in each of the partner cities of the EDICT project complement local transport policy and objectives in each of the cities. A brief description of the different policies gives a better insight of the context in which PRT was evaluated. In summary, each site has a particular case for PRT, identified as follows:

- the "*transport problem*" case, where there are identified existing problems of increasing traffic congestion and pollution (Ciampino, Huddinge and Almelo);
- the "*sustainable city*" case, where the project is not problem driven, but driven by environmental and lifestyle goals and local development plans which derive from the vision of a sustainable "City of Tomorrow" (Cardiff);
- the "*innovation policy*" case, where the project is not problem driven but driven by the goal of creating new opportunities through launching an innovation process (maximising the potential of the university campus) (Eindhoven).

The cities, the characteristics of their PRT schemes, their broad transportation strategies, and their progress in EDICT, are summarised in Table 2.1.

Table 2.1: Synthesis of Local Schemes

	Cardiff	*Ciampino*	*Eindhoven*	*Almelo*	*Huddinge*
Location	New regeneration development area on former dockland adjacent to city centre	Link from sub-regional centre and transport system to secondary airport	Link from University Campus to public transport systems.	Link railway station, city centre and hospital	Links within out of town retail and leisure development
Land-Uses Served	Business, government offices	Airport	Education and business	Retail, Rail, Healthcare, Education, Business	Retail
Scheme Promoter	City Council	City Council	Regional Council	City council	City Council
Main Objective	To provide sustainable, flexible access to regeneration site from city centre	To provide sustainable access to transport system	To provide sustainable access to transport system	To provide sustainable access to the transport system, improve city image	To link low-density retail and leisure facilities to public transport and car parks
Description of Scheme	Phased implementation of PRT scheme	Single scheme	Single scheme	Single scheme	Multiple lines
Summary of Progress	Test-track complete. Evaluation (including passenger trials) on test track and planned future scheme. Dissemination activities ongoing. Produced a video of the ULTra test track.	Routes identified and preferred option selected. Evaluation complete. Dissemination activities ongoing. Produced simulations of the PRT route.	Routes identified for evaluation. Evaluation carried out but not completed. The project was withdrawn from EDICT due to financial and political barriers. Produced PRT simulation.	Route identified for evaluation. Evaluation complete. Dissemination activities ongoing (included the production of videos showing mock-up system). Produced PRT simulation.	Route identified for consultation. Evaluation complete. Dissemination activities ongoing. Produced simulations of the PRT route.
Expected Implementation	Plans for Phase 0 in 2005 delayed due to temporary withdrawal of national funding in 2003. Change of political power in May 2004. Political support continues, but timescale is uncertain.	Depends on financial support from airport operator. PRT will require public funding.	Initial support faded. Process slowed down by tendering regulations. Knowledge, experience and momentum lost. Eindhoven study stopped,transferred to Almelo.	Phased PRT implementation. The first phase of this system was evaluated in EDICT. Preparation for a pilot scheme is planned after EDICT.	Full network in 2015.Potentially funded by 50% state subsidy. Needs political support and be part of the local and regional development plan to obtain funding.

Clearly EDICT offers a wide range of study sites with different needs and land-uses. Each city has evaluated the implications of implementation of a PRT system, with Cardiff having tested a specific PRT system – ULTra. However, full system implementation will, of course, be subject to the usual EC, national and local requirements for procurement.

3. EVALUATION

The evaluation methodology was developed at the start of the project. All cities followed the same methodology in order to enforce a level of consistency and to enable cross-city analysis.

3.1 The Assessment Framework

The EDICT Assessment Framework identified two main streams of assessment activities for the local assessment plans:

3. The assessments of the **impacts on the policy objectives** (these include efficiency and quality of the transport system, safety and security, accessibility, environment, economy and integration with other policies). Table 3.1 highlights the assessment areas evaluated in each city.

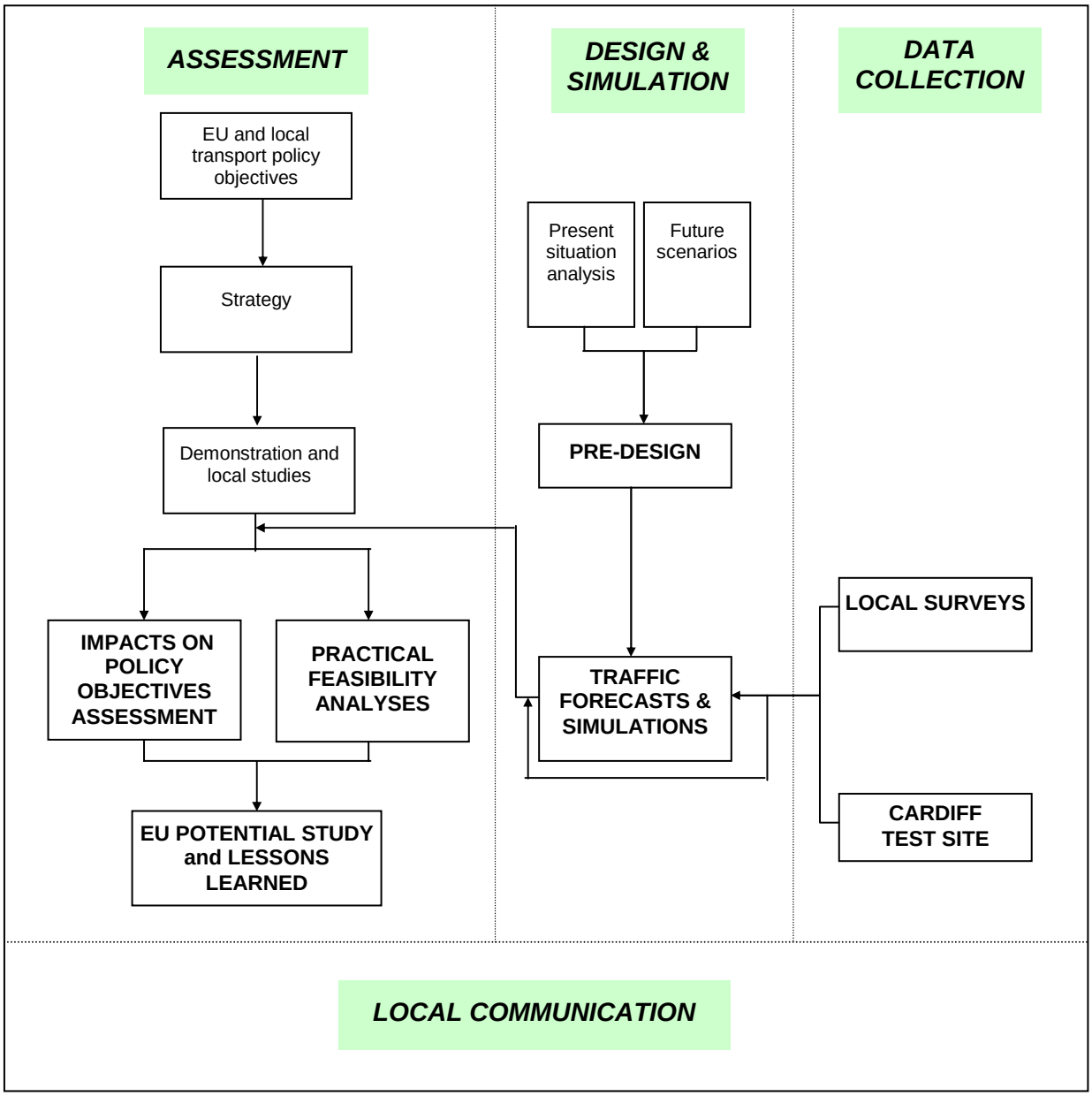
4. The **practical feasibility analyses** (these relate to distribution and equity, public acceptability and stakeholder support, financial and funding, technical and legal, political context and decision making process).

The framework comprised a set of complementary and supporting activities as follows:

- Modelling and simulation activities aimed at estimating the demand for the PRT system and the impacts on the mobility patterns in the affected area as well as at testing different management strategies for PRT;
- Data collection activities and interaction with stakeholders and the public which formed an essential part of the assessment process as they provide the necessary inputs to modelling and assessment; and
- Local communication activities which are also part of the assessment process in the study sites as they raise awareness and diffuse knowledge on the innovative system, a key objective of the EDICT studies.

Figure 3.1 outlines the main elements of the assessment process in the five cities.

Figure 3.1: The assessment process in the five EDICT cities



3.2 The assessment of the impacts on policy objectives

The assessment areas and policy objectives evaluated for each city are highlighted in Table 3.1.

Table 3.1 The cities local objectives evaluated in EDICT

	Cardiff	*Ciampino*	*Eindhoven*	*Almelo*	*Huddinge*
Transport efficiency and quality					
Achieve a balanced distribution of trip increases over all modes	✓	-	-		-
Reduce traffic congestion in the city centre	-	✓	-	✓	-
Support the planned increase of the railway network	-	✓	-	✓	-
Encourage greater sustainable mobility through development of innovative transport	-	-	✓	✓	-
Safety and security					
Increase level of safety	✓	✓	-	-	-
Encourage greater sustainable mobility through development of innovative transport	-	-	✓	✓	-
Accessibility					
Improve accessibility to achieve social and economic regeneration	✓	-	-	✓	-
Improve accessibility to the airport, railway station, offices, schools, shops	-	✓	✓	✓	-
Encourage greater sustainable mobility through development of innovative transport	-	-	✓	✓	-
Facilitate parking at a distance from the city centre	-	-	✓	✓	-
Attract visitors to the area	-	-	-	✓	✓
Environment					
Improve environmental and health impacts of transport	✓	-	-	-	-
Reduce car traffic-related emissions	-	✓	-	✓	✓
Encourage greater sustainable mobility through development of innovative transport	-	-	✓	✓	-
Decreased land use demand for streets and road traffic	-	-	-	-	✓

	Cardiff	*Ciampino*	*Eindhoven*	*Almelo*	*Huddinge*
Economy					
Encourage economic regeneration	✓	-	-	-	✓
Increase profitability of public transport	-	✓	-	-	-
Encourage greater sustainable mobility through development of innovative transport	-	-	✓	✓	-
Increase real estate values and opportunities for further development	-	-	-	-	✓
Integration with other policies					
The city should develop a sustainable society and provide the best choice for both living and trade and industry	-	-	✓	✓	✓
Encourage social regeneration and combat social exclusion	✓		-	-	-
Increase image of the city as leading in technology	-	-	✓	✓	-
Add to and build on PRT R&D in the country	-	-	✓	-	-
Contribute to the image of the university as an innovative high-tech organisation	-	-	✓	-	-
Research and experiment in innovation processes in public transport	-	-	✓	-	-

- not applicable

4. RESULTS

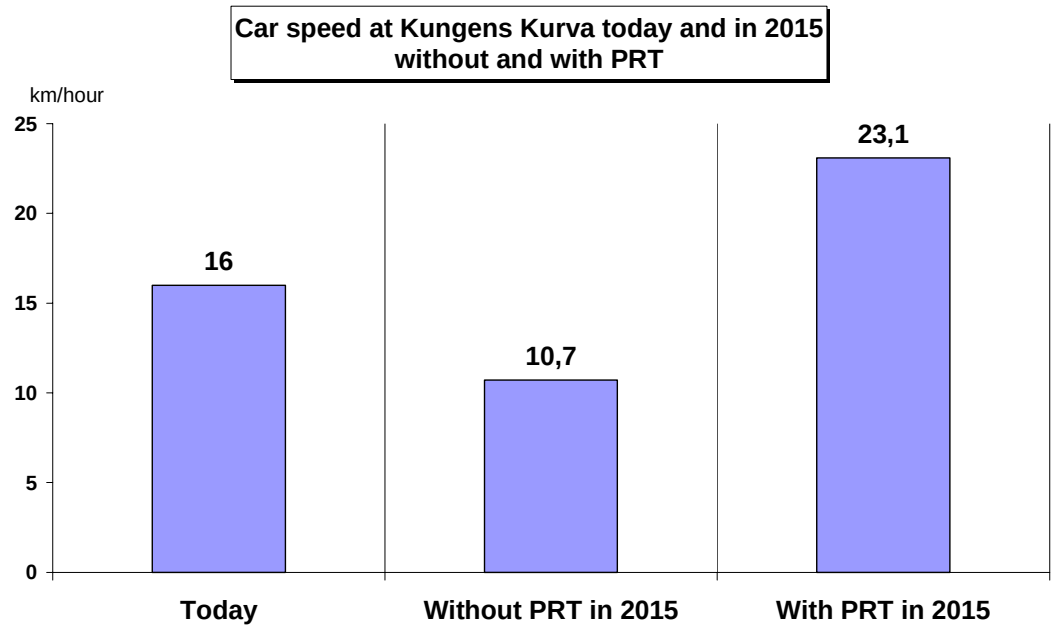
A summary of the key findings is provided below.

4.1 Impacts on Policy Objectives

4.1.1 Transport Efficiency and Quality

A key attraction of PRT over conventional public transport modes is that it eliminates waiting time, and offers direct and comfortable journeys. The stated preference survey findings indicate that these elements of PRT are an attractive factor for all transport users (including car and public transport). Furthermore, implementation of PRT is shown to lead to travel time savings for car and public transport users. Car traffic is also expected to be reduced in all study sites as a result of modal shift from car to PRT. Figure 4.1 for example, illustrates the calculated impact of PRT on traffic flow at the Huddinge site.

Figure 4.1 Traffic Flow at Kungens Kurva (Huddinge) with and without PRT



The investment and operating costs for the study networks vary by area since each proposed application is of a different scale and will attract different numbers of passengers. The system attracts the greatest number of passengers if it is integrated with the rest of the city's transport system.

The fare proposed is between 1-1.5 in 2006. In Cardiff this fare is per vehicle so when people share a vehicle they share this fare between them. Focus Group studies with people who have ridden on the ULTra test track say they would be willing to pay two to three times this amount because of the additional benefits it offers over conventional public transport modes.

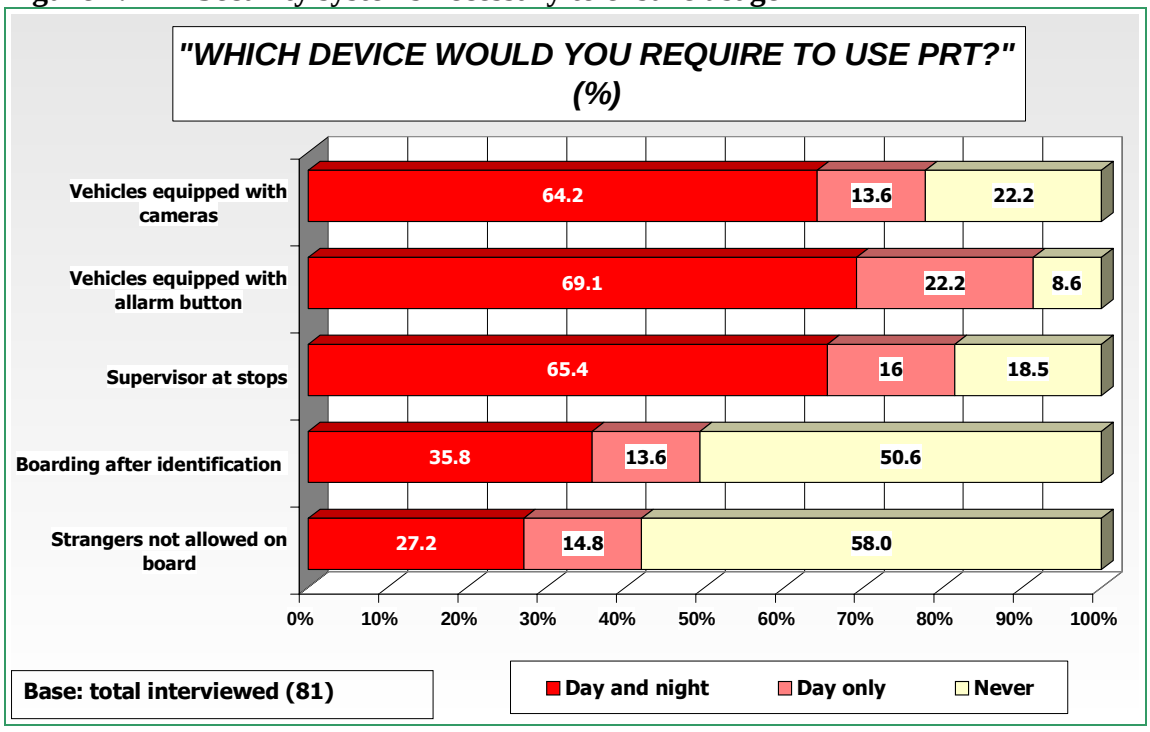
4.1.2 Safety and Security

PRT is generally regarded as a safer mode of transportation mainly because it is mostly elevated and therefore does not conflict with road traffic and / or pedestrians. The safety case for the ULTra system is also accepted by Her Majesty's Rail Inspectorate (HMRI). The HMRI authorised the passenger trials at the test track.

However, a key issue of concern emerging from the stated preference surveys and the ULTra user trials related to the system's safety and the personal security of passengers. Because the system does not exist and the public have nothing with which to compare it, respondents had reservations about its technical reliability and efficiency, and how it would cope in severe weather conditions. This latter factor is especially a cause for concern in Huddinge which experiences a lot of snow and ice.

Furthermore, because the system is driverless respondents raised an element of concern about their personal safety especially using the system alone. To enhance feeling of safety so that more people will use the system, it must be well-lit and be under continuous CCTV coverage, with direct links to the controller from all stations and vehicles, as indicated by the survey carried out at the Ciampino-Rome study site (Figure 4.2).

Figure 4.2 Security systems necessary to ensure usage



4.1.3 Accessibility

The main impact across the EDICT cities on accessibility is improved access to the PRT network areas. The evaluated PRT networks provide a connection within the present transport system. This connection will help to attract more visitors to the study areas, whether it is a retail site, recreational centre or airport. PRT is also proved to be a preferred choice of mode for disabled and elderly people; it is regarded as a means of transport that enhances mobility and independent travel.

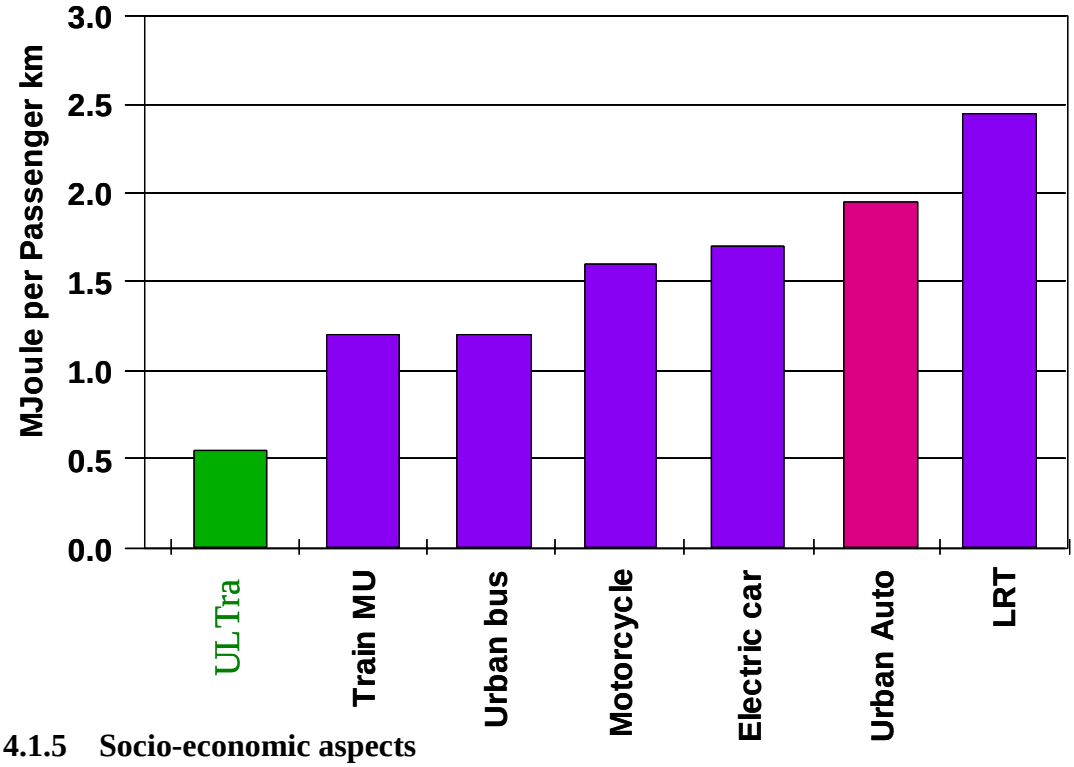
The user trials in Cardiff found that PRT (ULTra) is especially accessible to disabled and elderly people, and participants felt it to be more convenient, comfortable and easier to use than conventional public transport modes. It was also considered to reduce stress which many disabled and elderly people experience while using other modes of travel.

4.1.4 Energy and Environment

PRT vehicles are generally electric and lightweight. They use considerably less energy per passenger-km than cars or even conventional public transport (as illustrated by Figure 4.3). Even allowing for pollution caused by the production of the electricity required to run them there is a net saving in both energy and emissions compared with the modes which their passengers would otherwise use. Furthermore, the expected reduction in car traffic will lead to further reductions in CO_2 emissions. Electric PRT vehicles are also generally quieter than the alternative modes. Also PRT can be run inside buildings thus reducing visual intrusion or habitat destruction.

Studies in Huddinge also show no threat to habitat destruction. The proposed PRT network that connects Skärholmen residential area, its shopping centre and the metro station to the Kungens Kurva area, would enhance the attractiveness of the entire area. On the other hand, the need for new infrastructure may lead to increased visual impact which could be a problem in historic areas. In Almelo a detailed spatial design of the track has been made, showing that it would fit visually with the existing infrastructure.

Figure 4.3 Energy use by different modes



4.1.5 Socio-economic aspects

The cost-benefit analysis showed positive net present values. All the proposed PRT networks present positive social benefits which are expected to exceed costs. It should easily cover its operating costs. Such a system is expected to provide citizens with a transport system which saves time, effort and money, which attracts people from their cars, and which will support

new developments and regeneration sites. Further social benefits are brought by increased access for all groups in society to services that improve quality of life and employment opportunities. Many of these benefits go wider than the net profit from the system.

The revenue streams from the proposed PRT systems may not quite cover their capital costs on the predicted level of demand. Whilst it is possible that revenues would be sufficient to cover costs at the standard public discount rate, higher returns would be required from the investment if funding is sought from the private sector.

4.1.6 Integration with other policies

PRT is shown to make a positive contribution to achievement of local transport and social policy within the demonstration and network study areas. These relate to accessibility, social inclusion, and regeneration in addition to sustainable mobility objectives.

4.2 Practical Feasibility Analyses

4.2.1 User Acceptance and Attitudinal

The concept of PRT in all EDICT partner cities was well received by the public. The user trials of the Cardiff demonstration showed that user acceptance and willingness to use ULTra increased considerably after riding the system on the test track and using the prototype station and destination panel. There were some common issues of concern raised by the public across the study sites that included personal security and safety of the vehicle and stations; fares and ticketing; possible vandalism and the visual problems of running the system close to historic buildings; and the system's technical reliability. However these issues were regarded as being easily overcome through the implementation of personal security measures such as CCTV and good communication links between passenger and control centre in the vehicle and at stations; an area wide information campaign to raise awareness of how the system operates and its features. Despite the concerns there was still a high willingness to use and pay for PRT. The stated willingness-to-pay for the service was well above the intended fare of 1 per *vehicle* trip across sites.

PRT in particular was favoured for the following features, as quoted by respondents (focus groups) themselves:

- *"modern technology"*
- *"very quick, direct, no waiting"*
- *"lack of queues"*
- *"own space, can choose to travel alone"*
- *"no frustration, no road rage"*
- *"good for the environment"*
- *"you haven't got to argue with drivers"*
- *"not worrying about who else is in the carriage"*
- *"easy to switch on."*
- *"no driver"*
- *"more accessible than current public transport modes"*

Figure 4.4 User trials of a PRT system (ULTra) in Cardiff

4.2.2 Funding and Procurement

Although PRT is certainly an innovation, legal advice insisted that procurement of a pilot scheme must be via competitive bidding, and invitations to potential providers have made several false starts. Procurement of such a system, via the OJEC procedure will be necessary, but the European regulations for public procurement are not well-suited to innovations like PRT which currently presents a major barrier to funding a full-scale demonstration.

4.2.3 Risks

The project identified a number of risks to consider in the design and planning of a PRT system. These mainly relate to technical, political, procurement, personal security and legal issues. For the investor, there are technical risks that the system will not ultimately perform as proposed, and that it may cost more and take longer to bring to satisfactory operation than the designers claim. Whether the decision is made by a local authority using public funding, or by a company using private capital (as for example in an airport) there are serious political risks attached to failure.

The example of Cardiff and Eindhoven's difficulties in obtaining the necessary agreements and funding is an instructive one. It seems essential that the risks should be minimized by first constructing a small pilot scheme, in order to decrease the financial commitment, but also to minimise the public visibility and inconvenience if the system should have initial problems which take longer than anticipated to solve.

4.2.4 Political Context and Decision-making

The experiences of Cardiff and Eindhoven demonstrate the importance of the political context in enabling the development of an innovative project. Both projects were hindered by political problems. Although the proposed PRT networks in both cities received political support and financial backing in the initial stages of the project, it proved difficult to retain this support. Political support for highly innovative schemes may be controversial and subject to rapid change as the electoral cycle proceeds. If there is no political advocate bearing the risks and

burdens of the scheme and willing to reap only a small portion of the short- and long-term benefits, the scheme is likely to fail.

4.2.5 Actor's participation

A number of actors have been identified that offer a key role in the development and operation of PRT. There are a large number of different types of stakeholders involved in the design, operation and use of any PRT system. The project identified the following key stakeholders and their roles in the design, operation and use of any PRT system: national authorities, the European community, regional development authorities, local transport authorities, politicians, neighbouring city authorities, transport operators, other service providers, finance organisations, trade unions, users of the transport system, local community and pressure groups, potential residents, external firms, users, tourists, and the media.

Overall these findings inform us that PRT provides a highly accessible, user-responsive, environmental friendly transport system which offers a sustainable and economic solution for the "Cities of Tomorrow".

4.3 Summary of Findings by City

Table 4.1 highlights the key findings by city.

Table 4.1 Summary of findings by city

	CARDIFF	CIAMPINO	EINDHOVEN / ALMELO	HUDDINGE
Impacts on Policy Objectives				
1. Transport efficiency and quality	In 2006 ULtra is predicted to attract 5.67million passenger trips per year. Demand will grow as the commercial and residential development increases, rising to 7.42million trips by 2036. ULTra is predicted to attract 61% of present bus users, and 9% of walkers, and 8% of car commuters. It is also expected to increase the use of rail and bus. Mean wait time is only 0.3minutes.	The number of PRT passengers will be almost 2 million per annum in 2006 and over 4 million in 2036. Within the local area car traffic is expected to reduce by 57 million veh-km, 75 million fewer passenger-km by car and 372,000 hours less travel time. An increase of 11 million passengers-km is estimated on public transport.	A key attraction of PRT over conventional public transport modes is that it enables no waiting time, direct and comfortable journeys – a pulling factor for car users. Expected PRT patronage in Almelo is 6151 passenger trips per day. 35-40 PRT vehicles are required to meet this demand. Average waiting time is estimated at 2 minutes.	The PRT system is estimated to cost 57million (6.9 per km). At 0.79 fare per trip, the annual operating cost is expected to be 3.2million. Travel time between Skärholmen and Kungens Kurva is reduced by 41%. Travel time savings for car and PT users are up to 20 minutes. Car traffic is expected to reduce by 8% with PRT. Without PRT traffic is likely to rise by 40%.
2. Safety and security	ULTra is accepted as feasible and reasonable by HMRI. To enhance passengers' feeling of safety the system must be well-lit and be under continuous CCTV coverage, with direct links to the controller at all stations and on all vehicles.	The reduction in car use brings about reductions in accidents, injuries and fatalities. These are estimated as a saving in social costs of 1.8million in 2006 and 3.5 million in 2036.	A predicted reduction in traffic is expected to reduce the risk of accidents and injuries.	Reduced traffic congestion will ultimately reduce the risk of road accidents. PRT is considered to be safer than road transport since it uses an elevated guideway and therefore does not conflict with other modes.
3. Accessibility	Depends on the extent of the network. ULTra will be immediately available to residents of the Bay Area, but most other users will access it via some other mode of transport. Disabled people regard it to be more accessible and convenient than other present forms of public transport.	PRT will provide a much needed link to the airport and ease of transfer with rail services.	PRT would improve access to the hospital, shops and services, and also enable elderly and disabled people to use.	Access between stores at Kungens Kurva is significantly improved with PRT.

	CARDIFF	**CIAMPINO**	**EINDHOVEN / ALMELO**	**HUDDINGE**
4. Environment	There are substantial savings in energy use, equivalent to 2.5million litres of petrol per year and parallel savings in emissions. The saving in energy corresponds to a reduction in CO_2 of 3550 tonnes. There will be a visual impact as a result of elevated tracks.	Reductions in air pollutants stem from a reduction in car traffic. CO_2 emissions savings are substantial: 13,000 tonnes of CO_2 for reduced car traffic against a higher production of 116 tonnes of CO_2 at the generating plants for battery recharging of the PRT electric vehicles. Reductions in CO_2 emissions are valued as 0.6 M pa in 2006, reductions in all other emissions as 2.3M pa in 2006	The reduction in energy usage compared with cars is over 75%. Importantly, in peak periods when cars (and buses) are restricted by congestion this benefit rises to 90%. There is no threat to the habitat but the system's noise levels is slightly higher than legal standards for residential areas.	A total energy saving of 9 % of 162 GJ per day can be achieved. This will correspond to an energy saving of 59,150 GJ per annum. The PRT network between Skärholmen and Kungens Kurva reduces the amount of air pollution exhausts by 8 %. The CO_2 reduction amounts 1,610 tons per annum. The Skärholmen-Kungens Kurva PRT network does not bring any community severance. The PRT system overcomes the physical barrier (Euro route E4) between Skärholmen in Stockholm and Kungens Kurva in Huddinge.
5. Economy	Building the ULTra network (20km guideway) will cost £34.3M (51.5), with an annual operating cost of £2.05M (3.08M). Revenue is estimated at £4.3M (6.5M at the £1 fare per vehicle in 2006 rising to £5.6M (8.4M) in 2036. ULTra is expected to attract 5.67 million passenger trips per year, rising to 7.42 million by 2036.	At a fare of 0.50, revenue is expected to be 0.9M p.a. and 1.8 p.a. at 1 fare. The operating cost in 2006 is 3,1M. In 2036, at the 0.50 fare, revenue is 2,140,000 and 4.3M at 1 fare. The operating cost is 3.5M.	Investment costs for PRT in Almelo is estimated at 39 million and annual operating costs are 2million. The annual revenue, assuming a flat fare of 1 per passenger will be around 1.9million. The system almost covers its costs.	Investment cost: 57M (6.9 M /km) – including 7% for engineering works Annual operating cost: 3.2M/year (0.8 per passenger)
6. Integration with other policies	The proposed PRT system contributes to various local transport policies by encouraging transfer from car to public transport, and improving the vitality of the city by making facilities and jobs more accessible.	The proposed PRT system contributes to local transport policies in reducing congestion and enhancing the sustainability of public transport modes.	The PRT system is expected to increase land values, attract outward investment, in addition to contributing to sustainable mobility objectives.	Attracts 17% more visitors to Kungens Kurva, rising to 52% over time. 8% of car users will switch to PRT. The use of the light rail transit serving Kungens Kurva is also likely to increase by up to 20%. Land values are likely to increase with PRT in place.

	CARDIFF	CIAMPINO	EINDHOVEN / ALMELO	HUDDINGE
Practical Feasibility Analyses				
7. Distribution and equity	The proposed PRT system will serve residents of the redeveloping Bay area, improve accessibility to jobs and services for low-income residents, and access for disabled and elderly users.		All transport users are expected to benefit from the PRT system including disabled and elderly people. It also improves quality of life by improving access for non-car users to the hospital, shops/services.	The estimated social benefits (129million) exceed costs (95million). The direct costs of PRT make up 89million or 69% of all benefits.
8. User acceptance and stakeholder support	User attitudes are positive with a high level of acceptance and willingness to use. Stakeholder reactions are mixed. Some issues of concern about impacts on city image, visual intrusion.	Attitudes are positive to the proposed PRT route especially among travelers who are male, young, and currently use public transport. Personal security was an issue of concern.	User attitudes are generally positive and many benefits are perceived over conventional public transport modes.	Car and public transport users have a positive view of PRT and a high willingness to use. 57 % of survey respondents were in favour of the PRT system to be built. 1 in 5 believed it would be easer to travel without a car to the Kungens Kurva if PRT with PRT in place.
9. Funding and Procurement	The procurement process has been long and complicated.			
10. Technical and legal	The ULTra system has minimised many of the technical risks. There are legal risks because as yet, there is not a European regulations or regulatory body for such an innovative transport system.			
11. Risks	These included technical, financial and legal, and political.		As in Einhoven's case, the risk was a political one.	Only political factors present a barrier to a PRT application. Technical and personal security risks do not pose a problem.
12. Political context and decision making processes	Gaining and retaining political support for new and untried systems is difficult. This project was delayed because the Welsh Assembly Government withdrew its funding allocation.	The main barrier relates to the multiplicity of stakeholders. Financial support is required by the low-cost airlines otherwise the system will require public funding.	Political barriers in Eindhoven led to the project's withdrawal.	Gaining and retaining political support for new and untried systems is difficult. To date there has been no political support for PRT.

5. CONCLUSIONS AND LESSONS LEARNT

The detailed assessment carried out in the EDICT project suggests that PRT:

- can provide significant benefits and achieve a wide range of needs, policy objectives and land-uses, whether the motivation is transport driven, a sustainability or innovative case;

- can be cheaper to build and operate than conventional forms of guided public transport; for the application of the ULTra system to Cardiff, the assessment indicated that PRT would easily cover its operating costs, and provide a return which could pay for most, if not all, of its capital costs;

- provides a level of service which is superior to that available from conventional public transport, because there is very little waiting time, travel is essentially private, and is non-stop direct from origin station to destination; the mean speed is not high, but PRT is likely to be quicker than road travel, or rail travel with intermediate stops, over distances up to several kilometres in an urban environment;

- is well received by the public, both public transport and car users; attitudinal surveys show a high willingness and enthusiasm to use it for short-distances within city centres and for commuting trips;

- promotes the social inclusion of certain groups especially disabled and elderly persons by increasing their access to cities and key services e.g. retail, recreation, hospitals;

- is regarded as a quiet, safe, convenient and an efficient means of public transport with potential to replace car trips;

- can potentially enhance the image of cities, attract inward investment, and increase the economic value of land and premises; and

- provides positive rates of return from the investment in social cost-benefit terms.

Overall the findings inform us that PRT provides a highly accessible, user-responsive, environmental friendly transport system which offers a sustainable and economic solution for the "Cities of Tomorrow".

On paper, PRT looks much more attractive than conventional public transport, as proved in all EDICT sites. On the negative side, PRT carries a lot of risk because to date, there has been no full practical development for public use, least not in Europe. Although many public authorities are interested in the concept, as found in EDICT, not one has committed to installing such a system.

The example of Cardiff and Eindhoven's difficulties in obtaining the necessary agreements and funding is an instructive one. It seems essential that the risks should be minimized by first constructing a small pilot scheme, in order to decrease the financial commitment, but also to minimise the public visibility and inconvenience if the system should have initial problems which take longer than anticipated to solve. There may be political differences at

local, regional or national levels and winning over a sometimes sceptical public can also prove difficult. Often the support of one key politician can be the difference between acceptance and rejection. However, as proved in Cardiff and Eindhoven, this is a high risk element, as there can be abrupt changes of mind and many of the political aspects are beyond the control of scheme designers and promoters. The technical merits alone of any new proposed innovative system are insufficient to guarantee implementation. There are a number of stakeholders involved, and it only needs one of them to hesitate to bring the scheme to a halt.

In Cardiff the Wales Assembly Government still express support for the scheme at senior official level, but support of the elected members is less clear. In Wales, as in many countries, there is a strong feeling amongst elected members who are not from the capital that the capital city gets too large a share of the available funds, and this can raise opposition to the funding of a new service.

In Eindhoven, the local stakeholders were initially very enthusiastic to join the project, but later in the process, priorities changed due to emerging short term problems. The stakeholders preferred to invest in the solution of their short term problems instead of investing in rather uncertain long term developments. Furthermore, the identified short-term benefits of a pilot project at the local level did not make the project worthwhile or cost-effective. This innovation process often demonstrated that local partners were willing to participate, but could not be expected to plan and finance a process of innovation for which the rewards would be reaped at national and international levels. The solution would be to find a party that thinks it can make money on the introduction of a PRT system. Then it would be necessary to find a method with which the commercial party can benefit and the social benefits can also be served.

EDICT evaluated the risks and barriers to the implementation of a PRT system from which the following recommendations are put forward:

- It seems essential that the risks should be minimized by first constructing a small pilot scheme, in order to decrease the financial commitment, but also to minimise the public visibility and inconvenience if the system should have initial problems which take longer than anticipated to solve.

- There may be political differences at local, regional or national levels and winning over a sometimes sceptical public can also prove difficult. Often the support of one key politician can be the difference between acceptance and rejection. However, as proved in Cardiff and Eindhoven, this is a high risk element, as there can be abrupt changes of mind and many of the political aspects are beyond the control of scheme designers and promoters. The technical merits alone of any new proposed innovative system are insufficient to guarantee implementation. The solution would be to attract the private sector and perhaps develop a public-private partnership to promote and develop a scheme to reduce the risk of political uncertainty. Here it would be necessary to identify a means with which the commercial party can benefit and the social benefits can also be served.

- Whilst it is possible that revenues would be sufficient to cover costs at the standard public discount rate, higher returns would be required from the investment if funding is sought from the private sector.

- One of the main issues pertinent to Cardiff was the category in which to place a PRT system when preparing the OJEC notice, since a definitive description applicable to PRT systems could not be found in the Common Procurement Vocabulary (CPV). For example, there are very clear categories for Rail, Bus etc, but nothing for driverless automated Personal Transport. It is important for future procurement purposes, especially those involving OJEC, that a precise CPV category is established for particular innovative modes of transport, and a specific CPV category for this type of product should be created within the European Procurement Categories. Current EC procurement rules are not propitious for innovation, and have led to substantial delay.

6. OVERVIEW OF TECHNICAL PROGRESS

The work in EDICT was carried out under 6 major work-packages:

- WP1: Project Management
- WP2: Evaluation Framework
- WP3: Demonstration
- WP4: Local Assessment Studies
- WP5: European Potential and Impact
- WP6: Dissemination

The main scientific and technical issues addressed during the project's lifetime are described below and summarised in Figure 6.1.

6.1 WP1 Project Management

A Project Handbook was prepared for the Kick-Off Meeting in February 2001 to provide basic information and reporting guidelines on EDICT for all partners.

A Consortium Agreement was prepared and signed by partners.

All ten deliverables produced during the project were subject to quality assurance checks and submitted to the European Commission within the approved timescale.

Progress reports were submitted every 6 months to the European Commission which included an overview of the technical progress made, financial status and resources spent. Annual progress reports were also submitted with the annual cost statements.

Meetings

Seven consortium meetings were held during the course of the project as follows:

Consortium	Technical*	Dissemination	Cluster*
6-8 Feb 02 Cardiff	11-12 Apr 02 Rome (Assessment Framework)		15 Mar 02 Sophia-Antipolis
13-14 June 02 (F) Eindhoven / Delft			
2-3 Dec 02 (F) Huddinge			
26-27 Jul 03 Brno			
1-2 Dec 03 (F) Rome	10-11 May 04 Munich (European Potential)		
13-14 June 03			

Munich			
26 October 04 (F) Cardiff		25-26 October 04 Cardiff (International Conference)	

F=follower cities invited

6.2 WP2 Assessment Framework

An assessment framework for PRT was developed and agreed in detail by all partners at the start of project. It provided a common basis for assessment activities in the different sites, taking into account the differences in detail circumstances between the demonstration city and the other sites. The framework defined a process of permanent interaction between the team and the stakeholders and also provided guidelines for assessment of the transferability and implementation in the follower cities.

The assessment framework and methods applied in EDICT was reported in Deliverable 2.

6.3 WP3 Demonstration

The full-scale demonstration planned in Cardiff was to provide the critical practical information on the issues associated with real application of PRT. However due to the political and financial problems these plans were withdrawn and assessments were carried out on the ULTra test track instead. Information from this work was made available at the earliest possible stage to inform studies and assessments by all partners.

All planned work on the demonstration was completed and reported in Deliverable 8, Demonstration Report.

6.4 WP4 Local Assessment Studies

Each City was the focus for application studies, environmental assessments, social impact assessments, and economic evaluations undertaken by a group of partners principally associated with that City.

The local assessment studies are completed and reported in Deliverable 6, Site Assessment Report.

6.5 WP5 European Potential and Impact

This work has inputs from all partners but was led by partners not involved with the local assessment studies. The work evaluated the overall European Potential of PRT using results from the demonstration, the assessments, the interaction with ‘follower’ cities, and the results of a questionnaire sent to other relevant cities. This work included an assessment of the potential in accession countries.

A detailed workplan was prepared and finalised by the work-package partners at the Munich meeting. The questionnaire circulated to the follower and target cities was also administered reported in Deliverable 7.

6.6 WP6 Dissemination

This was an important task as it set out to ensure that results from the whole work and a common pool of knowledge and best practice are made available widely throughout Europe.

EDICT CD Video

A video of the ULtra test track and user trials in Cardiff was produced for the project and used for dissemination activities.

Project Leaflet

The project leaflet was finalised and distributed to each partner for local dissemination activities. Partners are expected to distribute the leaflet to local key actors and at relevant transport events and conferences. The leaflet has been distributed at events such as the ACCESS Conference, the FP6 launch, and a range of EC/domestic events.

A final project brochure has also been prepared highlighting the key findings of EDICT to disseminate to key actors and interested parties around Europe.

Project Website

At the start of the project a website was set up with information about the project, news on events and other dissemination material. The website is located on the Cardiff County Council's website. The website address is:

http://www.cardiff.gov.uk/edict/

Development of the project website was an ongoing activity throughout the course of the project. Partners were asked to provide relevant items to include on the website. Other features included a section for news updates, links to other relevant websites e.g. PRT sites.

Dissemination Database

A database of EU cities was developed in which the project CD and invitations to the conference mailed out to the contacts.

Presentations at Selected Events

During the course of the project, partners presented a variety of papers at regional, national, European and international events, as follows:

- Feb 18th 2002 Public transport alternatives Café Culturel Nottingham
- Feb 20th 2002 Powering future vehicles Institute of Mechanical Engineers
- Mar 4th-7th 2002 SAE International Exhibition Detroit

- Mar 20th 2002 Sustainable personal transport Institute of Electrical Engineers SW Cardiff
- April 30th 2002 Public Lecture at University of Bristol
- May 9th 2002 Presentation to Council for Integrated Transport Cardiff
- May 16th 2002 Institution of Civil Engineers and Transport Planning Society Sustainable Transport Policy
- Jun 12th 2002 VIP project 's Hertogenbosch
- "Personal Automated Transit for King's Curve, Sweden - an PRT system evaluation within the EDICT project" by Transek
- "Personal Rapid Transit – Theory to Reality" by Advanced Transport Systems
- "User-acceptance of personal rapid transit systems" by Delft University of Technology
- "Simulation of Personal Rapid Transit System in Eindhoven" by Delft University of Technology
- "The Nice Trip- How do we travel in 2015 and 2030?" The Swedish National Road Administration's Public Presentation, 2004-03-02 in Stockholm. Göran Tegnér lecturer, about on: "Can we trust Forecasts?" with a brief presentation of the EDICT project and of PRT.
- A Film Festival about Public Transport yesterday, today and tomorrow, called "Lines and Tracks", at Stockholm Citizen's House, Stockholm, 2004-03-27 Some 30 Pubic attendants. The PRT Kungens Kurva DVD-video was presented.

The risks and barriers of planning a PRT system and user attitudinal issues, as assessed in EDICT, were presented at the NETMOBIL dissemination workshop (June 2004).

A series of papers on the local assessment study findings in each of the EDICT partner cities was presented at the project conference in October 2004.

Articles and publications

- Lowson, M.V., "Sustainable Personal Transport" Proceedings of the Institution of Civil Engineers Municipal Engineer 151 March 2002 Issue 1 pp 73-82
- Lowson, M.V "The ULTra Personal Rapid Transit System" Paper 2002-01-0174 SAE International Congress Detroit March 2002
- Featherstone, C.T., Lieven, N.A.J. and Lowson, M.V, "Passenger Response to Emergency Decelerations: Determining Safe Stopping Distance using a Simple Passenger Dynamics Model". Paper 2002-01-0368 SAE International Congress Detroit March 2002
- van Zuylen, H.J., and Lowson, M., "Nieuvwe vervoersytemen vragen om gezamenlijke vise" verkeerkunde nummer 5-2002 pp30-34
- Lowson A.C., and Lowson, M.V., ULTra Urban Light Transport System Paper at the 2nd International Conference Smart Traffic Brisbane 22 23 July 2002
- Lowson, M.V., "Engineering the ULTra system" Ingenia Sep 2002 pp 6-12
- Lowson, M.V., "A New Approach to Effective and Sustainable Urban Transport" Paper 03-2140 Transportation Research Board Washington Jan 2003 Accepted for publication in Transportation Research Record
- Lichfield Scientific Society April 17th "ULTra : The Automatic Taxi System"
- Municipal Engineer – March 2002, Sustainable Personal Transport, Lowson MV
- SAE International Congress – Two Papers, Detroit March 2002, Lowson MV et al

- 2nd International Conference Smart Traffic Brisbane – July 2002, Lowson AC and MV Ingenia – Sept 2002, lowson MV
- NETMOBIL newsletter
- Newsletter prepared by Huddinge Municipality
- Artikel „I města potřebují nové dopravní systémy“ („Also cities need new transport systems“)
- Artikel „Projekt EDICT“ („EDICT Project“), newspaper „Dopravák“..
- Artikel „Projekt EDICT“ („EDICT Project“), newspaper „Dopravní noviny“, volume 14/2004, page 3
- “Personal Automated Transit for King’s Curve, Sweden - an PRT system evaluation within the EDICT project” by Transek
- “Personal Rapid Transit – Theory to Reality” by Advanced Transport Systems
- “User-acceptance of personal rapid transit systems” by Delft University of Technology
- “Simulation of Personal Rapid Transit System in Eindhoven” by Delft University of Technology
- M.M.Minderhoud, H.J.van Zuylen (2002) The assessment of the Operation of a Personal Rapid Transit System in Eindhoven, IEEE Conference Sept 2002
- Henk J. van Zuylen, Martin Lowson. (2002) Een Vervoersysteem voor de Toekomst; De pilot voor een Personal Rapid Transit systeem in Eindhoven. Verkeerskunde juni 2002 nin Dutch
- H.J. van Zuylen, A. Ouwehand, (2004) the innovation process for personal rapid transit in Eindhoven, 10th WCTR conference Istanbul.
- H.J. van Zuylen and Arlieneke Ouwehand, (2004) The failing innovation process for Personal Rapid Transit in Eindhoven, European Transport Conference October 2004 Strasbourg
- H.J. van Zuylen and Arlieneke Ouwehand, (2005) The failing innovation process for Personal Rapid Transit in Eindhoven, TRB Conference, Washington DC

Websites

- Comparison of Costs between Bus, PRT, LRT and Metro/rail; by Göran Tegnér; News Article presented at the Innovative Transportation Technologies home page:
  http://faculty.washington.edu/~jbs/itrans/gorancomp.htm

EDICT Conference

The final project conference was held towards the end of the project in Cardiff. The event was attended by 70 delegates from the UK, Europe and the US. The programme (included at Appendix A) featured a variety of presentations, including worldwide developments of PRT and other innovative transport modes, the key findings and lessons learnt in EDICT with sessions on the different case studies, and the European potential of PRT. Technical site visits took place for delegates at the ULTra test track which attracted a lot of interest from regional and European actors. The conference itself generated a renewed interest in PRT among local politicians and representatives

The conference proceedings were made available on the project website.

Figure 6.1 Final project conference (Cardiff)

Clustering

The clustering of EDICT has been established with Cybercar, Cybermove and STARDUST where different systems will be compared. The 1st cluster meeting was held in Sophia-Antipolis in March 2002 and focused mainly on developing an accompanying measure - NETMOBIL, for the clustering of these projects with the aim to widen resources for more comparative work. Within NETMOBIL three interactive workshop sessions are planned in which certain partners from EDICT will present the work carried out in the EDICT cities.

6.7 Deviations from planned work schedule

There were the following deviations during the course of the project.

Project Deliverables

The submission of Deliverable 1 – Inception Report was delayed due to the late arrival of partners' input. An extension of 1 month on the planned deadline (29/02/02) was agreed with the EC. The deliverable was submitted in March.

The submission of Deliverable 2 – Assessment Framework was delayed to ensure that all partners agreed with the final framework and to take account of specific requirements. The final version of the deliverable was submitted to the EC in August 2002.

The submission of Deliverable 3 – Local Assessment Plans was delayed due to the need to reflect changes that needed to be made to some plans. The final draft was submitted to the EC at the beginning of January 2003.

The deadline for Deliverable 6 (local assessment findings) and Deliverable 8 (demonstration report) was extended from May 2004 to June 2004 to enable the assessments to be fully completed, which were delayed by the evaluation plan.

WP3 Cardiff Demonstration

The demonstration activities was not based on the Phase Zero system in Cardiff, as originally planned, but took place at the ULTra test track. This was due to delays in acquiring planning permission to build Phase Zero - a process that extends beyond the EDICT timescale. The EC Project Officer was advised of this issue at the kick-off meeting and a formal letter was sent to the EC requesting endorsement of this change. The demonstration phase was re-scheduled to start at an earlier date than originally planned.

WP4 Local Assessment Studies

The Eindhoven study experienced some local difficulties with funding and gaining political support.

The assessment activities planned in Cardiff were slightly delayed due to the need to wait for the approval of the Railway Inspectorate on the modifications that needed to be made to the vehicle and test track, as described above.

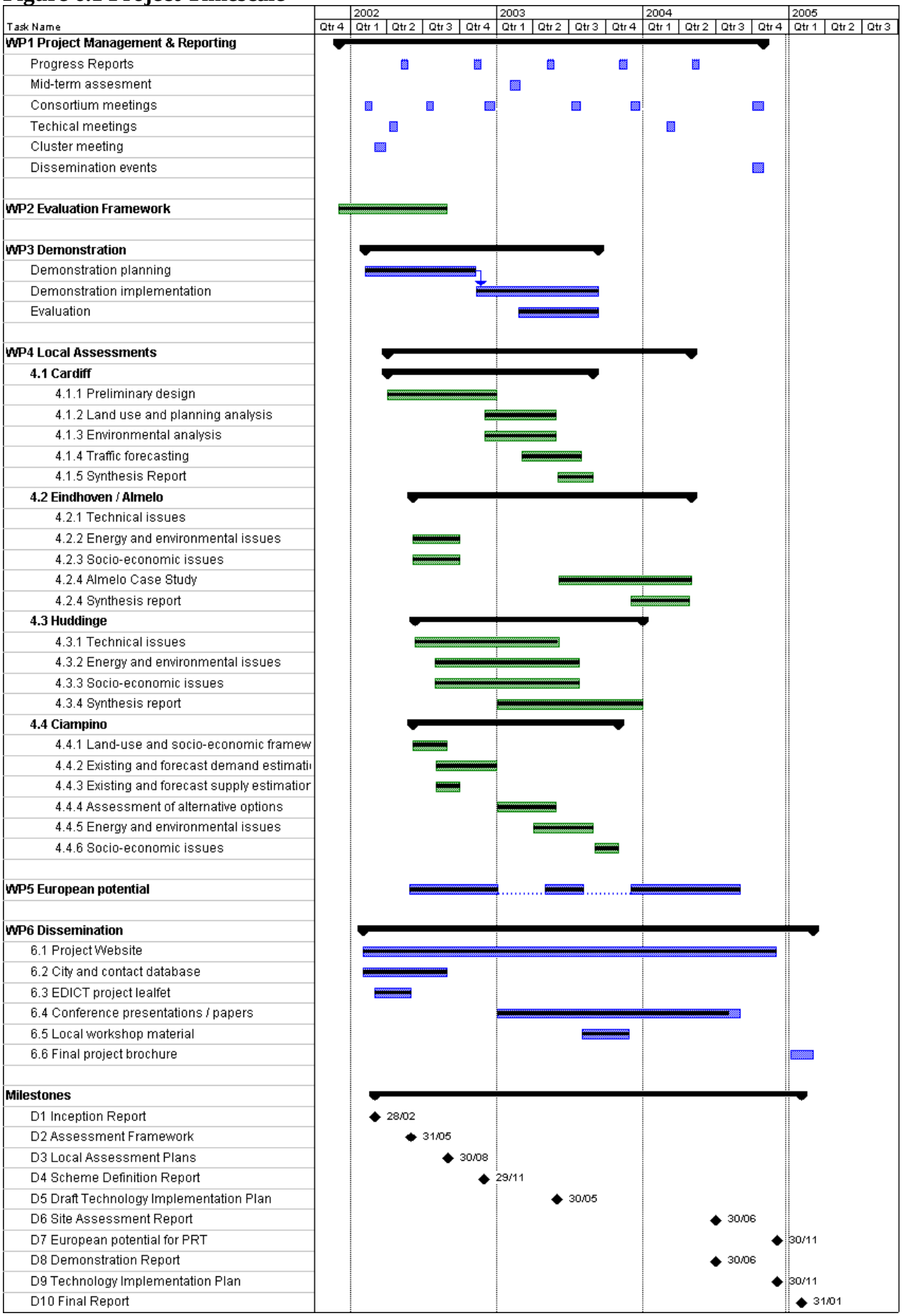
The findings of all assessments in each of the EDICT cities were fully reported in Deliverable 6.

Administrative and Financial Matters - Resource Transfers

Eighteen months into the project the Contract was amended to make the City of Almelo a full partner from 1st September 2003 in replacement of the City of Eindhoven which had to withdraw from the project for political and financial reasons. Part of this amendment was also a 6-month extension to the project to enable the local assessment work to be carried out by the Almelo partners. At this time resources were also transferred between partners in which to complete the work. The contract amendment was accepted by the European Commission.

6.3 Project Timescale

Figure 6.1 Project Timescale



7. DELIVERABLES

Ten project deliverables were produced by the EDICT Consortium and submitted to the European Commission through the project's lifespan. These included:

- Deliverable 1 Inception Report: included an enhanced and definitive version of the Description of Work, confirming details of project activities and time-scale, and the dissemination plan.
- Deliverable 2 Assessment Framework: provided a common framework and guidelines for the evaluation and assessment process for the project. It primarily acted as a practical working guide for the EDICT partners to help them carry out the local assessment studies in the four EDICT cities.
- Deliverable 3 Local Assessment Plans: outlined the detailed plans for the assessment activities at each site, based upon the common framework adapted for local circumstances e.g. availability of data.
- Deliverable 4 Scheme Definition Report: this set out the details of the planned demonstration and PRT study networks, and the technical appraisal undertaken for each site.
- Deliverable 5 Draft Technology Plan: database completed on the Cordis website, with the plans for exploitation of the PRT concept.
- Deliverable 6 Site Assessment Report: this covered the technical, environmental, social and economic results in detail for each site.
- Deliverable 7 European Potential for PRT: building on the results of the assessment and demonstration work this report evaluated the potential for the use of PRT in cities across Europe. It also has specific sections on PRT in accession countries and the follower cities.
- Deliverable 8 Demonstration Report: this report presented the results of the demonstration in Cardiff covering details of the final demonstrated system and the results of the evaluation activities.
- Deliverable 9 Technology Implementation Plan: updated version of the draft describing the exploitation of the PRT concept.
- Deliverable 10 Final Report: final publishable report providing an overview of the whole project and its results. A final project brochure was also prepared to accompany this report for dissemination purposes.

Appendix A

Dissemination Material:
EDICT events
Conference Papers
News articles

EDICT CONFERENCE PROGRAMME

"Advanced Transport Systems for the City of Tomorrow"

Supported by the Directorate-General for Research and Cardiff County Council

Day 1 - 25th October 2004

0900	Registration
0930	ULTra test track Technical Visit #1
1230	Registration Buffet Lunch

Chair – Chris Pike, Cardiff County Council

1330	Opening Session Welcome – Councillor Jim James Keynote Speaker – Lawrence Fabian, Advanced Transit Association The European Union's actions on sustainable mobility – Eric Ponthieu, European Commission Evaluation and Demonstration of Innovative City Transport – David Blackledge, TTR

Chair – Henk van Zuylen, Delft Technical University

1430	Session 2 – Personal Rapid Transit – the Cardiff Case Study The development of the ULTra concept – Martin Lowson, ATS Designing a PRT system for Cardiff – Tony Kerr, Arup
1530	Coffee break

Chair – Francesco Filippi, University of Rome

1545	Session 3 – What impacts will PRT have in Cardiff? Assessing the costs and benefits – Phil Bly, ATS Public and stakeholder consultation - Davina Fereday, TTR Video – User trials at the ULTra test track PRT and the Local Transport Plan – Chris Pike, CCC
1700	Questions & Discussion
1730	Close
1900	Civic Reception & Dinner - Cardiff Castle, library then Banqueting Hall

Day 2 - 26th October 2004

Chair – David Jeffery, Transport Research Group

0900	Session 4 – Assessing the value of PRT in other city environments PRT for a suburban shopping centre – Goran Tegner, Transek Connecting the city to the airport with PRT – Franco Filippi, CIRT The Netherlands experience – Henk van Zuylen, TUD
1030	Coffee break
1100	Session 5 – Other advanced vehicle technologies Technologies to assist the road vehicle driver – David Jeffrey, TRG Southampton The Cybercar concept – Tom Vogue, TRG Southampton

Chair – Chris Pike, Cardiff County Council

1200	Closing Session Summing up – The potential application of new vehicle concepts in European cities – Ulrich Leiss, IABG Closing Remarks – Councillor Christine Priday
1300	Buffet Lunch
1400	ULTra test track Technical Visit #2

Organised by

Transport & Travel Research Ltd

For more information contact Audrey Taylor (Conference Administrator), Transport & Travel Research Ltd, Tel: +44 (0)1543 416416, Fax: +44 (0)1543 416681 or E-mail: audrey.taylor@ttr-ltd.com

CONFERENCE PRE-ANNOUNCEMENT

A project supported by DG RESEARCH
of the European Commission

Research Directorate-General
FP6 Key Action
The City of Tomorrow and Cultural Heritage

EDICT

Evaluation and Demonstration of Innovative City Transport

CONFERENCE CALL

Advanced Transport Systems for the City of Tomorrow

Monday 25th – Tuesday 26th October 2004, Cardiff County Hall, UK
Hosted by Cardiff County Council
Supported by the European Commission

The conference will present the conclusions of the 3-year EDICT project and related initiatives, with presentations by leading experts from Europe and the USA, and speakers from the European Commission. It will be of particular interest to local authorities and other agencies interested in the potential of advanced transport systems.

- Worldwide perspective
- Evaluation and Demonstration of innovative solutions
- Development of the ULTra concept (personal rapid transit)
- Designing a personal rapid transit system
- The Needs of Citizens and Stakeholder feedback
- Impacts of Personal Rapid Transit in Cardiff
- Assessing the value and application of personal rapid transit in other European cities
- Advanced technologies to assist drivers

Delegate Rates: £50.00 plus VAT
Includes attendance at the conference, conference dinner, and technical visits to the ULTra test track (shown right)

Visit the project website – **http://www.edict.info**

Organised by

ttr Transport & Travel Research Ltd

For more information contact Audrey Taylor (Conference Administrator), Transport & Travel Research Ltd, Tel: +44 (0)1543 416416 or E-mail: audrey.taylor@ttr-ltd.com

PROJECT WEBSITE

Ενα ταξί που μοιάζει με διαστημικό όχημα κινείται σε δικό του δίκτυο δρόμων με ταχύτητα έως 80 χλμ. την ώρα! - και το κυριότερο χωρίς οδηγό! Μήπως ονειρεύομαι; Οχι, απλώς ακόμα γίνονται θαύματα!

Κείμενο: ΚΩΝΣΤΑΝΤΙΝΑ ΓΙΑΝΝΟΥΤΣΟΥ

Πέτα τον οδηγό απ'... το ταξί!

ULTRAtaxi: το επαναστατικό σύστημα ταξί που εκτοπίζει... τον οδηγό και εξασφαλίζει ήρεμες, ασφαλείς και γρήγορες μετακινήσεις έκανε το ντεμπούτο του στο Κάρντιφ της Ουαλίας.

«Εχω ένα όνειρο...» λέει ο σύγχρονος Αθηναίος. «Να μην είμαι πια έρμαιο των ταξιτζήδων, που με πηγαίνουν απ' όπου θέλουν, με βάζουν και κάθομαι δίπλα σ' όποιον θέλουν, με αφήνουν όπου θέλουν και με υποχρεώνουν να ακούω βλαστήμιες και καψουροτράγουδα πρωί πρωί».

Ισως και οι κάτοικοι της πόλης του Κάρντιφ να είχαν ένα παρόμοιο όνειρο, κι έτσι διατήρησαν μεν το ταξί, αλλά... πέταξαν έξω τον οδηγό. Απέκτησαν δηλαδή αυτό που λέμε «ταξί χωρίς... σοφέρ». Πράγματι, στην ουαλική πόλη το 97% των μετακινήσεων γίνεται με αυτοκίνητο. Ετσι, το δημοτικό συμβούλιο της πόλης αποφάσισε να βρει μια λύση για την καλύτερη μετακίνηση των πολιτών. Και υιοθέτησε το ULTRAtaxi, το νέο επαναστατικό σύστημα ταξί χωρίς οδηγό. Το ULTRA (Urban Light Transport System) είναι ένα αυτοματοποιημένο σύστημα ταξί, το οποίο σχεδιάστηκε από την ομάδα Advanced Transport του Πανεπιστημίου του Μπρίστολ και χρησιμοποιεί το δικό του δίκτυο δρόμων (επίγειο και εναέριο). Το κάθε ταξί, που μοιάζει με διαστημικό όχημα, κινείται με ηλεκτρισμό πάνω σε μια μονωμένη γραμμή σε σχήμα U, ώστε να ελαχιστοποιείται ο θόρυβος και η αντίσταση του αέρα.

Υπάρχουν στάσεις ταξί σε διάφορα σημεία της πόλης, όπου οι επιβάτες, εάν δεν βρουν ένα όχημα να τους περιμένει, μπορούν να το καλέσουν χρησιμοποιώντας μια smart card (έξυπνη κάρτα). Στη συνέχεια θα επιβιβαστούν στο ULTRAtaxi, θα βάλουν τη smart card στο ειδικό μηχάνημα, το οποίο είναι συνδεδεμένο με το κεντρικό κομπιούτερ και θα πληκτρολογήσουν τον προορισμό τους. Θα ενημερωθούν για το κόστος της διαδρομής και η πληρωμή θα γίνει αυτόματα (από τραπεζικό λογαριασμό) μέσω της έξυπνης αυτής κάρτας. Ο επιβάτης θα καθίσει αναπαυτικά και θα απολαύσει τη διαδρομή καθώς το ταξί τον πηγαίνει στον προορισμό του από τον πιο σύντομο δρόμο και με ταχύτητα από 40 μέχρι 80 χιλιόμετρα την ώρα!

Επειδή όλα ελέγχονται με κομπιούτερ, τα οχήματα μπορεί να κινούνται το ένα πολύ κοντά με το άλλο χωρίς να υπάρχει κίνδυνος ατυχήματος.

Επιπλέον κανείς δεν απαιτεί να ταξιδεύεις με συνεπιβάτη. Σε περίπτωση που σου συμβεί κάτι κατά τη διάρκεια της μετακίνησης, υπάρχει ένα κουμπί κινδύνου. Η υπηρεσία αυτή θα προσφέρεται 24 ώρες το 24ωρο.

Ηδη το Δημοτικό Συμβούλιο του Κάρντιφ έχει δοκιμάσει το σύστημα αυτό σε μια γραμμή 2 χιλιομέτρων. Το νέο μέσο μεταφοράς αναμένεται να τεθεί σε πλήρη λειτουργία μέχρι το 2004, οπότε θα κυκλοφορούν 120 τέτοια ταξί.

Αντε, σύντομα(;) και στα δικά μας!