BEST PRACTICE IN THE BUS INDUSTRY

REPORT ON A TRAVELLING FELLOWSHIP OF 2006/2007 FUNDED BY THE WINSTON CHURCHILL MEMORIAL TRUST

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Section 2 – Main Report (for publication)
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Executive Summary

My WCMT Fellowship, to study best practice in the bus industry, involved travel to three countries – Brazil, New Zealand, Australia – and lasted just under six weeks. I left the UK on Saturday 28 October 2006, returning on Friday 8 December 2006 (full travel details are shown in Annex A).

Aims
The purpose of my Fellowship was to experience first hand the following:

- the extensive, non guided, busway network in Curitiba, southern Brazil
- the trolleybus operation in Wellington, New Zealand
- the dynamic allocation bus station in Christchurch, New Zealand
- the O-Bahn guided busway in Adelaide, Australia

and to speak to the organisations and people responsible for planning and operating these systems. By doing this I hoped to understand how these systems work and problems and challenges in, planning, building and operating them. A list of the people and organisations I met with are detailed in Annex B.

My reasons for wishing to see these systems were as follows:

Brazil
A long term masterplan was written in Curitiba in 1965, which is still adhered to over forty years later. In essence this links planning and transport in a way that works, by concentrating high density residential development along high frequency, high capacity bus corridors. In the UK we have frequently talked about the benefits of linking land use planning in this way and produced several written policy documents, such as Planning Policy Guidance note 13. However, in general terms we are not good at putting advice this into practice. Curitiba showed this is possible. Curitiba’s buses carry as many passengers every day as the New York bus system, but for a considerably smaller population. I wanted to see how this is done and what could be transferred to the UK.

New Zealand
My principal destination here was Christchurch, to look at the dynamic stand allocation system in use at the Bus Exchange, opened in 2000. The main concern I had was that this could be a means of reducing the land take “footprint” of a bus station at the expense of offering an inferior service to bus passengers.

In general terms I found that the system worked to passengers’ benefit although there were some issues that would need to be taken into consideration for any such arrangement in the UK, such as avoiding conflict between bus and car movements and ensuring that there is spare capacity in the facility to allow for growth in bus use in future years.
There are no trolleybus systems still operational in the UK, other than in museums. The last working UK network was the one in Bradford, which shut down in 1972. Trolleybuses are often suggested now as a “green” and sustainable travel option. There are working trolleybus systems on the Europe continent, but while in New Zealand this was an opportunity to see a working example.

Australia
My travels included meetings at Sydney and Perth, but my main objective was to visit the Adelaide O-Bahn. This is a guided busway, currently the longest such installation in the world, which was built in the mid 1980’s. I found the O-Bahn to be very impressive and welcome the creation of a similar such busway in the UK, in the Cambridge area, in the next couple of years. Assuming that it is built to the same high engineering standards, passengers in the UK will benefit from those high standards that bus passengers currently enjoy in Adelaide.
1. Curitiba

Introduction
While they all agree that the city of Curitiba sits on top of a plateau, depending on which guidebook or information leaflet you read, the altitude ascribed varies between 900 and 990 metres above sea level. Notwithstanding this difference of opinion, all seem decided that it lies some 250 miles south of the major Brazilian city of Sao Paulo and about fifty miles inland from the coast at Paranagua. It is the largest settlement in the state of Parana, with a population of about 1.7m in the city itself and a catchment of some 3.2m people in “Greater” Curitiba. In recognition of its size and importance within the region, it is the state capital of Parana. Due to its location, one book considers the city also to be the Ecological Capital of Brazil with approximately 52 square metres of greenery per inhabitant. Strangely, while the excellent transport system in Curitiba gets a brief mention in most guidebooks, at least one informs us that “most travellers come to Parana for one thing: Iguazu Falls” (dramatic water falls that mark the border with Argentina), rather than the internationally famous Bus Rapid Transit system. To quote from the same guidebook about Brazil, “Despite Curitiba’s interesting history, it’s not a beautiful city and its appeal to the traveller is limited.”

Although Curitiba has existed as a settlement since 29 March 1693, like the rest of southern Brazil, Parana was largely neglected by the Portuguese colonists, who concentrated on coffee and sugar production, further north. When the state seceded from Sao Paulo in 1853 the economy was predominantly based on cattle. Growth in Curitiba has really taken off in the last fifty years or so and continues to develop apace. Today it is described as amongst Brazil’s richest, cleanest and best organised cities.

Beginnings of public transport in Curitiba
The first public transport within Curitiba would appear to have been a horse drawn tram, known as a “bonde”, introduced in 1887, although it should be noted that the railway to the port at Paranagua opened two years earlier. Travel on the trams was divided into two categories. Apparently it was obligatory in first class for passengers to wear shoes. In “bonde mixto” the official record says that passengers could travel bare foot (although this was perhaps the result of straitened economic circumstances, rather than a positive choice.) Electric trams were introduced in 1912, a very necessary change, as indicated by the almost threefold increase in ridership in twenty years, from 680,000 passengers in 1903, to 1.9m passengers in 1923. The first motor buses appeared in 1928 and (like London, and there are other similarities with London which we shall come to) the last tram ran in 1951. Nowadays there is a tram vehicle on static display in the Rua das Flores, (the first pedestrianisation scheme in the city, dating from 1972), although I was unable to determine whether this was a genuine example from Curitiba, or a piece of heritage nostalgia imported from elsewhere.
Figure 1 – General map showing bus network in Curitiba
Modern day public transport in Curitiba

The one person largely responsible for ensuring that modern day Curitiba developed in a more sustainable way is a man called Jaime Lerner. Born in 1937, the son of Polish immigrants, he was first elected mayor of Curitiba in the early 1970s, holding the office on three separate occasions, before subsequently moving on to become governor of Parana. In the mid sixties he had been instrumental in helping to develop a “Masterplan” while working at the IPPUC (translates as The Research and Urban Planning Institute of Curitiba). After his election to mayor he ensured that land use planning and transport development went hand in hand, rather than the traditional UK habit of building a new hospital or industrial estate somewhere inaccessible, then examining the transport problem created and expecting a bus operator to run a ten minute frequency to and from every part of the neighbouring town or city, at all times of the day or night. In Curitiba this process started in 1974 with the establishment of one strategic busway corridor, or “canaleta”, running from the city centre north eastwards, opening up development along that route. Over the last thirty years, in accordance with the Masterplan, this has resulted in the creation of a total of five major radial corridors, each provided with a reserved, centrally located, two direction busway, with parallel roads for all other traffic. The approach has been overwhelmingly successful. There has been a threefold increase in bus passengers carried since the 1970s. Now, taken as a whole, (i.e. not just the five strategic corridors) the Curitiba bus network carries an average of 2 million passengers every day. The five arterial routes have each progressed from using conventional buses, to (conventional) bendy buses, to the introduction, in 1991, of “bi-articulated” buses. In total there are 162 of these huge vehicles, which can each accommodate up to 270 passengers (although as with a London Underground train, the vast majority as standees) and on one section of route they are scheduled to operate at less than a one minute headway in the peak. The final physical ingredient in this unique Curitiba mix was the appearance from 1991 of the famous “tube stations” shelters at the bus stops served by these routes (see figures 2 and 3).

Role of URBS

All buses in Curitiba are privately owned and operated by a number of different companies (22 in the integrated network), but, as with London, they are contracted to work to a route, schedule, frequency and fare determined by a central body, in this case URBS (Urbanizacao de Curitiba S.A. – or Curitiba Urbanisation Company). URBS was created in August 1963 as a mixed capital company with its own technical and financial resources. Its principal task has been to plan and manage the Public Transit System in Curitiba, but it has wider social infrastructure responsibilities as well, such as street paving, lighting, sewage and landscaping. In more recent years it has gained additional functions, such as highway engineering and parking control (from the state government) in 1997.

Roles of different buses and fares policy

Curitiba’s buses are liveried in particular colours to indicate their function, regardless of which company actually operates them. The numbers and roles break down as per table 1.
Figure 2 – Bi-articulated bus approaching bus shelter

Figure 3 – View inside bus shelter
Table 1 – Break down of bus fleet in Curitiba

<table>
<thead>
<tr>
<th>Livery</th>
<th>Vehicle Type</th>
<th>Role</th>
<th>Passenger Capacity</th>
<th>Number in fleet</th>
<th>Number of routes using this type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 White</td>
<td>Minibus</td>
<td>City centre circular</td>
<td>30</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>2 Yellow</td>
<td>Midi bus</td>
<td>Conventional / Special Midibus</td>
<td>40 / 70</td>
<td>50</td>
<td>18</td>
</tr>
<tr>
<td>3 Yellow</td>
<td>Full size</td>
<td>Conventional / Trunk</td>
<td>80</td>
<td>385</td>
<td>90</td>
</tr>
<tr>
<td>4 Yellow</td>
<td>Bendy bus</td>
<td>Articulated trunk</td>
<td>160</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>5 Orange</td>
<td>Feeder / Special midibus</td>
<td>Conventional / Special Midibus from neighbourhood to interchange</td>
<td>70 / 80</td>
<td>655</td>
<td>212</td>
</tr>
<tr>
<td>6 Orange</td>
<td>Bendy bus</td>
<td>Articulated feeder from neighbourhood to interchange</td>
<td>160</td>
<td>74</td>
<td></td>
</tr>
<tr>
<td>7 Green</td>
<td>Full size</td>
<td>Circular – to interchange</td>
<td>110</td>
<td>33</td>
<td>7</td>
</tr>
<tr>
<td>8 Green</td>
<td>Bendy bus</td>
<td>Articulated circular</td>
<td>160</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>9 Grey / Silver</td>
<td>Full size</td>
<td>Direct Line</td>
<td>110</td>
<td>378</td>
<td>18</td>
</tr>
<tr>
<td>10 Red</td>
<td>Bi-articulated</td>
<td>Main corridor</td>
<td>270</td>
<td>162</td>
<td>6</td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td></td>
<td>1,860</td>
<td>352</td>
<td></td>
</tr>
</tbody>
</table>

(N.B. The numbers in the first column are my reference only – they are not used by URBS or the operators.)

The white and yellow buses (1, 2, 3, and 4 in table 1) do not form part of the “integrated fleet”. Their primary role is to provide short local journeys, to, or within, the city centre (or “downtown” as it is known). The flat fare for one journey is R$1.80 (less than £0.45 at November 2006 exchange rates, which does sound cheap by UK standards, but it must be borne in mind that average incomes in Brazil are considerably lower than the UK). On these services the fare is collected on the bus by an employee sat at the front of the passenger saloon who controls a turnstile. However, if you travel on the integrated network the flat fare applies to all journeys made until the passenger leaves the network at the end of the journey. To access the bi-articulated services at
a tube shelter you pass through a turnstile. This is done either by paying a person sat there to control the turnstile, or using a smartcard that releases the barrier automatically. No ticket is issued. Once in the system you can travel and interchange as much as you like for the one fare, until you physically leave the system at your destination, usually by walking through another turnstile. There are several interchange hubs at strategic points on the network which permit passengers to use the bi-articulated or Direct Line bus for the trunk part of their journey, but to access this route to/from their neighbourhood by travelling on an orange or green bus.

Although to UK eyes the fare already seems low, following a commitment by the current mayor, in 2005 the fare was reduced, from R$1.90 per journey, and on a Sunday a flat fare of R$1.00 now applies across the network. This latter initiative has generated a 40% increase in Sunday passengers, or some 100,000 extra journeys per day. At present farebox income across the network covers operational costs. Cross subsidy applies to the system so that the more heavily used routes and times of day subsidise the less busy buses.

Although more prosperous than the rest of Brail there is still an inequality in income, with a high proportion of residents of Curitiba receiving a monthly income of no more than R$700 (less than £180). Even at these fare levels bus travel accounts for more than 10% of this income. (Smartcards have been introduced but do not seem to offer a discount. Their advantage seems to lie in the removal of the need to carry cash and employers can provide them for staff if they so wish.

The grey / silver Direct Line buses are interesting. Firstly, the passenger entrance doors are only on the off side (i.e. driver’s side) of the vehicle. At some Interchange stations this can offer cross tube transfer between the bi-articulated and the Direct Line buses. It should be noted that it does have the downside at the Airport stop of placing the pick up point on the opposite side of the road to the point at which air passengers exit the building, thereby encouraging people to use the “Executive” bus service at R$6.00 instead! Secondly, these buses only pick up at designated tube stops, which for these services are spaced at approximately 3 km intervals (closer in the city centre). The theory is that these services offer a fast journey. However there is one problem with this theory, in that for much of their journey these buses are using the ordinary roads shared with other traffic, so this can reduce peak speeds. The bi-articulated services stop about every 400 metres on their reserved busway. This allows an average speed of 20 km/h. The aim for the Direct Line buses is to average 30 km/h, but unfortunately, despite the excellent public transport system available, Curitiban private vehicle ownership levels have increased to about one and a half times the level of 1991 (a sign of prosperity?), reducing this target speed to nearer 25 km/h, due to the effects of added congestion.

**How the tube stops work**

The bi-articulated buses (25 metres long) are all fitted with five sets of doors, labelled from 1 at the front to 5 at the rear. All the doors are fitted with a powered ramp that can bridge the gap to the equivalent doorway at the tube
stop to permit level and uninterrupted access from the tube. Unlike the problems experienced with some similar ramps fitted to buses in the UK, these seem to operate efficiently, quickly and reliably. The bus door numbers are displayed as stickers on the windows of each set of doors so as to be visible to passengers outside and are displayed on overhead plastic signs mounted adjacent to the relevant door inside the bus, visible to passengers getting off. At the less busy stops the standard arrangement is that a shorter tube shelter is used that encloses passengers to enable them to board at door 3 (only) and for passengers to disembark from the bus at doors 2 and 4 if they are leaving the network, or at door 3 if they intend to change buses at that stop, or are a wheelchair user. Each tube stop is equipped with a lift to enable wheelchair user to access the shelter. Due to the volume of alighting and boarding passengers in the city centre, many tube stops are long enough for the bus to use all five doors for both boarding and alighting. Where this happens the bus first stops at one tube to allow passengers to disembark (only) from all five doors. The driver then closes the doors and moves the bus one vehicle’s length to the adjacent, boarding, tube to permit boarding at all five doors. By doing this it avoids problems with any conflicting passenger flows at extremely busy stops. To reduce the workload for the driver, there are seven different sets of buttons in the cab to control the doors – five to open or close each set of doors independently, one to open or close doors 2, 3 and 4 together (for the less busy stops) and one to open or close all five doors simultaneously for the busy stops. Clearly it is crucial that the bus always stops at exactly the right point, otherwise the bus doors and tube doors will not line up and passengers will be unable to get on or off. This seems to be achieved by use of a discreet mark in the road but also, and probably more importantly, through driver experience, which enables the bus to approach at a fast speed whilst still stopping in the correct location.

Reimbursement to the operators
All revenue collected is assigned to URBS, which then distributes payments to the operators based on a number of parameters. One of these is the number of scheduled kilometres operated. The payments system was completely revised in 2005. This included a reduction in the reimbursement element for maintenance from 10% of the new capital cost of each bus, to 8%. URBS takes a 4% management fee of the total pot, although in part this sum can be used as a buffer to enable consistent operator payments to be made at times of lower demand at different times of year.

Table 2 - Mode split

<table>
<thead>
<tr>
<th>Travel in Curitiba</th>
<th>Including pedestrians</th>
<th>Motorised traffic only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus</td>
<td>44%</td>
<td>60%</td>
</tr>
<tr>
<td>Foot</td>
<td>20%</td>
<td>n/a</td>
</tr>
<tr>
<td>Car Share</td>
<td>3%</td>
<td>4%</td>
</tr>
<tr>
<td>Car – single occupancy</td>
<td>21%</td>
<td>29%</td>
</tr>
<tr>
<td>Motorbike</td>
<td>n/a</td>
<td>7%</td>
</tr>
</tbody>
</table>
Passenger complaints
URBS deals with all passenger queries and complaints. A telephone hotline (passengers can dial 156) exists. However, I was unable to get any data on complaint types or volume. It could be difficult to get these in context. I well remember being told in no uncertain terms at the bus users surgery I was involved in at Brighton that the (award winning) Brighton & Hove bus company was “the worst in Britain”. Not being able to understand Portuguese I was unable to tune in to passenger comments as I travelled on the buses in Curitiba, so am not in a position to comment.

Impressions of the system
From the first journey made it is evident that this is a well used and busy network. Judging by appearance (possibly deceptive) passengers seem to be drawn from something of a cross section of society. Additionally there is a thriving university in Curitiba which provides tuition for many students on courses up to 2300 at night, so there is a good passenger base in that sector. This is not purely a means of transport for the socially excluded, although the growth in private vehicle ownership may indicate an aspiration to move away from using public transport, possibly as a status symbol. URBS estimates that some 33% of the entire population uses public transport.

While the social and economic divisions, clearly evident in other Brazilian cities, are less conspicuous in Curitiba, there is still an economic underclass. Next to one of the tube stops I was photographing, a young, dishevelled, (presumably homeless) man was lying crashed out on his front in a doorway in the early afternoon.

There are one or two aspects of the buses that that may discourage people who can choose how they travel. The seats are not the most comfortable and the inside of the vehicles is a little spartan. Ride is generally ok, although the quality of the busway is deficient in one or two places. This can create a sort of Mexican Wave effect in the bi-articulated vehicles – particularly interesting if you are stood across one of the articulated joints, but felt along the length of the bus no matter where you are. There is also an indication of anti social behaviour, not unknown in the UK. Window etching seems to be almost as much of a problem in Curitiba as it is in some major British cities.

Unlike the UK where some highway authorities have had to resort to marking out bus lanes using green or red asphalt to differentiate them, it was notable that the busways in Curitiba look very much like the parallel general traffic lane. They are not extensively marked, or indicated as such, and yet people do not abuse them. The culture would seem to be that you do not drive your car in the bus lane, or park it on the bus stop. Mind you this may be related to the almost certain enforcement procedure. Miscreants are liable to find that they get five penalty points on their licence (they can have up to twenty before more severe action is taken) together with a large fine.

On the other hand, while visitors from overseas, who take an interest in such matters, may get very excited abut the BRT system in Curitiba, the locals seem to take it very much for granted. This has been the natural order of
things for thirty years and it works, although there are voices of dissent. I picked up some contrary views on a community radio programme posted on the Internet, (see link at bottom of page) perhaps surprisingly from the UK perspective, linked to fare levels (although as I have already said, most incomes are much lower than UK levels.)

To the UK eye, it initially seems odd to see a member of staff sat in every tube shelter (two in some of the busier ones). There are over 350 of these shelters, which makes for a lot of staff wages between 0500 and 2400, as well as the “conductors” on the buses where pre payment does not take place. However, you soon get used to this and there are doubtless benefits to be had from such a staff presence. In the UK we have become used to CCTV just about everywhere, whereas there is no such thing on the Curitiba transit network, as, presumably, the staff presence is felt to obviate this need. From a UK perspective, domestic bus operators might see some scope for operational savings here.

The Future
URBS has plans to develop the system further, although these will continue to be based on BRT, not least on cost grounds. It would like to increase both capacity and speed of the bi-articulated routes. Using conventional diesel technology the bi-articulated bus has reached its maximum size. The current buses run on four axles, only one of which is powered. It would need at least one other powered axle if the vehicle size increased. This may require use of new technology such as hydrogen fuel cells etc to provide electric traction to the axle.

In the shorter term URBS is planning two major changes. Firstly, it intends to provide additional capacity by introducing overtaking lanes at stops that could benefit faster Direct Line buses and possibly non stop some bi-articulated services. It intends to do this by the simple measure of staggering tube stops at some locations, instead of siting them opposite one another. By doing this it will enable a third lane to be created on the site of the relocated stop. It is hoped that average bi-articulated speeds could be raised to 25 km/h, if not more.

Secondly a new bi-articulated alignment (making a sixth corridor) is planned running approximately south west to north east, from Atuba to Pinheirinho, which will also serve the city centre. This will re-allocate road space on existing road number BR117. A new by pass has been completed around the city which releases BR117 from its strategic role, enabling another canaleta to be provided, due to be completed by mid 2008. It is clear that Curitiba has not run out of energy, or ideas, yet.
2. Wellington – Trolley Bus Network

Introduction

Most bus services in the Wellington area are provided by a company called Stagecoach Wellington, the City Council having sold its bus operations in 1992. Although still trading under the Stagecoach name at the time of writing, the UK Stagecoach group in turn divested itself of its New Zealand operations in November 2005. This company is now owned by a New Zealand based investment company, Infratil. Infratil has an agreement to use the Stagecoach name for five years from date of purchase, although it is likely to re-brand to another operating name in the near future.

Stagecoach operates a fleet of some 186 buses in the Wellington area, of which 60 are electric trolleybuses, the rest being conventional diesel buses. Bus services are provided on contract to the regional council, which specifies routes and frequencies. Although the buses are owned by Stagecoach, the overhead electrical supply is owned by a company called Wellington Cable Car Ltd, a trading arm of the city council (analogous in some ways to Network Rail’s ownership of the main line rail infrastructure in the UK.) However, day to day maintenance on the system and switchgear (much of which is 50 years old or more) is carried out on a contract basis by Stagecoach staff.

The current trolleybuses are over twenty years old, almost life expired and are not accessible to mobility impaired passengers. A 2001 review nearly saw the end of trolleybuses in Wellington, but a decision was made to retain them and modernise the fleet. By November 2006 three trolleybuses had been rebuilt as modern accessible vehicles see figures 4 and 5 for before and after photos). The bodies are completely new, but the old running units have been re-used. Interestingly, in a link with my visit to Curitiba the work on the running units is being carried out in Brazil. This upgrade will result in a fleet that should last another twenty years, although of course the running units will be over forty years old by that time.

Operational Experience

Although in my late forties, I have never travelled on a trolley bus in normal passenger service, so was unfamiliar with day to day operational issues. Travelling on the Wellington system it became apparent that there are some disadvantages of trolley buses. The most obvious problem was the operational inflexibility. Like most, these trolley buses are unable to pass one another, so must progress in single file even though the bus behind may be ready to overtake. For example where two different services share a section of route and a waiting passenger wants to travel on the bus in front, the bus behind must wait until this has happened. This was most apparent when trolley buses on three different routes were loading on the main city centre departure street in the evening peak. The bus at the back of the queue could not move away until the buses in front of it were ready to go. If one of these had a larger number of passengers to board, or there was some other problem causing a delay, then the back bus could only go at the pace of the slowest loading bus in front of it. At this point all three buses could leave in convoy. A result of this could be that the delay on one route could easily be
transferred on to one or two other routes, thereby creating unreliability on several routes at once.

Another issue is that while some types of trolley bus are fitted with traction batteries that allow limited movement away from the overhead power lines, this is not the case with the Wellington vehicles. Hence this can create two problems. Firstly, the trolley boom only permits movement about two metres each side of the overhead line. If an obstruction on the road (e.g. a road traffic accident) requires a wider manoeuvre, or diversion onto other roads, it can’t be done as the bus would lose its power source. Secondly, there are occasional electrical power outages on the system. At such times, all trolleybuses are stranded at the point they were when the power failed. This can mean that until the power supply has been restored, up to a third of the bus fleet is not only unavailable, but may also be causing major traffic congestion.

Against this, the trolley buses are iconic and are perceived to be “green” at the point of use, although a full energy and environmental audit may indicate a less clear advantage between them and modern diesel buses running to emission standards such as Euro 3 or 4 (or better).

While the company are fully aware of the operational limitations of the trolleybuses, there is a significant commercial advantage for Stagecoach. For as long as the regional council requires trolleybus operation of particular routes, Stagecoach (or its successor) is likely to be the only operator in a position to provide the necessary vehicles and hence win the contract.

At present the company has a five year operating contract but in view of the planned renewal programme is seeking a five year extension to that initial period. This would bring it in line with NZ rail contract lengths. It is interesting to see that the UK is not the only country that treats rail and bus modes differently.
Figure 4 – Trolleybuses laying over at Wellington station terminus

Figure 5 – One of the rebuilt wheelchair accessible trolleybuses
3. Christchurch – The Bus Exchange

Introduction
Christchurch Bus Exchange has been operational since late 2000. It is a bus station that replaced on street terminal facilities in central Christchurch, on Cathedral Square. At a time that new retail development was taking place the city council took the opportunity of incorporating the Bus Exchange as a part of this building work. Its significance lies in the fact that it uses dynamic stand allocation of buses to make it work.

Dynamic Stand Allocation
In most bus stations each service that calls there will be allocated to the same stand, so that for example you know that service 45 always goes from stand F. Dynamic Stand Allocation (hereafter referred to as DSA) is different in that it allocates a bus to one of a number of different stands, according to which one is free at the time. The advantage of DSA for the body commissioning the bus station is that it can significantly reduce the size of the footprint of bus station required and hence the cost of land acquisition and opportunity cost. This same reason is also the potential pitfall for bus passengers, which is why I wanted to go to Christchurch to see for myself how the Bus Exchange operates.

Description of the Bus Exchange
The Exchange is situated on the ground floor of a shopping mall in the city centre and has car parking directly above the vehicle area, although passengers can access the shopping area fairly easily by lifts or escalators from the Exchange concourse. It has three platforms under cover within the Bus Exchange (labelled A, B and C.) There are two departure bays associated with the Exchange outside on each side of Columbo Street (labelled D and E) and one departure stand on Lichfield Street, labelled “F”, primarily for the bus to the airport. Stands A to E are each capable of accommodating three buses.

In the Exchange, services are pre-allocated to one platform (e.g. “B”) but the exact stand number and position on that platform is variable, according to the order that the buses arrive at the Exchange. Delays caused by traffic congestion, or other reasons, will mean that buses do not always arrive in strict timetable order and will, inevitably, vary day by day.

Fundamental to making DSA work is real time passenger information (RTPI) described more fully below. As a bus enters the Exchange, the RTPI system already knows which route it is running on. However it loses GPS contact due to the building obscuring the link to the satellite, so, instead, the bus passes under a loop that reads a plate on the vehicle identifying the fleet number. The control system then has to determine whether a bay on the correct platform is free. If it is, the relevant bus number will appear on an LED display against the relevant stand number and is the authorisation for the driver to move on to that stand. In the Exchange passenger concourse the departure list will now
show that stand number against that bus service and a voice announcement
will also be made to advise intending passengers to go to the correct door.

If no stand is available, the bus must wait by the LED screen until such a time
as it does become free.

Occasionally the tag on the bus will not be recognised by the loop for some
reason (e.g. the battery in the tag is discharged). In this case the LED display
will show the legend “BUS” and the control room operator will log the fault with
the bus company so that the problem is rectified.

Real Time Passenger Information (RTPI)
This is a method of tracking buses, usually by Global Positioning by Satellite
(GPS). It can have a number of purposes. For passengers it can enable a
display at bus stops, or on the internet, or by SMS text messaging, advising
how their bus is progressing in real time, as opposed to its scheduled
departure time.

For bus operators it enables tem to track their fleet accurately and to turn
buses round to get them back on timetable if need be. It also highlights and
quantifies where delays regularly happen to allow for a change in timetable n
the short term and possible changes to the traffic system in the longer term.
Finally it can activate bus priority such as triggering early green phases at
traffic signals for late running buses.

Operational issues at the Bus Exchange
In general DSA and the Exchange seem to work reasonably well in
Christchurch. However, there are a number of current and potential problems.

Firstly, the car park referred to in the introduction has its entrance just past the
entrance (and exit) for buses to the Exchange. If cars queue to get into the car
park for any reason this can prevent buses from entering or leaving the
Exchange, bringing it to a standstill.

Secondly, Platform A can only be used for a small number of services from
one departure bay. This is because there are only two traffic lanes at this
point. Queuing buses waiting for a vacant bay on platform B or C regularly
block one lane. If the three bays on platform A were also used this would
completely block off access to the Exchange for all other buses.

Thirdly, due to inadequate manoeuvring space, the middle bay on both
platform B and C (B2 and C2) cannot be accessed if there is already a bus on
the front and rear bays (i.e. B1 and B3, or C1 and C3). The middle bay can
only be used if there is no bus on the rear most bay (B3 or C3) until after a
bus has stopped on B2 or B3 (see figure 6 for a diagram of the platform
arrangement.)

Each of these factors can significantly reduce the capacity and efficiency of
the Exchange.
Figure 6 – Plan of Christchurch Bus Exchange

(Reproduced courtesy of Metro)
Figure 7 – Lichfield Street view of Christchurch Bus Exchange

Figure 8 – Christchurch Bus Exchange waiting room area
Figure 9 – Bus Exchange boarding door B1

Figure 10
One of the elusive hybrid buses in operation in Christchurch
Some noteworthy features of the general Christchurch bus network

Timetables: There were some surprising elements of the network. As with Wellington, the bus network is specified by the regional council and operators bid for those contracts. While the Monday to Friday timetables were nearly all at a 15 minute or better frequency, this did not always apply to Saturday timetables. The route I used most during my stay in Christchurch was service 7. This was a 15 minute frequency during the day Monday to Friday but dropped to half hourly after 1830. However, the Saturday timetable was identical to the Sunday timetable at a half hourly daytime frequency but an hourly evening service.

There seemed some inconsistency, as another service, the “Orbiter” ran at ten minute intervals during the day Monday to Saturday and fifteen minutes at all other times (including Sundays).

Shuttle service: Christchurch City Council fund a free city centre Shuttle service. Although scheduled to be operated with hybrid buses, with lower emissions, while I was there most of the service was operated by conventional diesel buses, suggesting that the hybrid buses are not entirely reliable (figure 10 shows a view of one of these buses.)

Concession fares: Unlike the UK there are no reduced fares offered to pensioners in Christchurch.

Website cost comparator: The major bus operator in Christchurch, Red Bus, shows a ready reckoner on their website (http://www.redbus.co.nz) which enables you to compare your travel cost by car and bus. Although this is fairly low profile, it struck me as being a really interesting way of showing how much car travel can cost.

Future development of the Exchange

The Bus Exchange is approaching capacity. Shortly a decision will have to be made as to how the facility will be expanded. It is not possible to add capacity to the existing site. One idea is to develop another site on the opposite side of Lichfield Street to run in tandem with the existing facility. Alternatively a completely new location may be adopted for a new, larger facility to replace the existing Exchange.
4. Sydney

While in Sydney I stayed with an Australian WCMT Fellow, Christine Laurence and her partner, Peter Wright. In 2002/3 Christine’s Fellowship studied *Strategies, programs, policies and organizations promoting sustainable transport* (see http://www.churchilltrust.com.au/res/File/Fellow_Reports/Laurence%20Christine%2020021.pdf).

Christine had invited me to speak at a workshop of the Western Sydney Community Forum which was holding its AGM at the time I was in Sydney. This was an opportunity to meet with local transport providers, government officers and crucially, users. The photo of Joe Lynch and Christine Laurence, shown at figure 11, was taken at this event.

Prior to this, Christine had arranged for me to meet up with Matt Faber, now with the Roads & Traffic Authority, but previously a key member of the team that implemented the Paramatta to Liverpool busway. I rode the system with Matt while he explained the background to me. Priority running is provided for this route almost continuously from beginning to end and is very impressive. It consists of a combination measures. In some places it is simply a bus lane marked at the side of the road. In other places it runs on it own segregated (but non guided) alignment, at one point using the access road that had been provided for maintenance of a major water supply pipe to Sydney. In another section it runs in the middle of the road, in a similar manner to the busway in Curitiba.

The route was initially intended to be operated by Light Rapid Transit (LRT) rail type vehicles but the costs were such that this was not feasible and the project stalled. At a time when the budget and political will coincided, a decision was made to construct the route as a busway.

However this was not taken as a signal to skimp on the stands of provision. The stops are very high quality and known as “stations” rather than bus stops. I only managed a couple of photographs of the system but figure 12 gives some idea of the quality of the system.

One major problem encountered in the planning of the system was the operation of the service. Bus services in this area of Sydney have been operated on an area basis by private companies. The project was seen as cutting across these areas and caused considerable problems for the project team, since resolved.

Further information about the Transit Way can be found at:

http://en.wikipedia.org/wiki/Liverpool-Parramatta_Rapid_Bus_Transitway
Figure 11 – Two WCMT Fellows at the Western Sydney Community Forum

Figure 12 – Paramatta to Liverpool transit way “station”
5. Adelaide - The O-Bahn

Introduction
My reason for choosing to go to Adelaide was because of the O-Bahn, a system that gives buses significant priority and brings them up to Light Rapid Transit (LRT) standards. As the name suggests, the O-Bahn is a German idea that Adelaide adopted more than twenty years ago. The Adelaide system developed the German design such that the city is now the leading exponent of the concept, in terms of vehicle operating speed, route distance and service frequency. While I was aware of its existence and had seen pictures and read reports, I wanted to understand more fully why Adelaide chose this option, to see the system at first hand and to experience it myself by travelling on it. In view of the fact that the British government is now supporting the adoption of guided busways in Cambridgeshire and between Luton and Dunstable, this background would be particularly relevant. The fundamental questions I wanted to answer were exactly how the O-Bahn works, arguments for and against it and how it could transfer to the British bus operating environment.

General description of the area
Greater Adelaide is the capital city of the state of South Australia and comprises about 1.1 million people. However, it is low density, spread out across 80 km (50 miles) from north to south and is an area of high car ownership. It is worth noting that there are two car assembly plants in Adelaide – Holden (General Motors) and Mitsubishi. Many residents are employed by these factories and it could be considered a car city in much the same way that much of the West Midlands area of the UK used to be. Over 30 local councils used to serve greater Adelaide but this is now about 17 as the numbers have been reduced over recent years). Transport responsibilities of these authorities do not extend beyond maintaining roads and parking in their areas. Adelaide City Council is only in charge of the city square mile and a population of about 50,000 people (although the City of Adelaide Council controls the area inside the Park Lands which would be about 3 square miles.)

Information sources
In Adelaide I met Neil Smith, Director of Services & Planning of Transit Systems Australia and specifically responsible for Torrens Transit, now the largest bus company in the city, that operates the vehicles used on the O-Bahn, Tom Wilson, Principal Consultant in the Department for Transport Energy and Infrastructure at the Government of South Australia that contracts in the services of private bus operators, and, finally, representatives from the passengers’ lobby group People for Public Transport (PPT). (N.B. Torrens Transit takes its name from the river that runs through the city and the valley that the O-Bahn happens to shadow for much of its route.)
Figure 13 – O Bahn showing speed restriction sign

Figure 14 – Passing Paradise!
Background to bus operations in Adelaide

Tom Wilson had been a member of the project team that commissioned the system from the early 1980s onwards, so was best placed to give me the background to its origins and to the organisation of public transport services generally. He began by explaining that, at that time, he was more directly involved in bus operations, as the state government (South Australia) operated its own buses under the guise of the State Transport Authority (STA) between 1975 and 1994. A change of political control of the state government in 1993 from Labour to Liberal (or what UK residents would know as Conservative) and concerns about costs led to the re-organisation of the STA to a regulatory body, the Passenger Transport Board, and an operating agency, Trans Adelaide – and the introduction of competitive tendering. However, with one eye on what had happened in the UK, to avoid any on the road competition, the tendering form was much more like the London model, except done on an area, rather than individual route, basis. Although the competition requirement has never been applied to the suburban railways network, or the one remaining electric tram service - to Glenelg -, both of which remain under Trans Adelaide control, since 2000 all bus services in Adelaide have been privately operated.

Initially the British company Serco, which has its roots as a British military supplier, but has since diversified into many different activities, for example, running the London Docklands trains, education support services in places such as Walsall, or airside services at Newquay Airport in Cornwall, won the contract to run about half the Adelaide bus network. In 2005 the service contracts were either due for review and renewal, or re-tendering. Serco wanted more money to continue operating. Instead the state government decided to re-tender, at which point Torrens Transit who had operated about one third of the network since 2000, won the former Serco contracts to give them about 70% of Adelaide’s bus operations.

There are incentive payments to operators if they successfully grow passenger numbers (see later comments about ticketing arrangements and validation of tickets.)

It is worth pointing out here that there is one other significant difference compared to the UK bus competition model. Some 95% of Adelaide’s buses and many of the depots are state government owned assets, available for use and operation by the successful tenderer. The depots that do not fall into this category are in most instances those that Torrens Transit has opened itself since winning the tenders.

The missing public transport corridor

In Adelaide a (diesel) suburban railway network and one (electric) tram line form a cluster of radiating routes from the city centre. However, the outer north east suburbs grew rapidly in the 1970s but were unserved by either the trains, or the tram. The Labour state government of the time instituted a study into a rail based LRT scheme for this area, which would have joined up with the existing Glenelg tram line in the city centre. It was intended that this would
run along a strip of land reserved from the 1960s for a major road, as the freeway plans had been abandoned a few years before. One problem faced by this scheme was the opposition by Adelaide City Council to the re-introduction of trams in the city. From 1929 to 1958 Adelaide had a comprehensive tramway system (something still in place in Melbourne) but they all were closed down, with the exception of the Glenelg line. The city council of the time saw the re-introduction of trams as a retrograde step. Coincidentally, control of the state government passed from a Labour to a Liberal administration. The new political masters recognised the need for a high quality public transport corridor, but were concerned by the cost of the rail scheme. Almost overnight the decision was made to go for the O-Bahn rather than a rail based LRT system, on which a lot of design work had been completed. Construction of the O-Bahn began in the early 1980s, with phase one open to Paradise Interchange in 1986, followed by phase two to Tea Tree Plaza three years later. This phasing was largely due to financial restraints, rather than any technical difficulties or construction problems.

The line of the intended route had become something of an eyesore over the years, while all these discussions took place, an example of planning blight. With the construction of the O-Bahn the opportunity was taken to convert the surrounding 3 km corridor of land into a linear park. (The whole corridor of 12 km was landscaped, with special emphasis on the first 3 kmms along the river). Although this added considerably to the cost of the project, see table below) it delivered other, non transport, benefits.

What is the O-Bahn?
The O-Bahn (“Omnibus-Track”) is a guided busway system, a concept designed and created by Daimler-Benz and first used in Essen, Germany. A special track is provided that is equipped with continuous low raised walls along both sides of the track. Basically standard buses, fitted with guide wheels ahead of the front axle, run laterally along this track, the guide wheels following the path set by side guide rails. This enables these buses to run on a very narrow corridor, at high speeds, as the track is completely grade separated.

Apart from the guide wheels the only significant difference to the buses themselves are, uprated engines to enable the operation at higher speeds, and aluminium inner rings inside the front tyres to protect the guide wheels from damage in the event of tyre deflation.

In Adelaide the O-Bahn starts about three kilometres outside the city centre and runs along a 12 km route via Klemzig and Paradise interchanges to Tea Tree Plaza, a large shopping mall, next to Modbury Hospital. (Travellers to Paradise pass near St Peters on the way!) The guidance system is discontinued at the stations to enable buses to pass each other and for non guide way fitted interchange buses to enter the station to transfer passengers.

Due to the ground conditions in Adelaide the guide way construction method that was used in Essen had to be modified. The soil is predominantly clay,
which is liable to contract or expand, particularly at times of drought (such as currently - 2006 - experienced). Accordingly piles were sunk into the sub soil and the pre cast concrete 12 metre track sections mounted on top of these. Extreme precision was used in locating these track sections to ensure that each aligned perfectly with its neighbour to enable high speed running to take place.

While parts of the O-Bahn run through a wide avenue, due to the fact that this land was reserved for a freeway, there are some constricted parts of the route where the reduced land take permitted by the guidance system is very necessary. There are also several bridges required and these are smaller structures (with associated reduced capital costs) than would be required if guidance were not used.

Cost of the O-Bahn
The total cost of the project on completion in 1989 was A$97.8 million, broken down as follows:

Table 3

<table>
<thead>
<tr>
<th>Item</th>
<th>Total Cost (A$m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structures</td>
<td>17.0</td>
</tr>
<tr>
<td>Civil Works</td>
<td>10.5</td>
</tr>
<tr>
<td>Guided Track</td>
<td>18.9</td>
</tr>
<tr>
<td>Stations</td>
<td>6.3</td>
</tr>
<tr>
<td>Land acquisition</td>
<td>5.8</td>
</tr>
<tr>
<td>Busway landscaping</td>
<td>4.6</td>
</tr>
<tr>
<td>Vehicle fleet</td>
<td>22.0</td>
</tr>
<tr>
<td>Utility service alteration</td>
<td>2.5</td>
</tr>
<tr>
<td>Preliminary design</td>
<td>1.3</td>
</tr>
<tr>
<td>Administration and supervision</td>
<td>8.9</td>
</tr>
<tr>
<td>TOTAL</td>
<td>97.8</td>
</tr>
<tr>
<td>River landscaping</td>
<td>6.4</td>
</tr>
</tbody>
</table>

As can be seen the single largest item was the vehicle fleet, followed by the guided track, but these two elements would also be the two most expensive items for a new rail system.

At 1989 prices (ignoring the river landscaping) this gives a cost per kilometre of approximately A$8.15m.

Patronage effects
Prior to the opening of the O-Bahn the stopping bus journey time from Tea Tree Plaza to the city centre was 45 minutes, while semi-express buses took 35 minutes. After Phase 2 of the bus way opened this reduced to 23 minutes. Between the time the O-Bahn opened, to the mid 1990s, patronage on the system increased by 70%, albeit at a time when the population of the area
increased by 20%. There is some debate still about whether the cost benefit analysis of the system produces a result less than one, but looking at the crowds carried there is little doubt for the casual observer that the O-Bahn performs a much needed function, in a similar way to many public transport projects. Australian road schemes are usually subject to cost benefit analysis. However in Australia, with low passenger numbers, it is difficult to get any major public transport project to stack up in terms of a cost benefit analysis. Of course, either type of project can go over budget – although the O-Bahn did not.

The O-Bahn currently carries some 25,000 passengers per weekday, at a peak rate of about 4,800 an hour.

Vehicles used and fleet size
The original 92 buses were all supplied by Mercedes Benz and comprised 51 articulated type 0 305G and 41 type 0 305 rigid buses. These had an intended design life of 17 years. The first buses were delivered in 1983 for testing and almost all of the original O-Bahn buses are still in service in 2006, some twenty three years after the delivery of the first buses and twenty years after the opening of the first section of the track.

Torrens Transit operates a fleet of 550 buses. Of these some 130 are guide wheel equipped although Neil Smith said that it is a relatively straight forward job to add guide wheels to other buses in the fleet and stated that it would be possible to fit another 100 buses in a day, if necessary.

More recent orders for buses added to the Adelaide fleet has seen two changes of supplier, firstly to MAN and secondly to Scania. With the latest models, low floor accessible buses have been introduced to the O-Bahn. Currently the articulated low floor Scania's are not used on the O-Bahn due to some poor running characteristics which are being actively pursued with the supplier, with a view to resolution of these difficulties.

It was interesting to watch the performance of the different types of bus on the O-Bahn. The original Mercedes buses showed very little movement in the steering wheel while under guidance, whereas the steering wheel on the (rigid) Scania's showed considerably more, with associated lateral movement of the bus, suggesting that there must be some minor difference in the configuration of even the rigid Scania's, which did not give quite such a smooth ride as the older buses.

Speeds on the O-Bahn
Standard (metric) road speed limit signs are deployed on the O-Bahn. On joining the track buses are supposed to enter at 40 kph. However, different drivers interpreted this limit in different ways. I would estimate that the more confident drove straight in at a higher speed whereas those less certain kept to the advised limit. The maximum permitted speed is 100 kph (about 62 mph), with various lower limits applied on some of the curves sections and as the
route approaches stations. On the curves the reason for the lower advised speed is primarily to reduce wear on the back tyres rather than safety per se.

**Network development**

For many years O-Bahn services only ran to and from the city centre. More recently Torrens Transit has been instrumental in amending some service patterns (with state government agreement). A cross city Jetlink service (to and from the airport which lies to the west of the city) was introduced in 2005 and in the October 2006 timetable changes more cross city O-Bahn service were introduced to major shopping areas that lie to the south west, and to a university. By using the O-Bahn for the journey on the north eastern corridor, overall journey times by bus to these destinations are very competitive and attractive compared to car journey times.

This has related in two minor, and temporary, problems. Firstly, regular O-Bahn passengers have had to get used to checking the bus destination, as some buses now go to different places, whereas before they would simply get on the first bus that arrived. Secondly, most of the O-Bahn routes carry service numbers in the 5xx series, whereas the Jetlink routes carry the route numbers of J1, J2 and J3 and are operated with new low floor buses. As previously mentioned there are currently no low floor articulated buses operating on the O-Bahn at present. This can result in newer passengers holding back to catch a “J” bus despite travelling on a common section of route to the 5xx routes (many of which are operated by articulated buses). Not only does this extend the journey times of those passengers but it also causes overloading on the non articulated bus while the articulated bus goes through with spare seats. Over a relatively short period of time it would be expected that passengers will become aware of the new journey pattern and adjust their travelling behaviour accordingly.

**Fares and the ticketing system**

The state government sets the fare levels for the buses, local railways and the tram. It specifies a simplified, basically flat fare structure with ticket types valid either for travel on the day itself, or longer term. Those valid on the day give either two hours travel, or unlimited travel for the day, across all public transport modes within greater Adelaide. The latter costs A$7.20, or at current exchange rates (December 2006), just less than three pounds sterling. A bargain in UK terms.

The ticket type itself was one that I thought I recognised, but couldn’t quite place until the name – Crouzet – was mentioned, at which point I remembered that this was what had been used by the Tyne & Wear Metro for some years after the system was opened in 1980. I lived in Newcastle in the early 1980s and used the Metro a lot. It is a small traditional (for those that know their rail tickets - Edmondson) sized ticket with a magnetic stripe that runs down the back. This is machine readable. In the Adelaide context passengers are required to “validate” the ticket every time they board a bus, tram or train by inserting it into the special box by the door. In fact, after first use, this
“validation” is actually more about recording passenger journeys made than validating the ticket, although the “validation” also checks that the ticket is not being used after its two hour time limit – if it is a standard ticket. As highlighted by Neil Smith, the ticketing system is now one of the main reasons for delays on peak time services, as the ticket validation process can take up to five seconds per boarding passenger, possibly more for those less agile, or with mobility problems. While Tom Wilson acknowledged that the system was past its sell by date, he explained that there is currently no money available to replace it with a new one (e.g. smartcard based, such as the London Oyster system.) Having said that there is a danger of short term thinking, that governments of all colours are prone to, as the benefits of quicker boarding may result in an, albeit hard to quantify, pay back of extra passengers and less congestion.

The boarding delay has a knock on effect in terms of kerb space needed in the city centre to load buses. At an average headway of 45 seconds and a possible boarding time of up to five seconds per passenger there is pressure on bus stop space needed in Grenfell Street (the primary loading point in the city centre.) Such loading space is already at a premium.

**Accidents and breakdowns**

The O-Bahn has an extremely good safety record. One serious accident that occurred shortly after opening happened when a bus stopped, due to the fact that a vandal had placed a bicycle on the track that needed to be removed before the bus could continue. While the driver was doing this the following bus failed to stop in time and ran into the back of the stationary bus, injuring several people on both vehicles. Changes were made subsequently as a result, including the fitting of a flashing yellow beacon to each guide way bus, to be activated in such circumstances, linked to the emergency radio system to give a stop bus alert to warn other drivers. There have been no serious accidents since then. The most significant accident involved two articulated buses, both full of passengers. The first one slowed to a stop at Klemzig and the second one (behind) crashed into its rear – apparently the driver was distracted. This occurred while the buses were still on the track and I understand that there was less damage than would have occurred had the accident occurred on the open road. Some passengers were hurt, but no-one was killed. Many of the safety measures were introduced after that and the bicycle incident. The magistrate decided that for legal purposes the O-Bahn would be a “road” rather than a railway and that normal road rules applied to the O-Bahn, which may have some future affect if such an incident ever occurred in the UK. I am advised that O-Bahn buses would have been involved in many more accidents in the 20 years if they had been running on normal roads.

Occasionally, car drivers attempt to run their vehicles along the track, usually late at night and connected with the intake of alcohol. There are warning signs to try to stop this but if the driver ignores these the bottom of the car engine will be terminally damaged by the “sump buster” and the vehicle will be totally disabled within a few yards.
Total bus breakdowns on the O-Bahn are rare, but a specially adopted “push me / pull you” tow truck is rapidly despatched to remove the offending vehicle. While this is happening guide way buses are diverted to run on the ordinary roads (something a rail based system would be unable to do of course.) In other cases, where the bus suffers a more minor mechanical breakdown, but can still be moved under its own power, it would be driven to the first station, at reduced speed and then taken out of service.

**Bus priority elsewhere in Adelaide**

As mentioned in the introduction, Adelaide is very much a car orientated city and with the exception of the O-Bahn there is very little bus priority anywhere else, apart from a number of “B” lights with short bus lanes which give buses priority over other traffic starting from traffic signals, and several instances of longer bus lanes. Congestion is not the issue that it has become in many cities but during my short stay I experienced congestion problems during the afternoon peak when my bus into the city centre was delayed by heavy traffic backing up along King William Street.

There is no demand management in place and the city council seems to fall over itself to provide as many car parking spaces as possible. A figure quoted to me was there are 30,000 car parking spaces in the city centre, which if true is an incredible figure. I understand that Adelaide has the highest ratio of car park spaces to city employees of any Australian capital city.

**Go Zones**

Recognising that frequency is a big driver to increasing bus use, Torrens Transit and the State Government have worked together to caret “Go Zones”. These are corridors where during week days a bus is guaranteed to run at least every 15 minutes and at least every 30 minutes in the evening and at weekends. In 1999 there were just two of these zones in Adelaide. This has now increased to 32, a commendable improvement which should result in further patronage growth.

**Air conditioning**

All the newer buses, trains and trams in Adelaide (and elsewhere in Australia) are fitted with air conditioning – a very necessary feature is a climate that an become very hot (40 degrees Celsius plus on occasions in the summer). Where fitted, my experience as that it always worked, very effectively. This is in sharp contrast to the UK where, perhaps understandably few buses are fitted with air conditioning, although weather patterns do seem to be changing and the effects of global warming may see hotter weather in the UK. However, many UK trains do have air conditioning, but on older trains it frequently does not work, or is ineffective. Given that Australian systems can cope reliably with hotter temperatures this raises the question as to why UK operators cannot match this.
Bus stop numbers
One interesting feature of the general Adelaide bus and tram services, that I have not seen elsewhere, is the use of individual bus stop numbers, for ease of recognition and for unique description. This is a system that was started in the 1920s. Each corridor uses a sequential numbering system, once the service has left the city centre area, such that bus stop “9” is followed by a stop marked “10” etc. As well as being displayed on the bus stop flag, these numbers are referred to in the timetables. They do help both strangers to the city and more regular passengers to find their way around. Many bus passengers will have experienced occasions when trying to describe a bus stop as being “near to the blue house on the corner” or similar, only to be met by a blank stare from the driver. This way you simply say that you want bus stop 32, to which the driver smiles and says “I understand perfectly”!

As a small aside, Adelaide also demonstrated innovation in computer crew and bus scheduling in the 1960s, such that London Transport buses adopted the system.

6. Perth TravelSmart

Perth developed TravelSmart over ten years ago. Essentially TravelSmart is a method of targeting particular areas of the city and providing personalised travel information to identified non-users who would be prepared to consider changing their travel habits.

The question asked is whether they would like to save money on their car travel, rather than whether they would like to travel by more sustainable modes such as buses. Typically some 40% of those contacted express an interest. The success of the initiative is witnessed by the fact that car trips in the targeted areas reduce by 10% often matched by an equivalent increase in bus patronage.

Using cost benefit analysis has shown a positive outcome.

Cities in many other countries (including the UK) have adopted these sorts of techniques.

7. Bio diesel

An unexpected thread that ran through my Fellowship related to the use and development of Bio Diesel. The Stern Report about the economic cost of climate change was published while I was away and it attracted a lot of attention in both New Zealand and Australia, at the same time that Al Gore’s film An Inconvenient Truth was on general release.

While in Brazil I visited Tecpar, a science research centre in Curitiba, established 66 years ago. Originally its role was one of supporting agricultural
activities. Part of this centre is working on research and development for bio
diesel production technology, its application in diesel engines and quality
control. One issue is that while there are large supplies available of oil based
plants in Brazil there is a not a global standard for bio diesel as yet. European
standards are based on methanol whereas Brazil uses ethanol. Currently
Europe does not accept Brazilian bio diesel, although in part this is due to a
lack of data. Tecpar is working on producing this data to help validate the
integrity of Brazilian bio diesel.

A small fleet of four buses in the Christchurch fleet have been adjusted to run
on bio diesel. Currently these are using a blend of 95% conventional diesel
with the balance made up with bio diesel. This will be built up to a mix of 20%
bio diesel (known as “B20”). One problem in Christchurch is that in colder
winter weather the fuel can become gel like, making it unusable. The bio
diesel in Christchurch is currently vegetable oil based (using Palm oil from the
Philippines) however this will be changed to a tallow (i.e. animal based) blend.

The Christchurch experiment has shown the consumption of bio diesel is a
similar rate to conventional fuel as are the emissions, although carbon
monoxide and PM10s are slightly reduced. Two more buses were to be
converted at the beginning of 2007 and the trial runs until September 2007. If
all goes well all Christchurch buses may be converted.

In Adelaide, Torrens Transit is running all their fleet at a B5 level (i.e. a blend
using 5% bio diesel.) This is likely to increase to B20 but will depend on
sorting out coagulation problems.

8. WCMT - Australia

Travelling from Sydney to Adelaide gave me the opportunity to call in on the
head office of the Australian WCMT at Canberra. I met with Paul Sys, the
Chief Executive Officer. We had an interesting discussion about WCMT
objectives and methods.

9. Lessons for the UK

Curitiba
This is a first class system. The primary conclusions I drew were:

• Combining planning and transport provision works – it is not just theory
• Vision and political will is needed to deliver excellent public transport
• Keeping to a consistent plan over a significant time period brings
  sustained results (the masterplan dates back over 40 years). However
  it should be noted that it was introduced during a time when Brazil was
  under a military dictatorship – which I am not advocating for the UK!
Wellington
Trolleybuses may be perceived to be green but some fundamental questions need to be asked about whether they have the operational flexibility of diesel buses and whether the environmental benefits claimed for them stack up, when compared with modern diesel buses.

Christchurch
The Bus Exchange was impressive. However there were evident faults which would need to be addressed before adopting something similar in the UK:

- the site would have to be sufficiently separated from an entrance and/or exit to a car park to avoid the facility being adversely affected by queuing cars
- the site would need to be planned to accommodate predicted growth in bus travel and movement over a long term period (at least twenty years)
- The site would have to be accessible to buses such that all the bays provided are available at all times.

Paramatta to Liverpool Transit Way
As with Curitiba, proof that guidance is not an essential pre-requisite of a dedicated busway. The route is very effective but in part owes its existence to a political decision rather than considered transport planning. This is not so different to some decisions taken within the UK.

Adelaide
Adelaide has a very impressive system in the O-Bahn although its origins seem to be largely the result of a sudden political decision driven by financial concerns, rather than a considered transport planning decision and recommendation (as with the Paramatta to Liverpool Transit Way).

In the UK, government has now opted for guided bus on two corridors, again largely for political and financial reasons and is a volte face on their previously declared intention to have 25 new rail based LRT schemes up and running by 2010. At present Adelaide has the longest section of guided bus route in the world. This claim to fame will be replaced by the Cambridge to St Ives route when complete.

There is opposition to the two UK guided bus way routes, not least from heavy rail supporters who want the rail route re-instated (an unlikely outcome) and from others who see bus ways as a “cheap and cheerful” inferior option to rail.

My journey to Adelaide has demonstrated to my satisfaction that guided bus ways can deliver high quality, efficient public transport options comparable to rail based solutions. However, while cheaper to build and run than light rail, it should not be viewed as the “cheap” option and this is my concern with what may happen in the UK, where cost, rather than quality, may become the imperative (“happorth of tar” etc)
If an Adelaide type system is built in the UK then public transport could become an attractive option on those corridors, although there is the question as to how the Cambridge system will maintain the priority gained as it enters the city on conventional roads.

There is also a question as to how the trunk bus way and feeder services will be planned and operated within the UK’s deregulated market and how network ticketing will be implemented. It is possible that if more than one company is involved there will be “on guide way” competition resulting in uneven headways and an inability to use a return, or season, ticket issued by one company on the services of another operator.

On the plus side the UK has a more joined up approach to transport planning and demand management. The Australian system of local government that has no responsibility to work within a strategic transport planning framework seems bizarre and can result in local and central government agencies working against each other’s objectives.

The general approach to public transport provision in Adelaide seems a reasonable one but there are specific problems with investment, which constrain expansion of the bus network, and also the much needed replacement of the ticketing system. More public money is needed to sort this out.

Looking at the bigger transport planning picture, it seems that there is also at least one significant loophole in the Australian planning system that will have an impact on public transport and bus provision. Many airports, formerly owned by the federal government, have been sold off to private companies. Due to their previous ownership these airports were not subject to state planning law. This arrangement was not changed when the sites were sold and the new owners have been quick to spot this anomaly with the result that one or two vast new shopping centres have even built without any planning permission and without any financial contribution to the transport infrastructure that is needed to cope with these developments.

Finally, from a non public transport perspective, but from a sustainable transport viewpoint I would also comment adversely on the way that left turning traffic is allowed to proceed at signalled junctions if the route is clear in Australia. At even very large junctions, pedestrians get a very short green phase to cross the road. The light turns to a flashing red (do not start to cross) when the most athletic person has only reached the middle of the carriageway. Meanwhile cars are impatiently waiting to make their left turn manoeuvre. To my mind this is not the right balance, or a way of encouraging more walking in a city (or elsewhere). While crossing the road I was never confident that I was entirely safe and this feeling must be exacerbated in older or less mobile pedestrians. At least I can claim that the UK has something to offer Australian transport planners on this front!
TravelSmart
Curitiba and Adelaide demonstrated that effective bus priority will attract users from other modes. TravelSmart showed that growth in bus use can also be achieved by this very targeted form of information, although if cost, journey times and reliability are not commensurate with equivalent car borne options this success may be short lived.

Bio diesel
Modern diesel bus emissions are cleaner although this may be at the expense of increased fuel consumption. Bio diesel may offer a way of limiting net carbon emissions from internal combustion engines, although the jury is out on this. There is also a query as to whether enough vegetable oil can be produced without adversely affecting food supplies.
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- Ray Bentley

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- URBS and particularly Daniel Costa
- IPPUC

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- Stagecoach Wellington and particularly Bruce Kenyon
- The Harding family

In Christchurch
- Environment Canterbury and particularly Kevin Bell

In Sydney
- Christine Laurence and Peter Wright
- Matt Faber

In Adelaide
- Tom Wilson
- Neil Smith
- PPT

In Perth
- Peter Rampellini

And also of course to the Winston Churchill Memorial Trust (UK) for the opportunity to undertake this Fellowship in the first place.
Annexe A – Travel Itinerary

Saturday 28 October 2006
• National Express 504 Liskeard (1130) to Heathrow (1705)
• BA247 Heathrow (2145) to Sao Paulo (arrive 0610 Sao Paulo local time)

Monday 30 October 2006
• JJ3813 Sao Paulo (1150) to Curitiba (1245)

Wednesday 8 November 2006
• JJ3886 Curitiba (1730) to Brasilia (1918)

Friday 10 November 2006
• JJ3181 Brasilia (0537) to Sao Paulo (0710)
• JJ8026 Sao Paulo (0910) to Santiago (1210)
• QF322 Santiago (2305) to Auckland

Saturday 11 November 2006
• Crossed International Date Line so “disappeared”

Sunday 12 November 2006
• QF322 Arrive Auckland (0415 – local time)
• Train [The Overlander] from Auckland (0725) to Wellington (1925)

Tuesday 14 November 2006
• Ferry from Wellington (0825) to Picton (1235)
• Train from Picton (1300) to Christchurch (1821)

Sunday 19 November 2006
• QF046 Christchurch (1535) to Sydney (1650)

Thursday 23 November 2006
• Train Sydney (0705) to Canberra (1123)

Friday 24 November 2006
• Coach from Canberra (0932) to Cootamundra (1230)
• XPT Train from Cootamundra (1247) to Melbourne (1855)

Saturday 25 November 2006
• Train [The Overlander] Melbourne (0735) to Adelaide (1810)

Sunday 3 December 2006
• Train [Indian Pacific] Adelaide (1840) to Perth (0910 Tuesday)

Tuesday 5 December 2006
• Arrive Perth (0910)

Thursday 7 December 2006
• QF71 Perth (1630) to Singapore (2045)
• QF9 Singapore (2325) to Heathrow

Friday 8 December 2006
• Arrive Heathrow (0530 - local time)

Codes: BA – British Airways / JJ – Transportes Aereos Meridionais / QF - Qantas
Annexe B – Summary of meetings etc

**Tuesday 31 October 2006**
- Meeting with Daniel Costa, URBS, Curitiba

**Monday 6 November 2006**
- Meeting with Teresa Torres, IPPUC, Curitiba

**Tuesday 7 November 2006**
- Meeting with Bill Costa, Tecpar, Curitiba

**Wednesday 8 November 2006**
- Meeting with Antonio Jose Vellozo and Eduardo Jose Chipon, Cristo Rei, Curitiba

**Monday 13 November 2006**
- Meeting with Bruce Kenyon and John Hodgson, Stagecoach Wellington

**Thursday 16 November 2006**
- Meeting with Kevin Bell, Supervisor Passenger Services, Environment Canterbury, Christchurch
- Meeting with Michael Stocks, R&D Manager, Connexionz, Christchurch
- Meeting with David Stenhouse, Assistant Manager and Shannon Ussher, Operations Planner, Passenger Services, Environment Canterbury, Christchurch

**Sunday 19 November to Wednesday 22 November 2006**
- Stayed at house of Christine Laurence (Churchill Fellow) and partner Peter Wright in the Sydney area. Both supplied invaluable information, support and additional contacts during my stay in Australia.

**Monday 20 November 2006**
- Site visit to Parramatta to Liverpool T-Way and meeting with Matt Faber, Roads & Traffic Authority, Western Sydney

**Wednesday 22 November 2006**
- Western Sydney Community Forum annual conference – Bus Reform – Presentation about bus deregulation. Met with various government, bus operator and user representatives.

**Thursday 23 November 2006**
- Meeting with Paul Sys, CEO, WCMT Australia (Canberra)

**Tuesday 28 November 2006**
- Meeting with Tom Wilson - Principal Consultant Service Development Department for Transport, Energy and Infrastructure Public Transport Division, South Australia Government, Adelaide

**Wednesday 29 November 2006**
- Meeting with Neil Smith - Transit Systems Australia Director of Services & Planning, Adelaide.

**Thursday 30 November 2006**
- Meeting with representatives from People for Public Transport (PPT), Adelaide

**Tuesday 8 December 2006**
- Meeting with Peter Rampellini, Travelsmart Project, Government of Western Australia, Perth
Annexe C – Press coverage

- (Plymouth) Evening Herald – Wednesday 22 February 2006
- Cornish Guardian – Thursday 23 February 2006
- (Plymouth) Evening Herald – Friday 12 January 2007
- Bus & Coach Professional – 5 January 2007
- routeone – 25 January 2007