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**Towards advanced transport for the urban environment**

**Evaluation of passenger satisfaction with the Heathrow PRT system**

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## Executive Summary

The CityMobil project includes three demonstrations of advanced transport systems. The first of these is a **pilot installation of Personal Rapid Transport (PRT) at the new Terminal 5 of London's Heathrow Airport**. BAA's original purpose in building the Pilot System, which provides a shuttle loop between a business car park and the Terminal, was to prove the concept of PRT as a means of transporting passengers around Heathrow. If the demonstration provides a good and reliable quality of service, passenger satisfaction, and acceptable capital and operating costs, BAA will consider whether to extend the network.

Central to the CityMobil project is a comprehensive evaluation of the demonstrators, and of Personal Rapid Transit as demonstrated in the Heathrow system. This will form the basis of advice on the value of developing PRT more widely, not only for specialist locations such as airports, but more generally as urban public transport. In order to do this, it is necessary to judge the benefits and costs of PRT in comparison with alternative transport systems.

Prior to the PRT service, Heathrow Airport used a transfer bus service to link the T5 Business car park with the Terminal. Such bus services are used widely within the airport to transport passengers between the various car parks and the Terminal buildings, and also to link the different Terminals, car hire centres, hotels, staff workplaces, and various other centres of activity. In a fully-developed PRT network, many of these bus services would be replaced by PRT.

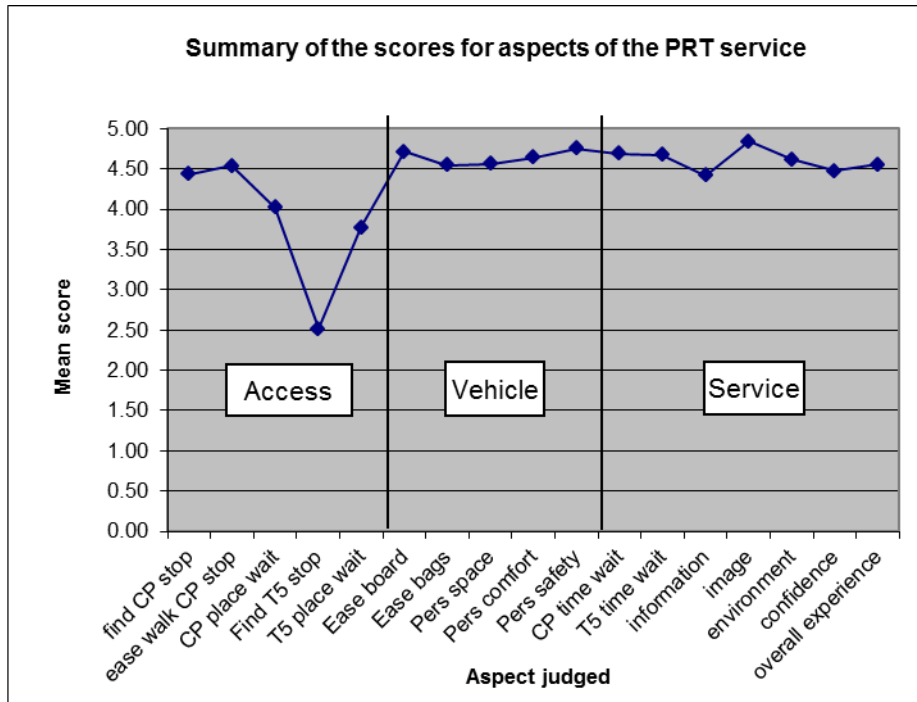
In evaluating the PRT service, it will be compared with the shuttle bus services. To do this, passengers using the transfer bus service were surveyed in March 2009, as reported in Deliverable 1.2.4.1. The survey questionnaire was based on the key parameters identified in Deliverable 1.2.3.1, which in turn was based on the recommended Framework for Evaluation of the CityMobil Demonstrations proposed in Deliverable 5.1.1.

**This Report describes a survey of the PRT passengers**, which is exactly similar to that made of transfer bus passengers, except for two additional questions concerned with passengers' assessment of the PRT service relative to the bus service, and with willingness-to-pay for PRT. These additional questions were asked after all the other questions, to ensure that they could not influence the previous answers, so that the two surveys were strictly comparable. This report is given in exactly the same format as D1.2.4.1, for ease of comparison. However, the comparison will be made explicit in Deliverable 1.2.4.3, which will discuss the relative scoring of PRT in comparison with the transfer bus. D1.2.4.3 will also discuss the views of the operator and owner of the Heathrow system, and will provide operating data on the system.

The survey of the PRT passengers was made on May 18<sup>th</sup>, 19<sup>th</sup> and 20<sup>th</sup> 2011. Passengers were asked to score a range of aspects of the service on a five-point scale, from 1="extremely poor" to 5="excellent". The method of administering the questionnaire was necessarily slightly different from the transfer bus survey, since in that survey supervisors were able to travel on the buses and assist passengers where necessary during the course of the journey. Nevertheless, the bus passenger questionnaire was mostly self-completed. For PRT, supervisors explained the reason for the survey when passengers entered the vehicles at the Terminal 5 station, and handed the questionnaire to them to fill in during the journey to the car park. The completed questionnaires were collected at the station, where supervisors could give any required assistance. Replies were received from 314 passengers, though 19 of these failed to score questions 15 to 21, which were on the back

side of the sheet, either because they did not realise they were there, or because of lack of time or perseverance.

This report shows the distribution of scores received for each of 22 questions concerning many different aspects of the PRT service, and of the access to it. **The average scores given for each of 17 attributes of the service are summarised in the Figure below.** It is clear that the great majority of the passengers surveyed rate the new PRT service remarkably highly.



The low score given for ease of finding the Terminal 5 station resulted from the fact that the directional signs to the station at Terminal 5 were not in place when the survey was made. Because the station is situated on level 2 of the multistorey short term car park alongside the Terminal building, and two floors above Arrivals, the route to find the station is neither short nor direct. This is not an optimal location for the PRT station, but was convenient for the construction of this demonstration PRT system. A system which was designed integrally into a terminal could have easier and more direct access, since the quiet, zero-emission vehicles could be brought within the Terminal building itself. The station as a place to wait probably also scores relatively lowly for the same reasons, though it is still marked as good. In any case, for most passengers there is no waiting involved, since the mean waiting time is 19 seconds. **Otherwise, every aspect surveyed achieved an average score of 4 or above, and eleven out of the seventeen aspects scored above 4.5.** Moreover, the problem with the T5 station signing was soon corrected, but this, and aspects of access at both ends of the PRT system, are not attributes of PRT itself. **The ten aspects which are specific to PRT itself (excluding “overall experience”, which also encompasses other aspects) have an average score of 4.62±0.04, where 5 is “excellent”.**

The two additional questions which were specifically aimed at the PRT service asked whether passengers thought the PRT service was better than the previous transfer bus service, the same, or worse. **90% of passengers thought PRT better than bus service, and no-one thought it worse.** The second question asked how much passengers would be willing to pay for an urban PRT service in their home town. **Only a bare 50% said they were willing to pay more for PRT than for a bus service.** This inconsistency between the high regard for the PRT service and a lack of willingness to pay for it is likely to be due to a

reluctance to give any grounds for increasing the car park charges or charging for PRT separately. Asking people how much they are willing to pay is always contentious, and in the end how much the market is likely to bear depends on the degree to which PRT provides a superior service to its competitors.

**Both this survey, and the transfer bus survey, were completed very successfully, and there is no reason to doubt that the scoring faithfully reflects the perceptions of passengers. The main interest of the surveys lies in the comparison between them, however, and this will be made in Deliverable 1.2.4.3.**

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# Evaluation of passenger satisfaction with the Heathrow PRT system

## 1 Introduction

The objective of the CityMobil project is to achieve a more effective organisation of urban transport, resulting in a more rational use of motorised traffic with less congestion and pollution, safer driving, a higher quality of living and an enhanced integration with spatial development. Its focus is on automated vehicles, whether operating on general-purpose roads or in segregated systems. Amongst a wide range of sub-projects, it contains three large-scale demonstrations: a Personal Rapid Transit (PRT) system at Heathrow Airport in the UK, an automatically-guided bus system at Castellón in Spain, and a low-speed cybercar shuttle in the car park of an Exhibition Centre in Rome. These demonstrators are intended to supply proof of concept of innovative transport systems integrated into the urban environment, and to obtain a comprehensive socio-economic assessment of their value. They will be assessed on the basis of the demonstrations, but this will be extrapolated to provide advice on their applications more widely.

The pilot installation of PRT serves a Business Car Park and links it to the new Terminal 5 of London's Heathrow Airport. Once PRT is shown to work successfully, BAA will consider whether to extend the network. The pilot system is essentially a shuttle system, and cannot fully demonstrate the advantages of PRT as a network where passengers can travel directly from any point to any other point on the network, without intermediate stops, and with little or no waiting. Nevertheless it will demonstrate the technical operation and reliability of the system, and its suitability for wider application. Thus it is not intended that the Pilot Scheme will of itself be economically justified, but it is intended to be the start of a fully operational PRT system. After the Pilot phase, the system will continue to serve passengers travelling between the business car park and Terminal 5. The design of the Pilot system must, therefore, be as detailed and functional as the larger network. Experience of the construction and operation of this Pilot will provide a basis for judging the merits of future applications of PRT.

Evaluation is an important part of the whole Project, and the methodology for this is addressed separately in Sub Project SP5. For the Heathrow Demonstrator, the PRT system is judged against the alternative conventional transport, in this case a transfer midi-bus service which took passengers between the car park and Terminal 5 prior to operation of PRT. Such bus services are used widely within the airport to transport passengers between the various car parks and the Terminal buildings, and also to link the different Terminals, car hire centres, hotels, staff workplaces, and various other centres of activity. In a fully-developed PRT network, many of these bus services would be replaced by PRT.

Passengers using the transfer bus system were surveyed in March 2009, and the results were reported in Deliverable 1.2.4.1. An exactly similar survey was administered to PRT users on May 18<sup>th</sup>, 19<sup>th</sup> and 20<sup>th</sup> 2011, shortly after the service began public operation.

This Report describes the PRT passenger survey, and its findings. The Report is structured in exactly the same way as the report on the bus passenger survey, Deliverable 1.2.4.1, so

that the results can be easily compared with those for bus passengers. Section 2 describes briefly the Heathrow PRT system, Section 3 the survey methodology, and Section 4 the respondents, where there were minor differences in their characteristics. Section 5 describes the distribution and average scores achieved for each of the 21 questions pertaining to passenger's perceptions of the PRT service, categorised into questions concerning access at the car park end, the vehicle itself, access at the Terminal 5 end, and the service overall. Section 6 concerns the two additional questions added to this survey, which were specific to PRT, and conclusions are drawn in Section 7. Detailed comparisons between the two surveys, and the relative attitudes to PRT and the transfer bus, will be made directly in a separate report, Deliverable 1.2.4.3, which will also contain the views of the operator and owner of the system, and summarise the operating data from the system.

## 2 The Heathrow Pilot PRT Scheme

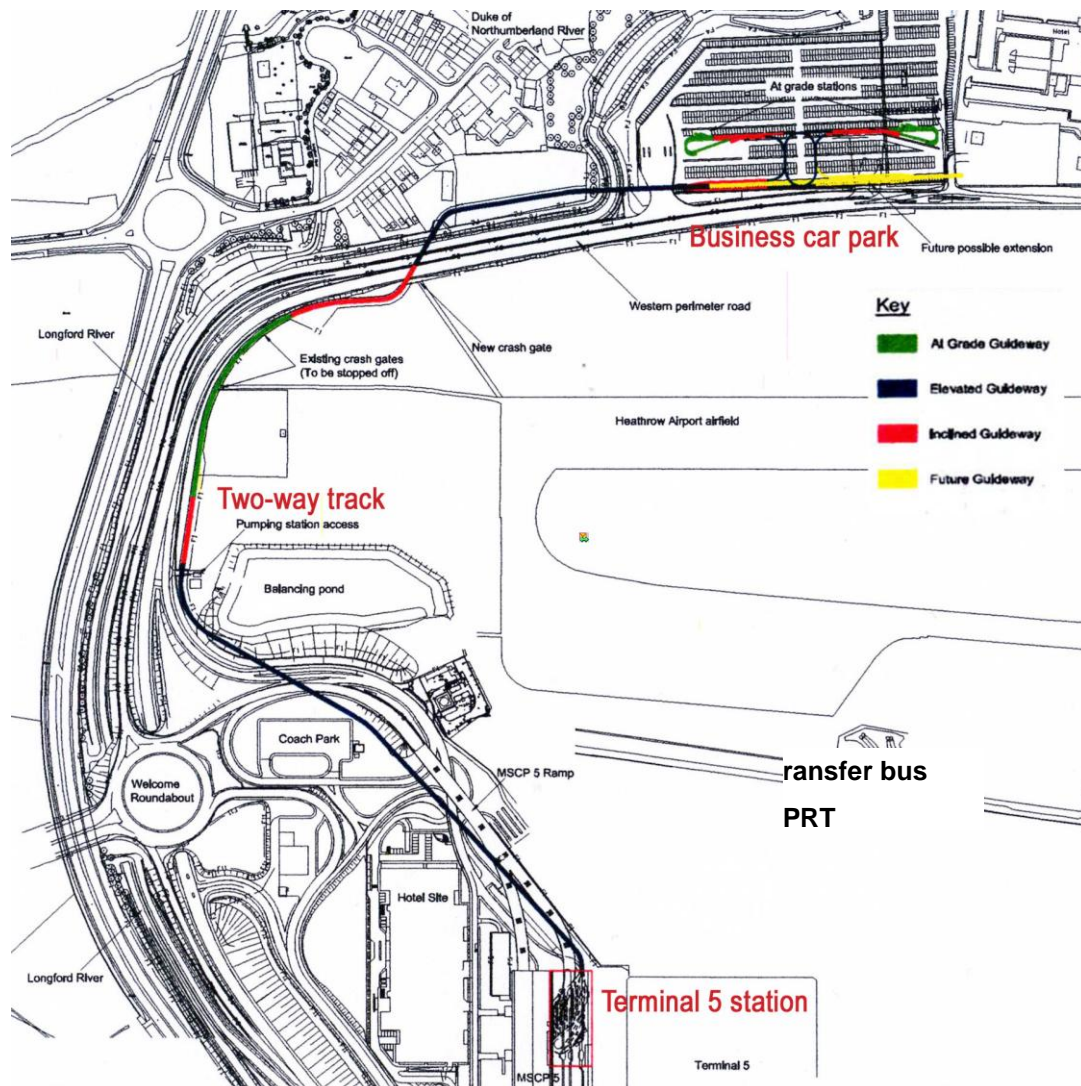
The Heathrow Airport Pilot PRT Scheme has been commissioned and financed by the airport owner BAA, now part of the Ferrovial Group. This follows an extended period of analysis of alternatives to provide the key landside transport needs of the airport. BAA concluded that all existing forms of public transport were unsuited to meeting their key requirements, on the grounds of cost or inflexibility or both, and that the best transport solution to meet their future needs is a PRT network.

BAA are financing the system in two ways, by a major contract with ULTra PRT Ltd (formerly ATS) to install, integrate and commission the ULTra PRT system, and secondly by making a substantial investment in ULTra PRT Ltd which has paid for the development of a full production system. CityMobil is monitoring the performance of the scheme and has funded some aspects of PRT beyond the scheme itself, with the aim of achieving an evaluation of the operation of PRT which can then be applied to other potential installations, including its use for urban public transport.

The scheme carries passengers arriving at the Business Car Park to the new Terminal 5 Building, which opened in March 2008. It has been described in Deliverable 1.2.2.2. The PRT network has 3.8 kms of dedicated guideway, collecting passengers from two two-berth stations in the car park, transporting them along an elevated dual-guideway mainline section which skirts the perimeter of the airport, and terminating in a four-berth station on the second floor of the multi-storey short-term car park alongside the Terminal 5 Building, as shown in Figure 2.1.

The system is served by 21 small four-seater battery-electric vehicles, controlled automatically. Except where there are sudden large peaks in arrivals, passengers find a vehicle already waiting to collect them at the stations, and there is little or no waiting. The scheme is intended as proof of concept.

It is important to understand that, because the PRT system is a pilot to demonstrate proof of concept, some aspects of its location are unavoidably sub-optimal. Had the system been designed as an integral element of the airport the Terminal 5 stations would have been installed closer to the Terminal building itself, either within the building (the PRT vehicles are battery electric and produce no exhaust emissions and very little noise) or placed along the exterior wall of the building, rather than on the 2nd floor of the multi-storey car park, where



**Figure 2.1 The PRT routing between the Business Car Park and Terminal 5**

connection to the Departure level, or from the Arrivals level, is via lifts or stairs. Thus in this after-fit access to and from PRT is substantially worse than to or from the buses. This will inevitably affect the assessment. Considering the relative travel times of the two modes, although this is not a major factor for the pilot system, generally across the airport PRT would be considerably quicker than bus since buses have to negotiate traffic signals, intersections and traffic congestion, while many bus services also stop at intermediate destinations. PRT, by contrast, runs non-stop from origin station to destination, though in some cases the routing might be less direct than by road. In this initial application, PRT operates essentially as a shuttle service, and consequently most of the guideway is two-way track. In a wider network the guideway would be designed as interconnected one-way loops, and vehicles would be able to navigate directly from any point on the network to any other, travelling automatically and safely across intervening junctions, and bypassing intermediate stations.

There are two stations in the Business Car Park, each with two berths. If the car park is full the mean walking distance to the nearest station is about 60 metres. From the car park PRT runs as shown in Figure 2.1 to a station on the second floor of the multi-storey car park alongside the Terminal 5 building, from where passengers walk across a level bridge into the mezzanine level of the airport. The departure level is on the fifth floor, and arrivals on the

ground floor below. The station on the second floor of the multi-storey (short-term) car park at Terminal 5 has four berths. The bus service, by contrast, dropped passengers at the Departure level, and picked passengers up at Arrivals level.

The PRT system first began operating a simulated revenue service in September 2010. BAA were unwilling to permit public operation until they were confident that the system could operate without any failures, and it was subjected to an extensive commissioning period to ensure that it was fully reliable, and met all its operating targets. In the autumn of 2010 and winter 2010-11 the system carried airport employees and numbers of visitors who came to examine the new system, and operated for extended periods in exactly the same way as for public operation. There were, inevitably, teething problems and equipment failures, though there were few problems with the operation of the PRT system itself; mostly problems affected components which might form a part of any conventional transport system, such as touch-screens and door sensors. Sequentially, minor problems were eliminated and in April 2011 the system began full public operation.

As noted above, if PRT were to be incorporated into the design of the Terminal it would deliver passengers directly into the building, and could in principle drop passengers at Departure level and pick them up at Arrivals level, though this would necessitate considerable additional length of track to accommodate the change in level. The mean run time from either car park station to the T5 station is 5.0 minutes, compared to a typical travel time of 5-10 minutes for the buses. The buses ran at a mean headway of 8.9 minutes, which corresponds to a mean waiting time of 5.2 minutes for randomly (Poisson) arriving passengers. For most PRT passengers there is no waiting at all, since most find a vehicle waiting for them in the station, though occasionally their selection of the destination on the touch-sensitive panel will call one up from another station or the depot. The mean passenger waiting time has been measured at 0.3 minutes. The buses did however offer an advantage over PRT at the Business Car Park of dropping passengers on request as they travelled around the car park, so that the mean walking distance on return was less than on the outer journey, though these stops delayed the journey for passengers left on the bus.

### 3 The survey



**Fig 3.1 The passenger survey**

The survey was carried out on May 18<sup>th</sup> to 20<sup>th</sup> 2011. The Questionnaire is appended at Annex A. It is exactly the same as that administered to the transfer bus passengers, but with the addition of two questions specific to PRT, dealing with how PRT compares with the bus service, and how much passengers might be willing to pay for PRT in an urban context. These questions were added after the main questions to ensure that they could not bias the answers to the main questions. The method of administering the survey was slightly different from the bus

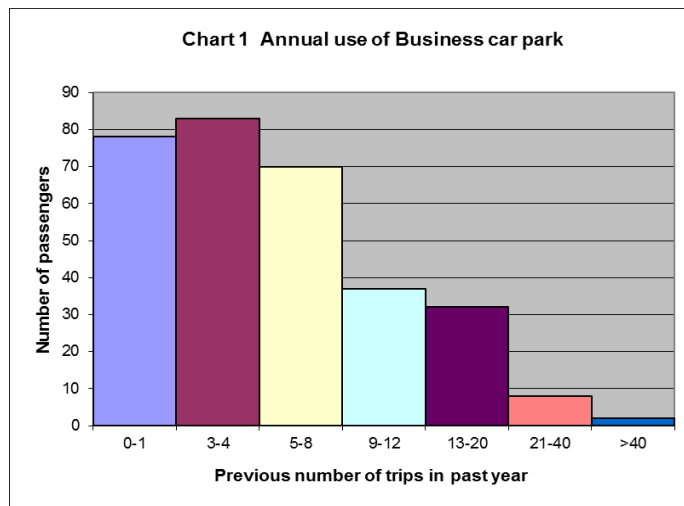
survey, because it was not practical to have the survey supervisors travel with passengers in the vehicle, as they had in the bus survey. Instead supervisors met passengers as they boarded vehicles at Terminal 5, explained the reason for the survey, and gave them the questionnaire form (Figure 3.1). Passengers filled in the form as they travelled to the car park station, where other staff collected the forms and provided any assistance needed.

Most of the questions required the respondents to assess various aspects of the service on a five point scale, from 1 = Extremely poor to 5 = Excellent. In all, attitudes were sought on 18 aspects, plus the two additional questions noted above. The survey also asked whether the respondent would recommend the car park service to a friend or colleague, using a 10-point scale: in the bus survey this was essentially for BAA's own use rather than for the CityMobil study, but here it was interesting to see how the response compared with that for the bus survey, since it provides an overall assessment of both bus service and car park.

## 4 The respondents

Usable returns were obtained from 314 respondents. Not surprisingly, given the nature of the car park, the overwhelming majority, 289 in 294, were travelling on business (20 passengers failed to reply to this question - indeed 20 passengers failed to fill in the reverse side of the questionnaire sheet, and only completed the first 14 questions). Of the rest, 4 were travelling on package holidays and one to stay in his own house abroad. The sample of non-business travellers is too small to make meaningful distinctions between the scoring for different travel purposes.

88% of the respondents were male, and only 12% female, reflecting a very strong bias in business travel, as was the case in the bus survey. Average rankings were similar for both males and females for most of the aspects surveyed, and in what follows differences between the sexes will be mentioned only where they are appreciable or of potential interest.



Respondents were asked how many times they had used the Business Car Park in the last year. This response is not comparable with the bus passenger survey, since in that survey the car park had been open for only slightly less than one year. As Chart 1 shows, some users were frequent travellers from Terminal 5: 42 had travelled more than 12 times from the Business Car Park. The surveyed trip was the first or second time of use for 78 respondents.

Passengers were not asked whether they had used the PRT system before, but it had been open for such a short time that very few would have had the opportunity.

## 5 Survey results

### 5.1 The Business Car Park

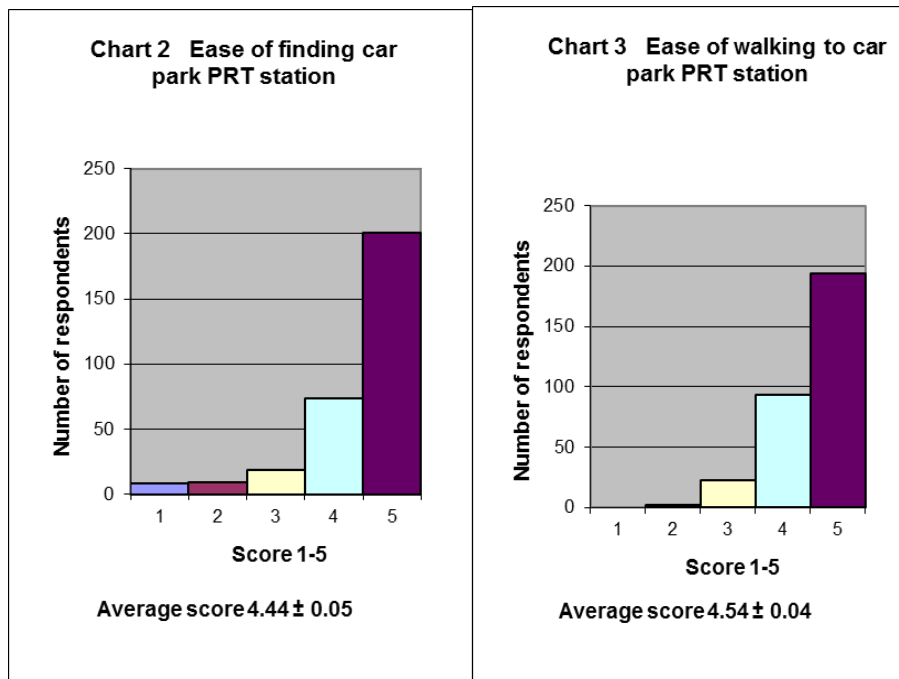
**“How would you rate the ease of finding the PRT station in the car park?”**

In the Business Car Park the two PRT stations are located towards the Perimeter road edge of the car park, and have sculpted wing-shaped canopies which are readily visible from any point in the car park (see Figure 5.1).



**Figure 5.1 PRT Station “A”**

This ease of finding the station is reflected in the high markings given in answer to the question, as Chart 2 shows. The standard deviations shown are those on the means. The sample size was designed to achieve discrimination between mean scores of  $\pm 0.1$  and this was generally bettered. The Heathrow stations are designed to be iconic, but in general PRT stations in a car park need be hardly more elaborate than bus stops. Indeed, it would be acceptable to keep the vehicle berths on line if there is no traffic from other car park stations passing through, provided there was an off-line waiting area for empty vehicles. There were, however, a number of passengers who marked this aspect low, perhaps because they did not realise that the very attractive station structures could be the transfer stations, when they were used to simple bus shelters.



**“How would you rate the ease of walking to the PRT station from your car?”**

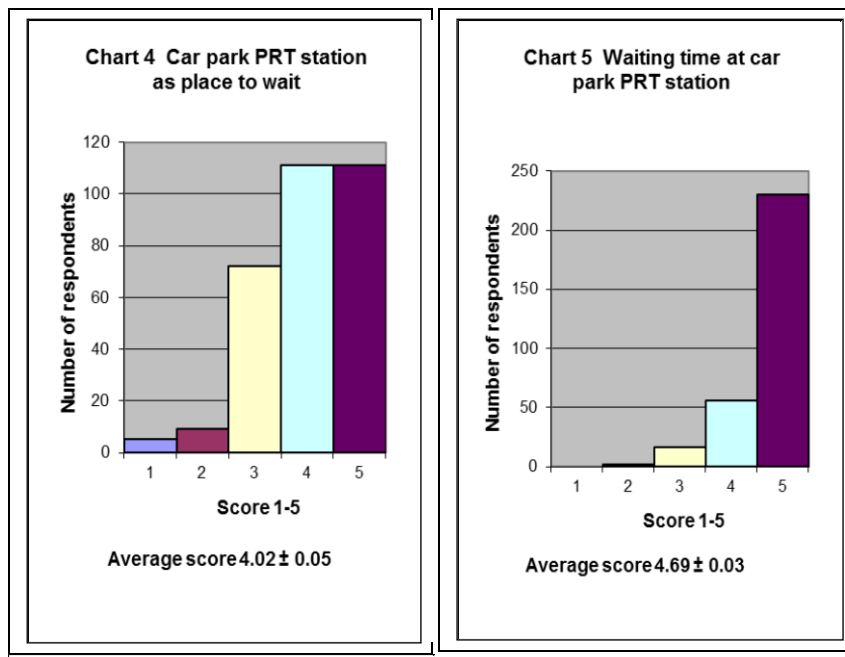
Similarly, as Chart 2 shows, travellers found no difficulty walking to the station, since the mean walking distance is only about 50 metres. It is the case, however, that unlike the transfer bus stops, which can be located anywhere in the car park where it is suitable for the bus to pass, PRT stations have to be located on the periphery because the guideway must be segregated, and this increases the mean access distance over a bus service.

**“How would you rate the PRT station in this car park as a place to wait?”**

The car park stations scored fairly highly as places to wait, though perhaps not as highly as might be hoped given the very striking architectural statement they make (Chart 4). They are well protected from the weather, though they do involve passengers interacting with a touch-screen to call the vehicle, an action not required with the transfer buses. In this small-scale pilot the screen is rather redundant, since the only available destination is Terminal 5, but in a larger network passengers will have to choose from a list of destinations. In practice, most passengers did not have to wait there, since they could immediately board a waiting vehicle, and would have little time to consider the attractiveness of the station as a place to wait. Nevertheless, 31 passengers gave the stations a mark of 1 or 2, indicating positive dissatisfaction with the stations. This is hard to understand, but possibly they felt the stations were too elaborate, and the mark was in protest.

**“How would you rate the amount of time you had to wait at the PRT station?”**

This question achieved a remarkably high mark (Chart 5), with only 5 passengers rating the waiting time as less than “good”, and 20 rating it “good”, ie 3. 241 gave it 5 marks. Given that the average waiting time across the survey was 19 seconds, and only 6% of passengers waited more than a minute, this is not surprising.



Walking through the car park to the station is in the open air, and Question 14 asked for a rating of the **weather at the time**. 76% of respondents marked the weather at 5 or 4, and 24% at 1 or 2. Although poor weather did depress the ratings slightly the effect was not statistically significant, as:

	Good weather (4&5)	Poor weather (1&2)
Ease of walking to car park station	4.56±0.04	4.45±0.08
PRT station as place to wait	4.04±0.06	3.96±0.11
Waiting time at station	4.72±0.04	4.62±0.08

In general, though, poor weather depressed the rankings slightly across all aspects, but only in the cases of personal space, personal safety and information was the difference statistically significant. This is clearly not an effect of the weather on the particular aspect, but simply that good weather encourages people to take a more optimistic view of life in general. Nevertheless, this is an aspect which will be considered in its possible effect on the overall comparison of the transfer bus and PRT surveys in Deliverable 1.2.4.3, since the weather during the PRT survey was, on the whole, better than during the bus survey.

There were no significant differences between the way **women** viewed the car park end of the system from the scores given by **men**. Women rated walking to the station at  $4.68 \pm 0.21$ , the station as a place to wait at  $3.94 \pm 0.17$ , and the waiting time at  $4.68 \pm 0.10$ , compared with  $4.50 \pm 0.04$ ,  $3.99 \pm 0.06$  and  $4.70 \pm 0.04$  respectively for men. Interest in this question arises because women might feel more vulnerable walking and waiting in a car park, but one potential strength of PRT is that, since waiting time is so short, vulnerability, even at night, is minimised. But in any case, the airport car parks are very secure places.

## 5.2 The PRT vehicles

Five of the questions related to aspects of the PRT vehicles or “pods” themselves. First, getting on the vehicle:

***“How would you rate the ease of boarding the vehicle?”***

***“How would you rate the ease of storing your baggage once on board?”***

As Charts 6 and 7 show, few passengers found difficulty with either aspect. Entering the vehicles is rather easier than entering a car, though it is necessary to bend the head a little when passing through the door. Unlike the transfer bus, there is no special rack for storing baggage, but there is plenty of space between the opposing bench seats to place baggage on the floor, and no lifting of bags into racks is required. It is the case, though, that this is a business car park, and many passengers have only light baggage.

Women found no more difficulty than men, with scores of 4.79 and 4.47 for boarding and baggage respectively, compared with 4.69 and 4.54 for men.

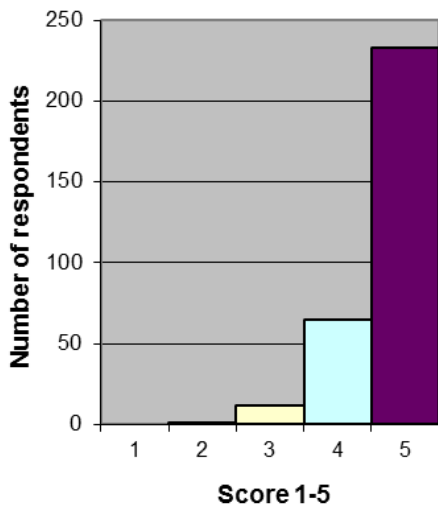
***“How would you rate the amount of personal space in the vehicle?”***

***“How would you rate your personal comfort whilst in the vehicle?”***

These two aspects are closely related, and the scores are very similar (Charts 8 and 9), though there are rather more low scores for space than for comfort, which may represent the distribution of physical size of the passengers. Roughly two thirds of passengers marked these aspects at 5 out of 5, so clearly they were very impressed by the vehicles. It may be the similarity to a private car which is so appealing.

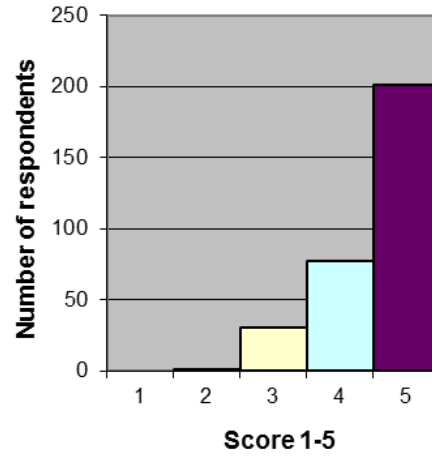
Women find the vehicle less spacious than men, but more comfortable, at  $4.35 \pm 0.16$  and  $4.74 \pm 0.10$  respectively, compared with  $4.57 \pm 0.04$  and  $4.61 \pm 0.04$ , but these differences are not statistically significant.

**Chart 6 Ease of Boarding**



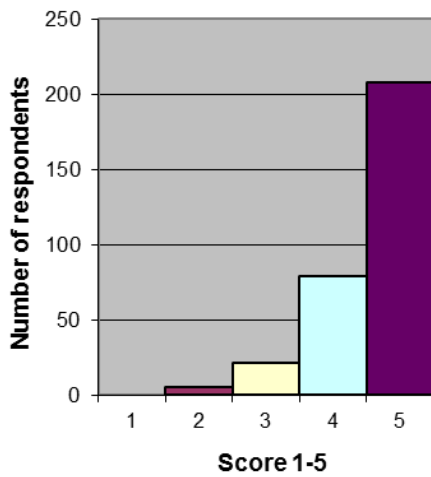
**Average score  $4.71 \pm 0.03$**

**Chart 7 Ease of storing baggage**



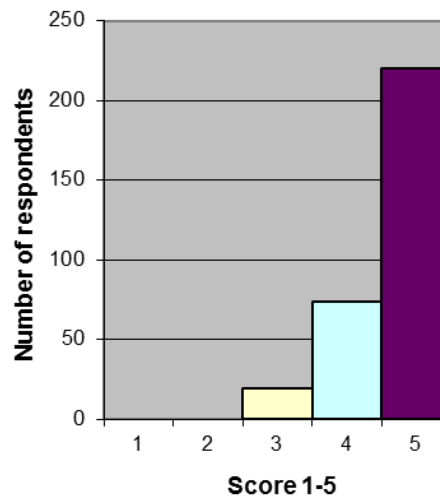
**Average score  $4.55 \pm 0.04$**

**Chart 8 Personal space**



**Average score  $4.57 \pm 0.04$**

**Chart 9 Personal comfort**

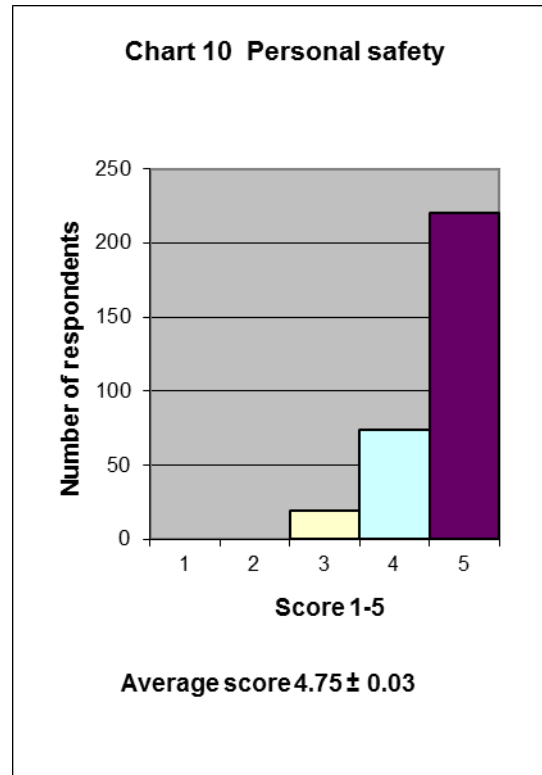


**Average score  $4.64 \pm 0.03$**

Lastly passengers were asked how safe they felt:

***“How would you rate your personal safety whilst in the vehicle?”***

It is remarkable that this question achieved the second highest score in the survey, after image. This is an entirely new mode of transport, and most of the guideway is elevated and on a gradient. Yet passengers clearly felt extremely safe. The question is compound, since safety encompasses both freedom from accident on the system, and freedom from assault, and it is not possible to say how these components were judged. The finding is very important for future designs of PRT networks, whether airport based or for urban transport. Women give a slightly lower score than men, at  $4.59 \pm 0.12$  compared with  $4.76 \pm 0.03$ , but the difference is not significant.



**5.3 The Terminal 5 station**

Three questions concerned access at the Terminal 5 end, and the survey was completed as passengers accessed the service at Terminal 5 and travelled to the car park. As noted previously, the T5 station is not at an optimum location, because the PRT system was designed as a pilot and introduced after completion of Terminal 5, when the easiest place to construct it was within the multi-storey car park alongside the Terminal building. Passengers have to take a lift to the Departures floor, where there is a bridge across to the Terminal building. For a PRT system designed as an integral part of a Terminal it would be possible to bring the vehicles into stations directly at Departure and Arrival levels, and close to the relevant check-in desks.

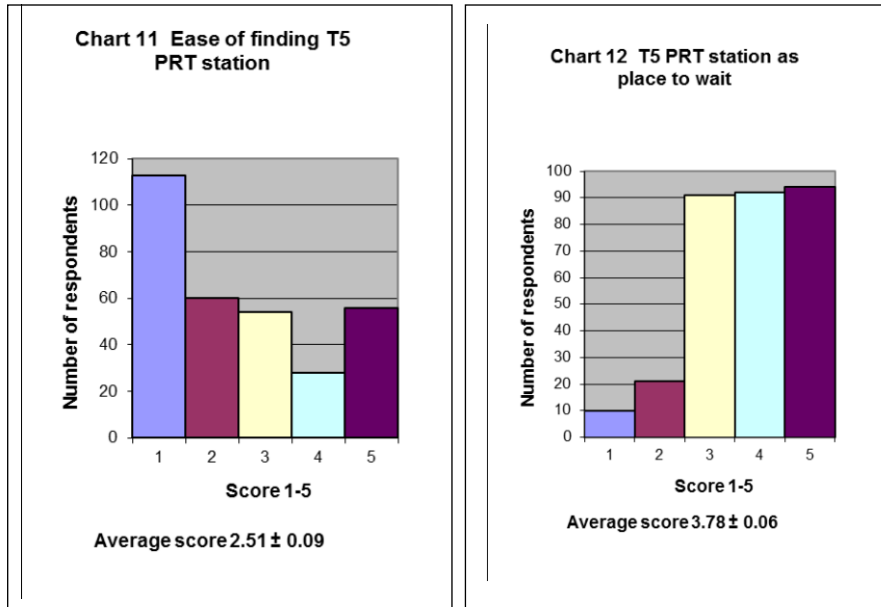
***“How would you rate the ease of finding the PRT station at Terminal 5?”***

As Chart 11 shows, this is an aspect that is rated very lowly, and the score of 2.51 is far below the scores achieved for all the other aspects. This is primarily because at the time of the survey signs pointing to the PRT station had not yet been installed in Terminal 5, though the rather circuitous route to the station might not have scored highly even if the routeing signs had been in place. Nevertheless, many passengers had no idea where to go, had to ask, and were clearly irritated. It is interesting, though, that even given the high praise passengers are giving to the system as a whole this aspect, which deserves to score badly, is singled out for a low marking, and this instils confidence that the survey is correctly identifying passenger attitudes. The routeing signs were installed shortly after the survey, so the scoring now would be very different.

***“How would you rate the PRT station at Terminal 5 as a place to wait?”***

This question received the second lowest score of the survey, probably in part because the difficulty of finding the station was fresh in the mind. Although the station is well-designed, with modern glass screening of the concourse from the berths, and glass doors which

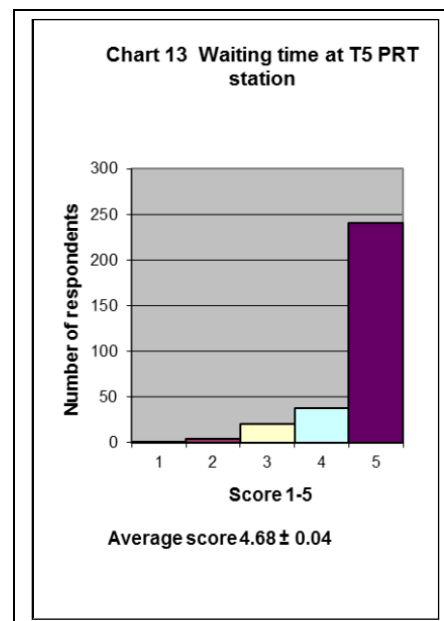
opened synchronously in the station and on the vehicle, the low roof and approach alongside the second floor of the multi-storey car park might give the impression of a place rather squeezed into a corner of a workaday car park. The transfer bus stop, alongside a draughty roadway, fared even worse, however.



Just as for the car park station, passengers were asked about their waiting time:

***“How would you rate the amount of time you had to wait at the station?”***

Despite passengers’ unhappiness with the directions to the T5 station, and their relative indifference to the station itself (though note that 3.78 still shows good satisfaction with the station), they appreciated the very short waiting times, or lack of waiting altogether, which PRT achieves. Waiting time at the station is marked almost exactly the same as at the business car park station, which again suggests a high degree of consistency in the survey, since the two questions were well separated in the questionnaire.

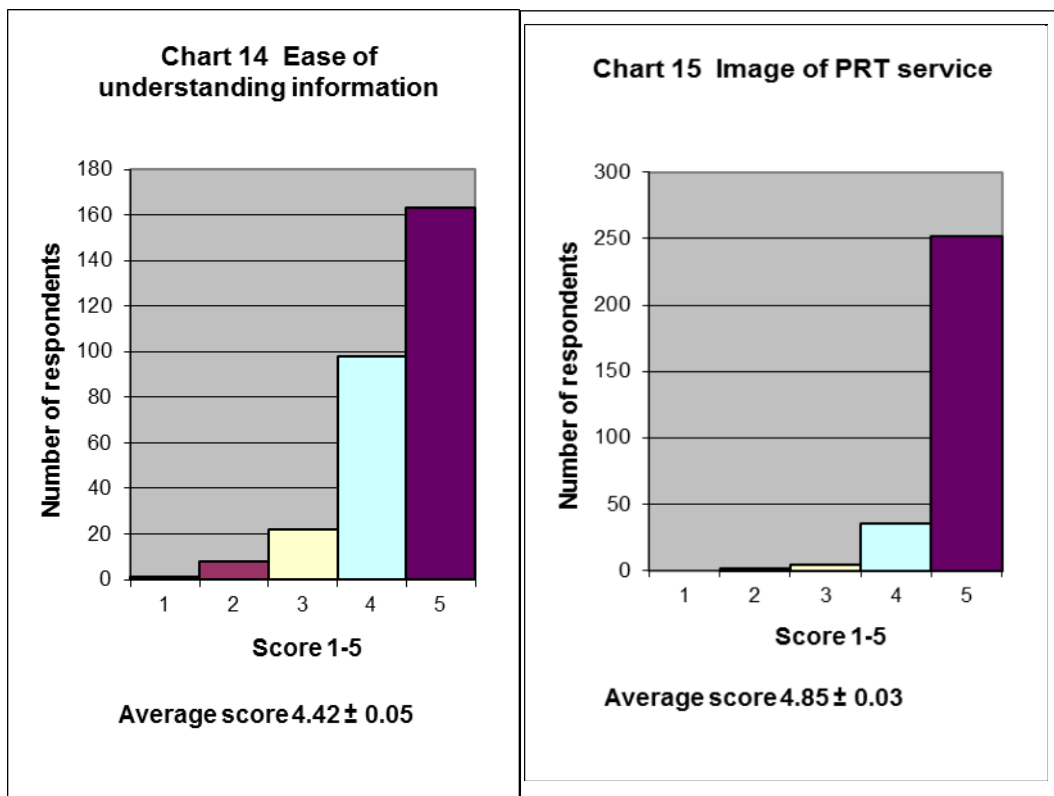


## 5.4 The Service

The remaining questions in the survey were concerned with the PRT service overall.

### ***“How would you rate the information about using PRT as being easy to use?”***

This is a crucial question for PRT, since while everyone knows how to use a bus (at least, when it is free), PRT is a mode which is entirely different from the conventional modes with which people are familiar and it is essential to provide information which makes the service easy to use. In reality, there is nothing complicated about calling and using PRT, but it is likely that passengers using it for the first time will be unsure what to do. As Chart 14 shows, however, passengers rated the information provided highly, and indeed the system can be seen to work smoothly, with passengers handling destination selection, boarding and alighting without difficulty. Only one passenger gave a mark of 1, and 8 marked the information at 2.

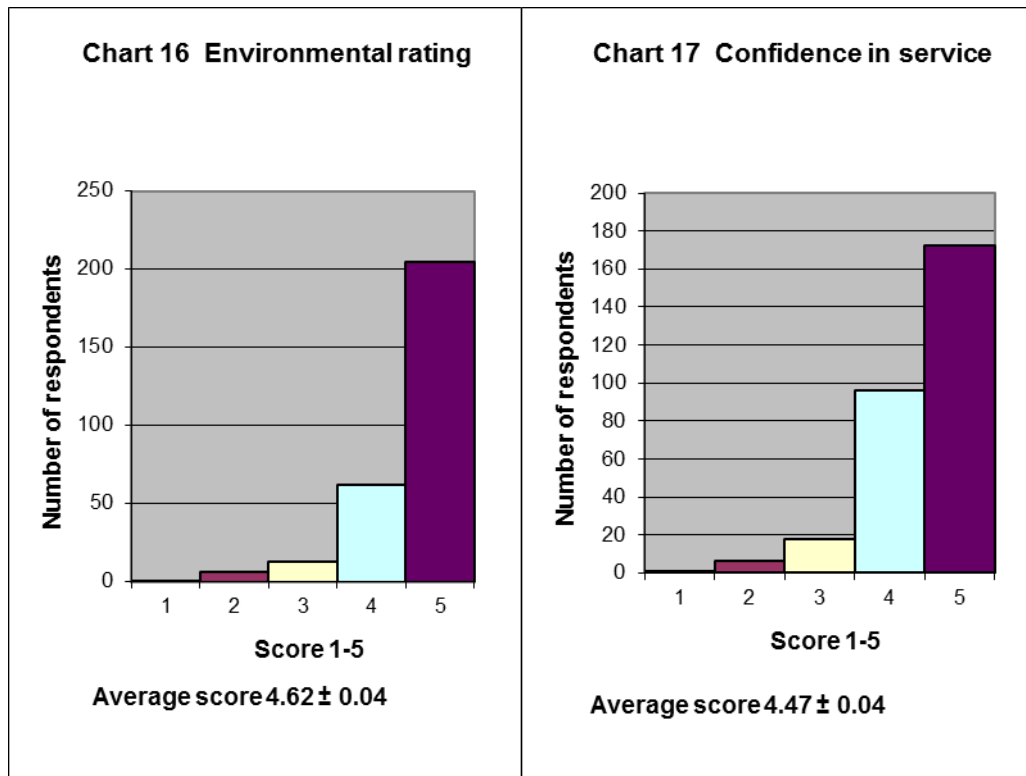


### ***“How would you rate the PRT vehicle (the “pod”) in terms of having a modern image for the airport?”***

It comes as no surprise that the image of the PRT system should be scored the highest of all the questions (Chart 15), though it will be nonetheless gratifying for BAA. Eighty six percent of passengers marked it at 5 for its modernity, presumably because it was regarded as very advanced technology. In terms of its automated operating system this is true, of course, but both guideway and vehicles are in fact based on tried and tested technologies, with many component parts supplied from the automotive industry. It is the whole ensemble which comes together to give most people who see the system the impression that this is a transport system taken from the future.

***“How would you rate the PRT vehicle for being environmentally friendly?”***

Passengers rated the environmental friendliness of PRT very highly, though they had no way of knowing the precise details of its energy use or emissions. It was obvious, though, that the vehicle was electric (though most passengers would not be able to say whether it was battery-electric or track-powered). They would guess that the vehicle had no emissions at the vehicle, and probably emissions from the electricity generating station would not be considered. The vehicle was clean and quiet, and was not powered by an internal combustion engine, and that was enough to justify the very high marking.



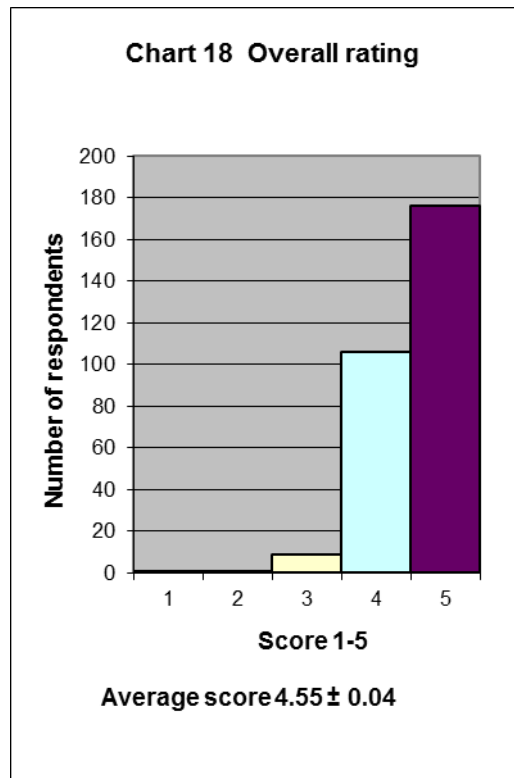
***“How would you rate your degree of confidence in the PRT service as a means of travelling between the car park and the Terminal?”***

As Chart 17 shows, this question is marked very highly, even though hardly any of the passengers would have had the opportunity to use the service more than once. It will be the case, however, that for almost all the respondents to the questionnaire the service operated smoothly and with little delay, since the reliability of the service since it began public operation has been very high (99.7% of passengers were served without any failure of the system). This marking reflects passenger’s pleasure and satisfaction with the PRT service in general, rather than any wider knowledge of the service’s reliability.

***“How would you rate your overall experience of the PRT service?”***

This aspect might be expected to be strongly related to the previous question, and as Chart 18 shows the score is very similar. 96% of passengers scored the system at 5 or 4. Only one passenger marked this at 1, and one passenger at 2, and in both cases they gave the

lowest marks to their Terminal 5 station experience: it may be they were particularly frustrated by the lack of signing, and marked most other aspects relatively lowly.



***“Would you recommend using this car park to a friend?”***

This question was asked for BAA’s own purposes, and clearly relates to use of the car park as a whole, but it provides an additional measure of the extent to which PRT might improve the image of the car park. The average score, on a 10-point scale this time, is 8.95±0.10. It is not clear how this might be interpreted in terms of the proportion of users who would definitely recommend the car park in a yes/no answer, but it suggests that the great majority of users are very satisfied with the overall car park arrangements, in a situation where they are paying a premium price (though for most the cost will be paid by employers). Given that the markings shown above are so high for aspects connected with the PRT transport, the very high willingness to recommend the car park must in large part be due to the PRT service.

**6 Questions specific to PRT**

Now we pass onto the two additional questions which were added to the PRT questionnaire after those questions which had been asked in the Transfer Bus survey. These were located in this way to ensure that they could not bias answers to the questions which were asked of both bus and PRT passengers, where the treatment had to be exactly comparable.

***“If you have previously used the Transfer Bus system at Heathrow, how do you rate the PRT system against the bus transfer?”***

As we have seen, many of the passengers were regular users of the Terminal 5 business car park, and although for the vast majority the PRT survey occurred on the first occasion when they used PRT, they would be very familiar with the previous transfer bus service.

Passengers were asked to tick one box according to whether they thought the PRT service was better than, worse than, or much the same as the previous transfer bus service. The replies were:

**259 passengers thought PRT better than bus**

**14 passengers thought PRT and bus were “much the same”**

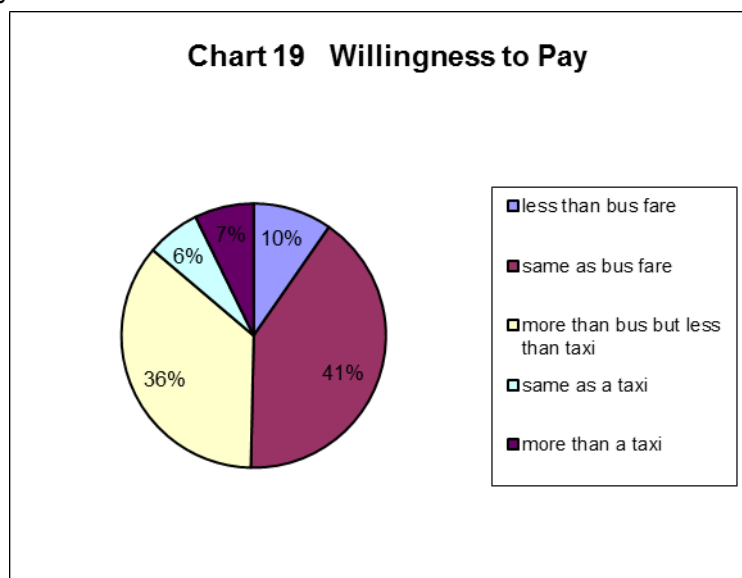
**0 passengers thought bus was better than PRT**

There is an overwhelming vote here for PRT over bus.

***“Suppose a PRT system were available in your home town and could take you from home into the town centre. What is the most you would be prepared to pay to use it?”***

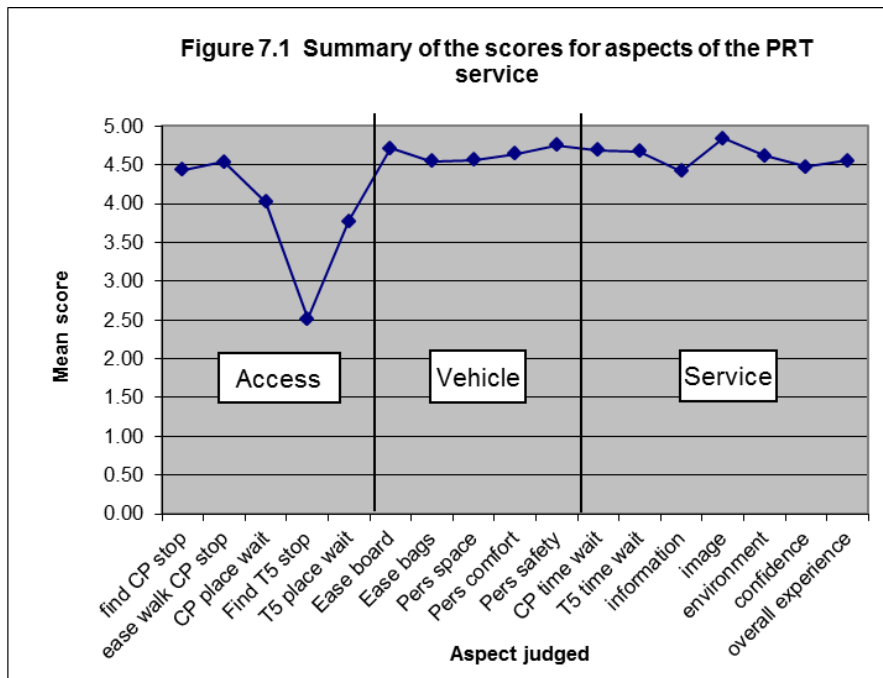
Willingness to pay is an important question in consideration of PRT. It is, however, difficult to obtain an unbiased opinion, and while it was sensible to examine the question at this opportunity interpretation of the answers is subject to obvious caveats. The business car park at Terminal 5 is fairly expensive, as car parks are at most UK airports, but the transfer from the car park to the Terminal is included in the fee and not charged separately. Questions about money may therefore be answered with some reservation, since passengers might consider that their answers could be used in decisions about car park charges and how to charge for transport. On the whole, such fears are likely to reduce the amount passengers say they are willing to pay, rather than increase it.

As Chart 19 shows, the largest number of passengers opted for paying “much the same as the bus fare”, though almost as many were willing to pay more than for bus, but less than for taxi. A few enthusiasts were willing to pay as much as, or more than, a taxi fare. Curiously though, 28 passengers said they were not willing to pay as much as a bus fare, despite the fact that no passenger had judged PRT to be worse than bus, and 23 out of the 28 had said that PRT was better than bus. This lack of consistency is presumably due to an unwillingness to give the airport any basis for charging more for the car park, or for the PRT service separately.



## 7 In Conclusion

This is the “After” survey of a two-stage comparison, and the important conclusions will follow from comparison of the PRT passenger survey with the transfer bus passenger survey, which will be discussed in Deliverable 1.2.4.3. Nevertheless, it is clear that the great majority of the passengers surveyed rate the new PRT service remarkably highly. Figure 7.1 summarises the average scores given to the various aspects.



The dissatisfaction with the lack of directional information to the Terminal 5 station is clear to see, and to a lesser extent with the location of the station as a place to wait. Otherwise, every aspect surveyed achieved an average score of 4 or above, and eleven out of the seventeen aspects scored above 4.5. Moreover, the problem with the T5 station signing was soon corrected, but this, and aspects of access at both ends of the PRT system, are not attributes of PRT itself. The ten aspects which are specific to PRT itself (excluding “overall experience”, which also encompasses other aspects) have an average score of  $4.62 \pm 0.04$ .

The two additional questions which were specifically aimed at the PRT service showed that the overwhelming majority of passengers thought the PRT service better than the previous transfer bus service (which had been scored as being generally satisfactory), and no-one thought it worse, but only a bare 50% said they were willing to pay more for PRT than for a bus service. This inconsistency between the high regard for the PRT service and a lack of willingness to pay for it is presumably due to an understandable reluctance to give any grounds for increasing the car park charges or charging for PRT separately. Asking people how much they are willing to pay is always contentious, and in the end how much the market is likely to bear depends on the degree to which PRT provides a superior service to its competitors.

Both this survey and the transfer bus survey were completed very successfully, and there is no reason to doubt that the scoring faithfully reflects the perceptions of passengers. The main interest of the surveys lies in the comparison between them, however, and this will be made in Deliverable 1.2.4.3.

# ANNEX A

## The Passenger Questionnaire

### T5 BUSINESS CAR PARK – PRT PASSENGERS



Heathrow has a new transport system to carry passengers between Terminal 5 and the Business Car Park. This Personal Rapid Transit system is the first of its kind in the world, and we are keen to know what passengers think of it. We would be grateful if you could spare a few minutes to tell us. Please fill in this questionnaire and hand in the form at the station where you alight, in the box provided. Thank you for your time.

[include a leading zero if less than 10]

1 How many times have you used this car park in the last 12 months?

--	--

1-  
2

Using a scale of 1 to 5, where **1 is 'Extremely Poor'** and **5 is 'Excellent'**, how would you rate the PRT service in terms of.....

2 Ease of boarding the vehicle?

--

3

3 Ease of storing your baggage once on board?

--

4

4 Amount of personal space in the vehicle?

--

5

5 Personal comfort whilst in the vehicle?

--

6

6 Personal safety whilst in the vehicle?

--

7

Thinking about **the journey from Terminal 5 to the Car Park**, how would you rate.....

(score 1 to 5 again)

7 Ease of finding the PRT station at Terminal 5?

--

8

8 The station at Terminal 5 as a place to wait?

--

9

9 The amount of time you had to wait at the station?

--

10

Now, thinking back to when you first arrived in this Car Park and transferred over to Terminal 5, how would you rate.....

(score 1 to 5 again)

10 Ease of finding the PRT station in this Car Park?

--

11

11 Ease of walking to the station from your car?

--

12

12 The station in this Car Park as a place to wait?

--

13

13 The amount of time you had to wait at the station?

--

14

14 How would you rate the weather at that time?

--

15

Using the same rating scale as before, and thinking about the PRT system in general, how would you rate...

- 15 The information about using the system as being easy to understand?  16
- 16 The PRT vehicle (the "pod") in terms of having a modern image for the airport?  17
- 17 The vehicle for being environmentally friendly?  18
- 18 Your degree of confidence in the PRT system as a means of travelling between the Car Park and the Terminal?  19
- 19 Your overall experience of the PRT system?  20

On a **scale of 0 to 10**, where **0 is 'Not at all likely' and 10 is 'Extremely likely'**, how likely would you be to recommend.....

- 20 ...using this Car Park to a friend or colleague?   21-22

- 21 What was the main reason for your trip today?  23

- Business 1
  - Holiday – Package 2
  - Holiday – Independent 3
  - Staying at own property 4
  - Visiting friends and relatives 5
  - Other non-business 6
- Place appropriate code in box above

- 22 If you have previously used the Transfer Bus system at Heathrow, how do you rate the PRT system against the bus transfer?  24

- PRT better than bus 1  (tick one box)
- Bus better than PRT 2
- Neither better nor worse 3
- Haven't used the bus 4

- 23 Suppose a PRT system were available in your home town and could take you from home into the town centre. What is the most you would you be prepared to pay to use it? (tick one box)  25

- Not as much as the bus fare 1
- Much the same as the bus fare 2
- More than bus, but less than taxi 3
- Much the same as a taxi 4
- More than a taxi 5

- 24 Are you male or female? please tick male  female  26

**Thank you for helping us with this survey**