Northern Ireland Assembly

Research and Information Service Briefing Paper

Paper 000/00 22nd June 2011 NIAR 000-00

Des McKibbin

Bus Rapid Transit (BRT)

1 Introduction

This paper provides examples of established best practice in the implementation of Bus Rapid Transit (BRT) from across Europe. In the context of the proposal for a BRT system to be established in Belfast, it gives a brief insight into the practical, physical-infrastructural and operational experiences of these systems elsewhere. The case studies have been chosen for their specific applicability to the Belfast proposals with consideration taken of the type of city (population/geography) as well as type/extent of BRT system employed.

2 Background

The Department for Regional Development (DRD) has developed a sustainable transport master plan for Belfast City Centre,[1] focused on:

- improving public transport services;
- providing better facilities for walking and cycling; thereby
- reducing travel by private car.

At the heart of this scheme are proposals for a Bus Rapid Transit (BRT) system. DRD had previously commissioned a Strategic Outline Case (SOC)[2] to assess the feasibility

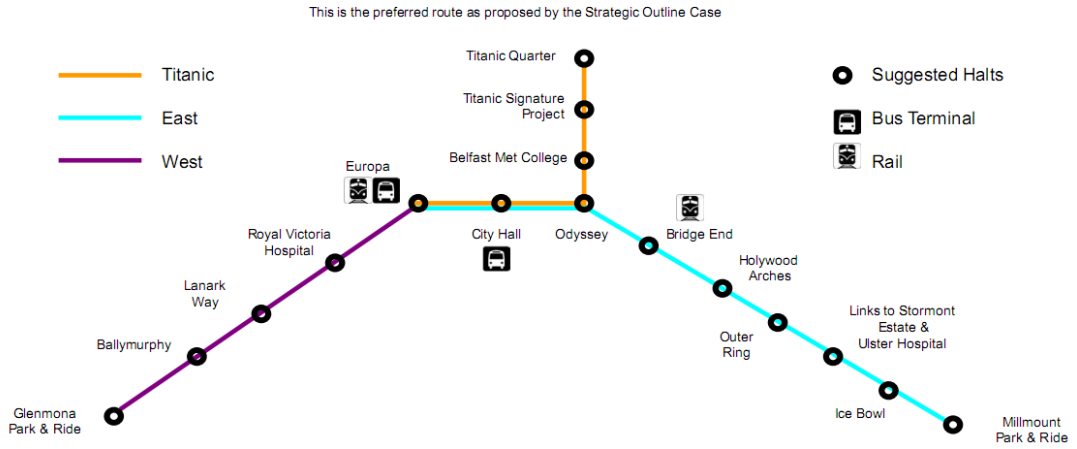
[1] DRD (2010) Belfast on the Move: Transport Masterplan for Belfast City Centre

of the delivery of a rapid transit network (Light rail or Bus based) in the Greater Belfast area. It found that BRT: a bus based express public transportation mode, to be most appropriate for Belfast, its key benefits include:

- rapidity (higher vehicle speeds);
- frequency (of service);
- reliability (less variables such as traffic and fare collection to disrupt service);
- comfort (similar to train); and
- cost effectiveness (in comparison to tram/LRT).

Based on this recommendation, the Executive agreed that a pilot should be progressed on 3 routes connecting the City Centre with Titanic Quarter, East and West Belfast (see figure one).

Figure 1: Proposed routes for BRT in Belfast



DRD (2011)

The Transport (NI) Act 2011 provides the Department with the legislative powers to bring forward these plans. This included the power to proceed with the purchase of vehicles and construction of necessary infrastructure, prior to awarding the contract for the management of the service, while it also makes provision for this contract to be awarded on a competitively tendered basis.

In terms of financing this project, provision has been made in the 2011-2015 budget for further planning and commencement of initial implementation measures. The next step will be the completion of an Outline Business Case (OBC) which will detail:

- network routes;
- procurement strategy;
- commercial business model; and
- fare system

[2] Atkins and KPMG, Strategic Outline Case, Consideration of Options for a Rapid Transit Network for the Belfast Metropolitan Area, Main Report, Feb 08 [online] available from: http://nia1.me/b3

3 BRT in Europe

While the use of this BRT concept is becoming more widespread across the world, one thing which is common among European cities is their dispersed structure i.e. while US cities often have high urban density, employment and residences; European cities often have a centre of employment to where the majority of the population must travel to work.[3]

That is not to say that all European cities are the same, far from it, therefore the urban context i.e. what type of city you have in terms of population, demographics and geography must be a fundamental consideration when developing any public transportation system.

Previously the demand for mass transit led to the emergence and then re-emergence of the tram, with modern examples scattered across Europe in cities such as Bordeaux, Nice, Strasbourg, Rome, Barcelona, Manchester and Dublin among others. Indeed this type of system was proposed for Belfast, however, the strategic outline case identified BRT as being more cost effective; investment in BRT can cost around 30% less than Light rail or tramways.[4] The capacity of BRT vehicles also lends itself to a city of Belfast's size where as in larger cities, the higher capacity of the tram is more practical.

3.1 BRT to BHLS

A major barrier to implementing a bus based transit system is overcoming the public's negative image of that mode, which stem from experiences of congestion, unreliability, long journeys, lack of comfort and generally a poor service, particularly in comparison to trams.

The French adapted the (American) BRT concept into what is now viewed as the European concept of BHLS (Buses with a High Level of Services). This was in recognition of the fact that investment in tramways is high and not suited in all urban contexts, while at the same time, in order to achieve modal shift consumers must be offered a service with a level of quality that is comparable to tramways.[5]

The development of the BHLS concept was recognised at a European level by COST: an intergovernmental framework for European Cooperation in Science and Technology. It launched Action TU603 in 2006 to:

- gain a better understanding of the [BRT] BHLS concept;
- identify and understand best practice; and
- Make recommendations of how this system can be applied across Europe.

[3] Lopez - Lambas, M.E. and Valdes, C. (2010) "Squaring the circle: The BHLS concept". *European Transport Conference 2010*. [online] available from: http://nia1.me/b6
[4] Ibid
[5] Certu (2010) "Buses with a High Level of Service (BHLS): Choosing and implementing the right system" Centre for the Study of Urban Planning, Transport and Public Facilities [online]

4 Best practice

Thirteen countries including the UK and Ireland are involved in the COST Action and many European cities have or are now developing the BHLS concept. What is clear is that it is a concept rather than a prescribed system. It is a flexible concept and how it is applied varies greatly across Europe depending on the urban context, in particular the population, geography, existing public transport provision, the budget and the desired outcomes. Examples of different systems that have adopted the BHLS concept across Europe include: Dublin – Quality Bus Corridor; Nantes – Busway 4; Gothenburg – Trunk Bus; and FTR – Swansea.

This list in not exhaustive; each example has been chosen based on its applicability to the Belfast BRT project: Dublin highlights the need for bus priority and advanced planning, Nantes provides the exemplar for BRT infrastructure, Gothenburg demonstrates that BRT can overcome the public's perception of buses while FTR is notable as it is one of the newer BRT operations, with its design based on established best practice; while it utilises the Wright Bus Street Car, proposed for use in Belfast.

4.1 Dublin Quality Bus Corridor

Dublin City is a conurbation with nearly 1.2 million inhabitants. Buses are the largest public transport mode used in the Greater Dublin Area (GDA) and bus lanes have been used in Dublin to improve the operating conditions for buses, in increasingly congested streets, since the early 1980s. Dublin has invested heavily in light rail rapid transit, with the Metro and Luas, however, their catchment is limited. The Quality Bus Corridor (QBC) concept is a move on from bus lanes with the goal to provide a clearly defined, high performance bus transportation system segregated from other road traffic.

4.1.1 Investment costs

QBCs provide a low–cost alternative to light rail (see table 1) with a much larger network able to run parallel with the Metro & Luas. A total of 400km is planned, of which 200km has been completed and a further 50km is in various stages of design and construction.[6] Average investment cost per km is €4.5 million.[7]

Table 1: Capital Investment

Capital Costs	Total (€M)	% Overall Capital Costs	2016 Target Mode Share
Metro	**7,221**	**68%**	**49%**
Light Rail	**2,124**		
Suburban Rail	**5,582**	**Combined**	**Combined**
Quality Bus Network	**808**	**4%**	**14%**

Source: QBN Project Office

[6] COST (2010) "Malahide Road Quality Bus Corridor – Dublin" [online] available from: http://nia1.me/b9
[7] Ibid.

4.1.2 Key success indicators

In terms of measuring the success of the QBCs in the GDA, significant monitoring takes place which show QBCs have successfully reduced average journey times and variability while they have been successful in effecting modal change from car.

- The number of bus passengers 35.06% from November 1997 to November 2009.
- The number of cars counted on the same routes has decreased by 25%.
- Bus average journey times in the morning peak were less than the corresponding car average journey times in 10 out of the 16 QBCs monitored.[8]
- There was much greater consistency in terms of vehicle speeds:
  - Inbound morning peak : 16.5 km/h
  - Inbound off Peak: 18.67 km/h

4.1.3 Key issues for success

The chief engineer involved in the project identified a number of key factors in the success of this project, which are transferable elsewhere, including:

- Achieving whole route priority;
- Having strong enforcement using ITS resources;
- Integration with other major public transport modes ;
- Park and Ride facilities, Integrated Ticketing & Real Time Passenger Information;
- Selling the concept of QBCs; and
- Political support & public acceptance [9]

[8] (NTA) National Transport Authority (2009)*"Quality Bus Corridor Monitoring Report"* NTA: Dublin [online] available from: http://nia1.me/b8

[9] De Burca, C. (2009) "Quality Bus Network Dublin". Conference Proceedings: UK BRT, December 2009, Cardiff [online] available from: http://nia1.me/bb

4.2 Nantes Busway 4

Nantes Busway is widely regarded as the leading example of BRT/BHLS in Europe.[10] Nantes is a conurbation of more than 570,000 inhabitants (280,000 in the city) located in the northwest of France. This population is very similar to Belfast where 268,323 people live in the city while 650,958 live within the Greater Belfast Area.[11]

Three tramway lines have been re-introduced to Nantes since the 1980s, while a fourth, referred to as BusWay 4, uses a BRT system, employing natural gas articulated buses (see figure 2).

Figure 2: Rolling stock: Mercedes Citaro GNV, low floor, 4 doors

4.2.1 Features of Busway 4

- Busway 4 entered into service on 6th November 2006;
- It is a 7 km long line with 15 stations (500m intervals);
- It connects the ring road to the centre of Nantes in less than 20 minutes;
- Is served by 4 park and ride facilities; and
- Has a frequency of 3.5 minutes at peak times

4.2.2 Investment costs (2005 prices):

The infrastructure cost for Busway 4 was €50M including studies/design, running ways, park and ride/stations, road works joined to the project, system and operating tools;[12] this brings the average infrastructure cost to approximately €7.5m per km. There is a rolling stock of 20 specific Natural Gas articulated buses (figure 2) which cost €460,000 each bringing the total cost up to around €8m per km (which is around 3 times less than for a tramway project).[13] The operating cost averages €3.6 per km[10]

[10] Lopez - Lambas, M.E. and Valdes, C. (2010) "Squaring the circle: The BHLS concept". *European Transport Conference 2010*. [online] available from: http://nia1.me/b6
[11]: Belfast City Council (2010) Belfast: A Profile of a City [online] available from: http://nia1.me/bf
[12] COST (2008) "The Busway in Nantes" [online] available from: http://nia1.me/bc
[13] Ibid

4.2.3 Key success indicators

- The line achieves the same regularity as the tram lines due to the high level infrastructure.
- The operating speed is 20km/h (peak) and from 21 up to 23 km/h in off peak hours.
- The line quickly drew substantial ridership, increasing from 17,000 users per day when it went into service, to 25,000 after six months
- The park-and-ride lots are always full.
- No major accidents have been registered to date.
- 25% of users have switched from private cars[14]

Figure 3: Example of cut through roundabout

4.2.4 Key issues for success

- Off-board fare collection (tickets sold on platforms);
- Priority at junctions and use of cut - through Roundabouts (figure 3);
- Clearly identified service i.e. strong brand;
- Comfortable buses with high end finishes and lighting;
- Audio visual information (at station and on-board) including next stop, transfers and waiting times;
- There is a possible problem with capacity (currently 120) at peak hours; the frequency has been brought down to 3.5 minutes in September 2007 and larger capacity vehicles may be required, such as bi-articulated vehicles (24.5m).

Figure 4 and 5: A view of the comprehensive bus shelter (20 – 25m in length) and real time passenger information at all stations[15] (L) as well as vehicle travelling on Busway 4 (R)

Deas and Nix (2010)

COST (2008)

[14] Certu (2010) "Buses with a High Level of Service (BHLS): Choosing and implementing the right system" Centre for the Study of Urban Planning, Transport and Public Facilities [online]

[15] Deas, M and Nix, J. (2010) "*transport for a better future: Policies that can change Ireland*". Conference Proceedings: Transport Ireland 2011: Dublin May 2011

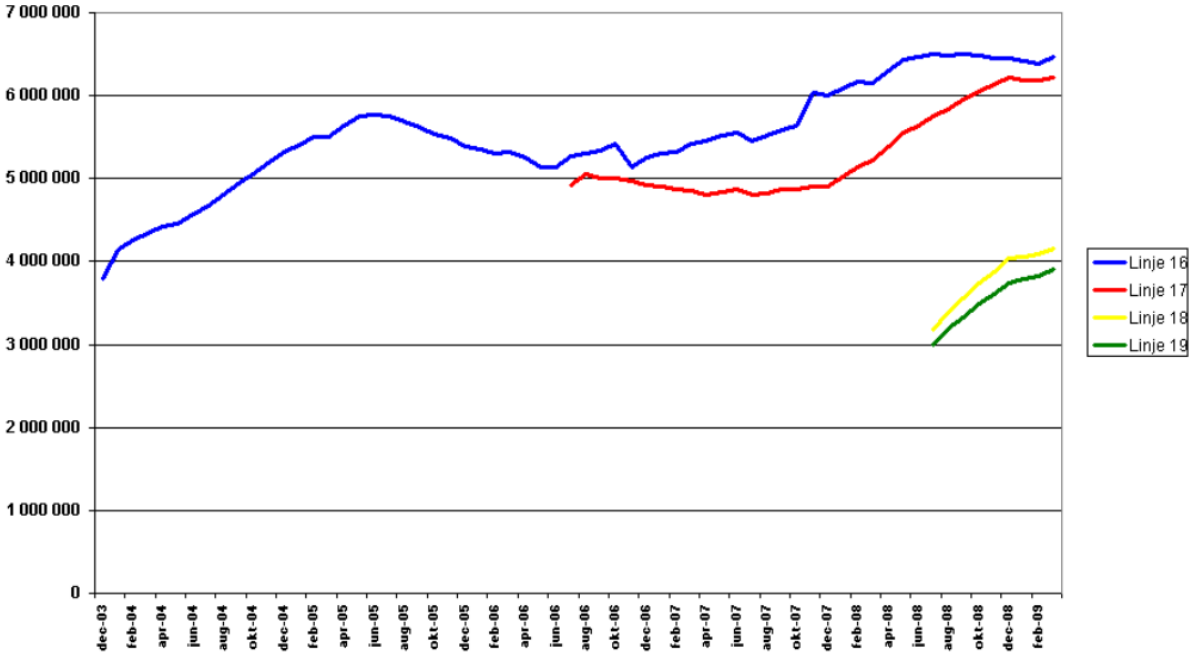
Gothenburg – Trunk Bus

Gothenburg is situated on the west coast of Sweden and is the major harbour of Scandinavia. The region has around 750 000 inhabitants. The use of Public Transport has been traditionally low in Gothenburg compared to other Swedish cities where it can reach as much as 40%. Gothenburg has eleven tram lines however there was a need to increase capacity and BHLS/BRT was chosen as it offered the best value for money. The first Route (16) launched in 2003 followed by the second (Route 17) in August 2005 while two additional routes were added in August 2007 (Route 18 and Route 19) with a further route (15) at the planning stage.

Key success indicators

The routes are very successful and as figure six shows they have taken little time to build passenger numbers with lines 16 and 17 increasing from 4 and 5 million passenger journeys per year, respectively, to in excess of 6 million. Lines 18 and 19 increased passenger trips by over 1 million in their first year of operation.

Figure 6: Trunk Bus Passenger Journeys December 2003 to February 2009



Daily passenger numbers are also very impressive and suggest that if buses offer the same level of service as trams they can attract the passenger numbers (table 2).

Table 2: Passengers by mode/route

Route	Pax Per day
Route 16	24,000
Route 17	20,000
Route 18	10,000
Route 19	10,000
Tram	25,000

Key issues for success

The "Trunk Bus System" has all the characteristics of the tram mode, providing buses with:

- dedicated lanes;
- boarding through all doors;
- high standard bus stops;
- real time information; and
- easy (off-board) fare payment.

FTR Swansea

Swansea is a city of 200,000 people located in South West Wales. The City and County of Swansea (CC Swansea) in partnership with FirstGroup launched a 'Bus Rapid Transit' system in 2009 which employs the same articulated vehicle (StreetCar bus) which is proposed for use in Belfast (see figure 7).

Figure 7: FTR Swansea Street Car

Source: FTR Metro

Swansea is one of the most recent cities to introduce BRT and the city has had to undertake significant works to provide the infrastructure necessary to give the ftrmetro the necessary priority over other vehicles which is so necessary.

The Metro system consists of the following essential elements of Bus Rapid Transit:

- On-Street Infrastructure: Priority vehicle infrastructure along the Metro corridor, consisting of priority measures and busways (with operational qualities similar to tramways). An integral aspect of this service is that only routes with priority infrastructure in place ('whole route priority'), in line with the need to offer tram-like operation to potential passengers are used.

- The Vehicle: An articulated StreetCar bus vehicle with the appearance and general qualities of a tram (figure 7), but running on-street on rubber tyres, not a fixed track
- Fast automated ticketing system: It is essential for purposes of dwell time at bus stops that the time taken to purchase tickets is minimised; thus, automatic ticket machines in the vehicle are provided.[16]
- Enhanced waiting facilities: Bus stop waiting facilities are of a high quality, incorporating Real Time Passenger Information and high specification bus shelters.

Summary

The aim of this paper was to provide examples of established best practice in the implementation of Bus Rapid Transit. BRT is a concept which is applied globally and is viewed both as a substitute or accompaniment for Light Rail Transit depending on the existing transport infrastructure. The major selling point of BRT is the fact it can cost up to 30% less to set up than LRT, however, to succeed it must adopt the same principles including:

- whole-route Priority;
- high frequency of trips;
- comfortable high-specification vehicles;
- quality infrastructure;
- on/off board audio visual information;
- integrated (with other modes) ticketing;
- off board or automated on board ticketing; and
- car parking (park-and-ride facilities).

The Dublin case study highlights the benefits of bus priority, in terms of achieving modal shift and reducing journey times. In the Belfast context, this will need to be achieved prior to introduction of the BRT network, although the Belfast on the Move master plan has made provision for this. It would be appropriate for the committee to arrange to visit Dublin Bus and experience the QBC concept first hand as it is the precursor to BRT.

Nantes provides the exemplar for BRT infrastructure, and is a particularly relevant example given the size of the city. The committee may be interested in Nantes Busway 4 as it has been successful in providing a truly integrated travel experience, linking the suburbs to the city centre, providing park and ride facilities at strategic locations to ease congestion while within the city Busway 4 is fully integrated into the existing transport provision. Nantes has taken every step to improve the public perception of

[16] Swansea's service started with tickets purchased at ticket machines at bus stops - the ftr metro driver (pilot) would simply drive. This was shown to be probelamtic in York (another First BRT service) and First introduced 'customer hosts'. Swansea has also opted to introduce customer hosts. These hosts issue and inspect tickets.

buses by providing high quality vehicles and bus stops which offer comfort as well as real-time audio visual information.

Gothenburg has been highlighted as a best practice example due to its unexpected success. Public transport in the city had been low in comparison to other Swedish cities and public perception of the bus was poor in a city which had been used to trams.

The first BRT project in the city was borne out of financial necessity but has proved phenomenally successful. The original Route 16 has almost the same average passenger numbers as the tram lines while newer lines have achieved a huge increase in passenger numbers in a very short time frame. This case proves that negative perceptions are quickly dismissed if the service meets the customers' requirements.

Swansea is a city comparable in size to Belfast but FTR Swansea was highlighted mainly due to the fact that it is one of the newer BRT operations, and would not have been considered in, for example, the DRD's Strategic Outline Case. Swansea has had the benefit of looking at established best practice both in terms of getting the infrastructure ready as well as focusing on the customer experience. As such it has ensured bus priority, created necessary stops/stations and utilised high specification, environmentally friendly and fully accessible vehicles – the same model as is proposed for use in Belfast.