

7 CITI - Options Identification & Initial Appraisal

7.1 Section Overview

- In the BMTP, the CITI rapid transit scheme was identified as a rapid transit proposal which would link Belfast city centre to Belfast City Airport through Titanic Quarter, with an extension of the scheme to serve a new retail development in the Harbour Estate.
- This assessment has concentrated on the core section of the CITI rapid transit route which is assumed can be delivered within the study timeframe of 2015. This includes the section of route between Belfast City Centre and Titanic Quarter (Phases 1 and 2). An extension of the core route to Queens University has also been considered as part of a high level review and sensitivity analysis. A separate assessment for the extension to City Airport / Tillysburn concluded that this extension should not be taken forward at this time.
- The core route option for CITI is to connect Belfast city centre to the Titanic Quarter via the existing highway network, taking account of the proposed city centre traffic management and public realm proposals currently being progressed by the Department. Concept designs have been developed for the core route which includes a dedicated lane which will provide priority for the rapid transit vehicles.
- A range of technology options have been investigated which includes non-guided buses which run on-street, guided buses (for the section of the route through Titanic Quarter) and light rail transit. A do-minimum scenario (i.e. which would be implemented in the absence of rapid transit) which includes the implementation of a Metro bus service will be considered as part of the financial appraisal.

7.2 The CITI Rapid Transit Route

In the BMTP, the CITI rapid transit scheme was identified as a rapid transit proposal which would link Belfast city centre to Belfast City Airport through Titanic Quarter, with an extension of the scheme to serve a new retail development in the Harbour Estate.

As the least developed of the rapid transit proposals identified in BMTP, the CITI rapid transit scheme was an initial route proposal only. The overall objectives for this route were as follows:

- To establish a high quality public transport link to the major developments in the Titanic Quarter as part of the urban design process enabling the Harbour Estate to grow as a closely linked complement to the city centre rather than a poorly connected rival centre;
- To link the city centre to the Harbour Estate via the Odyssey – thereby providing a public transport link that does not currently exist;
- To link the city centre and Titanic Quarter with the City Airport;
- To link a new rail station at Tillysburn / City Airport with the Harbour Estate; and
- To link a possible park-and-ride site at Tillysburn / City Airport with the Harbour Estate and the city centre.

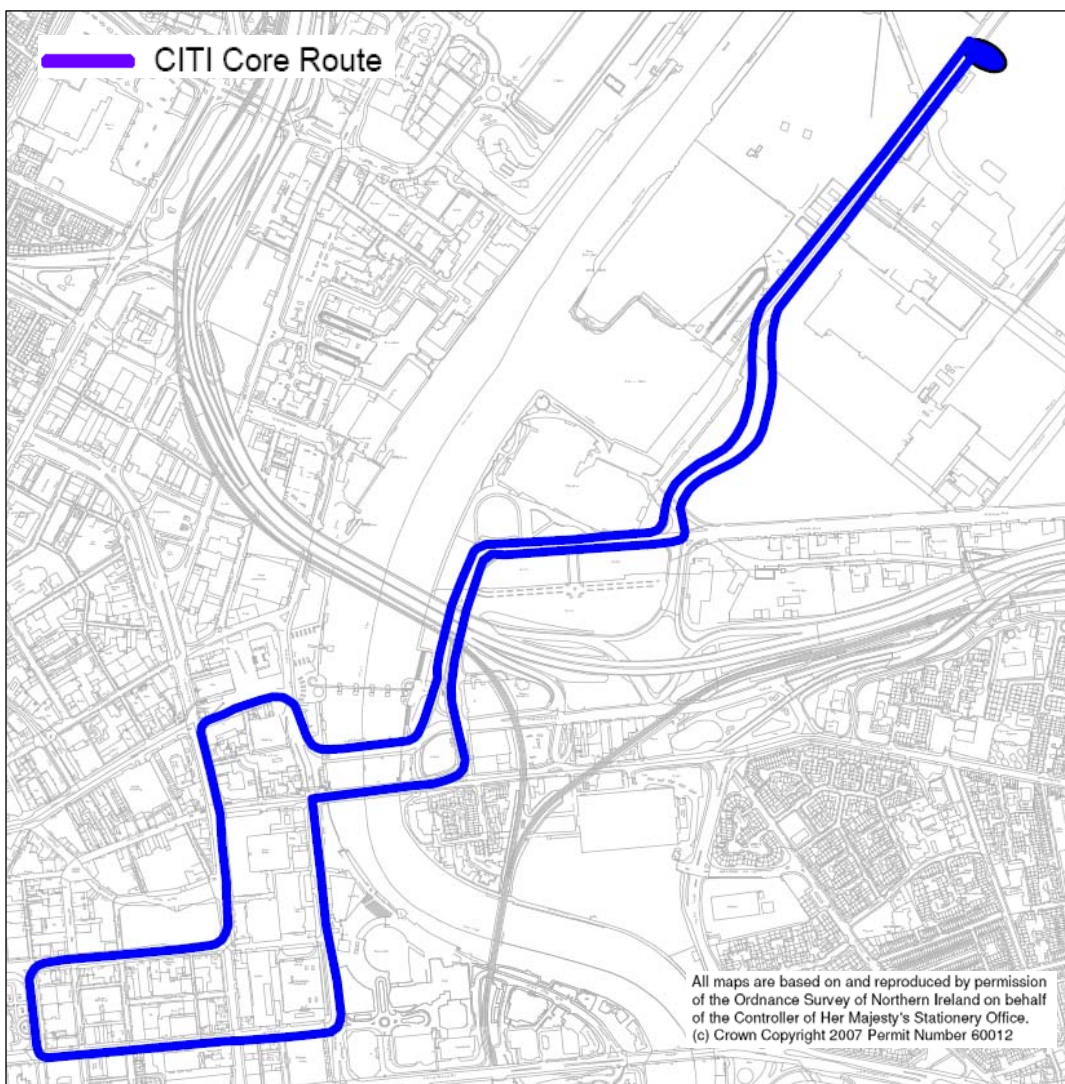
It should be noted that this assessment has only considered the core route of the CITI rapid transit route which is assumed can be delivered within the study timeframe of 2015. This includes the section of route between Belfast city centre and Titanic Quarter (Phases 1 and 2).

The further penetration of CITI into Titanic Quarter (Phases 3 and 4) will be considered as and when the concept designs for the Titanic Quarter development become more firm.

An extension of the CITI route through Titanic Quarter to Belfast City Airport / Hollywood Exchange Development site via a new swing bridge over the Musgrave Channel was considered as part of a separate report. This report provided a high level review of the feasibility of the route extension looking at engineering, planning and environmental issues. The report concluded that the proposed alignment (as shown in the Belfast Metropolitan Transport Plan) for an extension to the CITI rapid transit scheme beyond Titanic Quarter and into Belfast City Airport / Tillysburn should not be taken forward at this stage. A summary of the findings of the report is outlined in Chapter 8.

As shown in Figure 7.1 below, the core route option for CITI is to connect Belfast city centre to the Titanic Quarter via the existing highway network, taking account of the proposed city centre traffic management and public realm proposals currently being progressed by the Department. All technology options, including conventional bus, non-guided bus, guided bus (Titanic Quarter only) and light rail will be looked at as part of the detailed appraisal on this section of route.

Figure 7.1: CITI Rapid Transit Scheme – Core Route Option



Concept designs have been developed for a number of different rapid transit technology options along the core route identified above (see following section). The intent of the concept design is to illustrate, in plan, how each of the different options may work within their proposed corridors and to identify potential constraints and trade-offs required between high levels of public transport priority and general traffic operations. The concept designs for the core CITI route are attached at Appendix A.

It should be noted that, as agreed by the client steering group, the rapid transit study has utilised the proposed city centre bus routeing layouts produced by Arups Consultants on behalf of Translink. It is recognised that these layouts are conceptual at this stage and that the final city centre traffic management proposals (and subsequent routing of buses and rapid transit services) are subject to agreement between RPTD, Roads Service, DSD and Translink.

It is recognised that by utilising the proposed city centre bus routings that large sections of the CITI rapid transit scheme will utilise a one-way system around the city centre. It is recommended that a much more detailed study is undertaken as part of the detailed design of the system to determine the most direct, cost-effective and efficient city centre route. It is also recommended that two-way options which may include running on proposed pedestrianised streets are investigated. The final route choice through the city centre is unlikely to significantly influence the forecast patronage of the system but it may impact on the final locations of city centre stops; service operations; infrastructure requirements and capital and operating costs. Although a much shorter and more direct run may result in an overall reduction in capital costs, this will be dependent on local conditions and the need to incorporate existing (and future) traffic management, pedestrian and public realm considerations.

It should be noted that the concept designs have not considered in detail the implications for general traffic operations, pedestrians and cyclists – this should be considered at the next stage of design. In particular, Roads Service has identified a number of key issues which they consider to be critical to establishing the feasibility of the CITI rapid transit route. These include:

- On-street car parking provision within Titanic Quarter development, and in particular how the rapid transit proposals will integrate with on-street parking on that section of Abercorn Crescent, just before the turning circle; and
- The impact of rapid transit proposals (particularly LRT) on listed buildings in the city centre.

A more detailed assessment of these issues would need to be undertaken at the detailed design stage to establish the practicality and reasonableness of any solutions. However, for the purposes of this initial assessment, the outline concept designs have been developed to sufficient detail at this stage to allow an initial assessment of costs and testing in the Belfast Transportation Model.

The following assumptions should be noted:

- **Within Titanic Quarter**, it is assumed that the rapid transit scheme would utilise the core public transport corridors. It is assumed that the rapid transit services will be accommodated in segregated rapid transit lanes (no other vehicles permitted) within the existing carriageway width and general traffic would be reduced to one lane in each direction (and hence eliminating on-street parking along these routes). It is assumed that penetration of the rapid transit services will progress with the implementation of the phased development. For the purposes of this scheme appraisal, it is assumed that the penetration

of the services is linked to Phases 1 and 2 of the development (Sydenham Road to Hamilton Road).

- **Within Belfast City Centre**, it is assumed that the main pick up / set down location for rapid transit services will be at Belfast City Hall (the final location will be subject to agreement with all relevant parties). It is also assumed that rapid transit services will run on-street along the proposed city centre bus corridors currently being developed as part of the Belfast City Centre Public Realm Project – it is assumed that these bus lanes will be shared by rapid transit vehicles and other city centre buses. It is noted that the city centre bus routings used as part of this study are conceptual only at this stage and that the final city centre traffic management proposals (and subsequent routing of buses and rapid transit services) are subject to agreement between all relevant parties.
- **Between Belfast City Centre and Titanic Quarter**, it is assumed that the scheme will utilise the existing river crossings (Queens Bridge and Queen Elizabeth Bridge) as well as the existing highway network linking the Odyssey Complex and the main access into Titanic Quarter (i.e. Queens Quay and Sydenham Road). It is assumed that rapid transit services will be accommodated in segregated rapid transit lanes (no other vehicles permitted) within the existing carriageway width and the road space for general traffic would be reduced accordingly. For the purposes of this assessment, the existing highway boundaries have been used for the rapid transit alignment. However the Odyssey Car Park could represent an opportunity to provide a segregated route without the need to remove highway capacity and this should be looked at as part of the detailed design of the route.
- There are indicative plans (but not committed) to remove the Station Street Flyover in conjunction with proposed development in this area and to replace it with an at-grade junction. This is likely to present significant opportunities in the future to design in appropriate priorities at-grade and turning radii for rapid transit at this junction. Further consideration of this option should be considered at the detailed design stage and consultation undertaken with Roads Service and DSD.

7.3 Description of Options

As the route for the CITI rapid transit scheme is relatively fixed with regard to this assessment (see previous section), the different options for the CITI rapid transit scheme are based around the different technology options. Rapid transit is a general term for a quality public transport service offering improved speed, reliability, comfort and access features over conventional public transport services. In order to achieve the speed and reliability improvements, services operate (for at least part) on an exclusive or 'segregated' route, unaffected by highway congestion. The rapid transit options, along with the 'Do-Minimum' option against which they will be tested, are outlined in more detail in the following sections. These options will be taken forward to the more detailed appraisal (see next section).

7.3.1 Do-Minimum Option

For the purposes of this assessment, a 'Do-Minimum' option has been defined against which all of the 'Do-Something' options would be tested against. For the core section of the CITI route, the 'Do-Minimum' option is assumed to be the existing Metro bus service 26B which operates between Belfast city centre and the Belfast Harbour Area. It is assumed that the frequency of this service (which is currently every 30mins) would be increased to every 5mins in the peak hour in order to accommodate the demand associated with the Titanic Quarter development. It is assumed that this service is operated using standard low-floor Metro buses.

In addition, it is also assumed that the city centre traffic management and public transport priority measures would be in place around the city centre. This means that the bus service will benefit from new bus lanes along May Street, Chichester Street, Victoria Street, Oxford Street and Queens Square. Roads Service has advised that this scheme will be a “signing and lining” exercise and will cost approximately £106,800 to implement. This cost estimate is based on a simple unit rate of £0.1million per 2-way km of route (or £0.06million per 1-way km of route). It should also be noted that the Do-Minimum assumes that the Roads Service highway proposals for Bankmore Link are also in place.

7.3.2 Option 1: non-guided Bus-Based Rapid Transit (BRT)

The first option to be considered for the core CITI rapid transit scheme is a bus-based rapid transit option (BRT) that makes use of a combination of shared and dedicated rapid transit lanes. Concept designs for this option are attached at Appendix A.

Within the city centre streets, it is anticipated that the rapid transit services would utilise the dedicated bus lanes along Oxford Street, May Street, Chichester Street and Victoria Street that are proposed as part of the city centre traffic management proposals (i.e. rapid transit vehicles would share the lane with other buses). Outside of the city centre streets i.e. across River Lagan, Queens Quay, Sydenham Road and into Titanic Quarter, the rapid transit services would utilise a new dedicated rapid transit lane (i.e. no other vehicle permitted). This lane could be separated from vehicular traffic by a line painted on the road (similar to existing bus lanes) or a kerb depending on local circumstances.

It is assumed that the frequency of this service would be every 5mins in the peak hour in order to accommodate the demand associated with the Titanic Quarter development and to provide a regular and frequent service for users. It is assumed that this service is operated using high quality and modern BRT vehicles which have a higher capacity than standard low-floor Metro buses. A sub-option (Option 1B) will also be looked at which operates standard low-floor Metro buses instead of the higher quality and more expensive BRT vehicles.

7.3.3 Option 2: non-guided / guided Bus-based Rapid Transit (BRT)

The second option to be considered for the core CITI rapid transit scheme is a bus-based rapid transit option (BRT) that is the same as the option above except that the system would adopt guidance through Titanic Quarter only. This will allow the use of less carriageway width and more precision docking at stations. However the costs associated with providing the infrastructure are likely to be much more significant.

As unit cost rates from the Affordable Mass Transit are used to calculate the high level costs associated with the ‘guided bus’ element of this option, it is not our intention at this stage to determine what type of guidance would be used. This is more appropriately done through the detailed design process should this option be taken any further.

7.3.4 Option 3: Light Rail Transit (LRT)

The third option to be considered for the CITI rapid transit scheme is a light rail transit (LRT) option. Concept designs for this option are attached at Appendix A.

Within the city centre streets, it is anticipated that the LRT services would utilise the dedicated bus lanes along Oxford Street, May Street, Chichester Street and Victoria Street that are proposed as part of the city centre traffic management proposals although some amendments would be required to accommodate the turning radii of the LRT vehicles. There is also an issue with tight turning radii and the position of a number of city centre buildings. Outside of the city centre streets i.e. across River Lagan, Queens Quay, Sydenham Road and into Titanic Quarter, the LRT services would utilise a new dedicated LRT lane (i.e. no other vehicles permitted). This lane could be separated from vehicular traffic by a line painted on the road (similar to existing bus lanes) or a kerb depending on local circumstances.

It is assumed that the frequency of this service would be every 5mins in the peak hour in order to accommodate the demand associated with the Titanic Quarter development and to provide a regular and frequent service for potential users. It is assumed that this service is operated using high quality and modern LRT vehicles which are assumed to have a higher 'passenger attraction' factor coded into the Belfast Transportation Model compared to BRT vehicles.

It should be noted that if LRT is adopted and is anticipated to terminate in Titanic Quarter (and not be extended across the Musgrave Channel to Belfast City Airport / Tillysburn), then land will be required for a LRT depot (in which to house/maintain the LRT vehicles). There is no obvious place for this except within Titanic Quarter and as such any land is likely to attract significant land values as it is currently earmarked for development purposes.

As unit cost rates from the Affordable Mass Transit are used to calculate the high level costs associated with the light rail option, it is not our intention at this stage to determine what type of propulsion would be used i.e. overhead electrical wires or electricity from a third rail. This is more appropriately done through the detailed design process should this option be taken any further.

7.4 Summary of Options

A summary of the rapid transit options being considered as part of this appraisal is outlined in Table 7.1 overleaf. It should be noted that although BRT and LRT vehicles have typically larger capacity vehicles, this cannot be represented in the Belfast Transportation Model as the model does not take account of overcrowding. The issue of service levels and capacity of vehicles is explored in more detail in section 8.4.4 of this report.

Table 7.1: CITI Rapid Transit Options

Ref	Description	Segregation	Other comments
Do-Min	Existing Metro service 26B with increased frequency to 5mins in peak	City Centre public transport priority only.	Standard Metro bus, 5min freq in peak period. City Centre measures in place & Bankmore Link. 5 min freq in peak.
1A	New BRT service – using specialised BRT vehicles	Combination of shared bus/rapid transit lanes and fully segregated rapid transit lanes. Vehicles are not guided.	BRT vehicles (i.e. greater ‘passenger attraction’ factor than conventional buses, larger capacity). 5 min freq in peak.
1B	New BRT service – using standard buses	Same segregation as Option 1A above. Vehicles are not guided.	Conventional buses (same vehicles as existing Metro service). Only difference between this scheme and Option 1A is the reduced vehicle purchase costs.
2	New BRT service (same as Option 1A above except that the service adopts guidance through Titanic Quarter)	Same segregation as Option 1A above. Vehicles are guided through Titanic Quarter.	BRT vehicles. Only difference in costs of scheme from Option 1A is the additional capital costs associated with providing the guidance infrastructure through Titanic Quarter.
3	New LRT service	Combination of shared bus/rapid transit lanes and fully segregated rapid transit lanes.	LRT vehicles (i.e. greater ‘passenger attraction’ factor than BRT vehicles, larger capacity). 5 min peak freq.

Although all of the rapid transit options are to be considered in detail as part of this appraisal, the following should be noted as a summary of the relative attributes of each option:

- **System capacity** – generally BRT and LRT are capable of handling similar overall volumes of passengers except at very high volumes, where LRT can carry more passengers. LRT is generally able to handle more passengers with fewer vehicles due to their large carrying capacity, while BRT is usually better able to service lower passenger volumes more efficiently. The demand for the Belfast rapid transit corridors is expected to be at levels efficiently served by BRT;
- **Capital costs** – LRT is generally more expensive to build than either guided or unguided busways given the same type of alignment. Like for like comparison of costs is often difficult as system configurations will vary to take advantage of the relevant technology. BRT is often able to avoid capital costs associated with utility relocations;
- **Operating costs** – BRT is usually cheaper to operate than LRT at the likely patronage volumes that will be experienced in Belfast. At high patronage volumes, lower LRT operating costs per passenger can offset the BRT advantage of being able to more closely match demand and capacity;
- **BRT Guidance** – a guidance system is not a requirement for a high quality BRT system and is usually considered where constraints exist, such as in road widths, or where a specific need has been identified such as a desire for precision docking, or smoother rides;
- **Implementation, Staging and Conversion** – a significant difference between LRT and BRT is the manner in which it is implemented. LRT, because of the rail and catenary (if used) will require that a base system be established from the beginning along with a depot.

This implies that a significant upfront capital cost is required with the potential for lower costs for incremental systems expansion. A significant flexibility in terms of cost for BRT is the ability to stage implementation to align with demand, performance constraints and expenditure profile. In situations where BRT has been chosen as the preferred or 'short-term' option, there is sometimes a long-term intent to convert to LRT once demand or finances allow. Most BRT systems have made some provisions for possible conversion to LRT, both in the design of the infrastructure itself and the alignment;

- **Design parameters** – BRT and LRT have similar space requirements. LRT design parameters are generally more limiting than BRT;
- **Ride Quality** – ride quality is generally accepted to be somewhat better on LRT when compared to BRT in terms of the vehicle characteristics and operation on fixed rails. However, progress has been made on developing buses with LRT-like characteristics to improve the passenger experience and performance including multiple-door boarding, wider aisles and large windows, alternative propulsion systems and aesthetics;
- **Ability to attract ridership** – there is much debate over whether the attractiveness of LRT vehicles and the perceived permanence of the infrastructure are better able to attract patrons than BRT. While LRT is indeed an attractive option for most people, mode choice is largely dependent on factors that reflect people's priorities rather than something inherent to a technology. It is well documented that the key drivers of mode choice are travel time, cost and reliability of service. Historically, LRT has been better able to provide these benefits than has conventional bus, but a well-designed bus rapid transit system can offer LRT-like service with similar ability to attract riders.