

# SMARTBUS – BRINGING CONFIDENCE INTO PUBLIC TRANSPORT

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Photo by John Gray – Dundee City Council

## 1. A BRIEF HISTORY OF DUNDEE

Dundee is the fourth largest city in Scotland, and is situated on the north bank of the river Tay approximately 50 miles from Edinburgh. It developed at the foot of the Law hill and, with growth constrained by the river, it spread east and west along the banks of the Tay. Consequently the city today is approximately 3 miles wide by 9 miles long, with the “city centre” fronting on to the river.

Historically Dundee grew and prospered through the “3 J’s” of Jute, Journalism and Jam. In the 1830’s Dundee was the world centre for Jute production, with the ports along the Tay and the oil from the whaling industry (used to soften the fibres) being essential to the growth of this industry.

Little remains of the Jute industry in Dundee today. Over the last decade the city has sought to reinvent itself, and is now becoming a centre of excellence for research and development in high-tech industries.

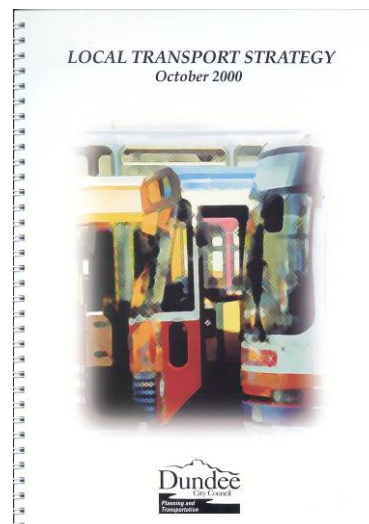
This reinvention of the city has led to increased prosperity, and an attempt to reinvigorate the city through new retail and leisure developments and a large scale pedestrianisation of the centre. The improvements made to the city have been nationally recognised, with Dundee being voted UK city of the year in 1999, and winning an award for urban renaissance in 2000.

## 2. PUBLIC TRANSPORT IN DUNDEE

Dundee has good public transport links with the rest of Scotland, with frequent direct rail services to Aberdeen, Edinburgh and Glasgow, and connecting services onwards to England along the East and West Coast Main Lines.

Public transport in Dundee is important, with approximately half of all households not having access to a car. This is due to a number of factors, including a large student population, an ageing population, and areas of high unemployment and low household income. With the increasing prosperity of the city there is therefore a latent potential for a significant increase in car ownership.

With this in mind Dundee's Local Transport Strategy, published in October 2000, was developed with accessibility as the top priority.



## 3. PUBLIC TRANSPORT FUND (PTF) BIDS

To support the implementation of schemes identified in the Local Transport Strategy documents, the Scottish Executive set up the Public Transport Fund (PTF). This was a fund to which local authorities could bid for additional borrowing consent to implement projects providing “step changes” in the provision of public transport.

Dundee's first three PTF bids in 1999, 2000 and 2001 targeted physical access to the city centre with improvements to the Northeast and Northwest arterial corridors, and implemented a pilot real time passenger information system along the Tayway corridor and around the Outer Circle. Dundee City Council was successful with each of these bids, and received additional borrowing consent to enable works to take place.

These bids covered all the schemes specifically named in the Local Transport Strategy, so, early in 2002, DCC commissioned a study investigating public transport requirements in Dundee. The study involved stakeholder workshops with representatives from the local authority, the major bus operators, city centre retailers, Ninewells Hospital, and the Friends of the Earth. The result of the workshops was a report highlighting the primary requirements for public transport improvements within Dundee. These recommendations formed the basis of the 2002 and 2003 PTF bids 'Bringing Confidence into Public Transport' (BCPT) and SmartBus, which were aimed at improvements to public transport infrastructure and information.

BCPT was an extremely ambitious, £2.31 Million bid, that aimed to provide Dundee with substantial improvements to public transport infrastructure and information within the city centre and at Ninewells Hospital, a major public transport hub to the west of the city.

The main elements of the BCPT proposal were:

- Development of a high quality interchange area comprising bespoke shelters and high levels of information.
- Creation of a new interchange facility at Ninewells Hospital.
- Provision of journey planning and local information in key public areas around the city via touch screen information terminals.
- Development of an Internet journey planning and local information service.
- Provision of a WAP journey planning service.
- Development of SMS 'next bus' information at all bus stops throughout the city.

During the bid process for the 2002-5 PTF award, the Scottish Executive changed the nature of the award from an "additional borrowing consent" to a "grant" for this and future years. Dundee City Council was awarded the full value of its PTF bid.

JMP was appointed to assist Dundee City Council with the design and project management of the work in April 2002. As work began on the BCPT project, DCC began putting together their PTF funding bid for 2003-6. This bid, entitled 'SmartBus', was designed to build on the benefits provided by BCPT, by upgrading bus stop infrastructure throughout the city, and by introducing real time information and improved security for passengers.

The key features of the SmartBus bid were:

- Raised kerbs at all bus stops to improve disabled access to public transport.
- Upgrading of approximately 300 bus shelters throughout the city to new, high quality units complete with information displays and lighting.
- Replacement of all bus stop poles and flags through the city providing information panels at all bus stops.
- Implementation of a real time passenger information system with real time displays in all bus shelters, and a feed to provide real time SMS information for all stops.
- Installation of a CCTV security system on all buses, providing full camera coverage of the interior of each bus.

Again the Scottish Executive awarded Dundee City Council the full value of their PTF bid, providing them with a further £6.77 Million of improvements to be provided over the period 2003-2006.

It was decided by DCC that project management of the infrastructure improvements and CCTV should be undertaken in-house, along with overall financial management of the entire SmartBus fund. JMP's commission was extended to include the design and project management of the real time information system.

## 4. BRINGING CONFIDENCE INTO PUBLIC TRANSPORT

The BCPT project was divided into 3 sub-projects:

- City centre interchanges.
- Ninewells Hospital interchange.
- An electronic public transport information system (PTIS).

Overall management of the BCPT project was undertaken by JMP, with the City Council taking on the design and project management responsibility for some aspects of the city centre and Ninewells Hospital interchange works.

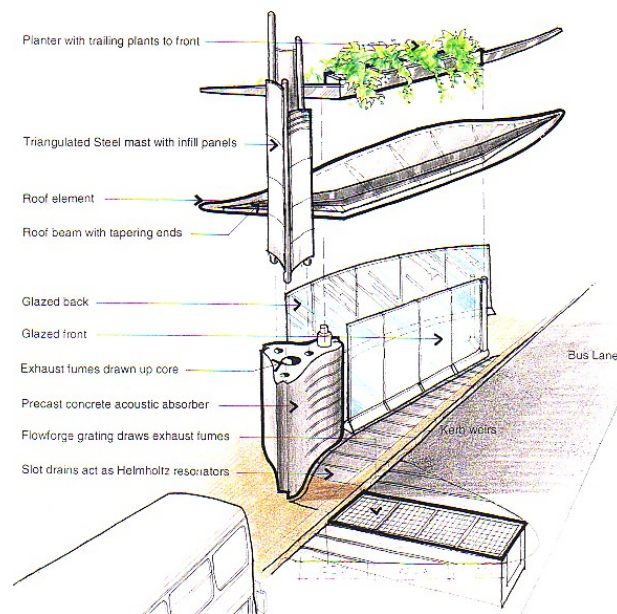
Prior to any design works commencing, JMP took key members of the city council project team on a fact-finding tour of new, high quality interchanges within the North of England to allow them to see the benchmark against which their project should be judged.

It was apparent from the tour that whilst many locations had introduced elements of what DCC were intending, nowhere had implemented the full package of works intended under the BCPT and SmartBus banners.

Notwithstanding this, a number of useful tips and best practice features were identified that could be incorporated in to the BCPT project.

### 4.2 City Centre Interchanges

JMP oversaw the running of an architectural design competition for the city centre interchange works, whereby four architectural consultancies were paid a fee to produce conceptual designs for one of the interchange areas, and the best aspects of all the designs were incorporated into the final scheme. The brief was to produce fresh, dynamic and appropriate bus interchange facilities in the City Centre areas of Dundee. The designs were also to complement and build upon the award winning streetscape of the City Centre and provide functional facilities that would encourage greater use of existing bus services.



The contract for the design of the final scheme was awarded to a local Dundee architectural consultancy, Nicoll Russell Studios.

Under the guidance of the DCC and JMP Steering Group, Nicoll Russell developed their conceptual designs for both the layout of the interchanges



and the design of bespoke shelters to be accommodated within the interchanges. A total of 5 City Centre sites were selected for new interchange facilities with the brief being to provide consistent facilities across these areas.



*Photo by John Gray – Dundee City Council*

The layout of the interchanges followed the precedent set at Ninewells Hospital for shallow saw-tooth arrangements to improve access for both the public and buses. Nicoll Russell Studios produced the preliminary layouts for the interchange groundworks with the detailed design being produced and the works tendered by DCC. A local contractor, Land and Building Limited, was appointed to construct the interchange groundworks.

The design of the bespoke shelters was worked up by Nicoll Russell Studios in association with the rest of the design team, with the final designs incorporating the following:

- A structure of curvilinear form and leaf-shaped roof
- Structure enclosed by glass sitting on a granite plinth
- Inclusion of an audio facility for the visually impaired
- Inclusion of real-time information signs manufactured by others
- Inclusion of an acoustic absorbent panel
- Inclusion of static information panels
- Tiled floor and high quality interior
- High quality lighting
- Designed to provide easy access for the disabled
- Inclusion of roof planters to enhance appearance



*Photo by John Gray – Dundee City Council*

The construction and erection of 17 bespoke shelters was awarded to Trueform Engineering Limited for the 5 sites within Dundee. Manufacture of the shelters began in May 2004 with the last shelters erected in November 2004.

### 4.3 Ninewells Hospital Interchange

In addition to the Scottish Executive grant, there was a further £100,000 available for works at Ninewells Hospital, contributed by the local NHS Trust.

The proposed works at Ninewells were to redevelop an existing interchange facility which was basic in nature and provide a new user-friendly facility in its place. The brief for this element of the project was to improve the operational characteristics of the interchange and create a comfortable facility for buses and taxis which would encourage greater use of these transport modes.

The works were split into two contracts:

- a groundworks contract for the interchange groundworks
- a building contract for the public areas

In addition, improvements to public transport information provision were provided as part of the citywide Public Transport Information System (PTIS) contract.

There were a number of issues with the bus interchange area at Ninewells Hospital that had to be solved to make the new interchange a success:

- The existing bus turning area was used as a public drop off zone leading to frequent problems with buses having to perform three point turns due to parked cars obstructing their passage.
- The public waiting area was largely exposed to the weather, with only some very dilapidated, unlit bus shelters providing any form of shelter.
- There was little public transport information available to the travelling public, and none within the main hospital concourse area.
- The interchange layout did nothing to separate out vehicle and pedestrian conflicts. It was commonplace for pedestrians to be walking across the main bus turning area.
- The existing tarmac wearing course on the interchange was prone to rutting and heavy wear at the bus stances and turning areas.
- Existing signage was unplanned and a high degree of clutter was apparent leading to conflicting and confusing information.
- The existing interchange suffered drainage problems with ponding evident during periods of rainfall.



- Taxi facilities were inadequate with taxis often parking and queuing in an inappropriate fashion.

Design of the groundworks was undertaken by JMP, with supervision of installation by DCC's City Engineers Department. In addition to providing a refurbished carriageway area for buses, the opportunity was taken to provide a public drop off zone prior to the bus interchange area. Access to the interchange could therefore be restricted to buses and taxis, with the latter provided with a dedicated waiting area. The new bus stances were designed with a shallow sawtooth layout and raised bus boarders for improved public accessibility and the carriageway was designed as a jointed reinforced concrete slab.

The use of reinforced concrete for the carriageway surface was a best practice design feature noted from Oldham Bus Station, where it had been used for its resistance to diesel spillages, its durability in terms of wheel track rutting and its resistance to vehicle vibration. A secondary benefit of the concrete slab was that it contrasted with the



existing roads, reinforcing the perception that the interchange area was not part of the general highway network, and was therefore out-of-bounds to private cars.

The specification for the concrete slab included the addition of air entrainment to increase the frost resistance of the concrete and improve its workability during placing and finishing. As the interchange required to be kept operational during the construction period, the Contractor R.J. McLeod was responsible for the difficult task of programming the construction of the concrete panels which made up the interchange surface. The task was made more difficult since the concrete surface could not be trafficked until the concrete had sufficiently cured. The levels of the interchange were reworked to improve drainage and special attention was paid to improving pedestrian facilities around the perimeter of the interchange.

A clear signing and lining strategy was developed to identify and segregate the various elements of the interchange and this has proved successful in managing its operation.

To ensure the bus turning area remained free from private vehicles, the city council took the opportunity to readopt the carriageway, and now enforces the drop off restrictions as part of their Decriminalised Parking Enforcement.





Design and supervision of the building works was undertaken by the city council's Architects Department. They produced a contemporary design that separates pedestrians from the carriageway with a glass wall, providing sheltered waiting areas and incorporating improved lighting and information displays.

#### **4.4 Public Transport Information System (PTIS)**

Design and project management of the implementation of the PTIS was undertaken by JMP on behalf of the city council. The original concept for the system was to “bring about a step change in the quality and availability of public transport information” in Dundee. This has been achieved through a number of methods:

- Large electronic departure boards in major interchange areas in the city centre and at Ninewells Hospital.
- Individual stance displays showing information on the next and subsequent departures in the city centre and at Ninewells Hospital.
- Audio information triggered by the Scottish entitlement smartcard with use restricted to those registered as visually impaired.
- Interactive information terminals located at 13 public areas in the city.
- Internet and WAP journey planning
- Improved static information displays within interchange areas.
- Development of an “overground” style bus map of the city for use at bus interchanges and in printed leaflets.

The design and preparation of tender documentation was completed by JMP in November 2002, and the contract was awarded via an EU Restricted Procedure tender route, in February 2003, to Steer Davies Gleave (SDG). Their team of subcontractors (MPC Northern, Region Services Limited (RSL), and Travel Info Systems (TIS)) provided project management, hardware and software services.

All electronic signs provided by this project comply with DDA guidance, utilising yellow LCD panels with a black background, and displaying both upper and lower case text. Within the bus stances audio information is provided, triggered by smartcards. To ensure minimum levels of abuse and annoyance to the public, only smartcards owned by members of the public who claim a visual impairment will trigger the information.





Interactive journey planning terminals have been installed within public areas in the city, including shopping centres, railway station, bus station, universities and colleges, and the Tourist Information office. They are permanently linked to the central server via a broadband internet connection to ensure information provided is always current. In addition to journey planning facilities, the terminals provide basic information on places of interest, including contact numbers and addresses, and allow users to see real time departure information for bus stops, and identify what facilities are provided at stops.

To ensure ease of use and maximum accessibility of the journey planners, two focus groups were held to canvas public opinions. Focus groups were broken down into 5 categories to ensure a broad range of opinions, abilities and computer literacy. The five categories were:

- Ninewells Hospital staff and students, aged 21 – retirement.
- Ninewells Hospital patients, aged 21 – retirement.
- General public, retirement age.
- 16-21, no further education, employed and unemployed.
- 16-21 in further education.

The first focus group was held early in the design process to identify general attitudes towards internet journey planning and public transport information. The second was held when the journey planner software was largely complete with the purpose of testing the interface and identifying any cosmetic changes required to improve public understanding of the use of the software.

The result of the focus groups was a simplified journey planner from that available on the internet, allowing people to plan a journey in 3 simple steps. Journey origins and destinations could be selected by a number of methods:

- Selection from a map
- Postcode entry
- Street name
- Name of company or place of interest

Journey results are presented in text format that can be printed out in large font, and all parts of a journey within the Dundee city boundaries are shown on a map on-screen.

**From LOCHEE HIGH STREET - HIGHGATE CENTRE to Dobbies Garden Centre**

Date of travel: Thursday, 24.11.05

Walk for approximately 3 minutes from Lochee High Street opp Highgate Centre to Lochee Bypass opp Adamsons Court.

Catch Bus 51 at 11:47 from Lochee Bypass opp Adamsons Court to Seagate at Marks and Spencers, arriving at 11:58. Final service destination: Seagate at Marks and Spencers. Service operated by Travel Dundee.

Catch Bus 76 at 12:10 from Seagate at Marks and Spencers to Dobbies Garden Centre, arriving at 12:30. Final service destination: Dobbies Garden Centre. Service operated by Strathtay Scottish Ltd.

Duration: 0:36

The internet journey planner provides all the facilities on the interactive terminals plus links to external websites for places of interest, and the opportunity to view and print out Dundee bus timetables.

Access to the internet journey planner is through a Dundee City Council travel information web page ([www.dundeetravelinfo.com](http://www.dundeetravelinfo.com)) that is being expanded to provide the public with a single information source for all transport enquiries within Dundee.

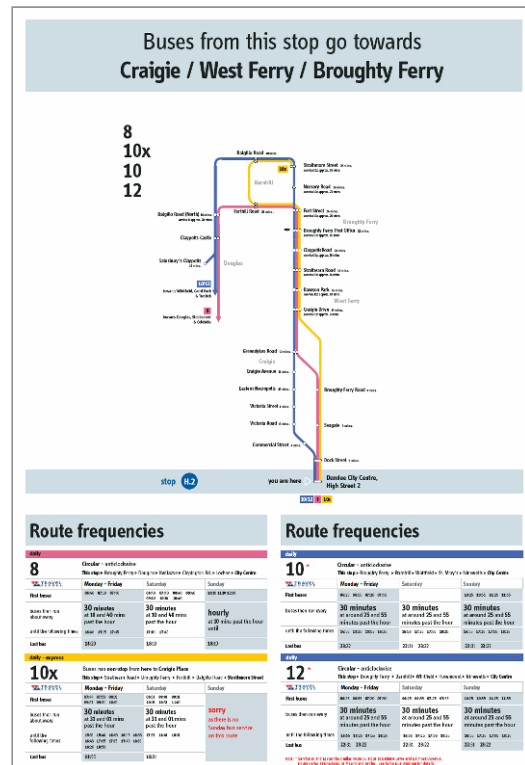
WAP access is obtained through a Dundee City Council WAP site ([wap.dundeetravelinfo.com/](http://wap.dundeetravelinfo.com/)), which offers the same journey planning facilities as the internet site.

In addition to the provision of high quality electronic information it was recognised that the standard of static information provided to the public needed improvements. This work was undertaken by SDG as an extension of the PTIS contract being project managed by JMP. The outputs from the work were a new “overground” style route map for the city, and schematic route maps and timetables customised to each bus stop for the city centre and Ninewells Hospital interchanges.

## 5. SMARTBUS

The SmartBus PTF bid was broken down into a number of discrete areas. These were:

- Provision of approximately 300 new and replacement bus shelters throughout the city.
- Improved accessibility of bus stops, including kerbing, drainage, bus stop poles and a minimum level of information.
- On vehicle CCTV on all buses operating within the city.
- Real time passenger information (RTPI) and active bus priority at traffic signals for late running vehicles on all buses operating within the city.



JMP’s role in the SmartBus project was for the design, supervision of installation and project management of the real time system.

The RTPI system was tendered in late 2003, and was awarded to ACIS in December 2003. The system will be fully operational by the end of March 2006, providing real time information to the public for all buses operating within the city.

The system provides information via electronic signs in all bus shelters, and at all other stops via server to server links to the PTIS system for internet/WAP and interactive terminals and to Traveline Scotland for display on their SMS service.



In addition to real time information for passengers, the system gives full fleet management and vehicle tracking facilities to the bus operators, and provides a voice radio and panic button facility on vehicles. It also offers the facility for providing bus priority at all signal installations in the city to late running buses. Communications between vehicles, servers and signs are all by PMR radio, with five channels being used in the system (1 control, 2 data and 2 voice).



Data communications are scheduled by a time division multiplex (TDM) system whereby each bus has an allocated timeslot within which it transmits data. This method provides highly efficient use of the radio channel, allowing 150 vehicles to use each channel with a 22 second update frequency.

Vehicle tracking is via a differential GPS system, offering sufficiently high levels of location accuracy to permit traffic signal priority and automatic clear-down of signs when a bus departs from a stop.

The real time system is currently being expanded outwards from Dundee, with Angus Council adding additional radio base stations and equipping further vehicles to enable information to be provided throughout Angus.

Other aspects of the SmartBus project will also be complete by the end of March 2006.

- The on-vehicle CCTV system is now fully installed and operational and offering safety benefits to passengers and drivers alike. All Travel Dundee and Strathtay buses within the city are fitted with CCTV, with between 5 and 8 cameras installed on each vehicle, continually recording to a hard disc system. In the event of an incident, the hard disc can be removed and the camera images used as evidence.
- 296 new and replacement bus shelters have been provided, all incorporating lighting, seating, real time displays, CCTV monitoring and raised kerbs.

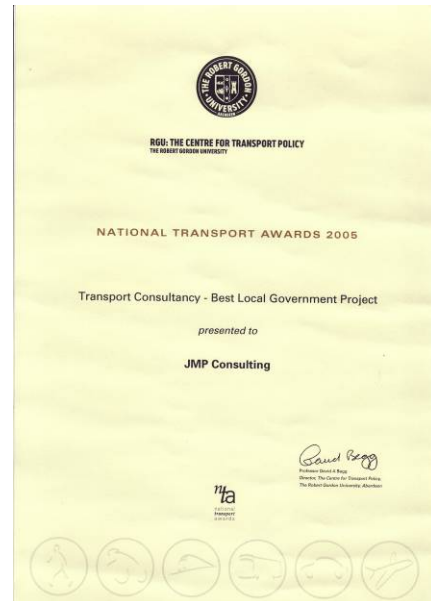


- All other stops (600+) have been provided with replacement bus poles and flags, incorporating illuminated information panels providing scheduled departure information and details for obtaining real time information via SMS.

## 6. AWARDS

The commitment to public transport improvements in Dundee and the high quality of delivery have been recognised through a number of prestigious awards for the participants in the projects.

- Dundee City Council won the 2004 Scottish Transport Award for Transport Information for the works at Ninewells Hospital
- JMP won the 2005 National Transport Award for Transport Consultancy: Best Local Government Project for their input to the BCPT and SmartBus projects.
- Travel Dundee (the major bus operator within Dundee) won the 2005 Scottish Transport Award for Best Public Transport Operator for the commitment they have shown to providing a 100% low floor bus fleet to improve accessibility.
- Dundee City Council won the 2005 Transport Authority of the year award for the facilities delivered under the BCPT and SmartBus projects.



The works in Dundee have generated a great deal of interest from other authorities within Scotland and throughout the UK, and have proven that with the right commitment from all stakeholders a “step change in the quality and availability of public transport information” can be successfully provided.

*Further information can be obtained from Roger Hacker of JMP Consulting (Tel: 0113 204 5765, email [roger.hacker@jmp.co.uk](mailto:roger.hacker@jmp.co.uk)).*