

GUIDELINES FOR IMPLEMENTERS OF Innovative Bus Systems



What is it about?

Characteristics

More efficient use of urban spaces, and space allocated to transport in particular can improve operational conditions for public transport. To give priority to buses in congested cities proves to be a very effective strategy. In its simplest form, a bus lane can be implemented only on a short stretch of road, as a through route - or bypass - for a congested zone. In many cases however, the bus lanes comprise a separate road network with their own traffic management system, traffic signals, and bus stop facilities.

Innovative bus systems:

- provide reliable services;
- present an attractive image for the operator;
- are a sustainable mode of transport;
- combine the advantages of bus and light rail.

Growth in urban areas has resulted in increased vehicle congestion, longer travel times, and increased travel distances for the majority of the travelling public. One option to expand transportation system capacity to move people is Bus Rapid Transit (BRT).

Key Benefits

The BRT concept, in which buses run on dedicated bus lanes, combines the advantages of a bus system with a light rail system. The benefits can be summarised as follows:

- reduced travel times (journey times in peak and off-peak hours are similar);
- reliable service and schedule (enables timetables to be constructed with greater certainty);
- high capacity and low-emission vehicles.



Nantes BusWay, on main running way
Photo: François Rambaud (CERTU)

Good Practice: Busway in Nantes, France

In 2005, France started its own concept of "Buses with a high level of service" (BHLS - Bus à Haut Niveau de Service) in order to improve sustainable and affordable mobility in urban areas. This system offers higher capacity within a similar use of space as light rail transit or metro.

The City of Nantes is a conurbation with nearly 600.000 inhabitants. The so-called Busway, launched in 2006, is 7 km long and has 15 stations. It connects the ring road to the centre of Nantes in less than 20 minutes, with a frequency of 4 minutes at peak hours. The operation speed is between 21 and 23 km/h.

This bus system incorporated all the elements that made the tramway a success: a central dedicated lane, well-designed and equipped stations, priority at intersections, high frequency and extended hours, ticket vending machines at stations, and park and ride facilities.

Is this something for us?

BRT on dedicated bus lanes is not only a solution for congested road sections, it can also be used to connect several districts or suburban areas with each other. The buses can operate in central (often congested) urban areas with the reliability of a light rail, while offering the flexibility of conventional buses in peripheral areas. They:

- offer a tramline capacity for lower costs along a congested corridor (but);
- operate with the flexibility of a bus in peripheral zones.

Check list	
City size	No size restrictions. The actual scope and importance of the measures and network will be dependent on the city size.
Costs	Relatively high cost of implementation (for infrastructure and vehicles) but cheaper than a similar tramway/light rail. Operating costs are lower too.
Implementation time	2-4 years (approvals and constructing infrastructure for BRT takes time).
Stakeholders involved	<ul style="list-style-type: none"> • Bus manufacturers; • System provider; • Operator; • Local authority.
Undesirable secondary effects	Restrictions for car users / parking space along the corridor (infrastructure)



Zuidtangent (NL) Bus at work
Photo: www.busfoto.nl

“The aim was to develop a high level of service (speed, reliability, comfort, frequency, accessibility, visibility, urban integration) with costs adapted to the expected demand. In comparison with a tram project, there are advantages of costs (7M€/km compared to 22 M€/km for a tram) and the easier implementation (shorter duration of works, simpler traffic management during the works...). With a strong political support, it is possible to reach a good level of quality and use the bus system as a tool to limit car traffic and thus obtain a strong modal shift.”

Damien Garrigue,
Vice General-Director
Nantes Métropole, Nantes, France

“The enhancement of a series of cross-city transport corridors to promote more efficient bus operation, together with the development of a bus loop system through the city centre will directly address existing reliability, punctuality and accessibility issues associated with the city’s bus services. When completed, the new system will provide a more user-friendly travelling experience in the City of Worcester, by significantly increasing interchange opportunities, improving accessibility to key locations and facilities, enhancing the public realm and making more efficient use of existing highway capacity. Additionally, this concept will act to make passenger transport services more reliable, generating increased patronage and facilitating commercial operation of passenger transport networks.”

Andy Baker,
Sustainable Transport Manager,
Worcestershire County Council
(NICHES+ Champion Region)

Benefits & Costs

Benefits

BRT systems vary from one system to another, but all provide a higher level of transit service than traditional bus transportation. As a result, BRT has become increasingly popular around the world, with dozens of new lines opening over the past few years.

Through the increased operation speed (compared to a conventional bus system), and high frequency, the reduction of travel time is the key impact, as this brings a high proportional benefit to the cost benefit analysis.

A successful bus system helps to generate a modal shift towards public transport, while reducing car traffic. It results in lower emissions and noise levels, cleaner air and a more liveable city. Benefits include:

- **travel time savings** for transit users;
- reduced vehicle **operating cost**, parking cost, and insurance savings for people who switch from private car to transit;
- improved access to jobs and amenities for certain population groups, especially transit-dependent travelers;
- potential **reduction in accident costs**;
- benefits from **reduced emissions**;
- lower costs for transit per passenger due to improved operating efficiency;
- benefits from **reduced environmental damage**.

Costs

The costs depend on the features of the project, estimates of future travel demand, and characteristics of the local area or region, such as the local economic and transportation conditions. Specific costs include:

- capital costs of materials and equipment;
- infrastructure construction costs;
- capital costs for new buses;
- operations and maintenance costs;
- overhead expenses of business, commercial and government fleets using mixed-flow travel lanes resulting from traffic delays in mixed-flow lanes;
- enforcement costs to government to prohibit use of dedicated lanes by general purpose traffic.

BRT in Worcester, UK

A new BRT system is in the planning phase in Worcester. The improvements will deliver improved infrastructure for all road users, support reliable bus services, provide quality bus infrastructure, improve accessibility and provide a realistic and sustainable alternative to the car.

The costs are estimated to be

Barbourne Road – £4m approx.

Newtown Road - £5m approx.

The cost benefit ratio is expected to be around 1.7 for both.

Users & Stakeholders

Users and target groups

The key target group of users is the general public. People want to move quickly within the urban area, avoiding congestion, in a sustainable way, and in comfort, no matter whether they are daily commuters, tourists, or any other group of users.

Residents need an attractive service and improved quality of life. This can be provided by using high-tech buses with energy-efficient engines and minimal air and noise emissions.

To deliver a high quality service for **transport users**, a wide range of information services, skilled staff, high operation speed and lower journey time is required.

Daily commuters prefer a reliable service without any delay at peak hours, which can be delivered by dedicated or separated lanes, transit priority at traffic lights and smart bus corridors.

The elderly and children need to be able to move easily, so physical accessibility is crucial. This can be achieved through low-floor vehicles and safe access to the stops.

Key stakeholders for implementation

Main stakeholders are the transport operator, system provider and the local authority of the city. The project team needs other professionals as well, including a financial advisor, a transport planner and an independent engineer as initiator.

The local authority's role is to co-ordinate with the decision makers, participate in the planning process and also to provide part of the funding.

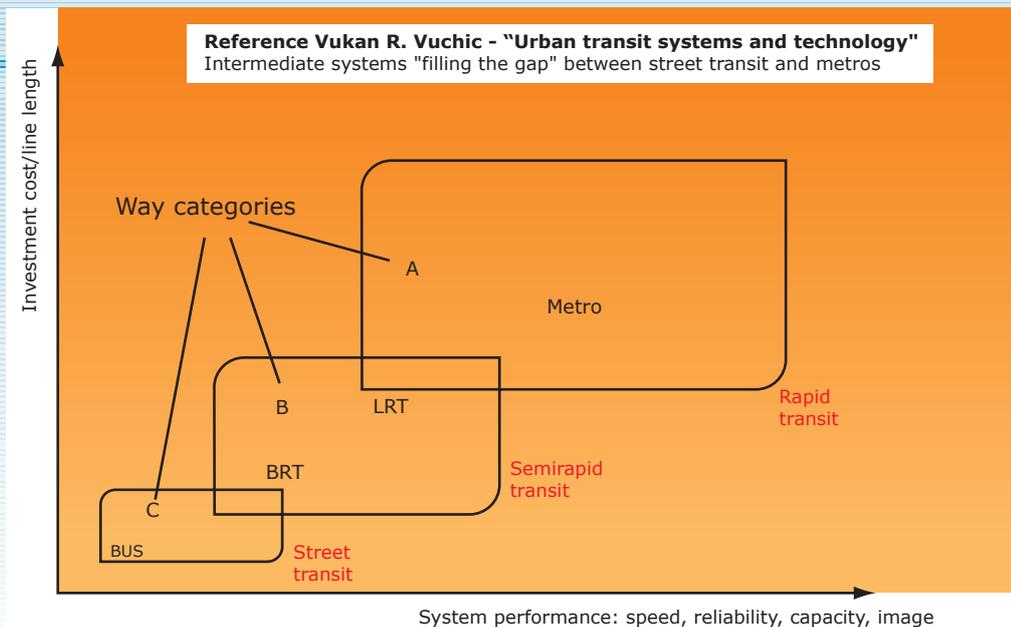
The transport operator is responsible for funding and participates in the planning and design process.

The transport planner's primary task is to plan and to design the scheme.

The financial advisor defines the financial structure and searches for funding resources.

The system provider plays a very important role, being the organisation responsible for implementation.

Finally, the police enforce new as well as existing regulations during operations.



Comparison of the investment costs for buses, rail-based systems and BRT, taking transport capacities into account
Source: François Rambaud

From concept to reality

Preparation



One of the most critical evaluation factors in considering conversion of a mixed-flow traffic lane for BRT use is the potential **benefits** and **disbenefits** to all corridor users. Perceived disbenefits for drivers may be more than offset by improvements for transport users, especially if there is a substantial mode shift from private cars to public transport (PT). Increasing PT capacity in the corridor can result in an increased person throughput for the entire corridor.

The use of Intelligent Transport Systems (ITS) on the facility, and on parallel and intersecting roads, may offset the traffic impacts of converting a mixed-flow travel lane for BRT use and actually improve travel conditions for all vehicles. It is critical that all of these factors are taken into account in the evaluation of a proposed lane conversion to determine the net benefit of the proposed action and the cost-effectiveness of the potential investment.

Key aspects at this stage

Implementation will usually be the responsibility of a single political body, e.g. local government. This simplifies the process in terms of decision making.

However, there is considerable potential for conflict between stakeholders because implementation results in restrictions upon other transport modes, particularly the car.

Consultation needs to be as broad as possible and the benefits must be strongly sold to the public. Complementary measures, such as smart access to the stops, adequate information systems, etc. are likely to be needed, with wider impacts on the travel environment as a result.

Creating political support

Robust analysis of the existing conditions (infrastructure, public transport services and traffic) is essential for credibility and the potential impact of the scheme must be significant to justify implementation.

Ideally, the benefits should cover the costs, taking into account the impacts on other modes – developing an effective evaluation method is therefore important. A sufficiently high bus service frequency is required with strict enforcement and a clear policy on shared usage of infrastructure (which can be a subject of strong criticism).

Stakeholder network

At the planning phase, the local authority and the transport operator usually define the principles and policies. The transport planner is responsible for planning, design and system specification in strong co-operation with the local authority.



Zuidtangent bus at Hoofddorp (NL)
Photo: www.busfoto.nl

Dedicating space to either bus lanes or busways may require the reallocation of roadway space from general traffic lanes or parking.

Given the potential community impact, changes of the roadway structure need to be planned carefully. Such reallocation can normally only be justified if bus frequency is at a high level (at least every 5 minutes), in situations where there is heavy congestion in car traffic on the remaining lane(s).

One solution, particularly used in the UK and Ireland, is peak-hour only bus lanes. The bus lane is operational at periods when the bus frequency is high (e.g. 07.00 to 09.30 into the city only), in order to maintain reliability, but at other times where buses are less frequent and general traffic is lighter, the lane is available for use by all traffic.

Lane marking can also be delineated using a ribbed texture so that the motorist hears a noise if his vehicle runs onto them.

They can be made even more visible and apparent by use of a more solid texture, e.g. a raised and painted curb.

Lane marking and colouring rely very much on the "good behaviour" of other road users for their effectiveness.

Policing and fines can help enforce conformity but will not guarantee success.

Ready for implementation?



Strong political commitment

Available funding

Support of PT users

Support of car users' association

"Take-a-lane" and "Add-a-lane" solutions examined

Traffic forecast and modelling show promising results

'Metrobus', a typical BRT System in Istanbul, Turkey

The municipality of Istanbul has developed an innovative transportation strategy based around installing a Bus Rapid Transit (BRT) system on the key routes in the city. The Metrobus system will be sustainable, rapid, economical and modern.

The key features of the Metrobus system include:

- special lanes reserved exclusively for buses;
- high speed travel along normally gridlocked traffic corridors;
- high capacity bus stations, instead of traditional bus stops.

The system is also integrated with existing public transport, facilitating travel across the city.

Istanbul's BRT system is a Public Private Partnership between the municipality, a public company and private sector. After drawing up master plans for the system, the municipality published an open tender for a private developer to realise the infrastructural aspects of the project. A public company was chosen to operate and maintain the Metrobus system on behalf of the municipality.

This example shows that innovative bus systems can be justified a metropolis like Istanbul (with 15 million inhabitants), just as well as in small cities like Lorient in France.

From concept to reality

Implementation



The implementation phase is the time when tactical and practical questions arise.

Key aspects at this stage

The financial structure and funding mechanism should be in place by this time, in order to be able to settle the bills. This means that all the stakeholders who provide financial resources must be contracted, and highly interested in the implementation process.

The users face the disruptions and inconvenience caused by the implementation works in this phase. Construction works cause restrictions to the

infrastructure usage, while the new service is not yet provided. This results in serious traffic and environmental burdens.

Depending on the public's reaction, this is the last chance to rethink the route. The concept can theoretically still be adapted, for example the width of a bus route can be decreased by using guided buses. Such alterations are likely to add to the project cost.

Creating political support

The political side may need to redefine the existing public service contract, in order to better fit the level of service to the demand of the residents and users.



Construction works: Cheap and easy implementation - construction of phase 1 of the A65 bus priority scheme outside Kirkstall Forge in Leeds in February 2007

Photo: John Illingworth

Stakeholder network

At this stage of the project, the operator has a less pronounced role, tending to observe rather than directly participate.

The system provider has a key role, and the **press and local media** may come into play to inform the public about the possible construction works and inconveniences.

Important

At the operation phase, many important issues arise.

Integrated ticketing and the **integration** of BRT into the existing context and infrastructure and **other modes of transport**, seem to be crucial.

Car users and related stakeholders should be involved and convinced in order to avoid failure.

United States experiences.

Generally, the public opposes "take-a-lane" strategies. When the California Department of Transportation converted general-purpose lanes to HOV lanes (High Occupancy Vehicle lanes) in 1976 on the Santa Monica Freeway, public outcry led to termination of the project and significantly set back other HOV lane development in the Los Angeles area. HOV projects implemented in Los Angeles since then have involved "add-a-lane."

A similar situation occurred in 1992, when HOV lanes were created along the Dulles Toll Road, outside of Washington, DC. After several weeks of unrestricted access to the HOV lanes, it became politically infeasible to restrict general traffic from using the lanes. After only a month of operation with restricted lanes, the lanes were re-opened to all vehicles.

The Santa Monica and Dulles examples indicate that once lanes are available to general traffic, converting them to exclusive BRT or HOV use is, at a minimum, very contentious.

'Le Triskell' Lorient, France

Le Triskell was developed similarly to the Nantes 'Busway', in that it provides optimum passenger comfort, and reduces waiting times. However, the design was adapted to meet the available resources and travel demands of the Lorient urban area.

There are some key points that are relevant regarding the long-term operation security:

- integrated ticketing, real-time information, raised curbs and shelters with extensive network-wide passenger transport information;
- enforcement through design, not technology.



BRT corridor in Lorient, France
Photo: Peter Staelens

From concept to reality

Operation



Key aspects at this stage

By limiting traffic to buses-only on certain streets, the traffic flow might increase in other streets and cause serious traffic problems that also can affect other bus lines.

There is widespread abuse of bus lanes in many European countries and sometimes this totally destroys the value of the measure. Typical examples are:

- short-term parking of cars on a bus lane (or even at a bus stop) while the driver is buying something;
- traffic merging into a bus lane in advance of a road junction by turning car drivers trying to avoid queuing;
- delivery of goods (the stopping of vans and lorries) on bus lanes in shopping streets.

Creating political support

Service on BRT systems is generally faster than regular bus services because the BRT buses have fewer stops and may run as frequently as comparable tram systems during peak travel times. BRT has proved to be an attractive way to get drivers out of their cars and into PT to reduce congestion. The initial cost to implement BRT is typically much less than Light Rail Transit; and in the right conditions, BRT lines can transport large numbers of people efficiently and cost-effectively.

Stakeholder network

In this stage of the project, the **transport operator** naturally plays the key role, while the local or transport authority is observing, monitoring and controlling.

Enforcement of measures such as parking controls is crucial to success, which means the **police** must be highly involved.



BRT in Istanbul, Turkey
Photo: Daimler AG (www.mercedes-benz.com/brt)

Further information & contacts

Further information

Bus Priority Measures, Best Practice report, November 2007

BusWay in Nantes, BHNS,
www.bhns.eu, www.nantesmetropole.fr

Zuidtangent, www.zuidtangent.nl

The National Academies, Transportaion Research Board, www.national-academies.org

Mercedes BRT, www.mercedes-benz.com/brt

Cities for Mobility, E-Magazine
www.cities-for-mobility.net

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The mission of NICHES+ is

to build on the success of the first NICHES project by stimulating a wide debate on innovative urban transport and mobility between relevant stakeholders from different sectors and disciplines across the EU and accession countries, in order to promote the most promising new urban transport concepts, initiatives and projects and transfer them from their current "niche" position to a mainstream urban transport application.

This publication is part of a series of 13 publications presenting the NICHES+ outcomes.

Worcestershire: innovation in Bus Rapid Transit

Worcester is one of the premier cathedral cities of England, its setting on the River Severn adds to its attraction and its role as a focal point for the regions rural communities give it a vibrancy and strong economic role within the region.

Access to the city centre has become car dominated within a street pattern with negligible potential for capacity enhancement. Bus travel is increasingly frustrated by delay and unreliability caused by traffic volumes and congestion in the city centre and the very limited provision of systematic measures to protect buses from these. In addition, traffic congestion in Worcester has led to a reduction in bus operating speeds along corridors without bus priority measures, with consequent increase in operating costs.

As a result, Worcestershire proposes to implement a series of High Quality Bus Rapid Transit (BRT) corridors across the city of Worcester as a means to provide a sustainable system of public transport for the future, and discourage car use.

Picture on front page:

BusWay in Nantes
Photo: Nantes Métropole

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