Údarás Náisiúnta Iompair
National Transport Authority

Waterford Metropolitan Area Transport Strategy

Transport Options and Network Development Report

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1 Introduction

1.1 Background

The National Transport Authority (NTA) is a public body set up under statute and established in December 2009. The role and functions of the NTA are set out in three Acts of the Oireachtas; the Dublin Transport Authority Act 2008, the Public Transport Regulation Act 2009 and the Taxi Regulation Act 2013. In August 2015, the Department of Transport, Tourism and Sport (DTTaS) published its policy document *"Investing in our Transport Future - Strategic Investment Framework for Land Transport"*. Action 4 of that framework states that: *"Regional transport strategies will be prepared by the NTA and provide an input to regional spatial and economic strategies".*

Having regard to its role in relation to transport, and the action placed upon it in the DTTaS policy document, the NTA, in collaboration with Waterford City and County Council and Kilkenny County Council, is developing a Transport Strategy for the Waterford Metropolitan Area (WMA) covering the period to 2040. The strategy will align with the over-arching vision and objectives of the National Planning Framework (NPF) and Regional Spatial and Economic Strategy (RSES) and will provide a framework for the planning and delivery of transport infrastructure and services in the WMA over the next two decades. It will also provide a planning policy with which other agencies can align their future policies and infrastructure investment.

1.2 Purpose of Report

The methodology for the development of the WMA Transport Strategy 2040 is undertaken on a step-by-step basis, from: reviewing the existing policy and transport baseline, undertaking a detailed future demand analysis, developing transport options, developing the draft Strategy for public consultation and subsequently finalising the Strategy, as shown in Figure 1-1.

Figure 1-1: Waterford Metropolitan Area Transport Strategy Methodology

Having developed the 2040 Baseline Demand in the "Demand Analysis Report", this report describes the process of developing the transport options for all modes (public transport, walking, cycling, car and freight). The principles and methodology for the development of the transport options is described, as is the modelling and refinement of these options.

A separate modelling report will outline the appraisal of the final Strategy option, utilising the South-East Regional Model (SERM) appraisal toolkit providing a quantitative appraisal that aligns with the Department of Transport, Tourism and Sport (DTTAS) Common Appraisal Framework (CAF).

1.3 Report Structure

The following provides a description of the contents of each section of the report;

- **Section 2:** Outlines the methodology applied in developing the Transport Network Options for all modes;
- **Section 3:** Outlines the development of the Public Transport network options on a corridor basis for different public transport modes;
- **Section 4:** Describes the objectives and proposals for the Walking Network;
- **Section 5:** Describes the development of the Cycling Network;
- **Section 0:** Outlines the Road Network development options; and
- **Section 7:** Concludes the report.

2 Transport Network Option Development Methodology

2.1 Option Development and Assessment Methodology

This report describes the process of options development for all transport modes. Figure 2-1 below outlines the methodology for the development and assessment of the strategy options. The upper-limit public transport demand was determined from the "idealised" public transport network model run as discussed in the "Demand Analysis Report". The "idealised" public transport network included very high frequency services on all main corridors into the city and an assumed minimum speed for public transport, intended to be representative of high priority.

The public transport options have been developed based on this "idealised" demand and subsequently updated and re-run in the SERM. Iterative model runs were undertaken to further refine and assess the options with the outputs partially informing the Multi-Criteria Assessment outlined in this report. The cycling, walking and road network were also modelled, refined and assessed iteratively in combination with the public transport proposals. The resulting outcome of this process is the identification of an Emerging Preferred Strategy Network.

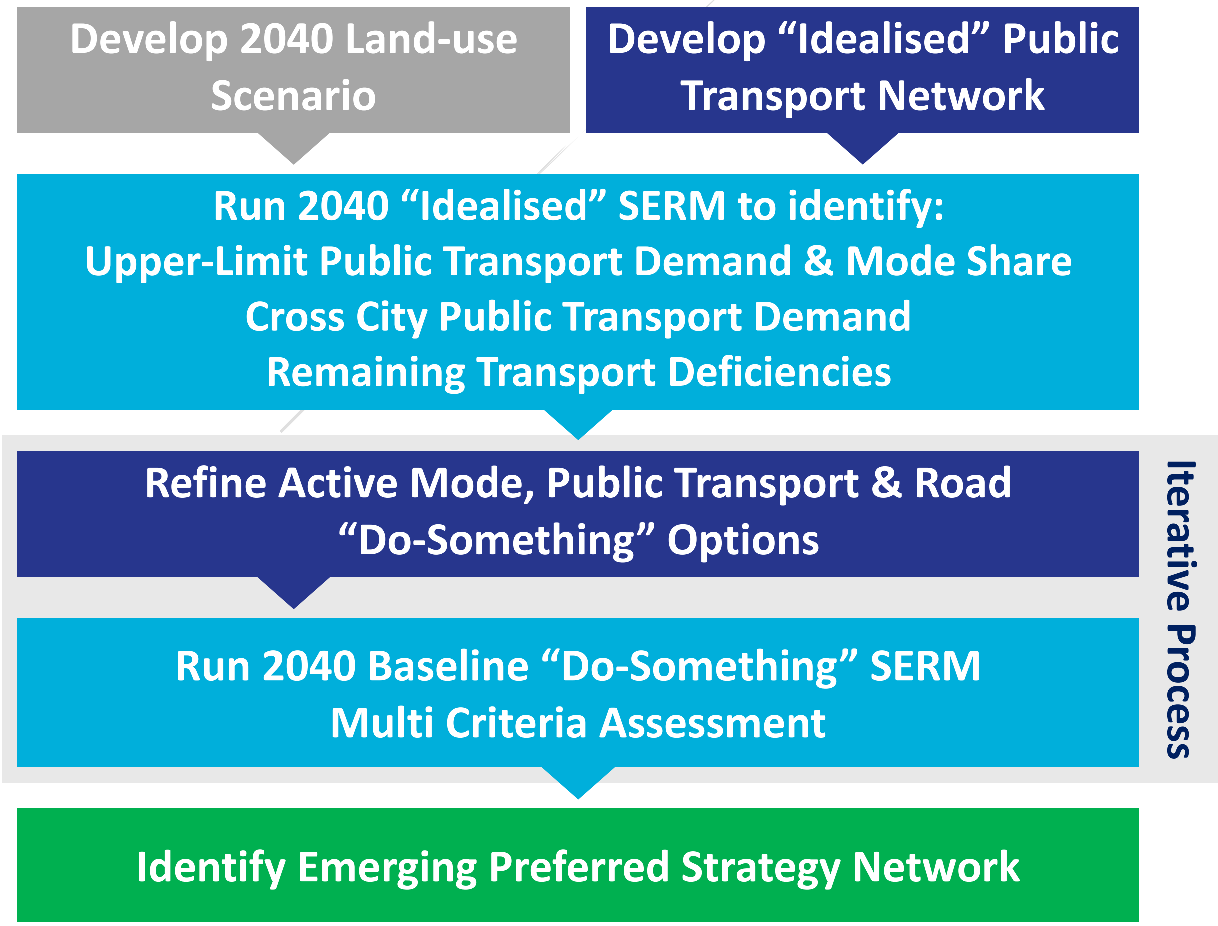


Figure 2-1: Option Development and Assessment Methodology

2.2 Network Options Development Hierarchy

The following lists the order in which the transport network has been developed. Initial stages focus on the development of the public transport network as the demand analysis has shown that the public transport mode share has the greatest potential for improvement. The cycling, walking and road networks have been subsequently developed.

- Public Transport Network;
- Walking Network;
- Cycling Network; and
- Road Network.

2.2.1 Development and Assessment of Transport Networks

The methodology under which the transport options have been developed and assessed is guided by the ***'Common Appraisal Framework (CAF) for Transport Projects and Programmes, March 2016'*** published by the Department of Transport, Tourism and Sport (DTTAS), which requires schemes to be appraised under the general criteria of Economy, Safety, Environment, Accessibility & Social Inclusion and Integration.

All transport proposals will subsequently be required to be assessed in line with TII Project Appraisal Guidelines (PAG) and DTTaS guidance for scheme appraisal before implementation. This process may include a Route Options Assessment and detailed Business Case. This process has not been undertaken as part of the strategy which is intended to be provide a framework for the delivery of transport infrastructure and services.

2.3 Public Transport Network

Public Transport Network Options have been developed for each corridor, based on the public transport demand associated with the corridors developed in the "Demand Analysis Report". Section 3.2 also outlines a description of each corridor. Based on the radial demand and the orbital demand the proposed route, service type, service frequency and level of priority have been developed and refined through further modelling.

There is some overlap between the public transport proposals and the road network where new links are required to facilitate the routing of public transport services. Public transport priority measures have also been included which in some instances impacts upon the road network. This is discussed further in Section 3 on a corridor-by-corridor basis.

2.1 Walking Network

The walking network will be reviewed to ensure integration and alignment with the proposals in the strategy.

2.2 Cycle Network

The cycle network has been developed using the Cycle Network Plan for Waterford City and Environs 2014 as a reference. The 2014 cycle plan will be reviewed to ensure integration and alignment with the emerging proposals in the proposed in the strategy. The network will also be extended as required to meet future demand.

2.1 Road Network

A review of the road network demand, which includes road network travel demand from beyond the WMA, has been undertaken to identify the pressures on the road network. National road network, regional road network and city road network will be considered. A review of committed road infrastructure will be undertaken and aligned to policy and demand needs within the WMA. The road network will also be reviewed with the aim of facilitating public transport, walking and cycling provision.

3 Public Transport Option Development

3.1 Typical Urban Public Transport Capacity Ranges

Figure 3-1 illustrates the range of public transport capacities, in passengers per hour per direction (pax/hr/dir), that can be achieved by different public transport models of Bus, Bus Rapid Transit (BRT), Light Rail Transit (LRT) and Metro / Heavy Rail. It shows that bus based public transport can cater for capacities of up to 2,000pax/hr/dir, BRT can cater for capacities between 1,000 and 4,000pax/hr/dir, LRT can cater for capacities between 3,000 and 7,000pax/hr/dir, with Metro or Heavy Rail catering for capacities above 5,000pax/hr/dir. While the values outlined in Figure 3-1 are not set in stone, they do provide a good indication as to the likely public transport requirements for the corridors being reviewed.

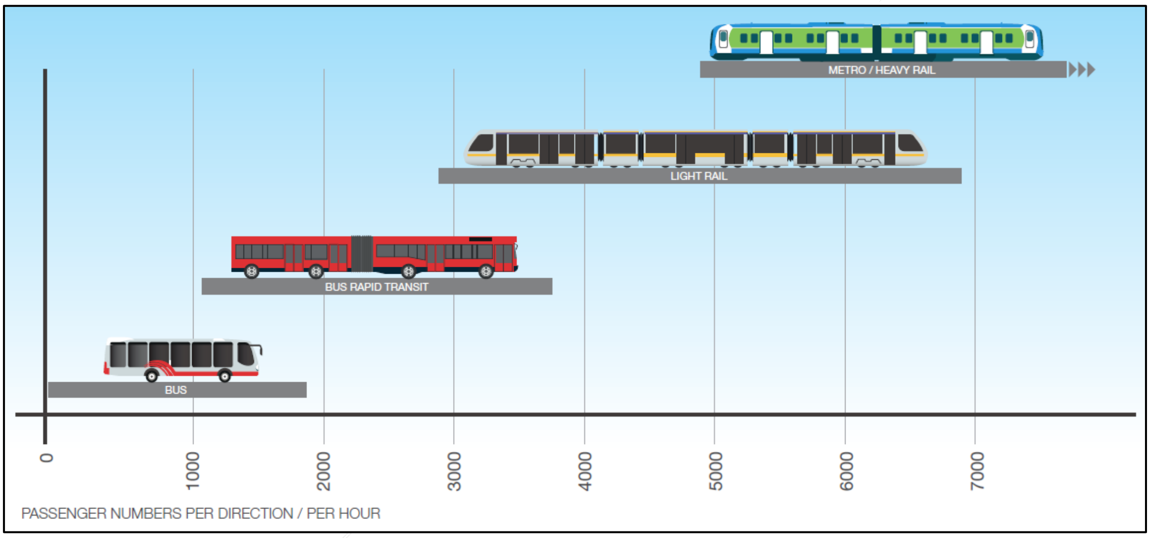


Figure 3-1: Public Transport Capacity Ranges[1]

3.2 Demand Corridors

To facilitate analysis of travel demand within the WMA, the area was divided into several corridors based on the national and regional transport networks around a central city centre core. These corridors are primarily used to describe radially based trips, which represents the most dominant trip pattern within the WMA. The corridors and the settlements within each corridor are follows:

- **Corridor A:** Ardkeen/Ballinakill/Knockboy and Passage East
- **Corridor B:** Poleberry, Ballytruckle/Kilcohan, South Waterford Rural and Dunmore East
- **Corridor C:** Poleberry, Tycor, Ballybeg/Lisduggan, Kilbarry, Killoteran and Tramore
- **Corridor D:** City Centre, Tycor, Carrickphierish/Gracedieu, Ballybeg/Lisduggan and Killoteran
- **Corridor E:** Ferrybank, Kilculliheen and Dunkitt
- **Corridor F:** Ferrybank, Kilculliheen and Belview

The corridors have been subdivided into smaller segments based on inner and outer sectors which allow for the greater understanding of movements along the corridor and orbital trips between corridors. The city core, sectors, corridors and segments are shown in Figure 3-2. The segments are named based on their corridor letter and sector number (i.e. Segment B1 lies with corridor B and sector 1).

[1] UITP Conference 2009 – Public Transport: Making the Right Mobility Choices

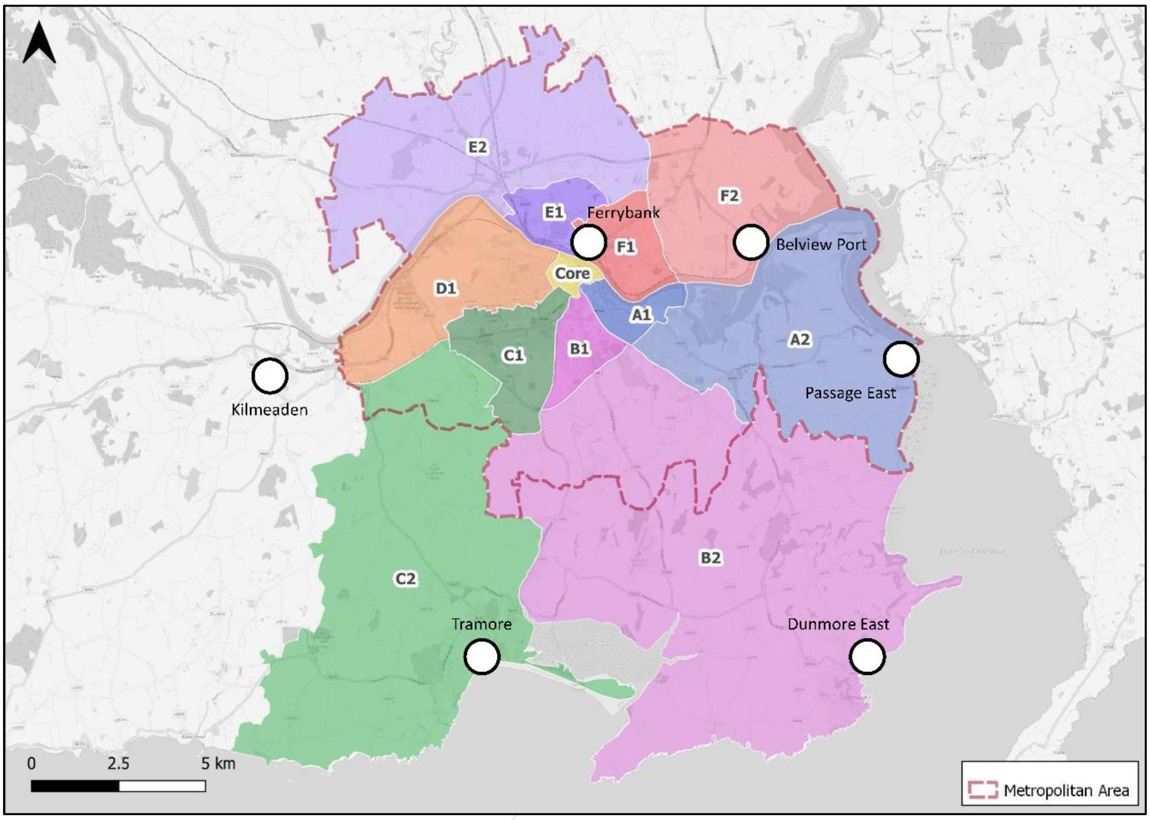


Figure 3-2 WMA Corridors and Segments

Figure 3-4 shows the AM peak hour public transport idealised demand associated with these corridors. For reference, Figure 3-3 confirms that the AM Peak has the highest trip demand by time period and is a robust time period for this options assessment. The demand is based on a simplified "spider's web" network. More details on this demand and spider's web mapping can be found in the "Demand Analysis Report". As shown, the highest radial public transport demand is along corridor A, followed by corridor D. In comparison, the orbital demand is lower with the highest demand modelled between Corridors D&E. It is important to note that the demand shown along one arm of the spider's web may be across more than 1 route or road link in the corridor.

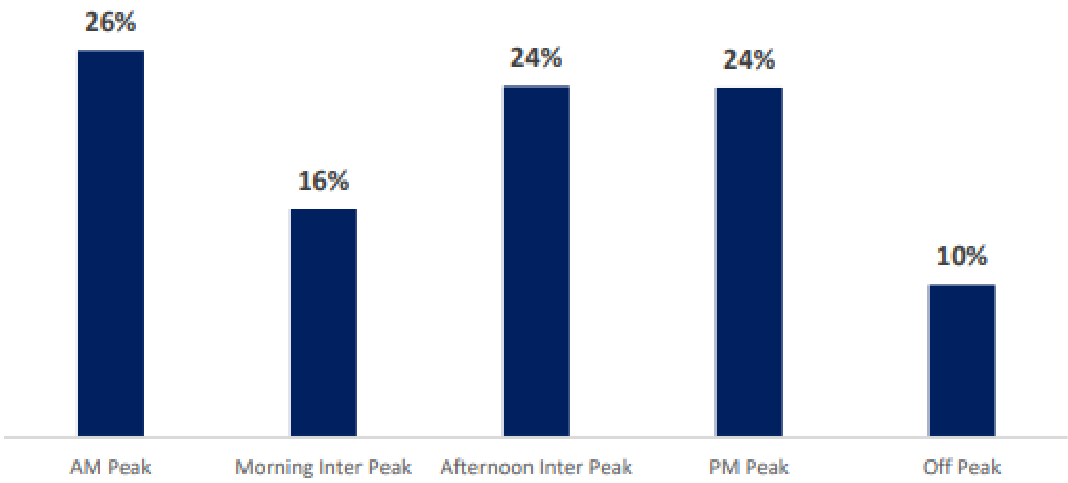


Figure 3-3: Percentage of 2040 Demand by Time Period

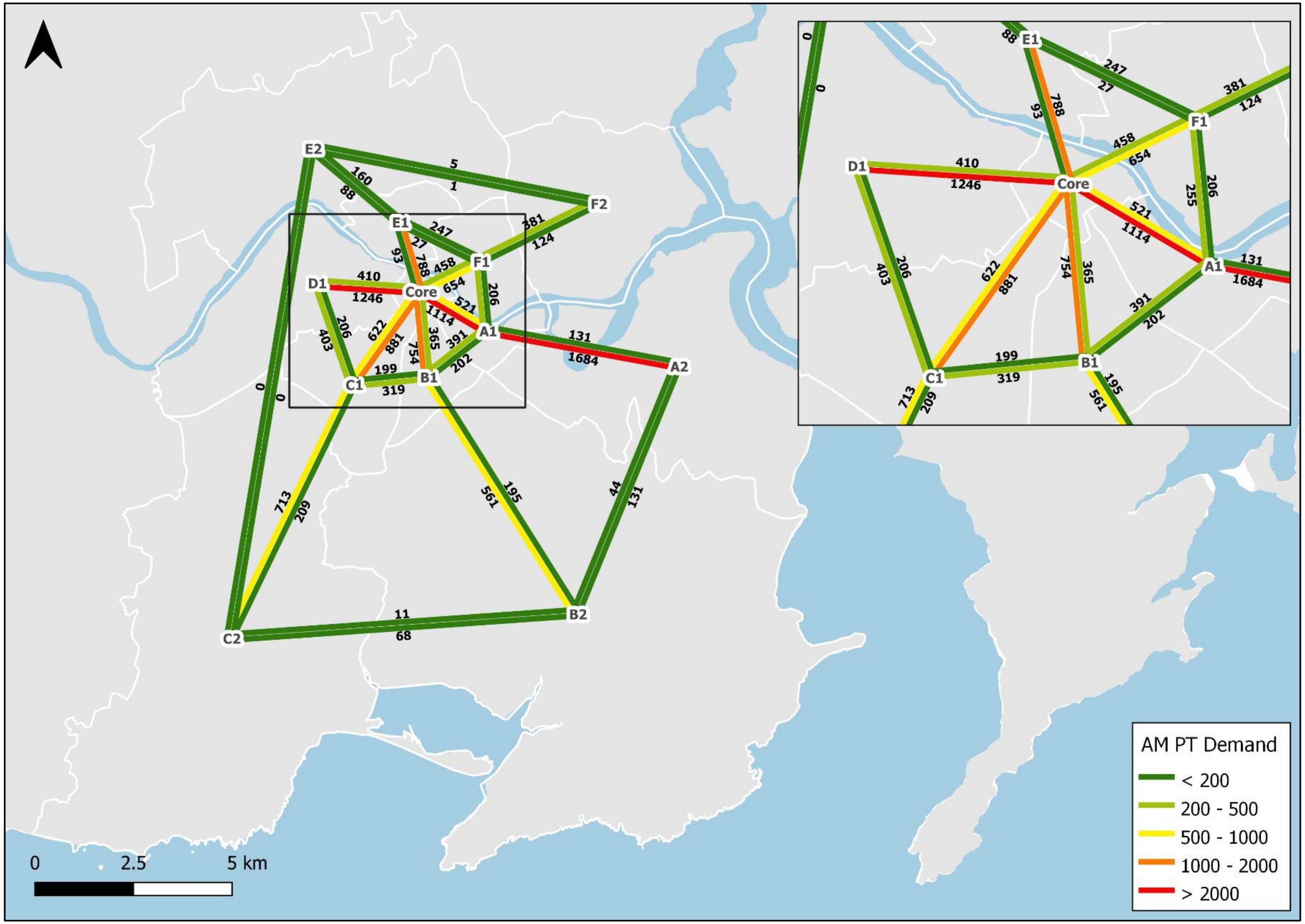


Figure 3-4: AM Peak PT Demand – All Corridors

3.3 Principles of the Idealised Public Transport Network

The "idealised" public transport network was developed based on six principles that created a network that maximises the public transport mode share. Figure 3-5 outlines the principles that underpin the performance of the "idealised" public transport network. To develop the WMA public transport network in more detail and to maximise the public transport mode share the principles that underpin the performance of the "idealised" network should be applied to the network options.

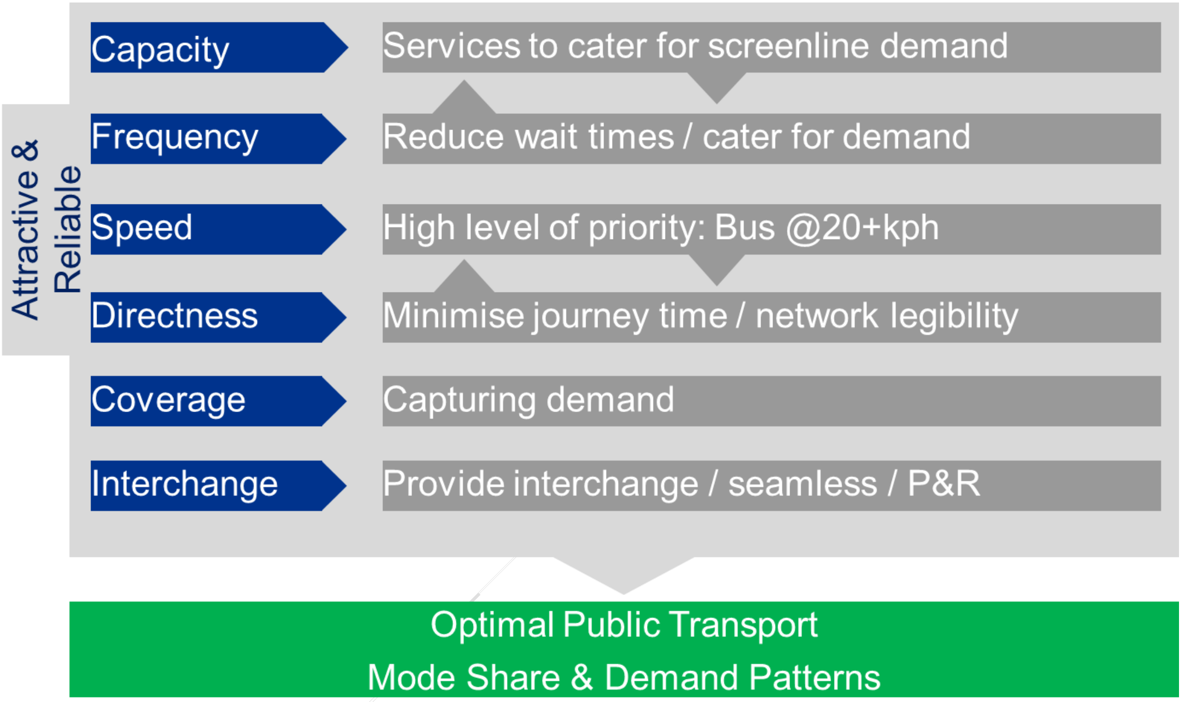


Figure 3-5: Principles of the Idealised Public Transport Network

3.4 Common Appraisal Framework (CAF) and Route Alignment Considerations

3.4.1 Consideration of Alternatives

The procedure for the assessment of the options is guided by the 'Common Appraisal Framework (CAF) for Transport Projects and Programmes, March 2016' published by the Department of Transport, Tourism and Sport (DTTAS), which requires schemes to be appraised under the general criteria of **Economy, Safety, Environment, Accessibility & Social Inclusion and Integration**. Alternative public transport provisions for the Public Transport Corridors have been considered to ensure that the preferred public transport meets the requirements of the CAF. It should be noted that a more detailed feasibility assessment and appraisal of the public transport schemes identified within the preferred option will be required at a later stage in the planning process.

The alternatives considered to meet the public transport demand within each corridor include the following:

- **Option 1:** Bus Services;
- **Option 2:** Bus Rapid Transit;
- **Option 3:** Light Rail Transit; and
- **Option 4:** Suburban Rail.

The options identified have been assessed relative to each other under the above five criteria using the following rating system outlined in Table 3.1. The assessment has been made for each of the six corridors identified in Section 3.2 and the options might vary depending on the existing and proposed infrastructure on each of them.

Table 3.1: Assessment Rating Table

Colour	Relative Performance
	Significant advantages over other options
	Some advantages over other options
	Comparable with other options
	Some disadvantages over other options
	Significant disadvantages over other options

3.4.2 Route Alignment Considerations

The route option alignments for the bus routes in each of the corridors have been developed considering the six principles that underpin the performance of the "idealised" public transport network. The six principles were defined in section 3.3 and relate to **capacity; frequency; speed; directness; coverage; and interchange possibilities**. These were considered to provide a comprehensive network that maximises the public transport mode share.

To ensure that the route option alignment and the proposed priority measures can be accommodated, a review was undertaken in the context of determining potential route alignments that meet these six principles. This review included:

- Existing Transport Network;
- Population Distribution & Density;
- Employment and Education distribution;
- Network Constraints; and
- Public Transport Service Catchment.

The capacity of each proposed route was then combined and compared against the idealised demand to ensure that a surplus of capacity was available. The capacity associated with different public transport options and frequency is outlined in Table 3.2.

Table 3.2: Public Transport Design Capacity and Frequency[2]

Capacity Assumptions	Seating Capacity	Crush Capacity	Design Capacity
Commuter Rail	285	415	350
Light Rail Transit	70	305	259
Bus Rapid Transit	60	120	102
Double Decker Bus	74	88	75
City Coach Bus	58	82	70
Intercity Bus	50	53	50
Shuttle Bus	30	30	30
Assumed Design Capacity reduction factor of 85% or 100% of seated capacity, whichever is larger			

Approximate 1 Hour Peak Design Capacity	CR	LRT	BRT	DDB	CCB	IB	SB
Design Capacity per Service Vehicle/Train	350	259	102	75	70	50	30
Frequency	**Capacity**						
60 min	350	259	102	75	70	50	30
30 min	700	519	204	150	139	100	60
20 min	1051	778	306	224	209	150	90
15 min	1401	1037	408	299	279	200	120
12 min	1751	1296	510	374	349	250	150
10 min	2101	1556	512	449	418	300	180
9 min	2335	1728	580	499	465	333	200
8 min	2627	1944	765	561	523	375	225
7 min	3152	2333	918	673	627	450	270
6 min	3502	2593	1020	748	697	500	300
5 min	4202	3111	1224	898	836	600	360
4 min	5253	3889	1530	1122	1046	750	450
3 min	7004	5158	2040	1496	1394	1000	600
2 min	10506	7778	3060	2244	2091	1500	900

[2] **CR:** Commuter Rail, **LRT:** Light Rail Transit, **BRT:** Bus Rapid Transit, **DDB:** Double Decker Bus, **CCB:** City Coach Bus, **IB:** Intercity Bus, **SB:** Shuttle Bus

3.5 Corridor A

3.5.1 Target Demand

Based on the public transport demand identified for Corridor A from the Spider's Web diagram which is based on the "Idealised" public transport network, the "Target Demand" can be identified. Table 3.3 shows the two-way AM Peak Corridor A screen line demand on the radial movements, highlighting the largest demand as the "Target Demand" for each movement. For Corridor A the highest one-way demand is 1,684 passengers between the inbound A2 outer and A1 inner section.

Table 3.3: Identifying Maximum Demand to Develop Public Transport Options

Service Type	Outer Radial (A2 – A1)	Inner Radial (A1 – Core)
Inbound	**1,684**	1,114
Outbound	131	521

3.5.2 Common Appraisal Framework (CAF)

Table 3.4 summarises the results of the multi-criteria assessment in line the CAF requirements for Corridor A. The table describes how each of the options compares against each criterion and the cells are colour coded to indicate relative performance.

Table 3.4: Assessment of Alternative Transport Measures for Corridor A

	Economy	Environment	Safety	Integration	Accessibility and Social Inclusion
Option 1: Bus Services	Corridor A generates the largest demand of 1,684 passengers. The bus capacity demand levels (Figure 3-1) indicates that this demand level can be accommodated within the bus capacity (up to 2,000 pax/hr/dir). With the bus corridors utilising the existing road infrastructure (with some localised widening) this will make the best use of investment in the current network and could provide a greater return on investment, in terms of benefit to cost ratio.	Bus-based network on Corridor A will be able to utilise existing road space, reducing the construction environmental impact. Bus-based network produces less GHG than the private car alternative. Options are available for different fuel sources.	High frequency bus corridors and priority for bus travel would reduce the number of cars in use and therefore would likely have a direct impact on collision rate. The improved bus priority infrastructure on corridors and the utilisation of road space (due to reduced private car volumes) to support segregated active travel modes will further contribute to improved user safety across the network.	An improved integrated bus network can connect with University Hospital, Ardkeen Shopping Centre, residential areas of Dunmore Road and Williamstown Road and the City. A high frequency service corridor with city centre connections and direct cross-city connections (other bus corridors) can access bus station, rail station and potential P&R sites.	An integrated high frequency and well-connected bus network can improve the accessibility and social inclusion to users and the flexible network can access most areas even with network constraints.
Option 2: Bus Rapid Transit	Given the idealised demand is across several roads/routes within corridor A, it is unlikely that a BRT service along a direct route would reach the capacity of between 1,000 and 4,000 pax/hr/dir. Though it is acknowledged that the demand on Corridor A could be potentially accommodated by the BRT. Although the BRT route would mainly utilise the current road highway at this stage of the design the BRT option would provide some return on investment, it will unlikely provide the same value for money, as the Bus Service Option.	BRT will likely have some impact on the surrounding environment, to accommodate route/junction widening, bus priority measures, BRT swept paths and to improve the permeability of the service. Similar to the Bus Service option, the BRT produces less GHG than a private car alternative. Options are also available for different fuel sources.	High frequency BRT corridors and priority for bus travel would reduce the number of cars in use and therefore would likely have a direct impact on collision rate. Similar to the Bus Service Option bus priority infrastructure on corridors and the utilisation of road space (due to reduced private car volumes) to support active travel modes will further contribute to improved user safety across the network.	Integration with other services and land-use is limited due to the proposed routing location of the BRT network along the corridor. One direct corridor is likely to be only served by BRT restricting its integration across the wider Corridor A area. The BRT (comparable with the light and rail routes) is unable to penetrate and integrate with the same number of routes as the bus services.	Potentially enhances accessibility. BRT will be restricted to a direct corridor mainly. Access may be limited in areas where infrastructure is constrained, resulting in longer walk times to access the BRT service.
Option 3: Light Rail Transit	The travel demand (1684 passengers) on Corridor A is well below the design capacity of between 3,000 and 7,000 pax/hr/dir for Light Rail. Therefore, it is unlikely that Light Rail would provide value for money given construction costs. Significant costs also associated with operation.	Environmental impacts in terms of construction will be significant, particularly within the city core where land and building take will be required. Potentially produces less GHG than private car alternative, though Bus and BRT offers same advantages.	Higher safety rate than car mode due to dedicated infrastructure segregating from other road users. However, Light Rail will have an impact on safety as its route will sever corridors and divide the city core, introducing conflicts at crossings and junctions for cars and active travel users.	Integration with other services and land-use is limited due to the proposed routing location of the Light Rail network along specific direct routes only. The Light Rail (comparable with rail and BRT routes) is unable to penetrate and integrate with the same number of routes as the bus services.	Potentially enhances accessibility. However, access may be limited in areas where infrastructure is constrained, resulting in longer walk times to access services.
Option 4: Suburban Rail	Travel demand on Corridor A (1684 passengers) is significantly below the design capacity of 5,000 pax/hr/dir for Heavy Rail. Heavy Rail on Corridor A would result in significant costs that are associated with the construction, land acquisition and operation of Heavy Rail.	Environmental impacts in terms of construction, particularly within the existing urban footprint and on a designated rail crossing bridge. This construction impact is further emphasised due to the lack of presence of Heavy Rail in this area. Potentially produces less GHG than private car alternative but does not offer any benefits over the other options.	Higher safety rate than car mode due to dedicated infrastructure segregating from other road users. The impact of Heavy Rail on Corridor A will have an impact on safety due to the severance and increased conflicts it would result in if constructed.	Integration with other services and land-use is limited to the proposed routing location of the Heavy Rail network along the corridor. Heavy Rail would require a designated rail crossing across the River Suir to integrate with Plunkett Station.	Enhances accessibility for those living along potential rail routes but has limited flexibility in serving other areas not on the route corridor.

From Table 3.4, "Option 1: Bus Services" is the preferred option for the corridor based on the multi-criteria assessment, providing the most benefits in terms of Economy (return on investment), Environmental Impact and Integration. Bus Rapid Transit is not preferred given that the capacity of the bus-based option can cater for the travel demand on the corridor and provide more flexibility. However, it is acknowledged the bus network could be upgraded to a BRT type service in the future should demand exceed capacity. Travel demand, population and employment densities are below that required for any other alternative public transport measures along the corridor such as Light Rail and Heavy Rail.

3.5.3 Services and Routes

The number of bus routes and frequency of these services were reviewed to meet the target demand in addition to providing sufficient coverage. Table 3.5 below shows an example of the methodology applied in determining potential public transport options to cater for the maximum target demand (between Corridor A and Waterford City Core). It shows that to cater for the target demand 3 bus routes are required, with two running at a 5-minute headway and one at a 30 -minute headway. This would result in a bus service passing from Corridor A into the City Core approximately every 2.5 minutes.

Table 3.5 shows the breakdown of the number of routes by type and frequency of service with the associated carrying capacity by design and carrying capacity utilising standing room (Crush Capacity). This is presented alongside the maximum demand for the service to indicate whether the Option caters for the target demand. For Corridor A, the Design Capacity caters for the target demand. If for any reason there is substantial additional demand, there is additional residual Standing Capacity if required. It is apparent that in general the maximum screen line target demand in Corridor A is of a scale that would require high frequency bus services across multiple routes.

Table 3.5: Option Development to Cater for Maximum Screen line Demand

Max Demand: 1,684 Service Type	Design Capacity	Indicative Public Transport Option
Double Deck Bus	75	2 routes X 5 min frequency
Inter-City Bus	50	1 route X 30 min frequency (Passage East / Crooke)
Design Capacity		**1,900**
Crush Capacity		**2,218**

Slightly lower frequencies could be provided in Corridor A and still meet the required level of capacity. However, this must be balanced against the attractiveness of frequency and the need to form a coherent cross-city network, as detailed in Figure 3-5.

3.5.4 Route Option Alignments

The route option alignments have been developed considering the six principles that underpin the performance of the 'idealised' public transport network presented in Section 3.4.2.

Three main routes were identified to cater for the proposed public transport options. Figure 3-6 illustrates the proposed Public Transport Options for Corridor A, outlining how the options have been developed to align with the six principles as much as feasibly possible.

They broadly serve each of the population settlement of the corridor connecting them to the city centre.

Bus Route 1: Blue

Bus Route 1 has been identified to run from St. Mary's Place along Dunmore Road and onwards to the City Centre via Passage Road and Newtown Road.

Bus Route 2: Dark Blue

Bus Route 2 has been identified to run from Williamstown Road along John's Hill to the City Centre.

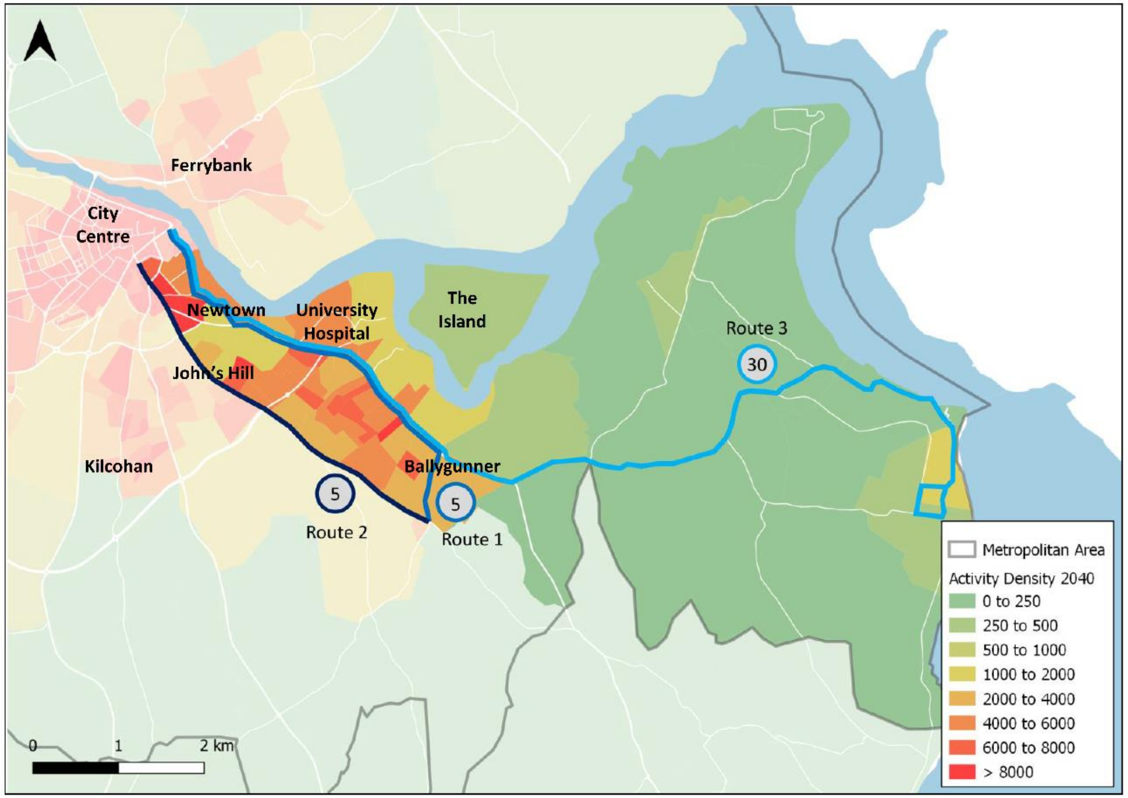
Bus Route 3: Light Blue

Bus Route 3 has been identified to run from Crooke along to Passage East before going onwards to the City Centre via the R683, Dunmore Road, Passage Road and Newtown Road.

3.5.5 Route Option Priority Measures

To achieve high speed, high frequency, reliable public transport services within Corridor A, increased public transport priority and provision is required, above and beyond the existing bus lane provision. The focus of the improvements to public transport speeds and priority will be along the Dunmore Road and Newtown Road from Passage Cross to the City Centre, as well as along the Williamstown Road and John's Hill from Ballygunner to the City Centre.

This priority may be in the form of bus lanes, priority signals or bus gates. Further, more detailed assessments will be required to determine the feasibility of different priority measures and the optimal combination of these measures. The supporting priority measures are illustrated in Figure 3-7.



Guiding Principles Table		
Capacity	The maximum 'idealised demand' (A2-A1) is 1,684 and represents 89% of the service capacity and 76% of the crush capacity.	
Frequency	Bus service passing from Corridor A into City Core every 2.5 minutes approximately.	
Speed	The provision of designated bus infrastructure and bus priority will improve speeds and journey time reliability along Corridor A. There is an existing bus lane inbound along Dunmore Rd and Newtown Rd. Additional bus priority is proposed along Dunmore Rd, Newtown Rd, Williamstown Rd and Upper Grange Rd.	
Coverage	80% of the population and 91% of employment within Corridor A are within the walking catchment of a high frequency bus service. Additional intercity and regional buses will provide additional coverage to the more rural areas of A2.	
Interchange	Interchange opportunities with Southern Orbital from all routes. All routes will also provide interchange at Bus Station. Blue and Light Blue routes also provide an interchange with Plunkett Station.	
Directness	The Blue and Dark Blue routes provide direct radial routes into the city. The Light Blue route provides a connection to Passage East / Crooke and then connects directly to the city.	
Local Route/Service	**Headway**	**Capacity**
Ballygunner-City Centre	5 min	900
Ballygunner-City Centre	5 min	900
Total	**2.5 min**	**1,800**
Regional Route/Service	**Headway**	**Capacity**
Passage East / Crooke-City Centre	30 min	140
Total	**30 min**	**140**

Figure 3-6: Corridor A – Route Alignment Options

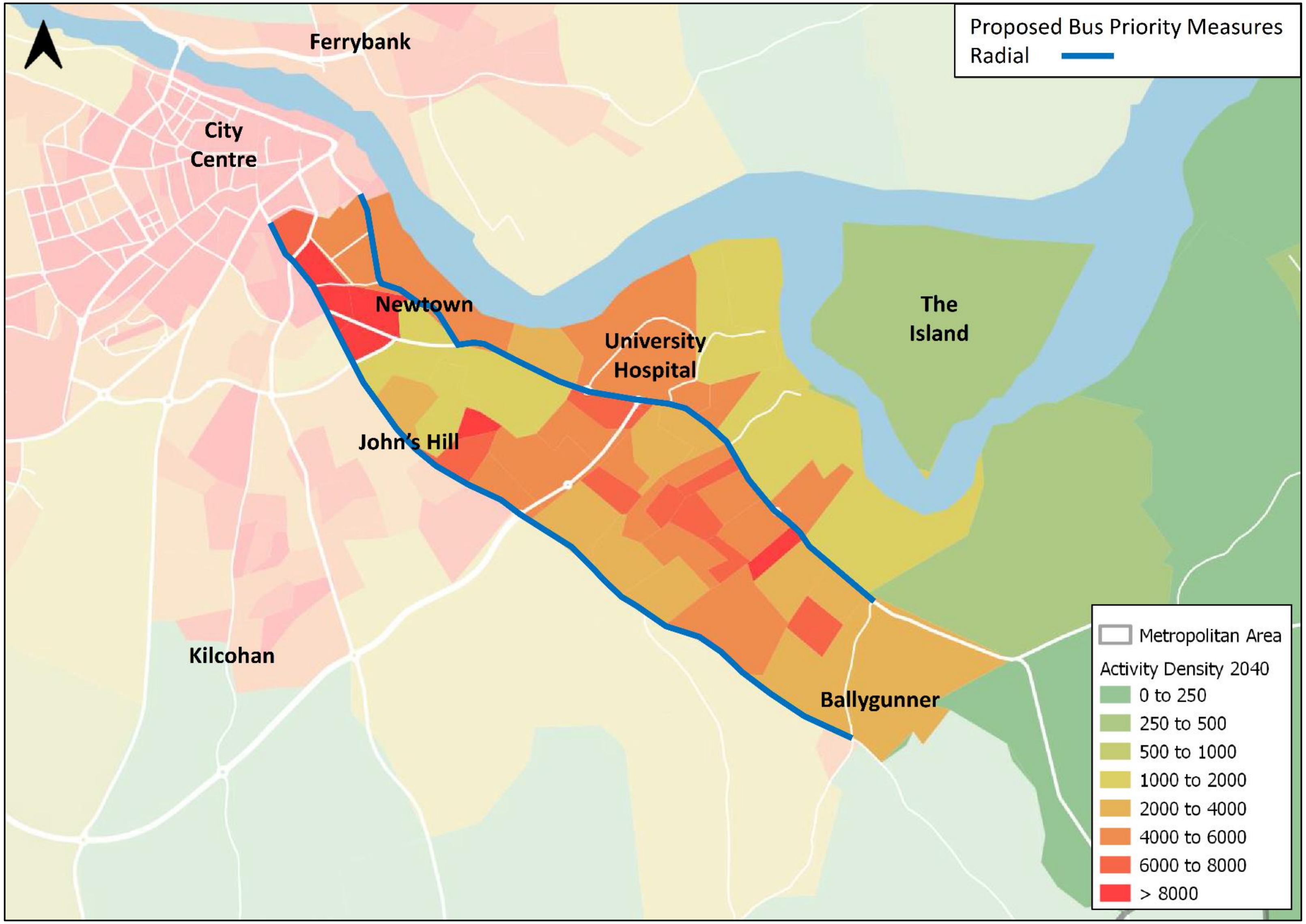


Figure 3-7: Corridor A – Supporting Priority Measures

3.6 Corridor B

3.6.1 Target Demand

Based on the public transport demand identified in the Spider's Web based on the "Idealised" public transport network, the "Target Demand" for Corridor B can be identified. Table 3.6 shows the two-way Corridor B screenline demand on the radial movements, highlighting the largest demand as the "Target Demand" for each movement. The highest demand along Corridor B is 754.

Table 3.6: Identifying Maximum Demand to Develop Public Transport Options

Service Type	Outer Radial (B2 – B1)	Inner Radial (B1 – Core)
Inbound	561	**754**
Outbound	195	365

3.6.2 Common Appraisal Framework (CAF)

Table 3.7 outlines the results of the multi-criteria assessment in line the CAF requirements for Corridor B. The table describes how each of the options compares against each criterion and the cell is colour coded to indicate relative performance.

Table 3.7: Assessment of Alternative Transport Measures for Corridor B

	Economy	Environment	Safety	Integration	Accessibility and Social Inclusion
Option 1: Bus Services	Corridor B generates a demand of 754. The bus capacity demand levels (Figure 3-1) indicates that this demand level can be accommodated within the bus capacity (up to 2,000 pax/hr/dir). With the bus services utilising the existing road infrastructure (with some localised widening) this will make the best use of investment on the current network and could provide a greater return on investment, in terms of the benefit to cost ratio.	A bus-based network on Corridor B will be able to utilise existing road space, reducing the need for significant construction works and reducing any associated environmental impacts. A bus-based network produces less GHG than the private car alternative. Options are also available for different fuel sources.	High frequency bus corridors and priority for bus travel will reduce the volume of cars along the corridor and therefore would likely have a direct impact on the collision rate. The improved bus priority infrastructure on corridors and the utilisation of road space (due to reduced private car volumes) to support segregated active travel modes will further contribute to improved safety across the network.	An improved integrated bus network can connect with residential areas of Kilcohan, Ballytruckle and Killure Road, as well as Waterford Primary Care Centre. The bus services can access wider areas of the city. A high frequency service corridor to city centre can access public transport interchanges - bus station and rail station.	An integrated bus network can improve the accessibility and social inclusion to users and provide access to areas not easily served by more infrastructure intensive modes.
Option 2: Bus Rapid Transit	Demand levels on Corridor B are below the proposed capacity of between 1,000 and 4,000 pax/hr/dir for BRT. Therefore, it is unlikely that BRT would provide value for money, given the construction and operation costs.	The BRT will likely have some impact on the surrounding environment, to accommodate bus priority measures, junction widening and to improve the permeability of the service. Similar to Bus Service Option, this option produces less GHG than private car alternative. Also, BRT options available for different fuel sources.	A high frequency BRT corridors and priority would reduce the likely number of cars in use and therefore would likely reduce the potential accident rate. Similar to the Bus Service option upgraded infrastructure and better use of road space for segregated active travel modes will further contribute to improved safety.	Integration with other services and land-use is limited due to the proposed routing location of the BRT network along the corridor. One direct corridor is likely to be only served by BRT restricting its integration across the wider Corridor B area.	Potentially enhances accessibility. BRT will be restricted to a direct corridor mainly. Access may be limited in areas where infrastructure is constrained, resulting in longer walk times to access services.
Option 3: Light Rail Transit	The travel demand on Corridor B is well below the capacity of between 3,000 and 7,000 pax/hr/dir for Light Rail. Therefore, it is unlikely that Light Rail would provide value for money given construction costs. Significant costs also associated with operation.	Environmental impacts in terms of construction, particularly within the city where significant land take may be required. Potentially produces less GHG than private car alternative, though Bus and BRT offers same advantages.	Higher safety rate than car mode due to dedicated infrastructure segregating from other road users. However Light Rail will have impact on safety as its route will sever corridors and city centre, introducing more conflicts at crossings and junctions for cars and active travel users.	Integration with other services and land-use is limited to the proposed routing location of the Light Rail network along specific corridors. The Light Rail (comparable with rail and BRT routes) is unable to penetrate the same number of routes as a bus.	Potentially enhances accessibility. However, access may be limited in areas where infrastructure is constrained, resulting in longer walk times to access services.
Option 4: Suburban Rail	Travel demand on Corridor B is significantly below the capacity of 5,000 pax/hr/dir for Heavy Rail. Heavy Rail on Corridor B would result in significant costs that are associated with the construction, land acquisition and operation of Heavy Rail.	Environmental impacts in terms of construction, particularly within existing urban footprint and on a designated rail crossing bridge. This construction impact is further emphasised due to the lack of presence of Heavy Rail in this area. Potentially produces less GHG than private car alternative but does not offer any benefits over the other options.	Higher safety rate than car mode due to dedicated infrastructure segregating from other road users. The impact of Heavy Rail on Corridor B will have significant impact on safety due to the severance and increased conflicts it would result in if constructed.	Integration with other services and land-use is limited to the proposed routing location of the Heavy Rail network along the corridor. Heavy Rail would require a designated rail crossing across the River Suir to integrate with Plunkett Station.	Enhances accessibility for those living along potential rail routes but has limited flexibility in serving other areas not on the corridor.

From Table 3.7, “Option 1: Bus Services” is considered to be the preferred option for the corridor based on the multi-criteria assessment, providing the most benefits overall while maximising the economic benefits and cost efficiency. Travel demand, population and employment densities are below that required for any other alternative public transport measures along the corridor such as Bus Rapid Transit, Light Rail and Heavy Rail.

3.6.3 Services and Routes

The number of bus routes and frequency of these services were reviewed to meet the target demand. Table 3.8 below shows an example of the methodology applied in determining potential public transport options to cater for the maximum target demand. It shows that to cater for the target demand 3 bus routes are required, with 2 running at a 10-minute headway and 1 running at a 30-minute headway.

The table shows the breakdown of the number of routes by type and frequency of service with the associated carrying capacity by design and carrying capacity utilising standing room (Crush Capacity). This is presented alongside the maximum demand for the service to indicate whether the Option caters for the target demand. For Corridor B, the Design Capacity caters for the target demand with significant available crush capacity if required.

Table 3.8: Option Development to Cater for Maximum Screenline Demand

Max Demand: 754 Service Type	Design Capacity	Indicative Public Transport Option
Double Deck Bus	75	2 routes X 10 min frequency
Inter-City Bus	50	1 route X 30 min frequency (Dunmore East)
Design Capacity		**1,000**
Crush Capacity		**1,162**

3.6.4 Route Option Alignments

The route option alignments have been developed in line with the six principles that underpin the performance of the ‘idealised’ public transport network presented in Section 3.4.2.

3 main routes were identified to cater for the proposed public transport options. Figure 3-8 illustrates the proposed Public Transport Options, outlining how the options have been developed to align with the six principles as much as feasibly possible.

Bus Route 1: Blue

Bus Route 1 has been identified to run from Killure Road, passing Ballytruckle Road and John Street. It then follows Parnell Street to the City Centre.

Bus Route 2: Dark Blue

Bus Route 2 travels from the Old Tramore Road, through Kilcohan Park, Ballytruckle Road and John Street. The route then continues along Parnell Street to the City Centre.

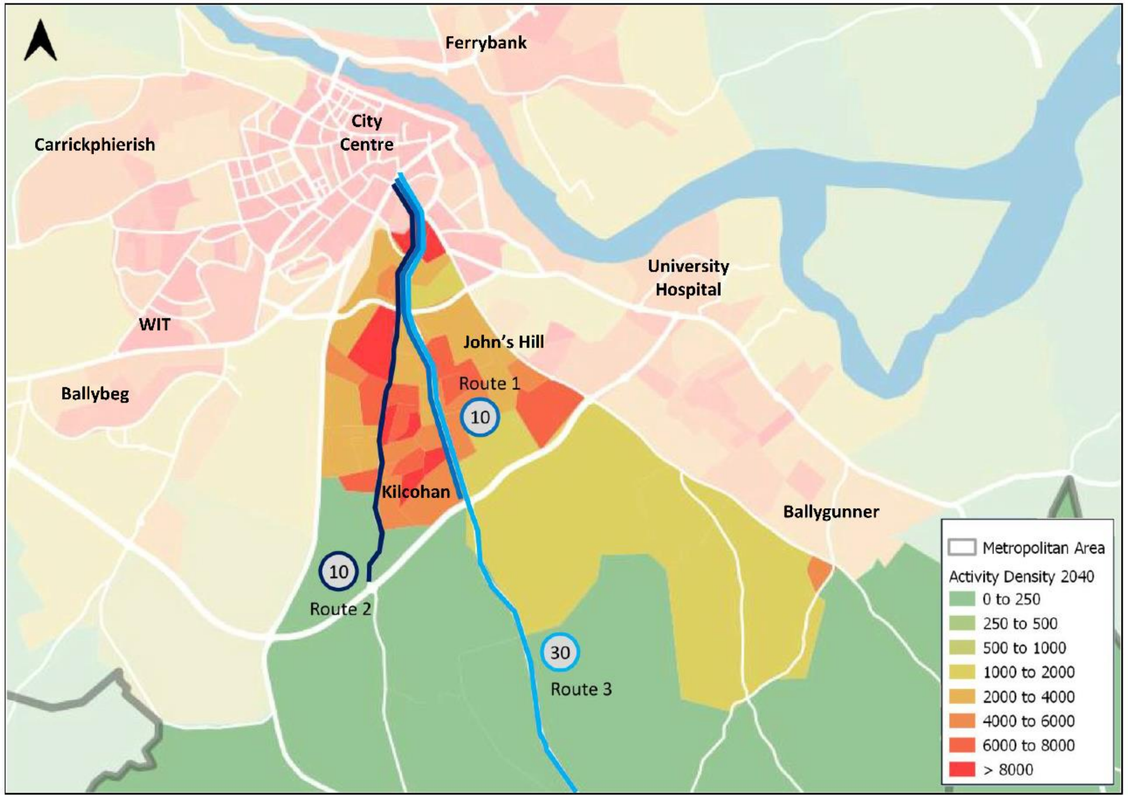
Bus Route 3: Light Blue

Bus Route 3 has been identified to run from Dunmore East, commencing in the town centre and routing along Convent Road and the L4202, before travelling toward the City Centre along the R684. It will then travel along the R708 past Waterford Airport onto Killure Road. It then follows Ballytruckle Road, John Street and Parnell Street to the City Centre.

3.6.5 Route Option Priority Measures

To achieve high speed, high frequency, reliable public transport services within Corridor B, increased public transport priority and provision is required. The focus of the improvements to public transport speeds and priority will be along the Killure Road, Ballytruckle Road from Airport Road Roundabout to the City Centre, as well as along the Old Tramore Road and Kilcohan Park from the Couse Bridge Roundabout to the City Centre.

This priority may be in the form of bus lanes, priority signal or bus gates. All priority measures are indicative and require further detailed modelling and assessment to assess their feasibility and identify the optimal package of measures. The indicative supporting priority measures are illustrated in Figure 3-9.



Guiding Principles Table	
Capacity	The maximum 'idealised demand' (B1-Core) is 754 and represents 75% of the service capacity and 65% of the crush capacity.
Frequency	Bus service passing from Corridor B into City Core every 5 minutes approximately.
Speed	The provision of designated bus infrastructure and bus priority will improve speeds and journey time reliability along Corridor B. Bus priority proposed along Killure Rd, Ballytruckle Rd, John St, Old Tramore Rd and Kilcohan Park.
Coverage	61% of the population and 51% of employment within Corridor B are within the walking catchment of a high frequency bus service. Additional intercity and regional buses will provide additional coverage to the more rural areas of B2.
Interchange	Interchange opportunities between all routes and Southern Orbital. All routes will also provide interchange at Bus Station.
Directness	The Blue and Dark Blue routes provide direct radial routes into the city. The Light Blue route provides a connection to Dunmore East and then connects directly to the city.

Local Route/Service	Headway	Capacity
Old Tramore Road-City Centre	10 min	450
Killure Road-City Centre	10 min	450
Total	**5 min**	**900**
Regional Route/Service	**Headway**	**Capacity**
Dunmore East-City Centre	30 min	140
Total	**30 min**	**140**

Figure 3-8: Corridor B – Route Alignment Options

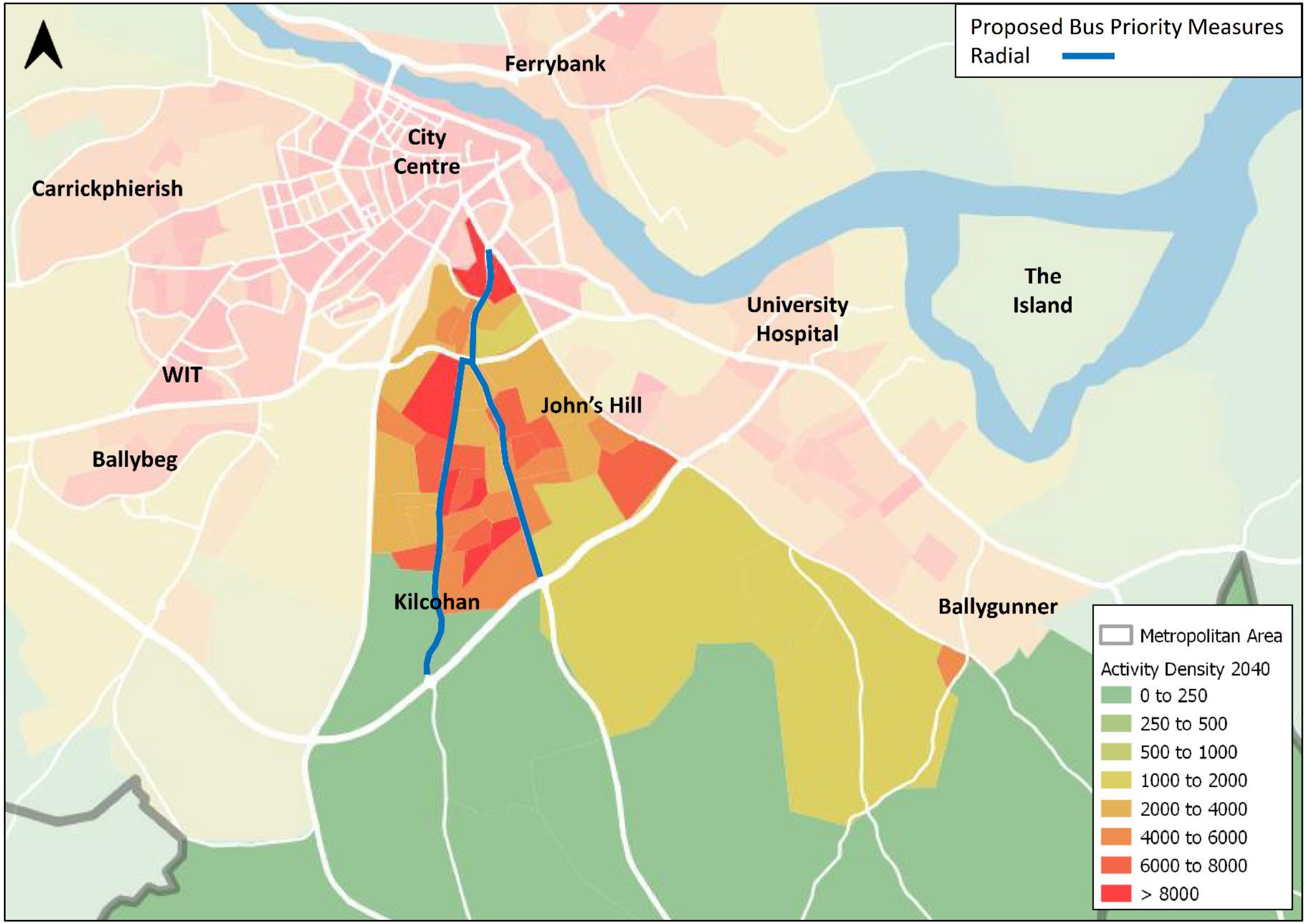


Figure 3-9: Corridor B – Supporting Priority Measures

3.7 Corridor C

3.7.1 Target Demand

Based on the public transport demand identified in the Spider's web based on the "Idealised" public transport network, the "Target Demand" for Corridor C can be identified. Table 3.9 shows the two-way Corridor C screenline demand on the radial movements, highlighting the largest demand as the "Target Demand" for each movement. The highest radial demand in Corridor C is 881 passengers.

Table 3.9: Identifying Maximum Demand to Develop Public Transport Options

Service Type	Outer Radial (C2 – C1)	Inner Radial (C1 – Core)
Inbound	713	622
Outbound	209	**881**

3.7.2 Common Appraisal Framework (CAF)

Table 3.10 outlines the results of the multi-criteria assessment in line the CAF requirements for Corridor C. The table describes how each of the options compares against each criterion and the cell are colour coded to indicate relative performance.

Table 3.10: Assessment of Alternative Transport Measures for Corridor C

	Economy	Environment	Safety	Integration	Accessibility and Social Inclusion
Option 1: Bus Services	The highest demand generated in Corridor C is 881. The bus capacity demand levels (Figure 3-1) indicates that this demand level can be accommodated within the bus capacity (up to 2,000 pax/hr/dir). With the bus corridors utilising the existing road infrastructure (with some localised widening) this will make the best use of investment in the current network and could provide a greater return on investment, in terms of benefit to cost ratio.	Bus-based network on Corridor C will be able to utilise existing road space, reducing the construction impact. Bus-based network produces less GHG than the private car alternative. Options are available for different fuel sources.	High frequency bus corridors and priority for bus travel would reduce the number of cars in use and therefore would likely reduce the potential accident rate. The improved bus priority infrastructure on corridors and the utilisation of road space (due to reduced private car volumes) to support active travel modes will further contribute to improved safety.	Better integrated bus network can connect with Waterford Institute of Technology, Waterford IDA, Boland's Retail Park, Six Crossroads Business Park, as well as residential areas of Ballybeg, Lacken and St. Paul's. Services can access wider areas of the city. Services can access wider areas of the city. A high frequency service corridor with city centre connections and cross-city connections can access bus station, rail station and potential P&R sites.	An integrated bus network can improve the accessibility and social inclusion to users and provide access to areas not easily served by more infrastructure intensive modes
Option 2: Bus Rapid Transit	Demand levels on Corridor C are below the proposed capacity of between 1,000 and 4,000 pax/hr/dir for BRT. Therefore, it is unlikely that BRT would provide value for money, given the construction and operation costs.	BRT will likely have some impact on the surrounding environment, to accommodate bus priority measures and to improve the permeability of the service. Similar to Bus Service Option Produces less GHG than private car alternative. Options available for different fuel sources.	A high frequency BRT corridors and priority would reduce the likely number of cars in use and therefore would likely reduce the potential accident rate. Similar to the Bus Service Option upgraded infrastructure and better use of road space for active travel modes will further contribute to improved safety.	Integration with other services and land-use is limited due to the proposed routing location of the BRT network along the corridor. One direct corridor is likely to be only served by BRT restricting its integration across the wider Corridor C area.	Potentially enhances accessibility. BRT will be restricted to a direct corridor mainly. Access may be limited in areas where infrastructure is constrained, resulting in longer walk times to access services.
Option 3: Light Rail Transit	The travel demand on Corridor C is well below the capacity of between 3,000 and 7,000 pax/hr/dir for Light Rail. Therefore, it is unlikely that Light Rail would provide value for money given construction costs. Significant costs also associated with operation.	Environmental impacts in terms of construction, particularly within the city where significant land take may be required. Potentially produces less GHG than private car alternative, though Bus and BRT offers same advantages.	Higher safety rate than car mode due to dedicated infrastructure segregating from other road users. However Light Rail will have impact on safety as its route will sever corridors and city centre, introducing more conflicts at crossings and junctions for cars and active travel users.	Integration with other services and land-use is limited to the proposed routing location of the Light Rail network along specific corridors. The Light Rail (comparable with rail and BRT routes) is unable to penetrate and integrate with the same number of routes as a bus.	Potentially enhances accessibility. However, access may be limited in areas where infrastructure is constrained, resulting in longer walk times to access services.
Option 4: Suburban Rail	Travel demand on Corridor C is significantly below the capacity of 5,000 pax/hr/dir for Heavy Rail. Heavy Rail on Corridor C would result in significant costs that are associated with the construction, land acquisition and operation of Heavy Rail.	Environmental impacts in terms of construction, particularly within existing urban footprint and on a designated rail crossing bridge. This construction impact is further emphasised due to the lack of presence of Heavy Rail in this area. Potentially produces less GHG than private car alternative but does not offer any benefits over the other options.	Higher safety rate than car mode due to dedicated infrastructure segregating from other road users. The impact of Heavy Rail on Corridor C will have significant impact on safety due to the severance and increased conflicts it would result in if constructed.	Integration with other services and land-use is limited to the proposed routing location of the Heavy Rail network along the corridor. Heavy Rail would require a designated rail crossing across the River Suir to integrate with Plunkett Station.	Enhances accessibility for those living along potential rail routes but has limited flexibility in serving other areas not on the corridor.

From Table 3.10 “Option 1: Bus Services” is considered to be the preferential option for Corridor C based on the multi-criteria assessment, providing the most benefits overall while maximising value for money. Travel demand, population and employment densities are below that required for any other alternative public transport measures along the corridor such as Bus Rapid Transit, Light Rail and Heavy Rail.

3.7.3 Services and Routes

The number of bus routes and frequency of these services were reviewed to meet the target demand. Table 3.11 below shows an example of the methodology applied in determining potential public transport options to cater for the maximum target demand. It shows that to cater for the target demand 6 bus routes are required, with 3 running at a 10-minute headway, 2 running at a 12-minute headway and 1 running at a 15-minute headway.

The table shows the breakdown of the number of routes by type and frequency of service with the associated carrying capacity by design and carrying capacity utilising standing room (Crush Capacity). This is presented alongside the maximum demand for the service to indicate whether the Option caters for the target demand. For Corridor C, the Design Capacity caters for the target demand with significant available crush capacity if required.

Table 3.11: Option Development to Cater for Maximum Screenline Demand

Max Demand: 881 Service Type	Design Capacity	Indicative Public Transport Option
Double Deck Bus	75	3 routes X 10 min frequency 2 routes X 12 min frequency (Tramore) 1 route X 15 min frequency
Design Capacity		**2,400**
Crush Capacity		**2,816**

3.7.4 Route Option Alignments

The route option alignments have been developed in line with the six principles that underpin the performance of the ‘idealised’ public transport network presented in Section 3.4.2. Two main routes were identified to cater for the proposed public transport options. Figure 3-10 illustrates the proposed Public Transport Options, outlining how the options have been developed to align with the six principles as much as feasibly possible.

Bus Route 1: Blue

Bus Route 1 has been identified to run from WIT West Campus, passing Cork Road, Parnell Street and onwards to the City Centre. It will link the City Centre to important employment and education areas at Waterford Industrial Estate, Waterford Institute of Technology and Boland’s Retail Park. This bus route is also considered as part of Corridor D.

Bus Route 2: Dark Blue

Bus Route 2 has been identified to run from the Waterford Retail Park along Kilbarry Road, before travelling along Cork Road and Parnell Street towards the City Centre.

Bus Route 3: Light Blue

Bus Route 3 has been identified to run from Paddy Browne's Road, passing Tycor Road, Keane's Road, Upper Yellow Road, Lower Yellow Road and Ballybricken Green to the City Centre. This bus route is also considered as part of Corridor D.

Bus Route 4: Purple

Bus Route 4 has been identified to run from Whitfield Clinic, passing Cork Road, Ballybeg, Ashe Road, Cannon Road and Barrack Street to the City Centre.

Bus Route 5: Black

Bus Route 5 has been identified to run from Newtown Hill in Tramore, through Tramore Town Centre and continues along the Tramore Road, Manor Street and Parnell Street and onwards to the City Centre.

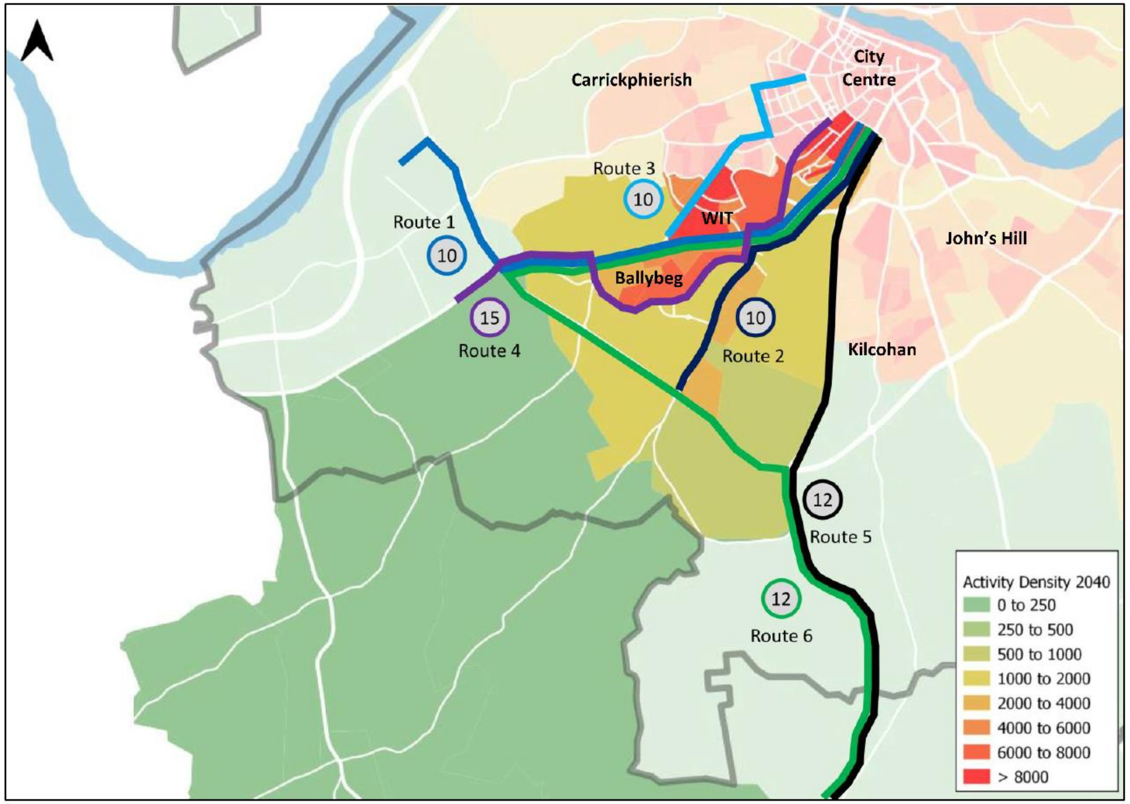
Bus Route 6: Green

Bus Route 6 has been identified to run from Newtown Hill in Tramore, along the Coast Road, Summerhill Rise, Ring Road through Tramore. Route 5 then travel along the Tramore Road, Manor Street and Parnell Street and onwards to the City Centre.

3.7.5 Route Option Priority Measures

To achieve high speed, high frequency, reliable public transport services within Corridor C, increased public transport priority and provision is required. Measures to improve public transport speeds and priority will be put in place on the Cork Road, Manor Street, Kilbarry Road, Ballybeg Drive, Paddy Browne's Road and Ashe Road to the City Centre.

This priority may be in the form of bus lanes, priority signal or bus gates. Further, more detailed assessments will be required to determine the feasibility of different priority measures and the optimal combination of measures. The supporting priority measures are illustrated in Figure 3-11.



Guiding Principles Table	
Capacity	The maximum 'idealised demand' (Core-C1) is 881 and represents 45% of the service capacity and 39% of the crush capacity.
Frequency	Bus service passing from Corridor C into City Core every 1.9 minutes approximately.
Speed	The provision of designated bus infrastructure and bus priority will improve speeds and journey time reliability along Corridor C. Bus priority proposed along Outer Ring Rd, Cork Rd, Manor St, Paddy Browne's Rd, Matties Hill, Kilbarry Rd and Ballybeg Drive.
Coverage	90% of the population and 96% of employment within Corridor C are within the walking catchment of a high frequency bus service. Additional intercity and regional buses will provide additional coverage to the more rural areas of C2.
Interchange	Interchange opportunities with Southern Orbital and all routes. All routes except Purple route will also provide interchange at Bus Station. Blue, Dark Blue and Purple routes also provide interchange with Plunkett Station.
Directness	The Blue, Dark Blue, Light Blue and Purple routes provide direct radial routes into the city. The Black and Green routes provide a connection from Tramore to the city.

Route/Service	Headway	Capacity
WIT West Campus-City Centre	10 min	450
Waterford Retail Park-City Centre	10 min	450
Paddy Browne's Road-City Centre	10 min	450
Whitfield Hospital-City Centre	15 min	300
Tramore-City Centre	12 min	375
Tramore-City Centre	12 min	375
Total	**1.9 min**	**2,400**

Figure 3-10: Corridor C – Route Alignment Options

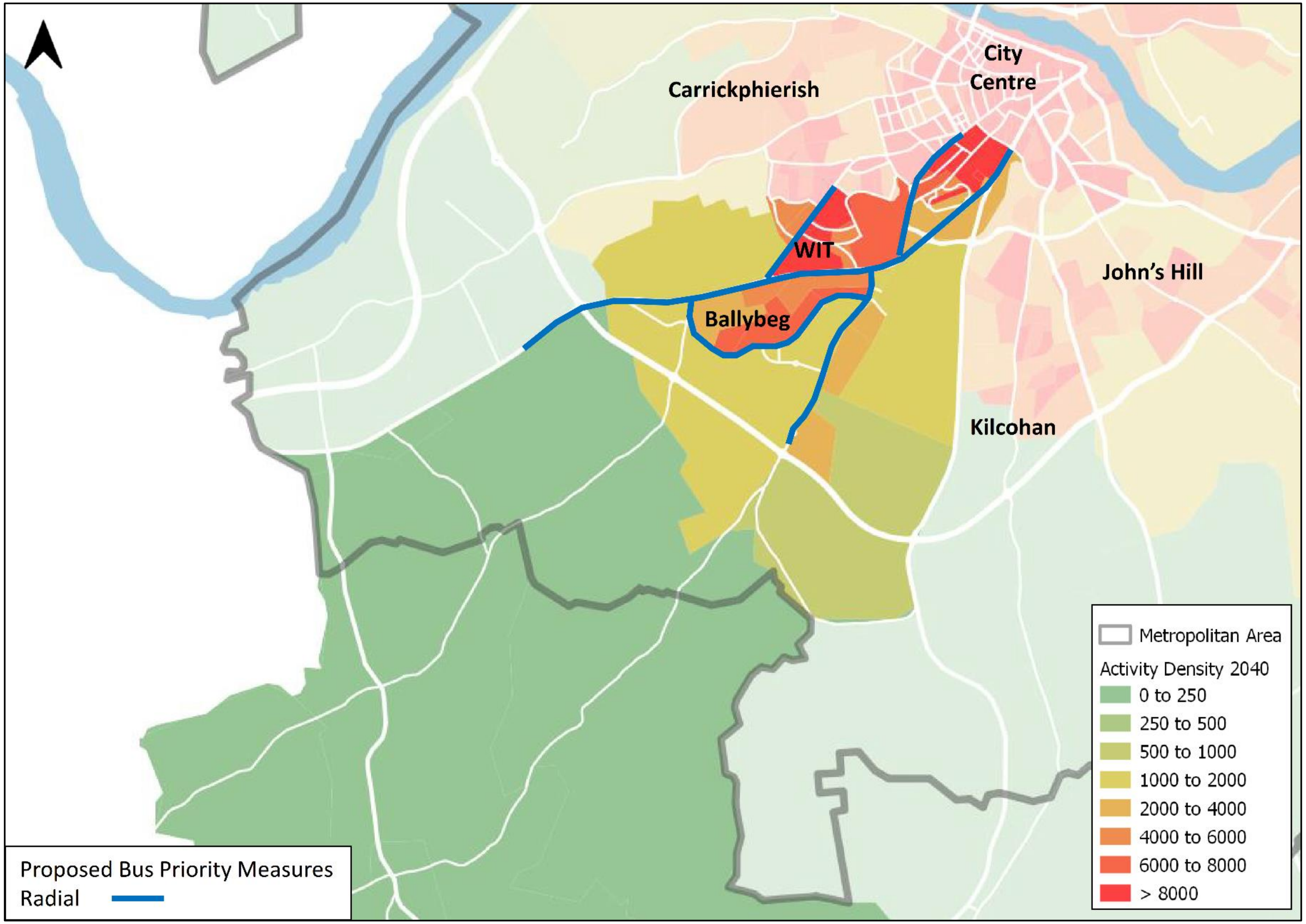


Figure 3-11: Corridor C – Supporting Priority Measures

3.8 Corridor D

3.8.1 Target Demand

Based on the public transport demand identified in the Demand Report based on the "Idealised" public transport network, the "Target Demand" can be identified. Table 3.12 shows the two-way Corridor D screenline demand on the radial movements, highlighting the largest demand as the "Target Demand" for each movement.

Table 3.12: Identifying Maximum Demand to Develop Public Transport Options

Service Type	Inner Radial (D1 – Core)
Inbound	410
Outbound	**1,246**

3.8.2 Common Appraisal Framework (CAF)

Table 3.13 outlines the results of the multi-criteria assessment in line the CAF requirements for Corridor D. The table describes how each of the options compares against each criterion and the cell is colour coded to indicate relative performance.

Table 3.13: Assessment of Alternative Transport Measures for Corridor D

	Economy	Environment	Safety	Integration	Accessibility and Social Inclusion
Option 1: Bus Services	Corridor D generates the demand of 1,246. The bus capacity demand levels (Figure 3-1) indicates that this demand level can be accommodated within the bus capacity (up to 2,000 pax/hr/dir). With the bus corridors utilising the existing road infrastructure (with some localised widening) this will make the best use of investment in the current network and could provide a greater return on investment, in terms of benefit to cost ratio.	Bus-based network on Corridor D will be able to utilise existing road space, reducing the construction impact. Bus-based network produces less GHG than the private car alternative. Options are available for different fuel sources.	High frequency bus corridors and priority for bus travel would reduce the number of cars in use and therefore would likely reduce the potential accident rate. The improved bus priority infrastructure on corridors and the utilisation of road space (due to reduced private car volumes) to support active travel modes will further contribute to improved safety.	Better integrated bus network can connect with WIT West Campus, Waterford IDA and Bilberry Industrial Estate, along with housing estates in Carrickphierish, Gracedieu, Tycor and Lismore Lawn. Bus-based services can access wider areas of the city. Services can access wider areas of the city. A high frequency service corridor with city centre connections and cross-city connections can access bus station, rail station and potential P&R sites.	An integrated bus network can improve the accessibility and social inclusion to users and provide access to areas not easily served by more infrastructure intensive modes
Option 2: Bus Rapid Transit	Given the idealised demand is across several roads/routes, it is unlikely that a BRT would reach the capacity of between 1,000 and 4,000 pax/hr/dir. Though the demand could be accommodated by the BRT. Although the BRT route would mainly utilise the current road highway at this stage of the design the BRT option would provide some return on investment, though it will unlikely provide the same value for money, as the Bus Service Option.	BRT will likely have some impact on the surrounding environment, to accommodate bus priority measures and to improve the permeability of the service. Similar to Bus Service Option Produces less GHG than private car alternative. Also, options available for different fuel sources.	High frequency BRT corridors and priority for bus travel would reduce the number of cars in use and therefore would likely reduce the potential accident rate. Similar to the Bus Service Option, bus priority infrastructure on corridors and the utilisation of road space (due to reduced private car volumes) to support active travel modes will further contribute to improved safety.	Integration with other services and land-use is limited due to the proposed routing location of the BRT network along the corridor. One direct corridor is likely to be only served by BRT restricting its integration across the wider Corridor D area. The BRT (comparable with rail routes) is unable to penetrate and integrate with the same number of routes as a normal bus.	Potentially enhances accessibility. BRT will be restricted to a direct corridor mainly. Access may be limited in areas where infrastructure is constrained, resulting in longer walk times to access services.
Option 3: Light Rail Transit	The travel demand on Corridor D is well below the capacity of between 3,000 and 7,000 pax/hr/dir for Light Rail. Therefore, it is unlikely that Light Rail would provide value for money given construction costs. Significant costs also associated with operation.	Environmental impacts in terms of construction, particularly within the city where significant land take may be required. Potentially produces less GHG than private car alternative, though Bus and BRT offers same advantages.	Higher safety rate than car mode due to dedicated infrastructure segregating from other road users. However Light Rail will have impact on safety as its route will sever corridors and city centre, introducing more conflicts at crossings and junctions for cars and active travel users.	Integration with other services and land-use is limited to the proposed routing location of the Light Rail network along specific corridors. The Light Rail (comparable with rail and BRT routes) is unable to penetrate the same number of routes as a bus.	Potentially enhances accessibility. However, access may be limited in areas where infrastructure is constrained, resulting in longer walk times to access services.
Option 4: Suburban Rail	Travel demand on Corridor D is significantly below the capacity of 5,000 pax/hr/dir for Heavy Rail. Heavy Rail on Corridor D would result in significant costs that are associated with the construction, land acquisition and operation of Heavy Rail.	Environmental impacts in terms of construction, particularly within existing urban footprint and on a designated rail crossing bridge. This construction impact is further emphasised due to the lack of presence of Heavy Rail in this area. Potentially produces less GHG than private car alternative but does not offer any benefits over the other options.	Higher safety rate than car mode due to dedicated infrastructure segregating from other road users. The impact of Heavy Rail on Corridor D will have significant impact on safety due to the severance and increased conflicts it would result in if constructed.	Integration with other services and land-use is limited to the proposed routing location of the Heavy Rail network along the corridor. Heavy Rail would require a designated rail crossing across the River Suir to integrate with Plunkett Station.	Enhances accessibility for those living along potential rail routes but has limited flexibility in serving other areas not on the corridor.

From Table 3.13, "Option 1: Bus Services" is considered to be the preferred options for Corridor D based on the multi-criteria assessment, providing the most benefits overall while maximising value for money. Bus Rapid Transit is not preferred given the capacity of a bus-based options can cater for the travel demand and provide more flexibility. However, the bus network could be upgraded to a BRT type service in the future should demand exceed capacity. Travel demand, population and employment densities are below that required for any other alternative public transport measures along the corridor such as Light Rail and Heavy Rail.

3.8.3 Services and Routes

The number of bus routes and frequency of these services were reviewed to meet the target demand. Table 3.14 below shows an example of the methodology applied in determining potential public transport options to cater for the maximum target demand. It shows that to cater for the target demand 4 bus routes are required, with 3 running at a 10-minute headway and 1 running at a 5-minute headway.

The table shows the breakdown of the number of routes by type and frequency of service with the associated carrying capacity by design and carrying capacity utilising standing room (Crush Capacity). This is presented alongside the maximum demand for the service to indicate whether the Option caters for the target demand. For Corridor D, the Design Capacity easily caters for the target demand. Should there be any additional demand, there is also residual additional Standing Capacity.

Table 3.14: Option Development to Cater for Maximum Screenline Demand

Max Demand: 1,246 Service Type	Design Capacity	Indicative Public Transport Option
Double Deck Bus	75	3 routes X 10 min frequency 1 route x 5 min frequecy
Design Capacity		**2,250**
Crush Capacity		**2,640**

3.8.4 Route Option Alignments

The route option alignments have been developed in line with the six principles that underpin the performance of the 'idealised' public transport network presented in Section 3.4.2.

4 main routes were identified to cater for the proposed public transport options. Figure 3-12 illustrates the proposed Public Transport Options, outlining how the options have been developed to align with the six principles as much as feasibly possible.

Bus Route 1: Blue

Bus Route 1 has been identified to run from WIT West Campus, passing Cork Road, Parnell Street and onwards to the City Centre. It will link the City Centre to important employment and education areas at Waterford Industrial Estate, Waterford Institute of Technology and Boland's Retail Park. This bus route is also considered as part of Corridor C.

Bus Route 2: Dark Blue

Bus Route 2 has been identified to run from Carrickphierish to the City Centre via Gracedieu Road.

Bus Route 3: Light Blue

Bus Route 3 has been identified to run from Paddy Browne's Road, passing Tycor Road, Keane's Road, Upper Yellow Road, Lower Yellow Road and Ballybricken Green to the City Centre. This bus route is also considered as part of Corridor C.

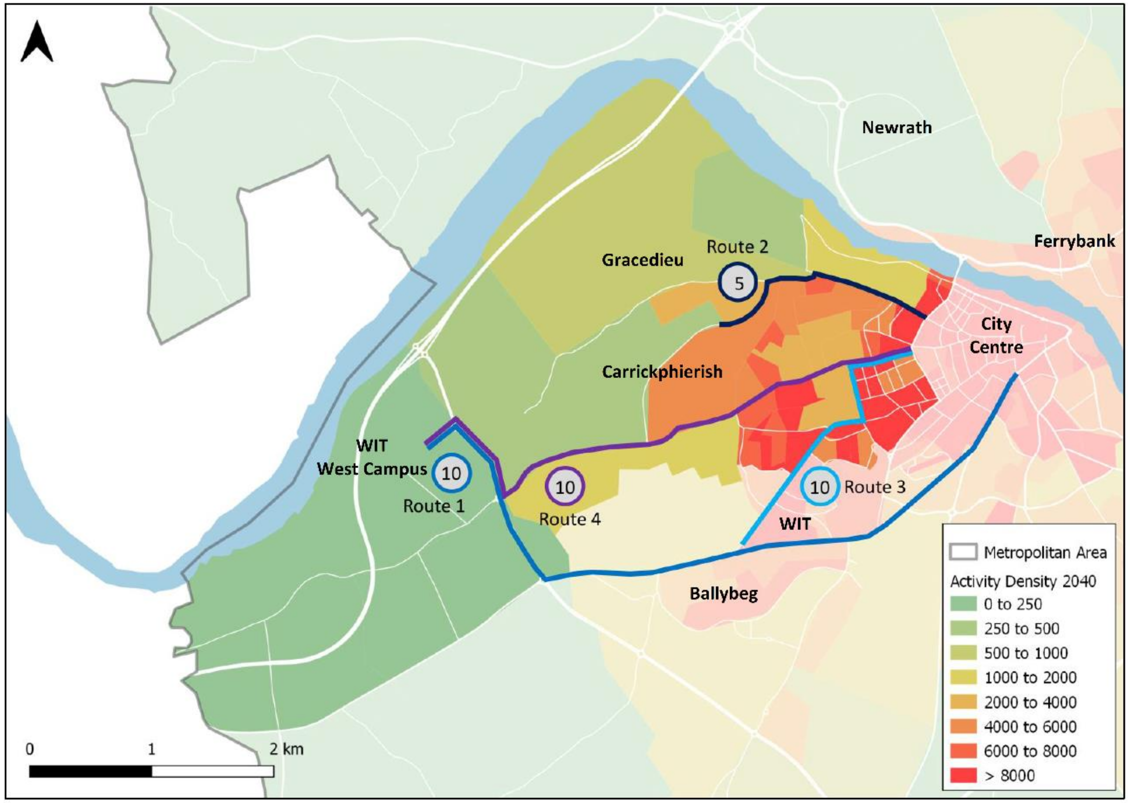
Bus Route 4: Purple

Bus Route 4 is proposed to run from WIT West Campus through Cleaboy Road and Upper Yellow Road. It then routes along Ballybricken Green and onwards to the City Centre.

3.8.5 Route Option Priority Measures

To achieve high speed, high frequency, reliable public transport services within Corridor D, increased public transport priority and provision is required. The focus of the improvements to public transport speeds and priority will be on the Outer Ring Road, Cleaboy Road, Upper Yellow Road, Tycor Road, Slievekeale Road and Knockhouse Road.

This priority may be in the form of bus lanes, priority signal or bus gates. Further, more detailed assessments will be required to determine the feasibility of different priority measures and the optimal combinations of measures. These supporting priority measures are illustrated in Figure 3-13.



Guiding Principles Table	
Capacity	The maximum 'idealised demand' (Core-D1) is 1,246 and represents 69% of the service capacity and 59% of the crush capacity.
Frequency	Bus service passing from Corridor D into City Core every 2 minutes approximately.
Speed	The provision of designated bus infrastructure and bus priority will improve speeds and journey time reliability along Corridor D. Bus priority proposed along Outer Ring Rd, Cleaboy Rd, Upper Yellow Rd, Knockhouse Rd, Gracedieu Rd, Tycor Rd and Slievekeale Rd.
Coverage	97% of the population and 95% of employment within Corridor D are within the walking catchment of a high frequency bus service.
Interchange	Interchange opportunities between Southern Orbital and all routes. All routes will also provide interchange at Bus Station.
Directness	The Blue, Dark Blue, Light Blue, Purple and Black routes provide direct radial routes into the city.

Route/Service	Headway	Capacity
WIT West Campus-City Centre	10 min	450
Carrickphierish-City Centre	5 min	900
Paddy Browne's Road-City Centre	10 min	450
WIT West Campus-City Centre	10 min	450
Total	**2 min**	**2,250**

Figure 3-12: Corridor D – Route Alignment Options

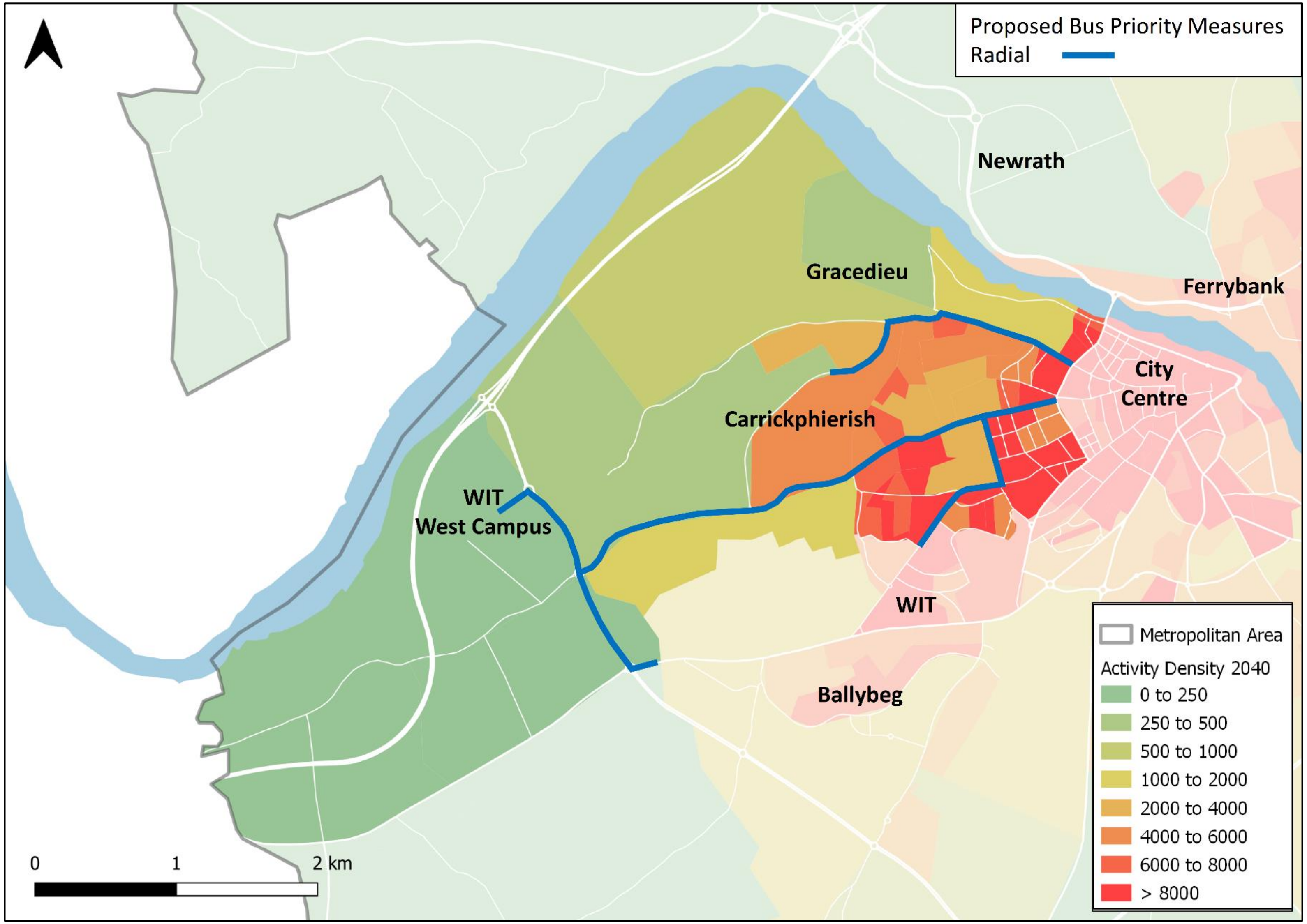


Figure 3-13: Corridor D – Supporting Priority Measures

3.9 Corridor E&F

3.9.1 Target Demand

Based on the public transport demand identified in the Spider's Web based on the "Idealised" public transport network, the "Target Demand" for Corridors E&F can be identified. Table 3.15 shows the two-way Corridor E&F screenline demand on the radial movements, highlighting the largest demand as the "Target Demand" for each movement. The highest radial demand is 860 passengers.

Table 3.15: Identifying Maximum Demand to Develop Public Transport Options

Service Type	Outer Radial (E2 – E1)	Inner Radial (E1 – Core)	Outer Radial (F2 – F1)	Inner Radial (F1 – Core)
Inbound	160	788	124	**860**
Outbound	88	93	381	713

Service Type	Outer Radial (E&F Combined)	Inner Radial (E&F Combined)
Inbound	284	**1,684**
Outbound	469	806

3.9.2 Common Appraisal Framework (CAF)

Table 3.16 outlines the results of the multi-criteria assessment in line the CAF requirements for Corridors E&F. The table describes how each of the options compares against each criterion and the cell is colour coded to indicate relative performance.

Table 3.16: Assessment of Alternative Transport Measures for Corridors E&F

	Economy	Environment	Safety	Integration	Accessibility and Social Inclusion
Option 1: Bus Services	Corridors E&F generates the combined demand of 1,684. The bus capacity demand levels (Figure 3-1) indicates that this demand level can be accommodated within the bus capacity (up to 2,000 pax/hr/dir). With the bus corridors utilising the existing road infrastructure (with some localised widening) this will make the best use of investment in the current network and could provide a greater return on investment, in terms of benefit to cost ratio.	Bus-based network on Corridors E&F will be able to utilise existing road space on, reducing the construction impact. Bus-based network produces less GHG than the private car alternative. Options are available for different fuel sources.	High frequency bus corridors and priority for bus travel on Corridors E&F would reduce the number of cars in use and therefore would likely reduce the potential accident rate. The improved bus priority infrastructure on corridors and the utilisation of road space (due to reduced private car volumes) to support active travel modes will further contribute to improved safety.	Better integrated bus network can connect with Plunkett Station, Belview Port and Slieverue Cross, as well as residential areas in Ferrybank and Mullinabro. Bus-based services can access wider areas of the city. Services can access wider areas of the city. A high frequency service corridor with city centre connections and cross-city connections can access bus station, rail station and potential P&R sites.	An integrated bus network can improve the accessibility and social inclusion to users and provide access to areas not easily served by more infrastructure intensive modes.
Option 2: Bus Rapid Transit	Given the idealised demand is across several roads/routes, it is unlikely that a BRT would reach the capacity of between 1,000 and 4,000 pax/hr/dir. Though the demand could be accommodated by the BRT. Although the BRT route would mainly utilise the current road highway at this stage of the design the BRT option would provide some return on investment, it will unlikely provide the same value for money, as the Bus Service Option.	BRT will likely have some impact on the surrounding environment, to accommodate bus priority measures and to improve the permeability of the service. Similar to Bus Service Option Produces less GHG than private car alternative. Options available for different fuel sources.	High frequency BRT corridors and priority for bus travel would reduce the number of cars in use and therefore would likely reduce the potential accident rate. Similar to the Bus Service Option, bus priority infrastructure on corridors and the utilisation of road space (due to reduced private car volumes) to support active travel modes will further contribute to improved safety.	Integration with other services and land-use is limited due to the proposed routing location of the BRT network along the corridor. One direct corridor is likely to be only served by BRT restricting its integration across the wider Corridor E&F area. The BRT (comparable with rail routes) is unable to penetrate and integrate with the same number of routes as a normal bus.	Potentially enhances accessibility. BRT will be restricted to a direct corridor mainly. Access may be limited in areas where infrastructure is constrained, resulting in longer walk times to access services.
Option 3: Light Rail Transit	The combined travel demand on Corridors E&F are well below the capacity of between 3,000 and 7,000 pax/hr/dir for Light Rail. Therefore, it is unlikely that Light Rail would provide value for money given construction costs. Significant costs also associated with operation.	Environmental impacts in terms of construction, particularly within the city where significant land take may be required. Potentially produces less GHG than private car alternative, though Bus and BRT offers same advantages.	Higher safety rate than car mode due to dedicated infrastructure segregating from other road users. However Light Rail will have impact on safety as its route will sever corridors and city centre, introducing more conflicts at crossings and junctions for cars and active travel users.	Integration with other services and land-use is limited to the proposed routing location of the Light Rail network along specific corridors. The Light Rail (comparable with rail and BRT routes) is unable to penetrate the same number of routes as a bus.	Potentially enhances accessibility. However, access may be limited in areas where infrastructure is constrained, resulting in longer walk times to access services.
Option 4: Suburban Rail	Travel demand on Corridors E&F is significantly below the capacity of 5,000 pax/hr/dir for Heavy Rail. Heavy Rail on Corridors E&F would result in significant costs that are associated with the construction, land acquisition and operation of Heavy Rail.	Environmental impacts in terms of construction, particularly within the existing urban footprint and for a designated rail crossing bridge. This construction impact is even more significant due to the lack of presence of Heavy Rail in this area. This mode will potentially produce less GHG than private car alternative but does not offer any benefits over the other options.	Higher safety rate than car mode due to dedicated infrastructure segregating from other road users. However, the impact of Heavy Rail on Corridors E&F will have significant impact on safety due to the severance and increased conflicts with other modes and movements it would result in if constructed.	Integration with other services and land-use is limited to the proposed routing location of the Heavy Rail network along the corridors. Heavy Rail would require a designated rail crossing across the River Suir to integrate with Plunkett Station.	Enhances accessibility for those living along potential rail routes but has limited flexibility in serving other areas not on the corridor.

From Table 3.16, "Option 1: Bus Services" is considered to be the preferred option based on the multi-criteria assessment, providing the most benefits overall while maximising the economic benefits. The corridor does not have the population or employment density to support a BRT or LRT line, while the creation of additional stations along the existing rail corridor would require substantial investment but would still not improve accessibility as the bus services provides greater coverage and flexibility in accessing the predominantly low-density residential areas in the corridor.

3.9.3 Services and Routes

The transport network for the WMA identifies a high frequency bus service to cater for this area of the network. As such the number of bus routes and frequency of these services were reviewed to meet the target demand. Table 3.17 below shows an example of the methodology applied in determining potential public transport options to cater for the maximum target demand. It shows that to cater for the target demand 4 bus routes are required, with all 4 running at a 10-minute headway.

The table shows the breakdown of the number of routes by type and frequency of service with the associated carrying capacity by design and carrying capacity utilising standing room (Crush Capacity). This is presented alongside the maximum demand for the service to indicate whether or not the Option caters for the target demand. For Corridors E&F, the Design Capacity more than adequately caters for the target demand. For any additional demand, there is residual additional Standing Capacity to accommodate additional passengers. It is apparent that in general the maximum screenline target demand in Corridors E&F is of a scale that would require high frequency bus services across multiple routes.

Table 3.17: Option Development to Cater for Maximum Screenline Demand

Max Demand: 1,684 Service Type	Design Capacity	Indicative Public Transport Option
Double Deck Bus	75	4 routes X 10 min frequency
Design Capacity		**1,800**
Crush Capacity		**2,112**

3.9.4 Route Option Alignments

The route option alignments have been developed in line with the six principles that underpin the performance of the 'idealised' public transport network presented in Section 3.4.2.

Five main routes were identified to cater for the proposed public transport options. Figure 3-14 illustrates the proposed Public Transport Options, outlining how the options have been developed to align with the six principles as much as feasibly possible.

Bus Route 1: Blue

Bus Route 1 has been identified to run from Slieverue Cross to the City Centre via the L3411, Ross Road, Dock Road and across Rice Bridge.

Bus Route 2: Dark Blue

Bus Route 2 has been identified to run from Mullinabro to the City Centre along Rockshire Road, Dock Road and across Rice Bridge.

Bus Route 3: Light Blue

Bus Route 3 has been identified to run from Belview Port, passing the L3412, Newtown Glen, Árd Glas, Dock Road and onwards to the City Centre across the Rice Bridge. This route will link the City Centre to important employment areas at Belview Port.

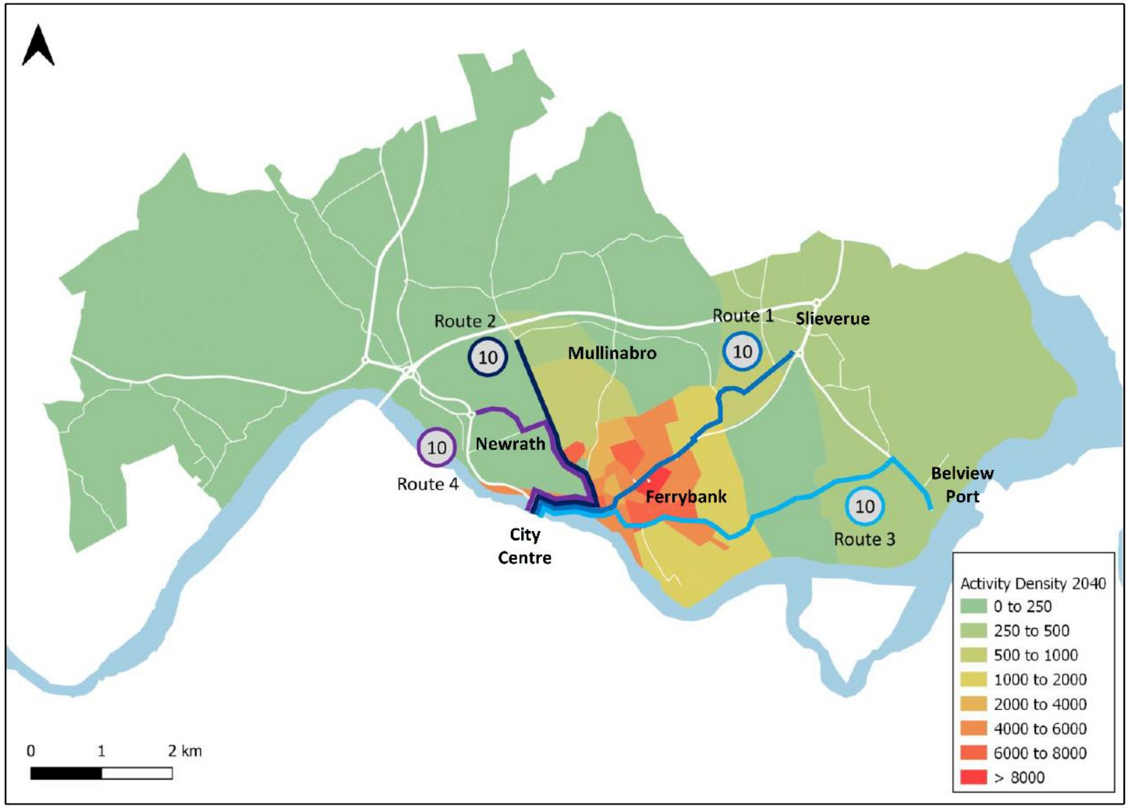
Bus Route 4: Purple

Bus Route 4 has been identified to run from Newrath Cross, travelling through Newrath Road, Rockshire Road, Dock Road and onwards to the City Centre across the Rice Bridge.

3.9.5 Route Option Priority Measures

To achieve high speed, high frequency, reliable public transport services proposed within Corridors E&F, increased public transport priority and provision is required, above and beyond the existing bus lane provision. The focus of the improvements to public transport speeds and priority will be along the L3411, Ross Road, Belmont Road and Dock Road to the City Centre, as well as the N29, L3412, Abbey Road, Newrath Road to the City Centre. Focus will also be on Rice Bridge for the improvements to public transport speeds and priority.

This priority may be in the form of bus lanes, priority signal or bus gates. More detailed assessments will be required to determine the feasibility of different priority measures and the optimal combination of measures. The supporting priority measures are illustrated in Figure 3-15.



Guiding Principles Table	
Capacity	The maximum 'idealised demand' (E1&F1-Core) is 1,648 and represents 92% of the service capacity and 78% of the crush capacity.
Frequency	Bus service passing from Corridor E&F into City Core every 2.5 minutes approximately.
Speed	The provision of designated bus infrastructure and bus priority will improve speeds and journey time reliability along Corridors E&F. Bus priority proposed along Newrath Rd, Rockshire Rd, Ross Rd, Belmont Rd, Fountain St, Dock Rd and Rice Bridge.
Coverage	82% of the population and 59% of employment within Corridors E&F are within the walking catchment of a high frequency bus service.
Interchange	Interchange opportunities at Plunkett Train Station for all routes. All routes except Purple route will also provide interchange at Bus Station.
Directness	The Blue, Dark Blue, Light Blue and Purple routes provide direct radial routes into the city.

Route/Service	Headway	Capacity
Slieverue Cross-City Centre	10 min	450
Mullinabro-City Centre	10 min	450
Belview Port-City Centre	10 min	450
Newrath-City Centre	10 min	450
Total	**2.5 min**	**1,800**

Figure 3-14: Corridor E&F – Route Alignment Options

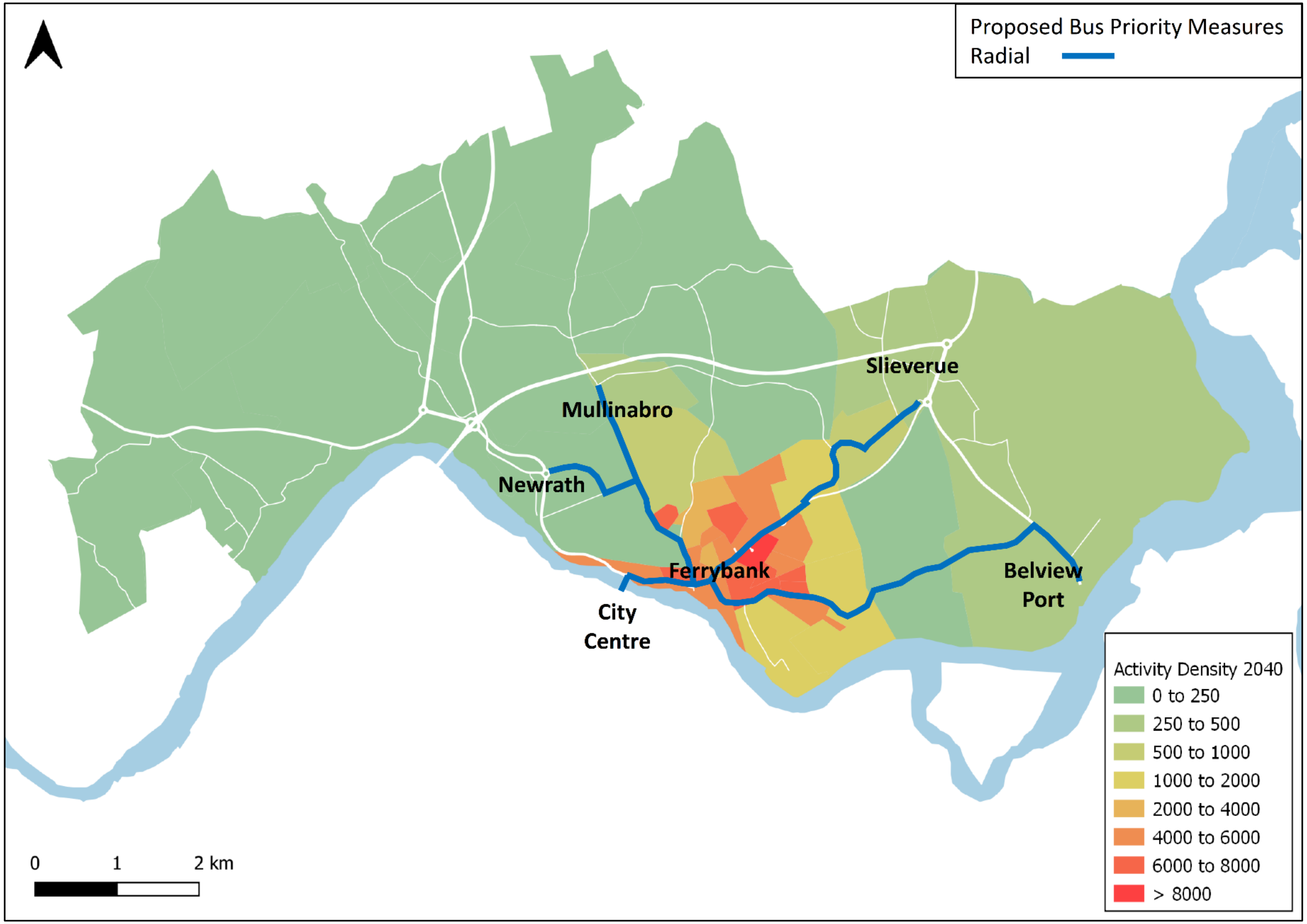


Figure 3-15: Corridor E&F – Supporting Priority Measures

3.10 Orbital Services

3.10.1 Target Demand

Based on the public transport demand identified in the Spider's Web based on the "Idealised" public transport network, the "Target Demand" for orbital movements can be identified. Table 3.18 shows the two-way Orbitals screenline demand on the radial movements, highlighting the largest demand as the "Target Demand" for each movement. The highest orbital demand is 247 on the north of the city between E1 and F1, and 403 on the south of the city between C1 and D1.

Table 3.18: Identifying Maximum Demand to Develop Public Transport Options

Service Type	Orbital North (E1-F1)	Orbital South (A1-B1)	Orbital South (B1-C1)	Orbital South (C1-D1)
Inbound	247	202	319	**403**
Outbound	27	391	199	206

3.10.2 Common Appraisal Framework (CAF)

Table 3.19 outlines the results of the multi-criteria assessment in line the CAF requirements for Orbitals. The table describes how each of the options compares against each criterion and the cell is colour coded to indicate relative performance.

Table 3.19: Assessment of Alternative Transport Measures for Orbitals

	Economy	Environment	Safety	Integration	Accessibility and Social Inclusion
Option 1: Bus Services	The Orbital creates an idealised demand of 403. The bus capacity demand levels (Figure 3-1) indicates that this demand level can be accommodated within the bus design capacity (up to 2,000 pax/hr/dir). With the bus corridors utilising the existing road infrastructure (with some localised widening) this will make the best use of investment in the current network and could provide a greater return on investment, in terms of benefit to cost ratio.	Bus-based network will be able to utilise the existing road network, reducing the overall environmental construction impacts. A high frequency direct orbital route will produce less GHC than private car alternative. Also, opportunities exist for buses with different fuel sources.	High frequency bus corridors and priority for bus travel would reduce the number of cars along the Orbital and therefore would likely have a direct impact on the collision rate. The improved bus priority infrastructure on the Orbital and the utilisations of road space (due to reduced private car volumes) to support segregated active travel modes will further contribute to improved safety.	Better integrated bus network can connect with University Hospital Waterford, WIT, Waterford IDA, as well as residential areas including Ardkeen, Ballytruckle, Ballybeg and Carrickphierish. Bus-based services can access wider areas of the city. A high frequency orbital can access public transport interchanges – bus station, rail station and P&R.	An integrated bus network can improve the accessibility and social inclusion to users and the bus option offers a flexible network that can access most areas, even with network constraints.
Option 2: Bus Rapid Transit	Demand levels on The Orbital are below the proposed capacity of between 1,000 and 4,000 pax/hr/dir for BRT. Therefore, it is unlikely that BRT would provide value for money, based on cost associated.	The environmental impact of the BRT on an orbital route would have some impact due to some localised widening and junction priority improvements. Similar to the bus service option, the BRT travel produces less GHC than a private car alternative. Also, options are available for different fuel sources.	The BRT service if implemented would offer a higher safety rate than car mode due to its dedicated infrastructure segregating from other road users. Also, the BRT service would reduce the volume of private cars on the network this reducing the potential accident rate.	Integration with other services and land-use is limited to the proposed routing location of the BRT along The Orbital. Compared to the bus option there is less flexibility in a BRT service route.	Potentially enhances accessibility. However, access may be limited in areas where infrastructure is constrained, resulting in longer walk times to access services.
Option 3: Light Rail Transit	Travel demand along the Orbitals (403 passengers) is well below the design capacity of between 3,000 and 7,000 pax/hr/dir for Light Rail. It is unlikely that Light Rail would provide value for money given the demand, construction costs and operation costs.	The environmental impact of the LRTon an orbital route would have some impact due the localised widening and junction priority improvements required. It is envisaged on the orbital routes a segregated LRT would utilise a traffic lane. Like the bus and BRT service option, the travel produces less GHC than a private car alternative. Also, options are available for different fuel sources.	Higher safety rate than car mode due to dedicated infrastructure segregating from other road users. However Light Rail will have an impact on safety as its route will server corridors and the city core, introducing more conflicts at exiting accesses, crossings and junctions for cars and active travel users.	Integration with other services and land-use is limited to the proposed routing location of the Light Rail along The Orbital.	Potentially enhances accessibility. However, access may be limited in areas where infrastructure is constrained, resulting in longer walk times to access services.
Option 4: Suburban Rail	Travel demand (403 passengers) is significantly below capacity of 5,000 pax/hr/dir for Heavy Rail. It is unlikely that the construction of orbital rail would be feasible and would have significant construction and operating costs, which are not warranted by demand.	Environmental impacts in terms of construction of new tracks and stations, particularly within existing orbital footprint is significant. Also the connections through the city core and across the River Suir will also have significant environmental impacts Potentially produces less GHC than private transport. Options available for different fuel sources.	Higher safety rate than car mode due to dedicated infrastructure segregating from other road users. The impact of Heavy Rail along The Orbital will have a significant impact on safety due to severance and increased conflicts it would result in if constructed.	Integration with other services and land-use is limited to the proposed corridor of the Heavy Rail.	Enhances accessibility for those living along potential rail routes but has limited flexibility in serving other areas of the corridor.

From Table 3.19, "Option 1: Bus Services" is considered to be the preferred option based on the multi-criteria assessment, providing the most benefits overall while maximising the economic benefits. Bus services allow for one clear orbital route that serves the main employment, education, retail, and residential areas on the south edge of Waterford City. Running these routes as BRT, Light Rail or Heavy Rail would not be feasible due to forecast loadings and cost considerations.

3.10.3 Services and routes

The transport network for the WMA identifies a high frequency bus service to cater for the orbital movements around the City. As such the number of bus routes and frequency of these services were reviewed to meet the target demand. Table 3.20 below shows an example of the methodology applied in determining potential public transport options to cater for the maximum target demand. It shows that to cater for the target just 1 bus route, south of the city is required. Orbital south will run at a 10-minute frequency.

The table shows the breakdown of the number of routes by type and frequency of service with the associated carrying capacity by design and carrying capacity utilising standing room (Crush Capacity). This is presented alongside the maximum demand for the service to indicate whether the Option caters for the target demand. For the orbital route, the Design Capacity is sufficient for the maximum demand outlined and will provide an attractive frequent service.

Table 3.20: Option Development to Cater for Maximum Screenline Demand

Max Demand: 403 Service Type	Design Capacity	Indicative Public Transport Option
Double Deck Bus	75	1 route X 10 min frequency
Design Capacity		**450**
Crush Capacity		**528**

3.10.4 Route Option Alignments

The route option alignments have been developed in line with the six principles that underpin the performance of the 'idealised' public transport network presented in Section 3.4.2.

1 main route was identified to cater for the proposed public transport options. Figure 3-16 illustrates the proposed Public Transport Option, outlining how the option has been developed to align with the six principles as much as feasibly possible.

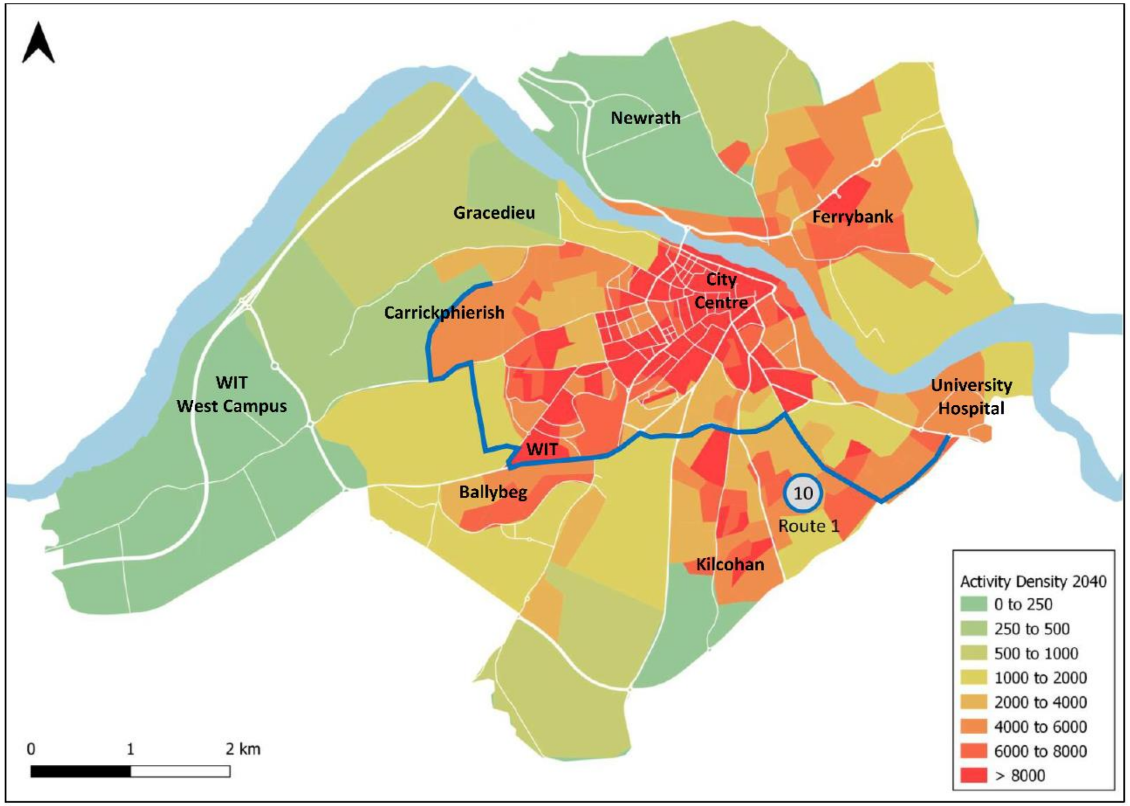
Bus Route 1: Southern Orbital

The Orbital South Route has been identified to run from the University Hospital Waterford along the Cumann na mBan Ring Road and onto Williamstown Road. Here it continues along Upper Grange Road and turns down Richardson's Folly and the Inner Ring Road. The route turns onto the Cork Road briefly and then turns onto Paddy Brown's Road. It turns into the Waterford Business Park and continues along Cleaboy Road. The route turns onto Carrickphierish Road and terminates at Carrickphierish Road. This route serves several important destinations including the University Hospital Waterford, Ardekeen Retail Park, Saint Otteran's Hospital, Kingsmeadow Business Park, Waterford Regional Sports Centre, Waterford Institute of Technology and the Waterford Business Park.

3.10.5 Route Option Priority Measures

To achieve high speed, high frequency, reliable public transport services proposed within the Orbital, increased public transport priority and provision is required. The focus of the improvements to public transport speeds and priority on the Orbital South Route will be on the Outer Ring Road, The Folly, Inner Ring Road, Sunrise Crescent, Industrial Estate and Carrickphierish Road.

This priority may be in the form of bus lanes, priority signal or bus gates. More detailed assessments will be required to determine the feasibility of different priority measures and the optimal combination of measures. The supporting priority measures are illustrated in Figure 3-17.



Guiding Principles Table	
Capacity	The maximum 'idealised demand' (C1-D1) is 403 and represents 90% of the service capacity and 76% of the crush capacity.
Frequency	Bus service passing across Waterford every 10 minutes approximately.
Speed	The provision of designated bus infrastructure and bus priority will improve speeds and journey time reliability along the Orbital. Orbital bus priority proposed along Outer Ring Rd, The Folly, Inner Ring Rd, Sunrise Crescent, Industrial Estate and Carrickphierish Rd. Orbital route will also use radial bus lanes and / or priority proposed along Williamstown Rd, Cork Rd and Cleaboy Rd.
Coverage	A total of 37,403 people and 15,657 jobs are within the walking catchment of the Orbital.
Interchange	The Southern Orbital provides interchange opportunities with all core bus services south of the River Suir.
Directness	The Southern Orbital runs along numerous key road connections which connect to various radial routes.

Route/Service	Headway	Capacity
University Hospital Waterford-Carrickphierish	10 min	450
Total	**10 min**	**450**

Figure 3-16: Orbitals – Route Alignment Options

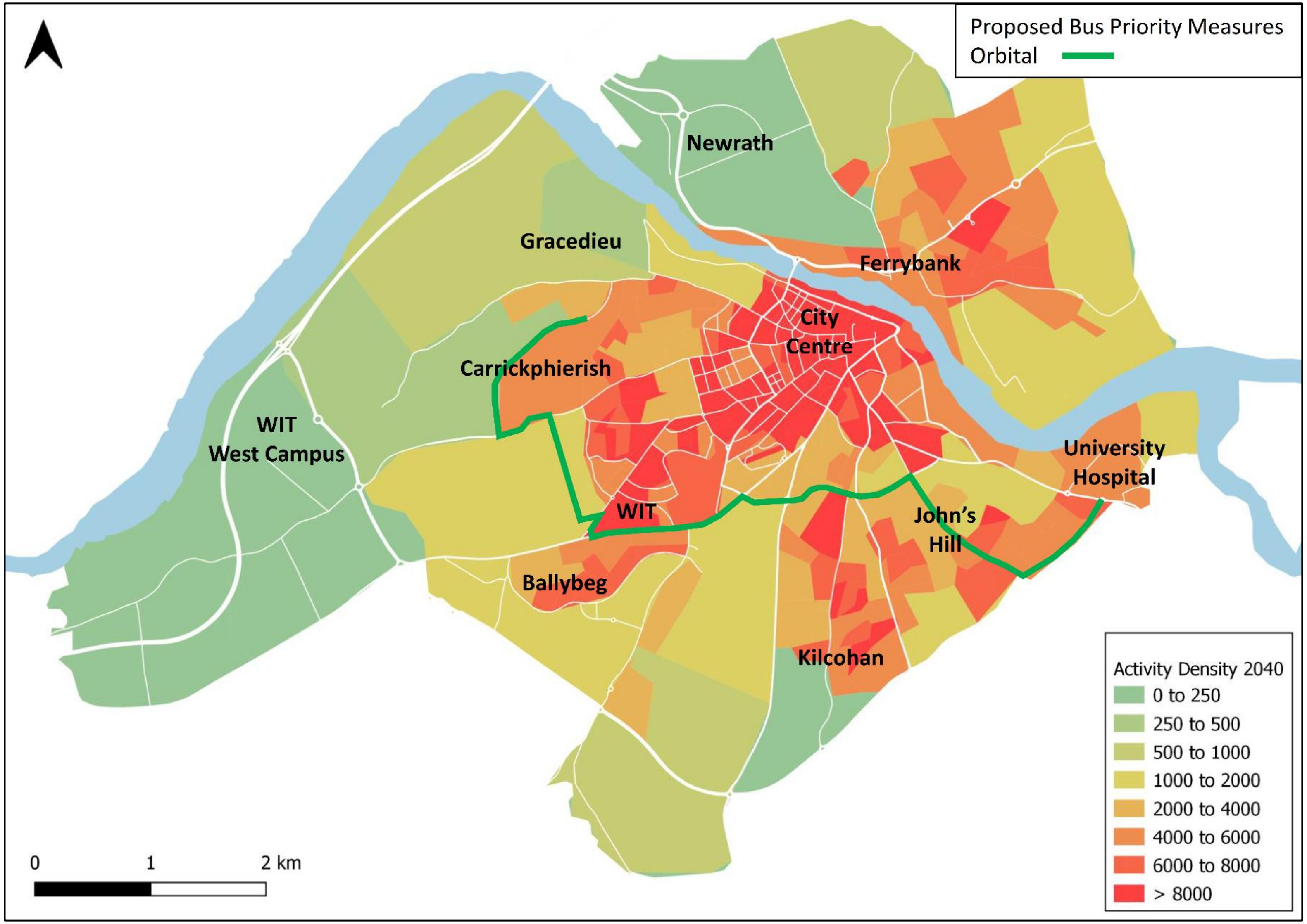


Figure 3-17: Orbitals – Supporting Priority Measures

3.11 Cross City Public Transport Services

3.11.1 Methodology

The Public Transport corridor assessment has developed radial public transport services and applied service frequencies and headways to each radial route. Cross City linkage between these radial routes can help to further increase the efficiency and effectiveness of the public transport routes by widening the catchment of the radial routes and providing connectivity between areas external to the City Centre.

The following outlines the methodology applied in determining the cross-city services, and also the route alignment that is taken through the City Centre:

- Determine cross city public transport demand;
- Identify radial services frequencies;
- Match radial services with high cross city demand and similar service frequencies;
- Identify public transport route entry points to City Centre;
- Target key interchange locations within the City Centre.

3.11.2 Determine Cross City Demand

As outlined in the Demand Analysis Report, and earlier in this report, the two-way cross city demand between the Corridors was determined. This two-way cross city demand is shown in Table 3.21.

Table 3.21 Cross-City 2040 AM Peak Two-way Idealised Demand

Corridor	B	C	D	E	F
A	Orbital	612	416	134	461
B		Orbital	416	51	336
C			Orbital	225	302
D				283	281
E					Orbital

As shown the highest cross city demand is between Corridors A and C. Based on the above table, there are 4 emerging cross city routes:

1. Corridor A to Corridor C;
2. Corridor A to Corridor D;
3. Corridor A to Corridor F; and
4. Corridor B to Corridor D.

Corridor A to C could potentially be served by a reasonable frequency bus service through Ballygunner Road / Parnell Street / Merchant's Quay / The Glen / Barrack Street / Paddy Browne's Road. This route would serve areas of higher densities along both corridors. The remaining demand would be served with an orbital service running east to west of the city.

Corridor A to D could potentially be served by one service utilising Ballygunner Road / Parnell Street / Merchant's Quay / Upper Yellow Road / Cleaboy Road.

The demand to/from Corridors A&F could be served by reasonable frequency bus services travelling through Ballygunner Road / Parnell Street / Merchant's Quay / Rice Bridge / Dock Road. These reasonable frequency bus services would then serve Slieverue Cross and Belview Port.

Corridor B to D could be served by a reasonable frequency bus services through St John's Park / Ballytruckle Road / John Street / Parnell Street / Merchant's Quay / Summerhill / Gracedieu Road.

3.11.3 Matching Cross City Services

To determine the cross city services a route matching exercise was undertaken. This route matching exercise involves identifying proposed public transport services that have a high cross city demand and have similar service frequencies. Figure 3-18 illustrates the results of cross city public transport service matching, with the proposed matched services colour coded on the route map and identified in the matrix to align with the cross-city demand matrix. As shown, the highest cross city demand is served by the higher frequency with lower frequencies between corridors with lower demand. Most cross-city movements will be facilitated by the radial routes shown, or the orbital corridor presented in Figure 3-16.However, there are some movements which will require interchange between services in the City Centre.

3.11.4 Review of Metropolitan Bus Network

The Metropolitan Bus Network will be subject to review within the lifetime of this strategy. While this report outlines the bus network assumed for the purposes of strategy preparation and assessment, it should be noted that it has been informed by forecast travel demand only. In reviewing the existing bus network, proposed changes will require to be informed by several other factors, most notably established travel patterns and operational requirements.

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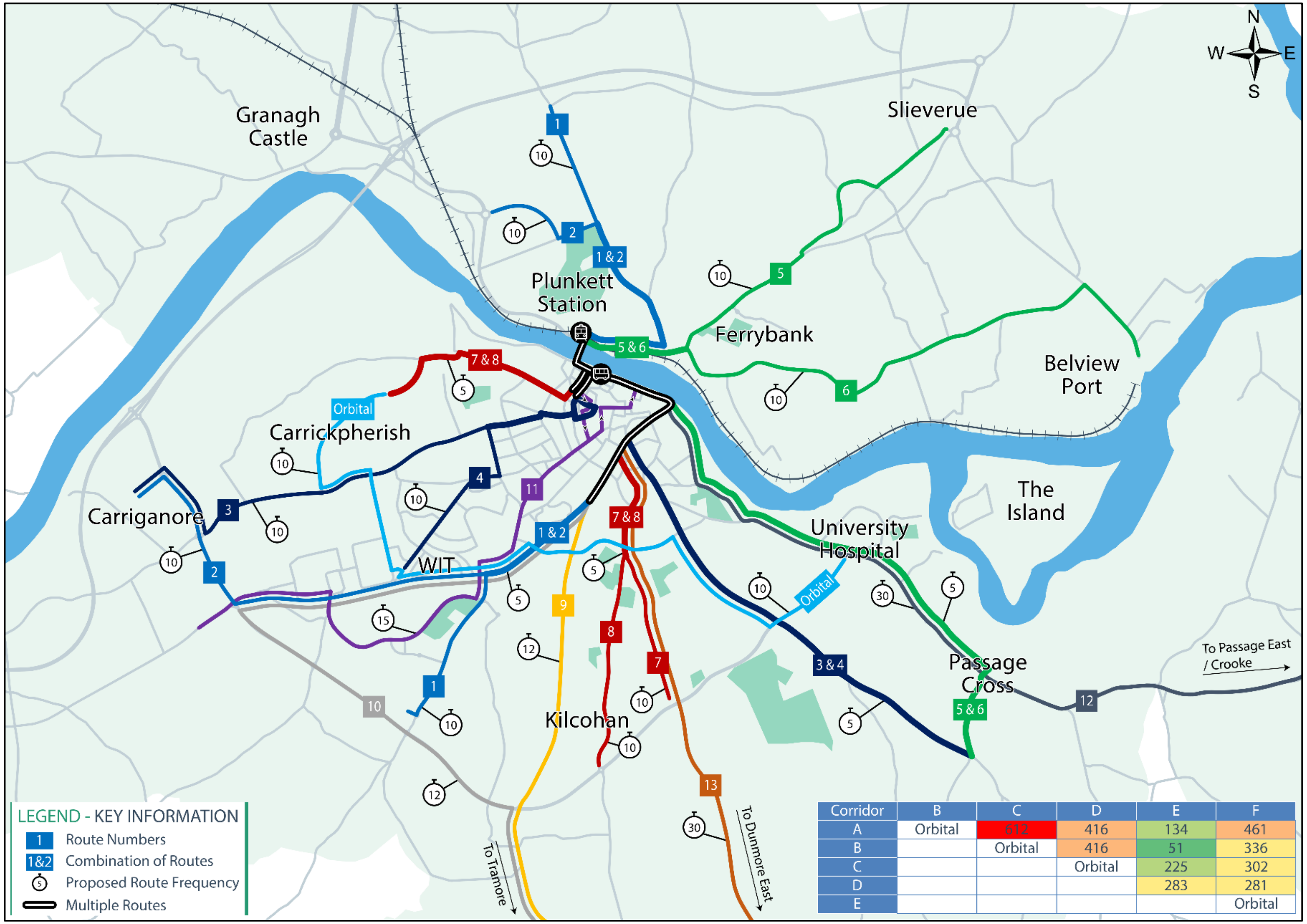

Corridor	B	C	D	E	F
A	Orbital	612	416	134	461
B		Orbital	416	51	336
C			Orbital	225	302
D				283	281
E					Orbital

Figure 3-18: Matching Cross City Demand with Proposed Radial Services

3.11.5 City Centre Bus Routing

There are currently many one-way streets within Waterford City Centre which are dominated by private car. Based on the existing network, proposed buses would be required to divert through this one-way network creating loops and impacting the efficiency and legibility of the proposed bus network, which is highlighted in Figure 3-19 below. There is currently no significant bus priority along these routes which results in considerable delays and impacts journey time reliability for buses. This in turn impacts the attractiveness of the proposed bus network.

Figure 3-19 outlines the routing of the proposed network based on the current configuration of the road network along with the number of proposed bus services per hour on key links in the morning peak.

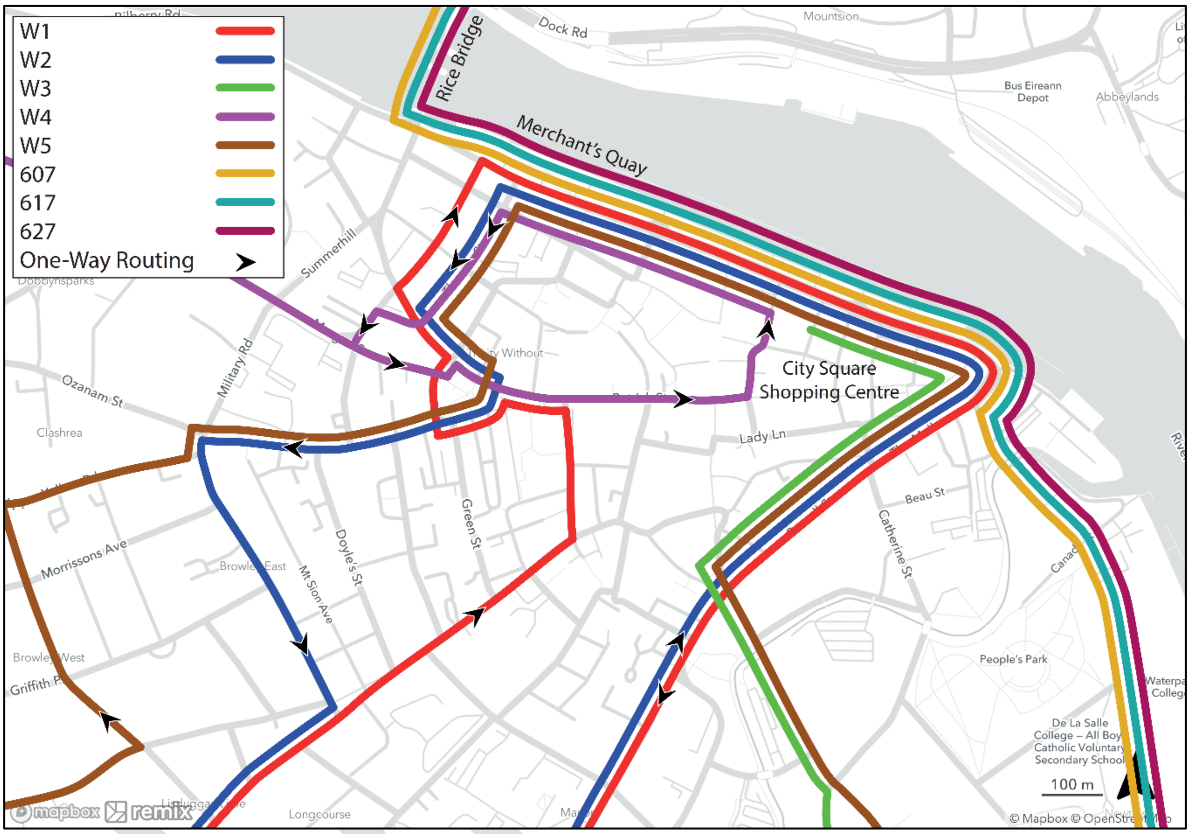

Figure 3-19: Waterford City Centre Bus Routing Existing Network

3.11.6 Proposed City Centre Priority Measures

As the public transport routes converge on Waterford Centre they combine and group into roads and streets approaching the City Centre (Figure 3-21). The following lists the main Gateway entry point streets that are proposed to cater for multiple public transport routes:

- **Merchant's Quay:** 62 buses per hour (AM Peak);
- **Parnell Street:** 46 buses per hour (AM Peak);
- **Manor Street:** 22 buses per hour (AM Peak);
- **Dock Road:** 24 buses per hour (AM Peak).

The objective when considering priority measures within the City Centre was to connect these main gateway points ensuring the principles of the idealised public transport network outlined in Figure 3-5 are adhered to (Capacity, Frequency, Directness, Coverage, Speed and Interchange).

Based on these principles and the proposed bus network several measures are proposed to rationalise the bus network. These measures include removal of one-way bus loops where possible and providing a significant level of bus priority. This priority will be required to ensure the competitiveness of public transport as an attractive alternative to car. The proposed measures are shown in Figure 3-20.

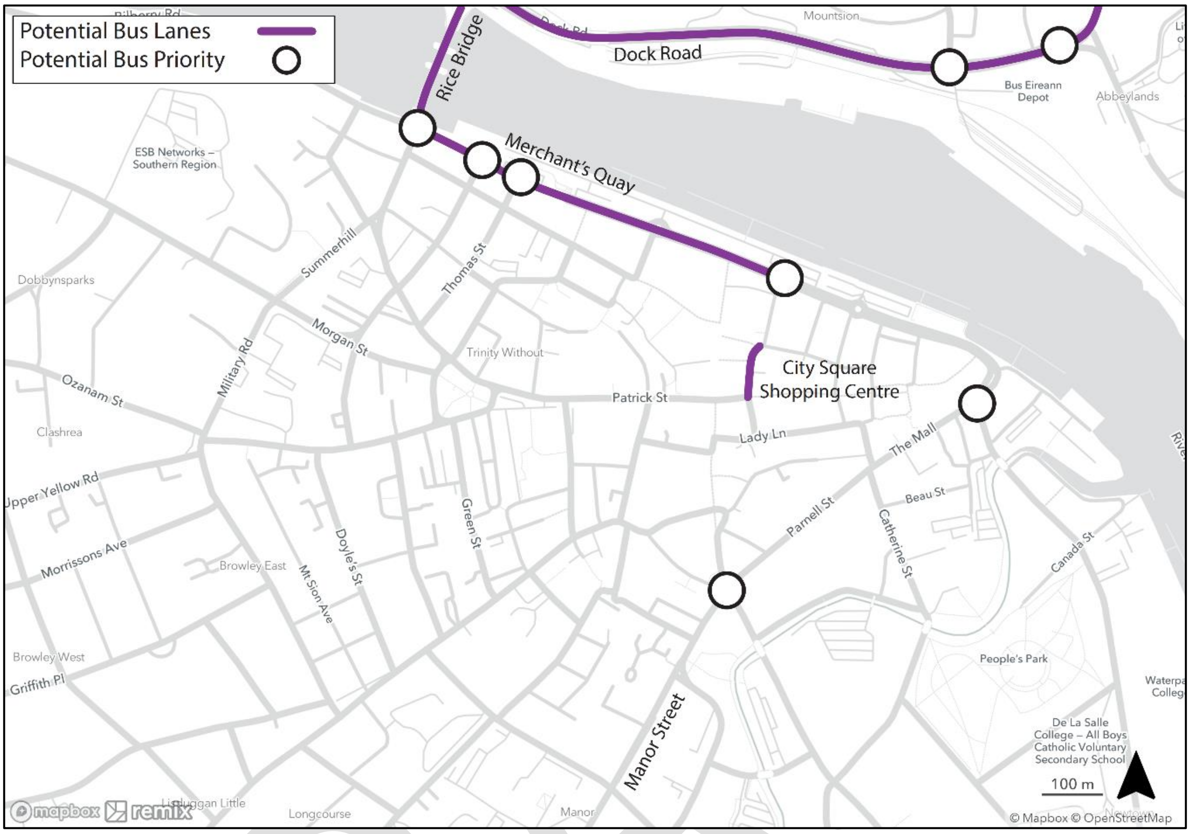

Figure 3-20: Waterford City Centre Measures

With the measures in place the bus network will become more direct and journey time reliability will improve. The proposed route network is shown in Figure 3-21.

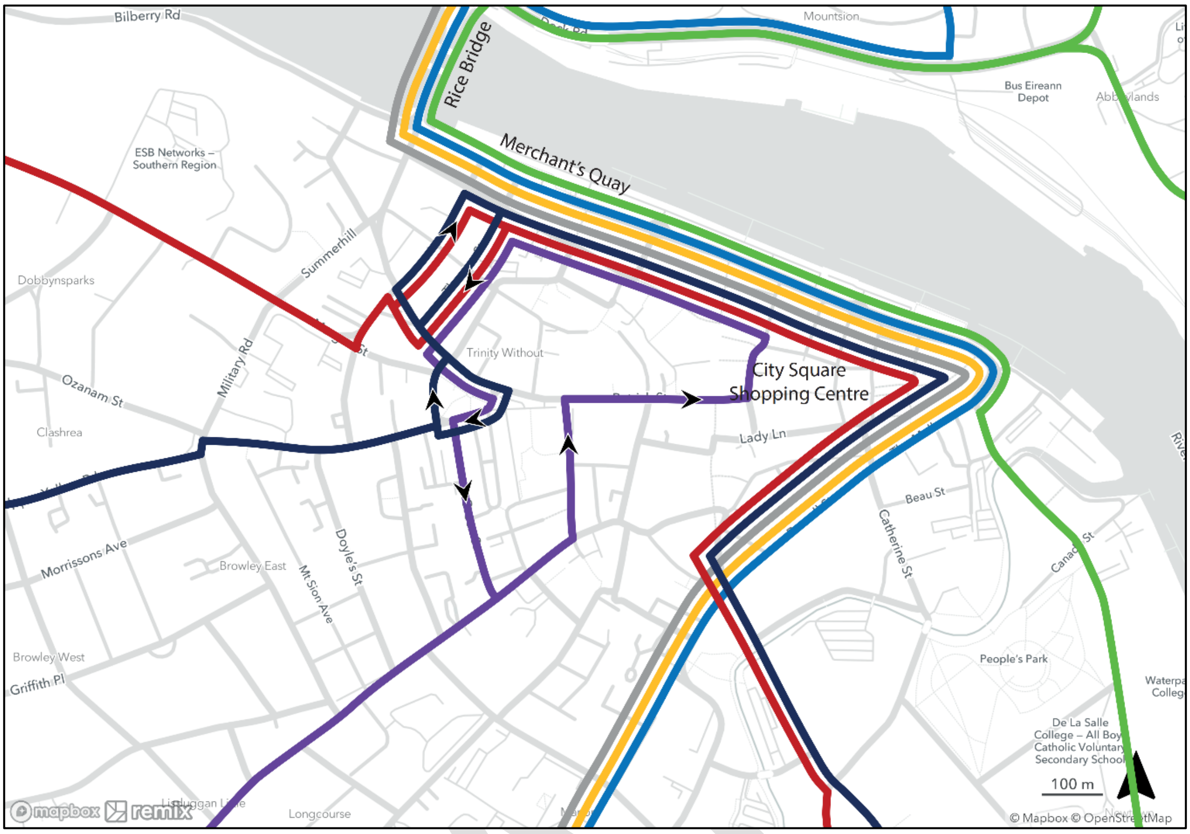

Figure 3-21: Proposed Bus Network Revised City Centre Routing

The proposals outlined are preliminary only and will require significantly more detailed modelling to understand the full impact along with a detailed assessment of traffic management implications. However, it should be recognised that considerable levels of priority will be needed to ensure the proposed public transport is attractive relative to car in order to promote a significant change in car mode share. As part of the implementation of WMATS, it is intended to carry out a comprehensive Waterford City Centre Traffic/Demand Management Study which is intended to determine in detail these matters.

3.12 Park and Ride

3.12.1 Function of Park and Ride

Park and Ride involves providing car parking spaces at public transport nodes and interchanges to provide access to the City Centre and key destinations via public transport with managed secure parking.

Park and Ride as a component of the WMATS is a means of increasing the accessibility of the transport network to a population that might not otherwise access the network through modes such as walking, cycling or public transport transfer from car.

3.12.2 Location of Park and Ride

The location of Park and Ride sites is key to achieving the desired benefits of private car reductions. Park and Ride sites need to be situated where they can provide a competitive advantage versus car-based travel in terms of journey time to destination, security of parking, and cost of parking. Park and Ride sites are proposed at key locations around the periphery of Waterford City within the WMA to widen the catchment and maximise the use of the proposed public transport network. They are located on key strategic corridor routes where public transport provision has the capacity to serve the increased demand at these points.

3.12.3 Proposed Park and Ride Sites

The following lists the proposed Park and Ride sites and the network catchment it is intended to capture:

- **Slieverue Cross:** Slieverue Cross served by one radial bus route with a bus every 10 minutes;
- **Newrath Road:** Newrath Road Park and Ride has been previously proposed in the Waterford Planning Land Use and Transportation Strategy (PLUTS). Newrath Road served by one radial bus route every 15 minutes;
- **Outer Ring Road / Cork Road:** Cork Road served by two radial bus routes. Radial bus service every 5/6 minutes; and
- **Dunmore Road:** Dunmore Road Park and Ride has been previously proposed in the Waterford PLUTS. Dunmore Road served by two radial bus routes with a bus every 5 minutes.

Figure 3-22 illustrates the proposed Park and Ride locations on the proposed public transport network.

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Figure 3-22: Proposed Park & Ride Facilities

4 Walking Network

4.1 General Objectives

The following outlines the general walking network objectives for WMA;

- An increase in walking levels for work, education and leisure across the WMA, particularly for short journeys (less than 2km);
- Addressing the safety issues and barriers that prevent citizens and visitors from walking more in Waterford;
- Supporting a high quality and fully accessible environment for all abilities and ages by continuing to develop a safe, legible and attractive public realm;
- Facilitate the role of walking as part of linked trips, particularly with rail and bus journeys; and
- Promote a far higher standard of urban design in new developments, and in highway design, in a fashion that consistently prioritises pedestrian movement and safety over that of the private car.

To achieve the above outcomes, the following key actions need to be addressed:

- Radial routes to City Centre need improvement;
- Pedestrian priority areas to be expanded, enhanced and de-cluttered;
- Widening and upgrading of footpaths;
- Greater enforcement of parked cars encroaching on footpaths;
- Upgrade walking provision in tandem with bus corridor priority improvements and Cycle Network implementation; and
- Future Land Use:
    - Ensuring that the design and layout for new development provides connectivity to the existing street network and is fully permeable for walking and cycling;
    - Quality of walking routes to public transport stations and stops needs careful consideration and priority;
    - New carriageway layouts and junctions to be consistent with Design Manual for Urban Roads and Streets (DMURS) standards and principles and pedestrian priority across local junctions;
    - No “cul-de sac” design, i.e. ensure filtered permeability (for walking and cycling) is provided as a part of new developments; and
    - Walking accessibility to schools from local catchments, a prime consideration.

4.2 Strategic Routes

The following routes connect residential areas to key areas of employment and third-level education in Waterford City Centre and suburbs. It is envisaged that these will be upgraded in tandem with the provision of the bus priority and enhance the pedestrian (and cycle) network to enable greater levels of walking commuter trips or as part of linked trips with public transport. The strategic routes include:

- **Ashe Road / Cannon Street / Barrack Street:** Former Waterford Crystal site, Presentation Secondary School, Mount Sion Primary School;
- **Carrickphierish Road, Gracedieu Road:** Waterford IDA, ESB Networks;
- **Cleaboy Road / Upper Yellow Road / Morgan Street / Patrick Street:** Waterford IDA, Lismore Heights, Ballybricken through to City Centre;
- **Cork Road:** WIT, Waterford IDA, Boland's Retail Park, Ballybeg;
- **Dock Road:** Connecting Ferrybank through to the City Centre;
- **Dunmore Road:** University Hospital Waterford, King's Channel;
- **Old Tramore Road / Ballytruckle Road:** Kilcohan through to City Centre;
- **Orbital Walking Route:** Morrisson's Road, Military Road, Bridge Street through to City Centre;
- **Passage Road / The Folly / Inner Ring Road:** Newtown, Kingsmeadow Retail Park, Waterford Regional Sports Centre, Cork Road;
- **Upper Grange Road / John's Hill / John Street:** Outer Ring Road through to City Centre;
- **Viking Triangle**;
- **Waterford City Centre:** John Street, Michael Street, Broad Street, Barronstrand Street through to Active Travel Bridge;
- **Waterford Institute of Technology Area:** Paddy Browne's Road / Sunrise Crescent;
- **Deise Greenway**;
- **New Ross Greenway**;
- **Suir Greenway**;
- **Rice Bridge**; and
- **Active Travel Bridge at Clock Tower**.

The proposed strategic walking routes, along with proposed greenways, are shown below in Figure 4-1.

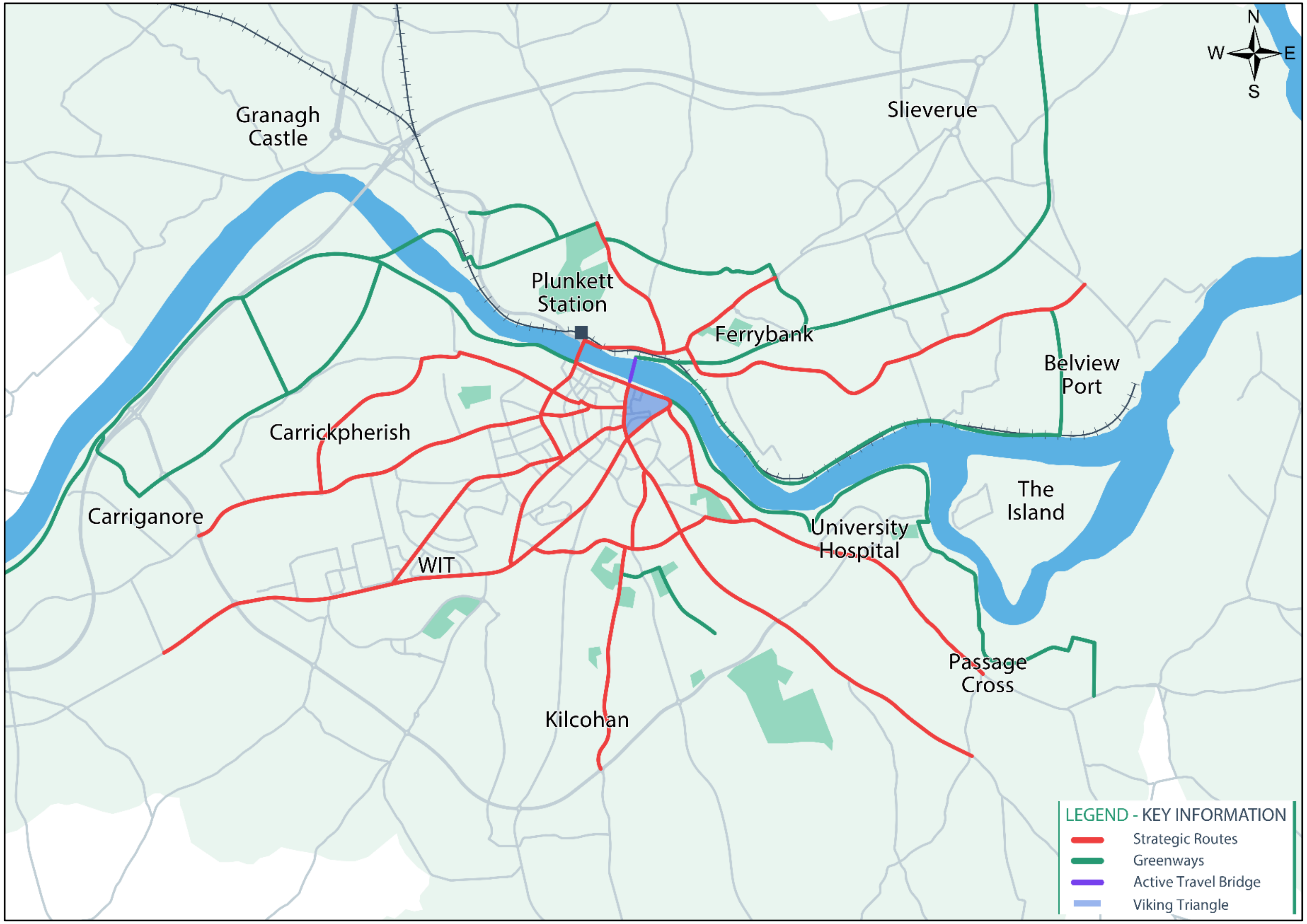

Figure 4-1: Strategic Walking Routes

4.3 City Centre Network

As detailed in Section 6.3.1 a review of the city centre street network is required. This should consider in detail the movement of pedestrians through the city, the widening of footpaths and provision of additional crossing points and shared space where appropriate. There should also be further improvements made to the public realm within the city centre, building on the considerable work done to date by Waterford City and County Council in enhancing public realm, most notably within the Viking Triangle.

Whilst Waterford City Centre's historic core is compact, pedestrian access is inhibited in some areas by a limited number of pedestrian bridges over the River Suir, substandard crossing facilities, wide multi-lane one-way streets and high volumes of vehicular traffic and speeds on approach roads. Waterford City Centre has significant potential to enhance its walkability due to its favourable flat topography and recent public realm improvements including pedestrian priority areas and improved crossing facilities.

Considerable growth within Waterford City Centre is envisaged up to 2040. It is understood that several projects such as the North Quays SDZ will be progressed over the lifetime of the Strategy. These developments will attract increased pedestrian activity across the City meaning that an uplift in the quality of the pedestrian environment is required.

Walkability improvements envisaged for the City Centre over the lifetime of the Strategy include:

- Re-allocation of road space to prioritise pedestrian movement;
- Key junction improvements to prioritise pedestrian connectivity and permeability;
- Matching crossing facilities with pedestrian desire lines;
- Removal of street clutter;
- Improvements to the city-wide wayfinding network;
- Enforcement of illegal parking on footpaths;
- Undertake regular Walkability Audits with a variety of stakeholder groups;
- North Quays SDZ including a new pedestrian/cycle bridge over the River Suir;
- Enhanced connectivity between the City Centre and Plunkett Station; and
- Adequate provision of publicly accessible toilets, lighting and seating.

4.4 Metropolitan Towns

Given the high level of out-commuting experienced in the Metropolitan towns, walking should be promoted as part of linked trips with public transport. The pedestrian environment around bus stops should be improved in Tramore, Dunmore East, Passage East and other metropolitan town and village centres. These will be undertaken using the Area Based Transport Assessment (ABTA) methodology published by the NTA and TII, in tandem with land use proposals that consolidate village centres, strengthen their place function and reduce the ribbon-development patterns evident in villages like Tramore and Passage East/Crooke. LAP objectives for the pedestrian environment for Ferrybank are supported by WMATS.

4.4.1 Ferrybank

Ferrybank is located north of Waterford City, as highlighted in Figure 3-2. Ferrybank is a major commercial and residential area in the WMA, with Belview Port and Grannagh Business Complex present. Ferrybank currently lacks formal and informal public spaces to create a focal point within the area. The focus will be on improving the sense of place in Ferrybank, through the creation of an

"Urban Village" along the Belmont/Ross Road. This "Urban Village" will be further improved with the potential construction of the Ferrybank Relief Road.

Ferrybank is disconnected from Waterford City Centre, due to the lack of river crossings. Currently, Rice Bridge is the only access point between Ferrybank and the City Centre. The creation of a Sustainable Transport Bridge as part of the North Quays SDZ, along with the potential creation of a Downstream River Crossing in the Maypark area will improve this connectivity between Ferrybank and the City Centre.

4.4.2 Passage East / Crooke

Passage East / Crooke is located to the east of Waterford City, along the R683 as shown in Figure 3-2. There appears to be a disconnect between Passage East and Crooke, as Passage East is a mixture of commercial and housing, while Crooke is predominantly housing. The pedestrian environment between Passage East and Crooke is challenging due to the distance between both settlements. There is an approximate distance of 1km between Passage East and Crooke, with no footpath present along the L4076. The focus should be on strengthening the village centre connection between Passage East and Crooke.

4.4.3 Tramore

Tramore is located south of Waterford City, along the R675 as portrayed in Figure 3-2. Although Tramore is located outside of the WMA, it is of importance to the WMA based on its population and proximity to Waterford City. Tramore is a major tourist destination within Waterford due to Tramore Beach and the Tramore Amusement Park. Tramore has a compact town centre; however, the pedestrian environment is of mixed quality and car dominated. The focus should be on improving the connections between the housing estates and the town centre, as well as improving the connection between Tramore and Waterford City Centre.

4.5 Universal Design Walkability Audit Toolkit for Roads and Streets

The NTA's *Universal Design Walkability Toolkit for Roads and Streets* was developed as a collaboration between the NTA, Age Friendly Ireland, Green-Schools and the National Disability Authority's Centre for Excellence in Universal Design. This Audit was created to help check that neighbourhoods and streets are places where people of all ages and abilities can walk safely, conveniently and independently. To check all the above, the Audit can be used to capture the existing conditions of a specified walking route in relation to its 'Walkability'. Walkability is the extent to which the built environment is supportive of pedestrians living, shopping, visiting, engaging with or spending time in an area.

The Audit is intended to be undertaken by a wide range of people of various ages and abilities, as well as Local Authority officers. The outcomes of the Audit would then be compiled and analysed to determine whether improvements should be made to the study area.

4.6 School Streets

"School Streets" are becoming an attractive solution to providing active travel to schools. A "School Street" is a road outside of a school that implements temporary restrictions on motorised traffic at school drop-off and pick-up times. These restrictions apply to school traffic and through traffic, which create a safer, calmer space for children, parents and residents to walk or cycle to school. "School Streets" also result in a reduction of air pollution, poor health and road dangers. Residents would still have access to their homes during these times.

The Strategy will support the implementation of "School Streets" initiatives through the WMA.

4.7 Age Friendly Towns

Changes to age-profiles of the WMA will require that the public realm and transport network will need to adapt to consider the needs of older people, those with mobility, visual or hearing impairments and those with buggies.

Improvements include further re-allocation of road space in favour of pedestrians in the city and town centres, quayside areas, matching crossing facilities with pedestrian desire lines and re-timing of signals to reduce pedestrian wait times.

4.8 Amenity Routes

Amenity routes provide a linkage between and improve access to areas of public open space and recreational amenities.

Local amenity routes normally cater for both pedestrians and cyclists. Minimising conflict between pedestrians and cyclists will become a more pressing concern as the popularity of these areas increases. Where full segregation between pedestrian and cyclist movement is not possible, site-specific interventions including traffic calming of adjacent residential streets, low level bicycle rumble strips and considerate walking and cycling campaigns to reduce conflict may be appropriate. Shared pavements for pedestrians and cyclists are often not an appropriate response and cause conflict between a range of users, particularly in a constrained environment.

Waterford's waterfront location combined with its greenways and many green spaces offers considerable opportunities to create green-blue corridors throughout the city and suburbs connecting these areas. The benefits of green-blue corridors are multi-faceted including:

- Promote positive health and wellbeing;
- Improve air quality;
- Protect and increase urban biodiversity;
- Enhance access to nature; and
- Contribute to flood management.

4.9 Wayfinding

Lack of awareness of routes and distances to destinations can be a barrier to walking, not only for tourists or visitors, but also for those with autism or dementia.

Wayfinding can address these issues through creating information systems that can guide people through a physical environment. Examples of wayfinding include the development of signage and information systems for both pedestrians and motorists. Comprehensive wayfinding information systems often combine signage, maps, symbols, colours and other communications. These signs can allow people to create "mental maps" of their terrain and simplify their routes. These information systems can enhance an individual understanding and experience of each destination in the WMA.

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4.10 Improved Permeability

A permeable street network is a key component of supporting more walkable environments. Much of the residential development layout across the WMA in recent decades has favoured impermeable, cul-de-sac layouts leading to circuitous routes to local services, schools and public transport stops.

Measures to improve permeability for pedestrians include:

- Opening walled boundaries/cul-de-sacs;
- Traffic filters to restrict rat-running by vehicles whilst allowing pedestrians and cyclists to pass through. Lower traffic volumes allow for social and leisure uses of the street, including as play spaces for children;
- DIY Streets encourage communities to redesign their owns streets affordably in a way that puts people, safety and street-life first. This concept aims to make streets less car dominated, and more community focussed, making them safer and more attractive places to live;
- Requiring quality design and pedestrian accessibility audits in planning applications for new residential areas;
- Provision of pedestrian and cycle crossings to link areas that are separated by roads or other physical barriers; and
- Planning and design that ensures accessibility for persons with mobility challenges.

The NTA's *Permeability Best Practice Guide* is available to assist local authorities and other organisations in tackling the issues that impact on permeability providing a basis for addressing the legacy of severance.

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5 Cycling Network

The proposed cycle network for the WMATS is based on the draft Cycle Network Plan for Waterford City and Environs 2014. Additional cycle links have been proposed to align with the WMATS proposed transport networks.

5.1 Cycle Network Plan for Waterford City and Environs 2014

The Cycle Network Plan for Waterford City and Environs set out the envisaged cycling network for the Waterford Metropolitan Area (WMA) and forms the basis of funding and delivery of the cycle network. The study is an important component in Waterford City and County Council's vision of developing a cycling culture within the WMA.

The proposed network has been developed based on all the following:

- National Cycle Manual requirements and guidelines for cycle network;
- Regional and local policies as well as proposed and committed schemes;
- Agreed targets of modal share;
- Comprehensive cycling trip demand analysis using data from the Central Statistics Office, POWSCAR and available traffic count surveys;
- Journey times comparison analysis; and
- Evaluation of the existing cycling facilities and quality of the service.

Key priorities for development of the Cycle Network Plan include:

- Identify a cycle network that provides continuous and coherent routes between the main trip generators and attractors;
- Achieve a quality-of-service level B or greater in each primary corridor;
- Achieve a quality-of-service level B and no less than a level C of service in secondary routes;
- Provide a quality-of-service B in feeder routes.

The proposed network for Waterford city and suburbs is illustrated in Figure 5-1. This includes the routes included in the Cycle Network Plan along with some refinements and additional links, particularly in the City Centre to align with the proposed city centre public transport proposals.

5.1.1 Primary Network

Primary routes have been designated as such because they are intended to cater for the highest level of demand. These routes are supplemented by secondary routes which may provide access to residential catchments.

5.1.2 Secondary Network

Secondary routes will have the function of linking between principal cycling routes on the Primary network and zones, such as residential and zones with schools and amenities.

5.1.3 Feeder Network

The Feeder Network has been developed to indicate possible connections from residential and employment areas to the Primary and Secondary cycle networks across the city. In this instance, it was sought to designate the routes with least possible traffic conflicts while maintaining the importance of direct and convenient access.

5.1.4 Greenways

A greenway network for completely (or almost) traffic free cycling has been proposed. This has been developed based on a considerable existing network of greenway routes, the upgrade of existing paths to provide a comprehensive greenway route network and the use of disused existing railway lines.

5.1.5 Filtered Permeability

In addition to the dedicated cycle route types listed above, provision of filtered permeability measures will be pursued in existing and new residential developments. This filtered permeability aims to improve linkages at the local level for walking and cycling throughout the city.

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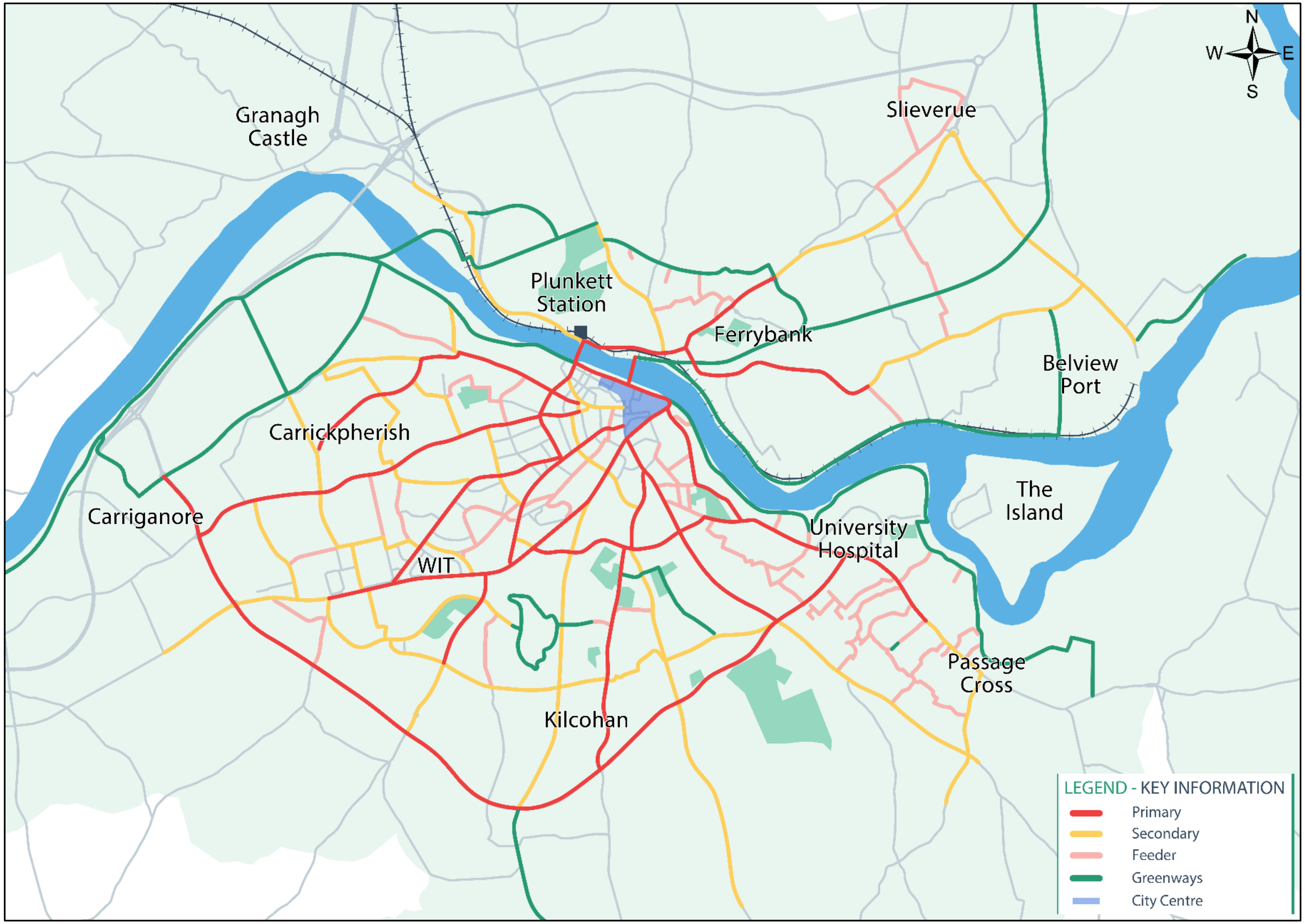

Figure 5-1: Waterford City & Suburbs Cycle Network Plan

5.2 Bike Share Scheme

The NTA have previously confirmed the launch of a new public bike sharing scheme for Waterford City. The scheme will see up to 14 docking stations distributed across Waterford City and will be available to hire 19.5 hours a day, 7 days a week, 365 days a year. This allows people access to bikes when they are required and offers more opportunities for individuals to cycle across the City.

The proposed station locations were issued for non-statutory consultation in September 2021. The indicative locations of the proposed docking stations are highlighted in Figure 5-2 below.

Figure 5-2: Indicative locations for the Waterford Bike Sharing Scheme Docking Station (Source: National Transport Authority, 2021)

6 Road Network Options

6.1 National Road Network

This section outlines the National Road network infrastructure proposed as part of the WMATS. It takes into consideration European and National policy in the context of Spatial Planning and National Roads[3], the National Development Plan (NPD), and TII's National Roads Programme 2018 – 2027.

6.1.1 Review of Spatial Planning and National Roads

The Spatial Planning and National Roads guidelines set out planning policy considerations relating to development affecting National Primary and National Secondary Roads, including motorways and associated junctions. The following key extracts from the guidelines are important considerations for determining the function of the National Roads in the context of the WMATS Strategy:

Function of National Roads

"National roads play a key role within Ireland's overall transport system and in the country's economic, social and physical development. The primary purpose of the national road network is to provide strategic transport links between the main centres of population and employment, including key international gateways such as the main ports and airports, and to provide access between all regions. Better national roads improve access to the regions, enhancing their attractiveness for inward investment and new employment opportunities and contribute to enhanced competitiveness by reducing transport costs. However, in recent years, increasing population and car ownership rates, changes in lifestyle and employment, and improvements in the quality of the road network have also contributed to the unsustainable outward expansion of urban areas."

Strategic Traffic

"Strategic traffic, in the context of national roads, primarily comprises major interurban and inter-regional traffic, whether HGV, car, public transport bus services or other public service vehicles, which contributes to socio-economic development, the transportation of goods and products, especially traffic to/from the main ports and airports, both freight and passenger related. In particular, any local transport function of national road bypasses and relief roads in respect of the urban areas they pass through is, and must continue to be, secondary to the role of these roads in catering for strategic traffic."

Based on the above any proposed measures should not serve to encourage the inappropriate use of the National road network by local car traffic and should increase the attractiveness of public transport alternatives and to render investment in such public transport improvements more economically viable. Without these interventions, the WMA will continue to experience increasing congestion and private car use which put at risk any substantial investment already made on the national roads of strategic importance.

6.1.2 Proposed National Road Network

The following sections identify proposed infrastructure improvements for the national road network within the WMA, that form part of the WMATS.

[3] Spatial Planning and National Roads, Guidelines for Planning Authorities, January 2012, Department of Environment, Community and Local Government.

6.1.3 N24 Cahir to Waterford

The improvement of the existing N24 between Waterford and Cahir, which passes through towns and villages including Clonmel, Kilsheelan, Carrick-On-Suir and Mooncoin. These improvements include:

- N24 Carrick-On-Suir Bypass;
- N24 Clonmel Outer Bypass;
- N24 Clonmel to Cahir Road Improvement;
- N24 Mooncoin Bypass.

This proposal is consistent with the NPF's National Strategic Outcome 2, to provide Enhanced Regional Accessibility. The NDP identifies the N24 Cahir to Waterford as a national roads project that was part of the previous NPD and is subject to further approval.

Phase 1 of this N24 project (Concept and Feasibility) was completed in February 2021; the non-statutory public consultation then took place between the 4th May 2021 and 1st June 2021; and Phase 2 (Options Selection) has commenced and is scheduled to take 24 months to complete.

6.1.4 N25 Waterford to Glenmore

The improvement of the existing N25 between Waterford and Glenmore, through the creation of a dual carriageway national primary route which will connect to the N25 New Ross Bypass and the N25 Waterford City Bypass. This proposal is consistent with the NPF's National Strategic Outcome 2, to provide Enhanced Regional Accessibility. The NDP identifies the N24 Cahir to Waterford as a national roads project that was part of the previous NPD and is subject to further approval. The N25 Waterford to Glenmore is part of the Ten-T Comprehensive Network.

6.2 Regional Road Network

Additional regional road network provision needs to undertake a multi-modal function, catering for public transport, walking and cycling in addition to car traffic. The regional road network provision is required to cater for the following:

- Provide access to development lands;
- Cater for walking and cycling linkage;
- Provide access to public transport routes;
- Cater for orbital public transport provision;
- Removal of strategic traffic from Waterford City Centre; and
- Removal of local traffic from strategic road routes.

To achieve this the cross section of these roads should cater equally for active modes, public transport and car traffic as follows:

- Footpath and Cycle lane provision – 33% of cross section;
- Bus lane and priority provision – 33% of cross section; and
- Road traffic lane – 33% of cross section.

The following outlines the additional regional road network provisions for WMATS.

6.2.1 Ferrybank Relief Road

The Ferrybank Belview Local Area Plan 2017 highlights the proposal of the Ferrybank Relief Road. The proposed Ferrybank Relief Road is approximately 2km in length and connects Belmont Roundabout to Newrath, where it will join up to the existing Newrath Road. The scheme incorporates a bypass of Ferrybank to help create an "Urban Village" within Ferrybank. The proposed route alignment is shown in Figure 6-1.

Enhancing the road connectivity between Newrath and Belmont Roundabout is considered to ensure that traffic travelling in an east-west direction will no longer need to pass through the central, built-up area of Ferrybank. This removal of traffic with the built-up area of Ferrybank will result in the creation of a safer, more attractive public space within Ferrybank. This road connectivity also aims to increase the connectivity and permeability of existing residential areas.

6.2.2 Abbey Road to Belmont Road

The Ferrybank Belview Local Area Plan 2017 mentions the possibility of a north-south link between Abbey Road and Belmount Road. The proposed north-south link between Abbey Road and Belmount Road is approximately 1.4km in length and provides an opportunity to create a north-south link in the area. Connectivity is currently hampered north to south due to the presence of the disused railways line between New Ross and Waterford. This proposal would create a new north-south connection in the vicinity of Ross Abbey and Clover Meadows housing schemes. The proposed route alignment is shown in Figure 6-1.

6.2.3 Outer Orbital Road

The Draft Waterford City and County Development plan 2022-2028 mentions the possible creation of the Outer Orbital Road. The proposed Outer Orbital Road extension is approximately 11km in length and connects the Outer Ring Road / Tramore Road roundabout to Belview Port, where it will connect to the existing N29. The proposal aims to create a new connection between the south of Waterford City to Belview Port, to aid with the removal of traffic within the City Centre. This road connectivity also plans on creating an additional river crossing from east of The Island to Belview Port. The proposed route alignment is highlighted in Figure 6-1.

6.2.4 Junction Improvements

Junction improvements are proposed to improve traffic flow, provide for public transport and, in some instances, the pedestrian environment. These may include the upgrade of junctions to include Intelligent Traffic Systems (ITS) or smart traffic signalling.

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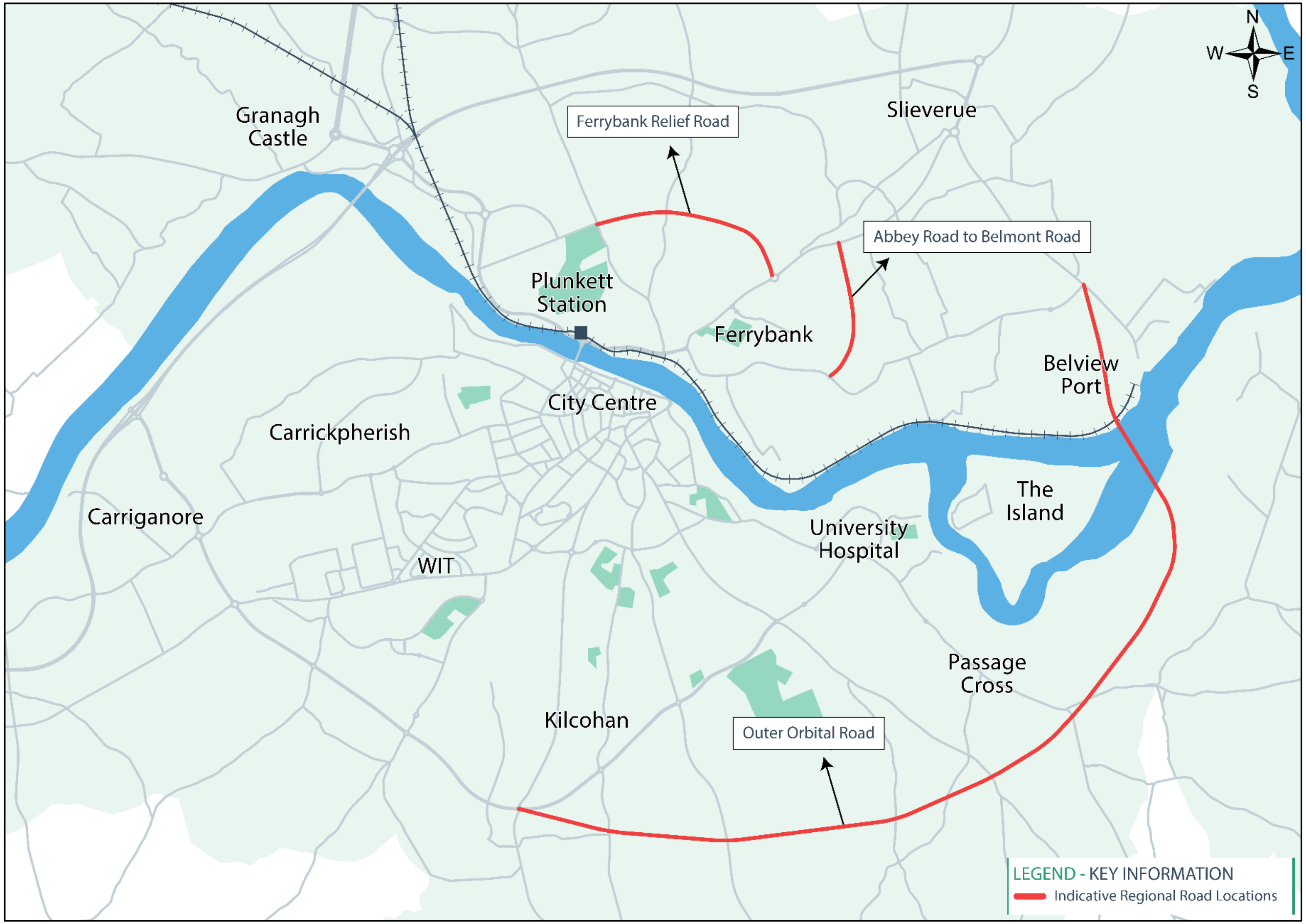

Figure 6-1: Approximate locations of the proposed additions to the Regional Road Network

6.3 City Road Network

6.3.1 City Centre Traffic Management

As discussed in Section 3.11.5, there is a need to improve the level of public transport priority through the city along several key corridors. In addition, the street network needs to be reviewed with the aim of prioritising space for public transport, walking and cycling provision with the intention of creating a more attractive and vibrant experience for residents and visitors and improving air and noise quality. Local access should be facilitated with designated driving routes into the City and off-street carparks. Public transport will be given priority on several routes in the form of bus lanes, time-restricted bus gates or Advance Bus Signalling at junctions.

There is currently a high level of on-street car parking present within the City Centre. This is especially present along the Quays, where approximately 1,000 car parking spaces are provided. The quantum and fare structure for daily long-stay parking in the city needs to be reviewed.

6.3.2 Heavy Goods Vehicles Restrictions

HGVs play an integral role in moving goods throughout the WMA and nationwide. HGV movement can have significant impacts on traffic operations, noise, air pollution and the safety of other road users, particularly within urban environments.

The central area of Waterford City is unsuitable for heavy goods traffic and HGV restrictions are already implemented in Waterford, restricting access to only those vehicles of a suitable size with an origin or destination in the centre. There is currently a 3.5 Tonne weight restriction implemented on:

- Airport Road
- Ballytruckle Road
- Bilberry Road
- Butlerstown Road
- Cannon Street
- Carrickphierish Road
- Church Road
- Cleaboy Road
- Gracedieu Road
- Grange Road
- Grattan Quay
- Griffith Place
- Keane's Road
- Knockhouse Road
- Lismore Park
- Morrisons Avenue
- Ozanam Street
- Skibbereen Road
- Slievekeale Road
- Suir Street
- Sunrise Crescent
- Tir Connell Avenue
- Upper Yellow Road

There is also a 5 Axle Ban Area within Waterford City Centre, covering the Quays and the Viking Triangle. Figure 6-2 illustrates the current HGV Restrictions within Waterford City.

The implementation of designated 'lorry routes' on National roads at designated times of the day will help reduce through traffic and mitigate delays and conflict with other modes. In addition, regulating delivery times by limiting them to off-peak periods would contribute to off-setting local traffic congestion. This could also bring additional benefits to freight operators in terms of reductions on travel times and operating costs.

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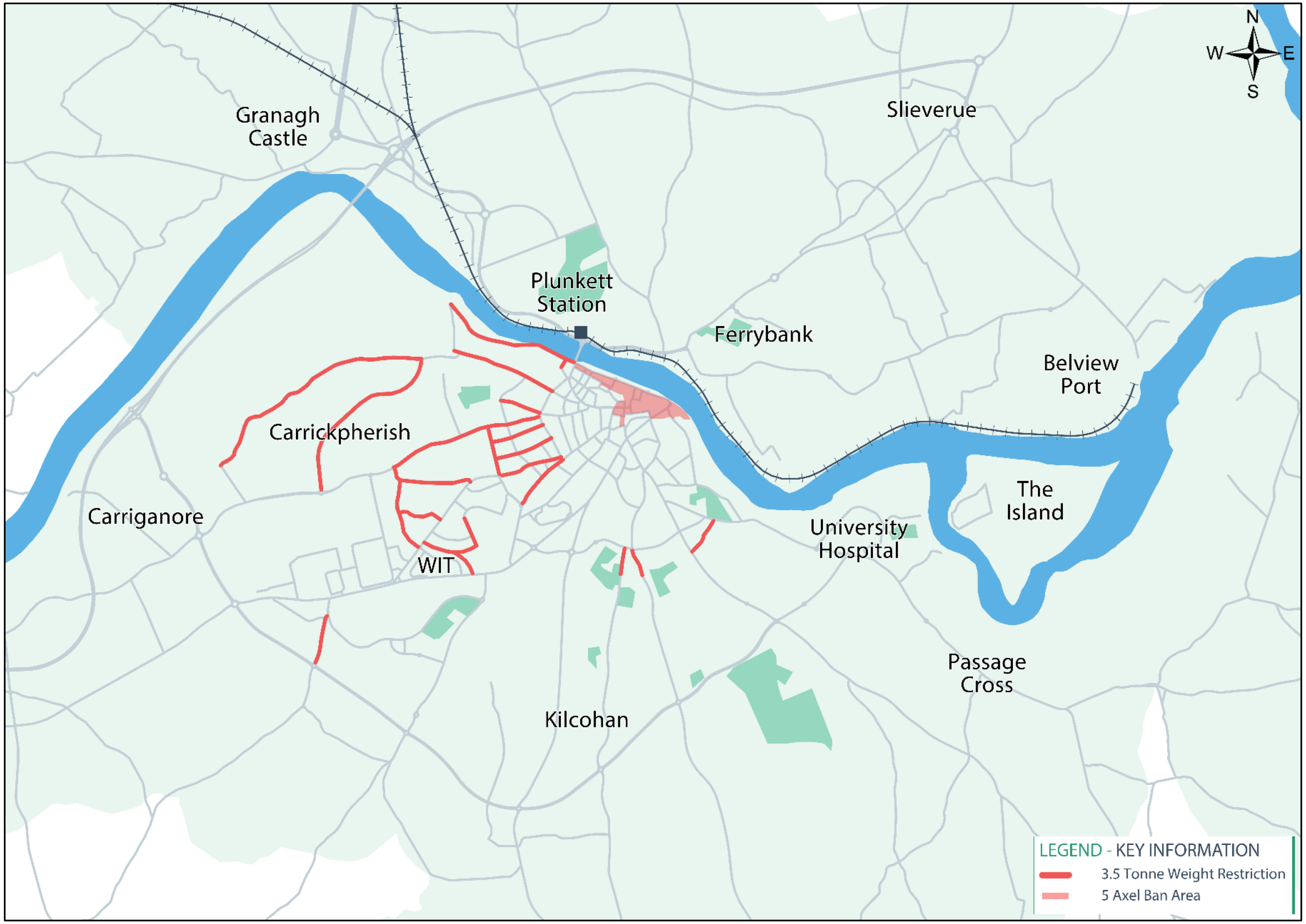

Figure 6-2: HGV Restrictions Waterford City

6.4 Bridge Crossing Network

This section outlines the Bridge Crossing infrastructure proposed as part of the WMATS. It takes into consideration European and National Policy in the context of the National Development Plan (NPD), as well as Local Policy in relation to the Waterford City and County Development Plans, Kilkenny City and County Development Plans, Waterford Metropolitan Area Strategic Plan (MASP) and Waterford Planning Land Use and Transportation Strategy (PLUTS).

6.4.1 River Suir Sustainable Transport Bridge

Waterford City and County Council have secured funding for a River Suir Sustainable Transport Bridge, which proposes to transform the quayside of Waterford City. A new bridge which accommodates pedestrians, cyclists and an electric shuttle bus service over the River Suir approximately in front of the existing Clock Tower on the south quays and a former industrial brownfield site which shall be developed as a Strategic Development Zone (SDZ) on the north quays is approved. The development also includes a plaza to be located at the south quays landing point. This plaza will be paved and landscaped, including lighting, street furniture, planting and associated ancillary works.

It is anticipated that the Sustainable Transport Bridge will promote further development of Waterford City and facilitate the development of the North Quays SDZ lands. Rice Bridge is currently the only other crossing of the River Suir within Waterford City centre. Due to the limited crossing over the River Suir, the residential areas of Ferrybank and Bellfield to the north of Waterford City are limited with their connectivity to Waterford City. The location of the Sustainable Transport Bridge is highlighted in Figure 6-3.

6.4.2 Downstream River Crossing

The Waterford MASP includes information on the provision of an additional Downstream River Crossing in the vicinity of Maypark or Ardkeen. This Downstream Crossing is proposed to extend the Outer Ring Road northwards, linking the two sides of Waterford City. This bridge crossing would also serve to curb the future growth of traffic within the City Centre, as it would provide an alternative routing option across the River Suir. The Downstream River Crossing would also link future development sites on the Outer Ring Road to the Port of Waterford and the North Quays, as well as improve access to the University Hospital.

The Downstream River Crossing aims to:

- Complete the orbital road network and provide a compact shape in which the City will develop;
- Provide a distributor route around the City;
- Link development areas to the north of the River Suir to housing and other developments to the south;
- Provide traffic relief for the City Centre; and
- Provide a further alternative crossing point of the River.

The indicative location of the Downstream River Crossing is shown in Figure 6-3.

6.4.3 The Mall to Ferrybank

The Waterford MASP also highlights the objective of creating a proposed road bridge from The Mall to Ferrybank. This bridge crossing is proposed to link Ferrybank to the City Centre, via The Mall to the south of the River Suir and Abbey Road to the north of the River Suir. Like the Downstream River Crossing, this bridge crossing aims to remove traffic from the city centre, particularly strategic traffic and through traffic. This would allow for the reallocation of road space in the city centre and provide an alternative routing option across the River Suir.

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The indicative location of The Mall to Ferrybank River Crossing is highlighted in Figure 6-3 below.

6.4.4 Outer Ring Road

The Draft Waterford City and County Development plan 2022-2028 mentions the possible creation of the Outer Orbital Road (Figure 6-1). The Development Plan also highlights that this route is also connected to an additional river crossing from east of The Island to Belview Port. Like the Downstream Crossing and The Mall to Ferrybank river crossings, the Outer Ring Road bridge crossing aims to provide an additional crossing over the River Suir, along with reducing through traffic currently travelling through the City Centre.

The indicative location of the Outer Ring Road bridge is shown in Figure 6-3.

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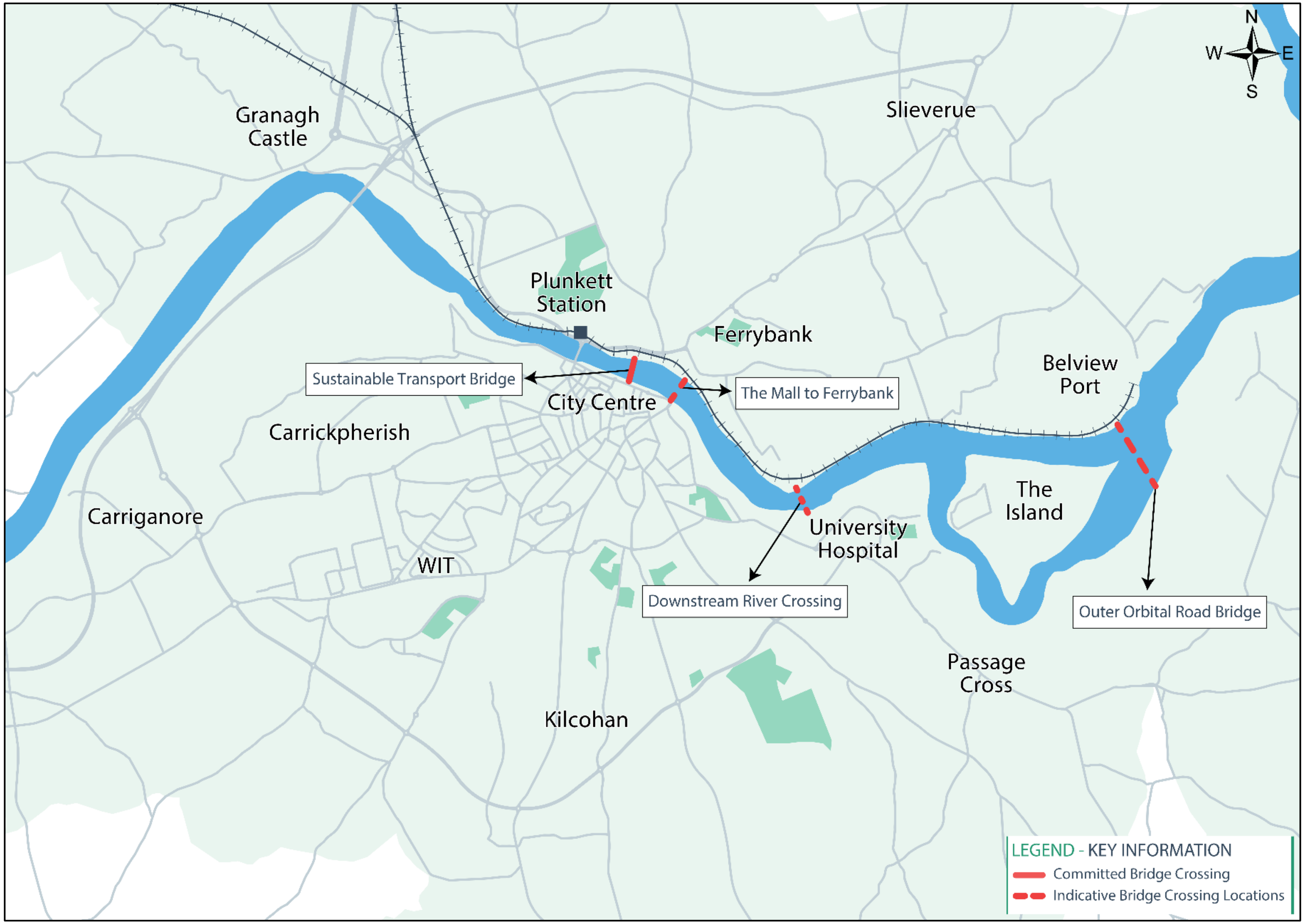

Figure 6-3: Approximate locations of the Bridge Crossing Network

7 Conclusions

The aim of this transport strategy is to design a transport network that will accommodate the future demand trips within the Waterford Metropolitan area by 2040. Building on the detailed Baseline Review and the Demand Analysis of forecast development growth a multi-modal transport options and network development exercise has been undertaken. This transport options and network development assessment has resulted in a transport network that:

- Will cater for future demand to 2040;
- Enables Waterford's development in line with National Planning Framework to 2040 and beyond;
- Meets strategic and local transport needs;
- Provides strategic public transport corridors along which future development can be focused;
- Prioritises public transport, walking and cycling;
- Is scalable and flexible to changes in demand levels; and
- Can adapt public transport level of service to meeting demand requirements.

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