

Delivering Strategies

Cork Area Transit System Study

Draft Final Report

Report for Cork City Council and partners

In association with HKTT

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Executive Summary

Introduction

MVA Consultancy, in association with Healy Kelly, Turner and Townsend (HKTT), was commissioned by Cork City Council in June 2008 to undertake a public transport feasibility study for the Cork Metropolitan Area.

The feasibility study, was subsequently renamed the Cork Area Transit System (CATS) Study, to reflect the need for a systematic or network wide approach to the future development of public transport in the Cork Metropolitan Area.

The study has been undertaken with direction from a Project Team, with representatives from Cork City Council Traffic and Planning Departments; Cork County Council Traffic and Planning Departments and Bus Éireann.

Study Objective

The overarching objective of the CATS Study is to develop the public transport network in Metropolitan Cork to support a more concentrated and, therefore, sustainable pattern of development, with a renewed emphasis on Metropolitan Cork as a place to live and work.

A high quality public transport system has a major role to play in the achievement of this objective, as without it, private car will remain the only viable alternative form of transport for most residents of the Metropolitan Area. This would result in a continuation of current unsustainable travel patterns into the future.

Study Context

Baseline evaluation of the public transport network and services; and travel characteristics within the Metropolitan, and wider CASP areas was undertaken to inform current issues relating to public transport provision and use within the study area. The findings of this exercise are summarised as follows:

1) Travel Characteristics

An analysis of Census 2006 journey to work data has found there to be high levels of car use within the study area. In Cork City, only 7% of journeys to work are undertaken by public transport, whereas in the Metropolitan Ring¹, the equivalent figure is 3%.

An analysis of journeys travel patterns indicates a dispersed travel demand pattern, which presents a challenge in terms of economically developing high quality public transport services to meet these demands. Furthermore, the existing public transport network does not match the strongest observed travel patterns within the study area.

¹ Defined as the area located between the City and Metropolitan Area boundaries.

2) Land use/ development related issues

The following land use and development related issues have a major bearing on the high levels of car use:

- 54% of the Metropolitan Ring population resides in rural areas or small villages outside of the largest eight towns. These areas are difficult to serve by public transport;
- The relatively low densities of development in main towns within the Metropolitan Ring, e.g. Ballinacollig, Midleton, Carrigaline, and the car oriented nature of development in these areas negatively impacts on public transport accessibility; and
- High levels of private non-residential car parking provision throughout the CASP area, which is not supportive of public transport use.

3) Public Transport Network and Service Provision

The following are the key public transport network and service related issues identified as part of the baseline evaluation process:

- The current rail service offers limited coverage of the Cork Metropolitan Area, and, as a result, is used by a very low percentage of people as a means of travelling to work;
- The existing public transport network does not meet the dispersed trip patterns which have arisen as a result of development within the Cork Metropolitan Area;
- Most bus services in the Cork Metropolitan Area operate at headways of 15 minutes or greater and these frequencies are not sufficiently high to represent an attractive alternative to car;
- Since 2000, Cork City and County Councils have implemented a programme of bus priority measures, termed Cork Green Routes, which aim to improve bus services within the area. From experience to date, it does not appear that they provide adequate priority to meet the target speed of 20kph, or to maintain reliable bus service operations throughout the City; and
- The quality and uniformity of bus stop infrastructure throughout the study area is not considered adequate in terms of meeting passenger demands.

4) Cork Area Strategic Plan (CASP) Update

The CATS Study has been undertaken within the context of the Cork Area Strategic Plan (CASP) Update. CASP Update sets the framework for the development of Cork City and wider Region up to 2020. This updated plan forecast that the population of the CASP area will increase from 378,000, in 2006 to 488,000 in 2020 – representing growth of over 29%. The majority of this new population will reside within the Cork Metropolitan Area.

CASP Update has identified two potential Rapid Transit² Corridors to support the future spatial allocation of developments with the CASP area:

- an east-west corridor running from Mahon to Ballincollig, via the City Centre and Docklands; and
- a north-south corridor linking Ballyvolane with the Airport, via the City Centre.

The central aim of CATS is to support CASP Update, by developing an integrated public transport system that meets the needs of Metropolitan Area up to 2020, and beyond.

Future Transport Issues Facing the Cork Metropolitan Area:- Why develop CATS Strategy?

Transport modelling undertaken in relation to this study, has taken into account committed public transport improvements e.g. Mallow and Midleton Suburban Rail networks, and additional planned future road infrastructure. Notwithstanding the committed transport improvements, the modelling has indicated that:

- although the public transport mode share is forecast to increase in the future throughout the Metropolitan Area, from 7% in 2006 to 12% in 2020, the vast majority of journeys to work will still be by private car; and
- average network car speeds between 2006 and 2020 are forecast to fall by approximately 15%. This reduction in overall network traffic speeds will arise from the scale of future forecast growth within the context of CASP Update, and the spatial allocations of development therein.

This high level of car use and forecast increases in traffic congestion is considered unsustainable from economic, environmental and public health perspectives. The CATS Strategy therefore aims to address these issues by developing an integrated public transport network, supported by relevant travel demand management measures.

Option Development and Evaluation

The key issues arising from the baseline evaluation exercise as it relates to the Cork Metropolitan Area are outlined above. Detailed consideration has also been given to the future settlement patterns in the Cork Metropolitan and wider region, as outlined in CASP Update.

² The term Rapid Transit denotes the provision of higher quality public transport infrastructures and services than those provided by conventional bus services. While specific consideration is given to both Bus Rapid Transit (BRT) and Light Rail Transit (LRT), although hybrid options with characteristics of both modes are possible

The next step in the CATS Study was the option development process, which aimed to identify the most appropriate means of satisfying the study objectives.

Based on a consideration of the key future settlement and transport issues facing the Cork Metropolitan Area, the following scenarios were developed and assessed:

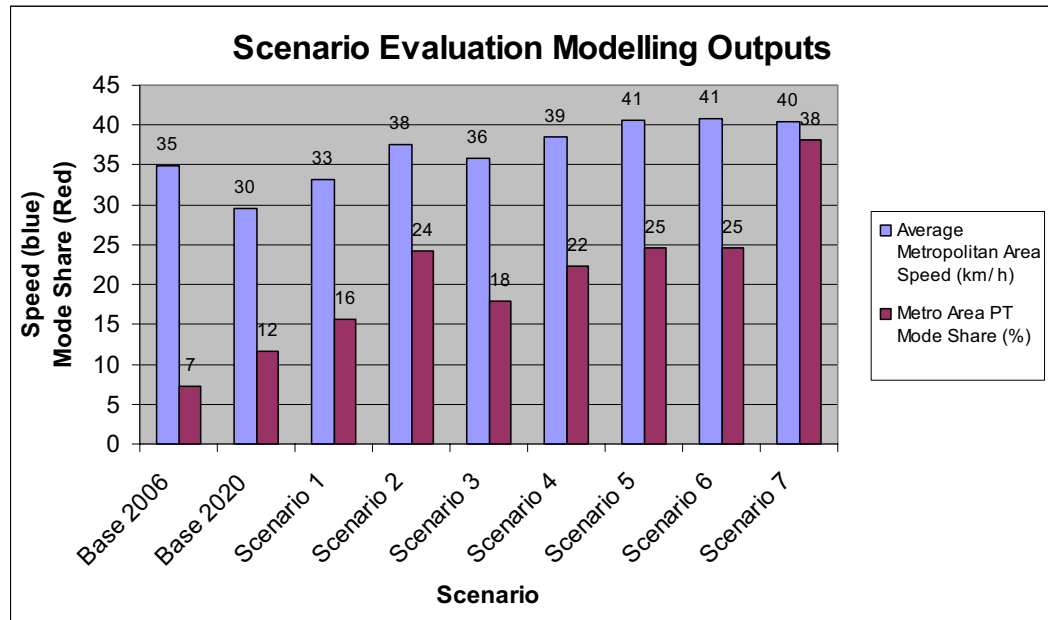
- **Scenario 1, Do-Minimum:** This scenario represented the committed future transport network, i.e. the base 2006 transport network with committed road and Suburban Rail network improvements in place. Furthermore, enhancements to the bus infrastructure and services along the Green Routes, as envisaged in the context of CASP Update are also assumed to be in place.

All further scenarios, include committed road, Suburban Rail and Green Routes improvements, i.e. their implementation as currently planned is assumed by 2020.

- **Scenario 2, Phantom Network:** The phantom network concept facilitates an unconstrained analysis of potential public transport demand on key corridors in the Cork Metropolitan Area. In modelling the phantom network, it is assumed that each corridor on the network will operate with optimal characteristics in terms of frequency and speed. This will ensure that public transport represents a highly attractive mode for those travelling along the corridor. This approach allows an unconstrained identification of the potential for public transport on each corridor.
- **Scenario 3, Bus Based,** which represented a reconfiguration of the bus network involving the development of a series of interlinking bus services covering the North and South City. This scenario was developed to address coverage and connectivity weaknesses related to the existing bus network, in particular the lack of strong orbital links.
- **Scenario 4, East-West Rapid Transit Corridor + Reconfigured Bus Network:** The Phantom Network Scenario development and assessment process facilitated the testing of a wide range of corridors in terms of maximum potential passenger demand. Of the corridors assessed, only one, the east-west corridor from Ballincollig to the City Centre, Docklands and Mahon has demonstrated high passenger flows of the order that would require capacity above and beyond that which could be provided by conventional bus.
- **Scenario 5, East-West Rapid Transit + Reconfigured Bus Network + City Centre Traffic Management Plan:** This scenario represented Scenario 4, plus a reconfiguration of traffic management arrangements in the City Centre.
- **Scenario 6, Scenario Rapid Transit, Ballincollig to Docklands:** This scenario involved the same public transport and highway network restrictions as Scenario 5, however the Rapid Transit Corridor has been terminated in Docklands and replaced by a bus service operating between Docklands and Mahon.
- **Scenario 7, Development intensification along Rapid Transit Corridor:** This scenario represented an identical transport network to Scenario 5, however an additional 33,275 population and 39,992 jobs were located along the corridor with a view to:
 - To assess the ability of the system to cater for future intensification of development, beyond the levels allocated in CASP Update; and
 - To assess the transport and economic benefits of such a development scenario.

The forecast performance of each scenario in terms of Metropolitan Area network traffic speeds and public transport mode share are illustrated in the figure below.

Figure S.1.1 Scenario Evaluation Modelling Outputs, Average Metropolitan Area Network Traffic Speeds and Public Transport Mode Share



Option Development and Evaluation Findings and Implications

The key findings from the option development and evaluation stage of the CATS Strategy are:

- Based on an assessment of future transport demand within the study area, as determined by population/ employment allocations outlined within CASP Update, the development of a single Rapid Transit Corridor from Ballincollig to Mahon is required. The Rapid Transit Corridor would intercept key retail (e.g. in the City Centre, Mahon Point), educational (UCC and CIT) and employment destinations (e.g. City Centre, Docklands, Model Farm Road) along its length;
- The eastern portion of this alignment, from Mahon to Docklands, is not justified on the basis of the levels of development currently envisaged in the Mahon area. As a result, a prerequisite for the introduction of this phase of the alignment is the adoption by the City Council of a Local Area Plan (LAP) for the Mahon area, which would facilitate an intensification of development beyond CASP Update levels. In its absence, Phase 2 of the Rapid Transit Corridor is not required to meet the transport needs of this area. In this situation, conventional bus services connecting Docklands with Mahon are recommended;
- The success of the Rapid Transit Corridor, as modelled, is entirely dependent on full public transport priority along its length. The introduction of the corridor would therefore require the implementation of an extensive set of traffic management restrictions along its length. This will ensure system performance is not undermined

by general traffic congestion, i.e. that operating speeds are highly competitive relative to private car use, and that traffic congestion does not undermine system reliability;

- To better meet Metropolitan Area travel demands in terms of improved frequency, increased priority, better matching of observed and forecast origin and destination patterns; a reconfigured bus network is considered to have substantial benefits. The reconfigured bus network would be supported by improved bus priority on Green Routes, and new bus operating infrastructure elsewhere. This bus network is required in addition to the Rapid Transit Corridor, and is essential to meet the travel needs of the study area as a whole;
- The introduction of a City Centre Traffic Management Plan would increase overall levels of accessibility to the Core City Centre area, and contribute to the sustained residential, retail and commercial growth of this key area. This would have substantial benefits across the full Metropolitan Area, with a further transfer to public transport (Rapid Transit and Bus) and improvement in area wide general traffic speeds. For this objective to be achieved it will be necessary to:
 - re-allocate road space on City Centre streets, to ensure a more appropriate balance is achieved between the needs of each transport mode; and
 - remove through traffic from Core City Centre streets, and the island in particular, leading to an improvement in the environment for public transport vehicles, pedestrians and cyclists.
- In the context of the current land use plan for the CASP area, this Rapid Transit Corridor could operate as Bus Rapid Transit (BRT), or similar system. The line's maximum flows do not indicate that investment in a fixed rail system such as LRT is required, even for a 2030 scenario with a greater than 50% growth in population and employment in the full CASP area compared to 2006 levels;
- Each scenario has been assessed in the context of CASP Update population and employment allocations. Given that CASP Update has been developed on the basis of significant forecast growth of the region:- approximately 30%; up to 2020, it is therefore essential that development along the corridor is prioritised taking on board:
 - The need to support additional development along Suburban Rail corridors to Mallow and Midleton; and
 - Rapid Transit phasing considerations discussed later in the Report.

This will help ensure forecast passenger flows on the Rapid Transit Corridor are realised. The prioritisation of development along the corridor is particularly important in a growth scenario that is lower than that envisaged in CASP Update up to 2020;

- The forecast increase in public transport use along the Suburban Rail corridors to Mallow and Midleton, from 8% in the Do-Minimum Scenario to 16% post implementation of the Strategy, may give rise to capacity problems in key infrastructure along these corridors. Iarnród Éireann has confirmed that infrastructure on the Cork Suburban Rail Network will have sufficient capacity to cater for growth in Suburban Rail use post implementation of CATS, and that the potential exists, via increasing frequency/ and or lengthening train sets, to cater for passenger flows well in excess of the forecast 2020 passenger flows. Future planned improvements to rail infrastructure, e.g. at Kent Station will, however, need to accommodate forecast

passenger flows, and interchanging passenger movements arising from implementation of CATS; and

- The preferred strategy, representing the introduction of the Rapid Transit Corridor and reconfiguration of the bus network, was assessed to ascertain the capacity of the Rapid Transit Corridor to cater for increased development beyond the levels indicated in CASP Update for 2020. Based on information provided by the Planning Departments of Cork City and County, the corridor was assessed and found to have to capacity to accommodate, an additional 33,275 residents, and 39,992 jobs beyond CASP Update allocations. This would represent growth of 36% and 56% respectively over 2020 CASP Update levels for the catchment of the corridor.

Description of Preferred Strategy

The preferred CATS Strategy includes the following key components:

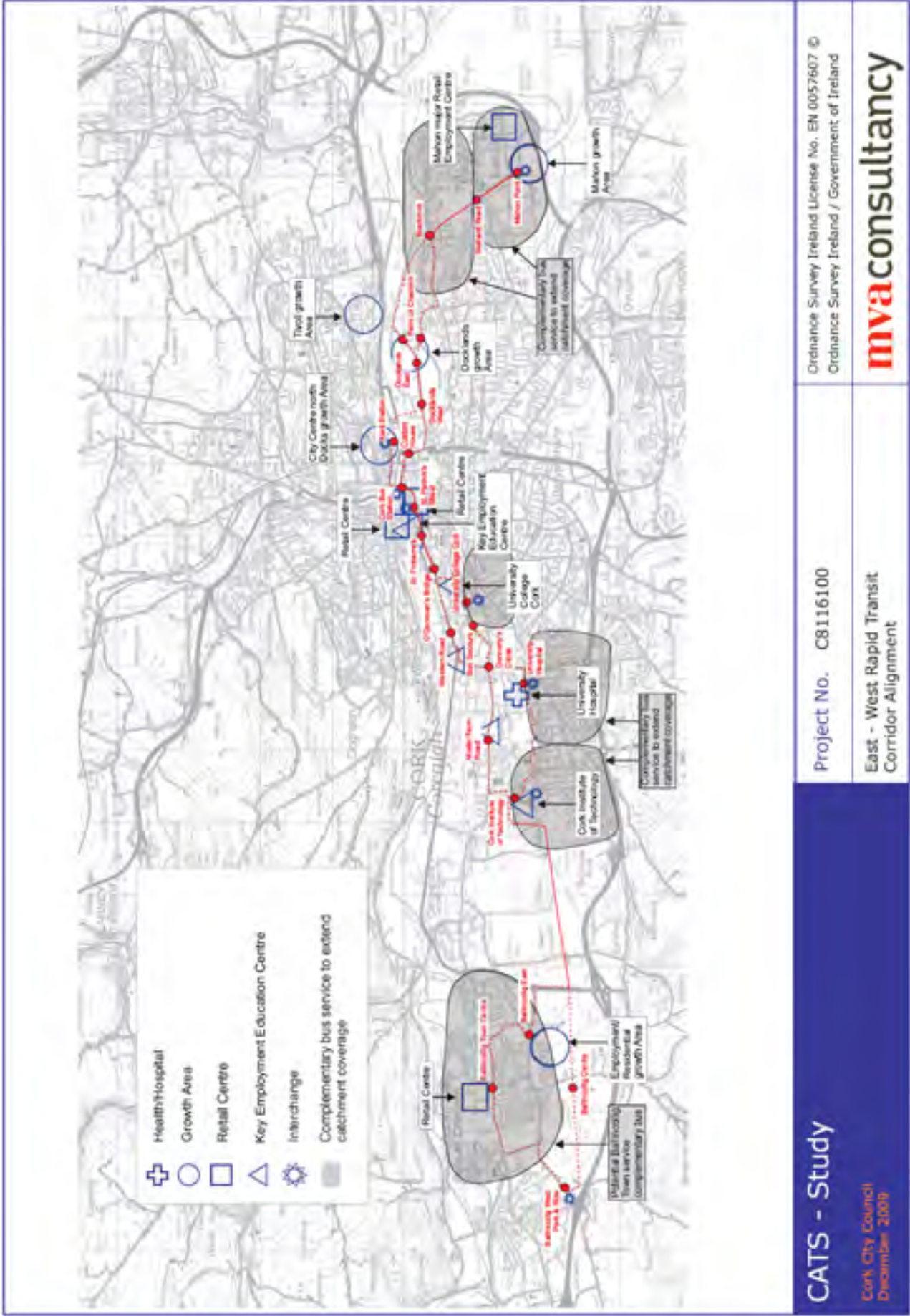
- The development of a single Rapid Transit Corridor, running from Ballincollig to Mahon, via the City Centre and Docklands. The alignment of the corridor is indicated in Figure S.1.2, overleaf. It is recommended that the Rapid Transit Corridor be implemented in a phased manner as follows:
 - Phase 1a, from Docklands to Bishopstown, with services commencing operation in 2014,
 - Phase 1b, from Bishopstown to Ballincollig, with services commencing operation in 2017, and
 - Phase 2, from Docklands to Mahon, which is assumed to commence operation in 2020, but is dependent on the adoption of a LAP for the Mahon area to increase development in this area beyond levels envisaged by CASP Update;
- The phased implementation of an enhanced and reconfigured bus network. Approximately 83 additional buses would be required to cater for the growing public transport needs of the Metropolitan Area. The bus network would require significant additional bus priority to protect buses from general traffic congestion; and
- The implementation of a City Centre Traffic Management Plan, the objective of which is to improve accessibility to the City Centre by all modes and to increase the capacity of the transport network to cater for increased movements to, from and within this area.

In addition to the above core measures, the following additional measures are considered to be essential to the success of the Strategy, and are considered essential in the context of the considerable capital costs associated with implementing the above recommendations:

- The implementation of a series of integrative measures including:
 - Integrated fares,
 - Public transport interchanges,
 - Park and ride,
 - Integrated Public Transport Information (IPTI), and
 - Demand Responsive Transport;

- Implementation of supportive land use policies to intensify development along the Rapid Transit Corridor in a manner that supports the delivery and success of the system. This is particularly important in the context of a growth scenario less than that which was envisaged at the time of preparing CASP Update;
- Implementation of supportive parking standards in Cork City and County that promote development along public transport corridors, and manage the car mode share in a manner that is consistent with the forecast mode share arising from implementation of the Strategy; and
- Implementation of supportive travel demand management promotional measures across the Metropolitan and wider CASP areas to reduce overall levels of car use. The following specific measures are therefore considered to be applicable and to offer significant benefit to the Cork Metropolitan and wider CASP area:
 - Workplace Travel Plans;
 - School Travel Plans; and
 - Personalised Travel Planning.

Figure S.1.2 East-West Rapid Transit Corridor Alignment



CATS Strategy Recommendations for North-South Corridor

The option development and evaluation process undertaken, allowed for the testing of the potential for public transport along a range of corridors throughout the Metropolitan Area. In particular, it was important to evaluate the potential for high quality public transport on the north-south corridor between Ballyvolane-City Centre-Airport identified in CASP Update. This approach facilitated a determination of the potential for public transport, based on a conceptual public transport network with optimal operating characteristics.

Of the extensive set of corridors assessed using the Phantom Network approach, only one, the east-west corridor from Ballincollig to Mahon, via the City Centre, has potential passenger flows of sufficient magnitude to justify a Rapid Transit public transport solution. Passenger flows on the remainder of the network were substantially lower. On the north-south corridor, which was identified in CASP Update as a potential Rapid Transit Corridor, forecast peak hour flows (including CASP update projected growth) are a maximum of 936 to the north of the City Centre, and 1,218 to the south of the City Centre.

As a result, significantly improved conventional bus services, operating on enhanced bus priority infrastructure, represent the most appropriate solution to the transport needs of areas along the north-south corridor from Ballyvolane to the Airport, via the City Centre. Furthermore, given the likely capital costs associated with implementing Rapid Transit on this corridor, and the low forecast passenger flows, a Rapid Transit solution along the lines proposed for the east-west corridor does not represent an economically feasible solution.

City Centre to Ballyvolane

A new two-way loop bus route (Route No. 7) would connect the City Centre with Ballyvolane, operating at the same headways and speeds as the remainder of the bus network is recommended. This bus service would operate at a frequency of 6 per hour, with an estimated journey time between the City Centre and Ballyvolane of 21 minutes. It would also facilitate interchange between this bus service and Suburban Rail and Rapid Transit services operating on the east-west corridor.

City Centre to Airport

The recommended strategy to the south of the City includes an extension of the express bus service from the Airport via the City Centre and the bus station, to Kent Station. This would directly link rail and bus services with the Airport, in addition to providing for direct interchange between Rapid Transit and bus services operating along this corridor.

This express bus service would be supplemented by a second additional bus route (Route No. 6) connecting the Airport to the City Centre, operating at the same headways and speeds as the remainder of the bus network. This route would be especially beneficial in supporting potential future development along the alignment such as at Tramore Valley. The estimated journey time from the airport to the City Centre on this route would be approximately 25 minutes. At present a peak frequency of approximately 12 buses/ hour between stopping and express bus services along this route is deemed adequate to meet future forecast demand levels, although this could be increased subject to increasing future demand.

Strategy Appraisal

Although forecast passenger flows on the Rapid Transit Corridor have indicated that BRT may represent the most appropriate mode to cater for forecast transport demands along the Rapid Transit Corridor, appraisal of the Strategy has been undertaken for both BRT and LRT modes. This was undertaken to enable a robust decision as regards the selection of mode along the corridor.

Forecast AM Peak Metropolitan Area Mode Share for Public Transport

The forecast 2020 Metropolitan Area AM peak hour (08:00 to 09:00hrs) public transport mode share for the preferred is 25%, disaggregated as follows:

- 8% (6,176 passengers) for BRT;
- 3% (2,277 passengers) for Suburban Rail; and
- 14% (10,824 passengers) for Bus.

These forecast AM peak hour passenger numbers demonstrate the significant role of Rapid Transit in the context of the growth of the Cork Metropolitan Area, as outlined in CASP Update. Furthermore, bus is forecast to carry the majority of public transport users within the Metropolitan Area in 2020, with 14% of all AM Peak trips (56% of total public transport passengers) using this mode, thus illustrating the role of this mode following implementation of bus relates recommendations contained within CATS.

Capital Cost of CATS Strategy Implementation

The table below provides capital cost estimates associated with implementation of the CATS Strategy, with either BRT or LRT introduced along the east-west Rapid Transit Corridor.

Table S.1.1 CATS Strategy Capital Implementation Cost Estimates

	Estimated Cost Reconfigured Bus + BRT, € million	Estimated Cost Reconfigured Bus + LRT, € million
Reconfigured Bus Network	160	160
Bus Rapid Transit	306	-
Light Rail	-	1,020
Total Capital Costs	466	1,180

As can be seen from these cost estimates, the development of the Metropolitan Area public transport network, with BRT as an integral component would represent a substantially lower capital implementation cost of approximately €714 million, compared to those associated with LRT implementation.

Economic Appraisal

An economic appraisal of the preferred strategy was undertaken with a view to determining the wider economic benefits associated with implementation of the strategy. The economic evaluation was undertaken using TUBA (Transport User Benefit Appraisal), with Irish input parameters, as detailed in the Cost Benefit Parameters and Application Rules for Transport Project Appraisal Report.³

The appraisal was undertaken for the Strategy as a whole, i.e. the reconfigured bus network, Rapid Transit Corridor and the City Centre Traffic Management Plan.

The Benefit to Cost Ratio (BCR) for the Strategy, with the Rapid Transit Corridor from Ballincollig to Mahon implemented as BRT is forecast to be 2.04, representing high value for money.

The BCR could, however, be further enhanced if additional development were located along the corridor. The economic benefit of such an approach has been assessed in the context of this additional development being in place in 2030. If an additional 33,275 residents and 39,992 jobs were located along the alignment of the corridor, this is forecast to improve the BCR to 2.85.

If the Rapid Transit Corridor were developed as LRT, the system would deliver low value for money in the context of the population and employment allocations contained within CASP Update (BCR = 1.04). Assuming a similar redistribution of growth along the corridor, as per BRT, above, the BCR would increase to 1.47, still representing a low value for money return.

Significantly higher levels of population and employment growth, over and above those forecast for the CASP area up to 2020 would be required for the development of the corridor as LRT to represent medium to high value for money, i.e. both a higher overall rate of population/ employment growth, and a radical departure from the current spatial planning policy for the CASP area.

Bus Rapid Transit (BRT) or Light Rail Transit (LRT)

A broad ranging review of the applicability of both BRT and LRT to the Cork Metropolitan Area was undertaken, considering forecast passenger flows, economic return, and a range of other factors. Based on this review, BRT is considered to represent the most appropriate mode in the context of the Cork Metropolitan Area for the following reasons:

- The scale of development along the corridor at present is not sufficient to merit the development of LRT, whereas a stronger case exists for BRT Phase 1a, from Bishopstown to Docklands than for LRT on the basis of current transport demands;
- CASP Update provides an outline of spatial planning policy for the CASP area up to 2020. In the context of the future allocations of development within this plan, BRT represents the most appropriate solution in terms of its ability to meet passenger demands up to 2020, and beyond (to 2030);
- Whilst additional development along the Rapid Transit Corridor is recommended if the system is developed as BRT, a radical departure from CASP Update would be required

³ Goodbody Economic Consultants, August 2004

to facilitate implementation of LRT. Furthermore, developing the system as LRT would be a higher risk strategy, as its operational success would be dependent on significant future development/ redevelopment along the corridor;

- The timeline for implementing LRT is typically a minimum of 10 years from conception through to commencement of operation. As a result, LRT would not likely be operational until 2018 at the earliest (BRT could be implemented by as early as late 2014/ early 2015). Such a timeframe for implementation would not be compatible with current development plans for the Docklands area in particular. Furthermore, opportunities to locate additional public transport oriented development along the corridor would be undermined by such a lengthy timeline for delivery;
- The capital costs of implementing BRT are significantly lower, at approximately 30% of the overall cost of LRT. Transport 21 is a capital investment framework under the National Development Plan through which the transport system in Ireland will be developed from 2006 to 2015. The €1 billion+ implementation costs for LRT would indicate that funding for LRT would not likely be secured until post 2015, thus supporting the view that 2018 would be the earliest possible implementation date;
- The economic return of the CATS Strategy (reconfigured bus network, Rapid Transit Corridor plus the City Centre Traffic Management Plan) is substantially higher if BRT instead of LRT is implemented along the Rapid Transit Corridor. Development of the Rapid Transit Corridor as BRT in the context of CASP Update population/ employment allocations would yield a BCR of 2.04 (high rate of return) for BRT compared to 1.04 (low rate of return) as LRT;
- BRT represents a more flexible solution to the transport demands of a growing City, where new infrastructure is required to facilitate implementation. This is true for Cork Docklands, given the projected phased delivery of highway network improvements, and the requirement to operate Rapid Transit on this new infrastructure; and
- The level of disruption associated with BRT implementation is generally less than with LRT. While it is preferable to relocate as many utilities as possible from the alignment of BRT, to minimise the risk of disturbance to operations arising from roadworks, and to ensure the surface integrity is maintained in the future, it is not essential to do so along the full alignment. This can reduce the disruption in sensitive areas, where extensive investment in urban realm has recently been undertaken.

Environmental Appraisal

"We aim to minimise the negative impacts of transport on the local and global environment through reducing localised air pollutants and greenhouse gas emissions."

Department of Transport, 2009

The above statement is one of five key goals set out in the Department of Transport's recent 'A Sustainable Transport Future – A New Transport Policy for Ireland 2009 – 2020'. It is a clear signal that the need to deliver a more sustainable and cleaner transport system has achieved a prominent place on the climate change and wider political agenda.

The Strategy performs very positively in terms of reduced environmental general traffic related pollutants. In the case of CO₂ emissions, it is expected that there would be an 18%

reduction arising from implementation of the Strategy. This equates to an annual reduction of 19,655 tonnes and represents a significant decrease in transport related CO₂ emissions. Such a reduction will have a significant role to play in the achievement of reduced emissions at a national level.

The Strategy is also forecast to contribute positively to the achievement of reduced emissions at a local level. Key emissions, the primary source of which is road transport related activities are forecast to decline. For CO, a 25% reduction in emissions values is forecast, and for PM₁₀ a 24% reduction is forecast.

Engineering Feasibility

An outline engineering feasibility of the Rapid Transit Corridor has concluded that it is possible to implement a Rapid Transit Corridor linking Ballincollig to Mahon via Bishopstown, the City Centre and Docklands. However, the following generic infrastructural and traffic management interventions will be required:

- Utility and service diversions;
- Road construction / widening;
- Land take;
- Traffic signal and junction reconfiguration to prioritise Rapid Transit movement;
- Re-allocation of road space; and
- Traffic management strategy to facilitate:
 - multi-modal movement within the Rapid Transit Corridor, and
 - Rapid Transit and non-car transport modes in the Core City Centre area.

Institutional Arrangements, Enhanced CASP Model/ CATS Programme Board Model

The broad ranging recommendations contained within the CATS Strategy, and the complex multi-agency nature of the measures contained therein, will require a higher level of co-ordination between the various transport agencies in the CASP Area than that which has existed up to now. As a result a formalisation of the existing CASP structures is considered an imperative to the timely and efficient delivery and success of the Strategy.

To address this issue, a CATS Programme Board is recommended to strengthen existing arrangements in the CASP area as they relate to transport, and facilitate planning and implementation of the CATS Strategy. The Programme Board would report to the CASP Steering Group, would consist of:

- An independent Chairman, with responsibility for delivering the CATS Strategy, and reporting directly to the CASP Steering Group;
- Senior officials representing Cork City, Cork County, Bus Éireann, Iarnród Éireann, An Garda Síochána, Department of Transport and other interested parties as nominated by the CASP Steering Group; and
- A CATS Programme Manager.

The establishment of a CATS Programme Office is also recommended, with adequate resources to manage co-ordination, planning and implementation of the Strategy. The Project Office would be managed by the CATS Programme Manager, who would report directly to the CATS Programme Board. The CATS Programme Office would have a series of Project Teams, each tasked with delivery of a specific strand or strands of the CATS Strategy.

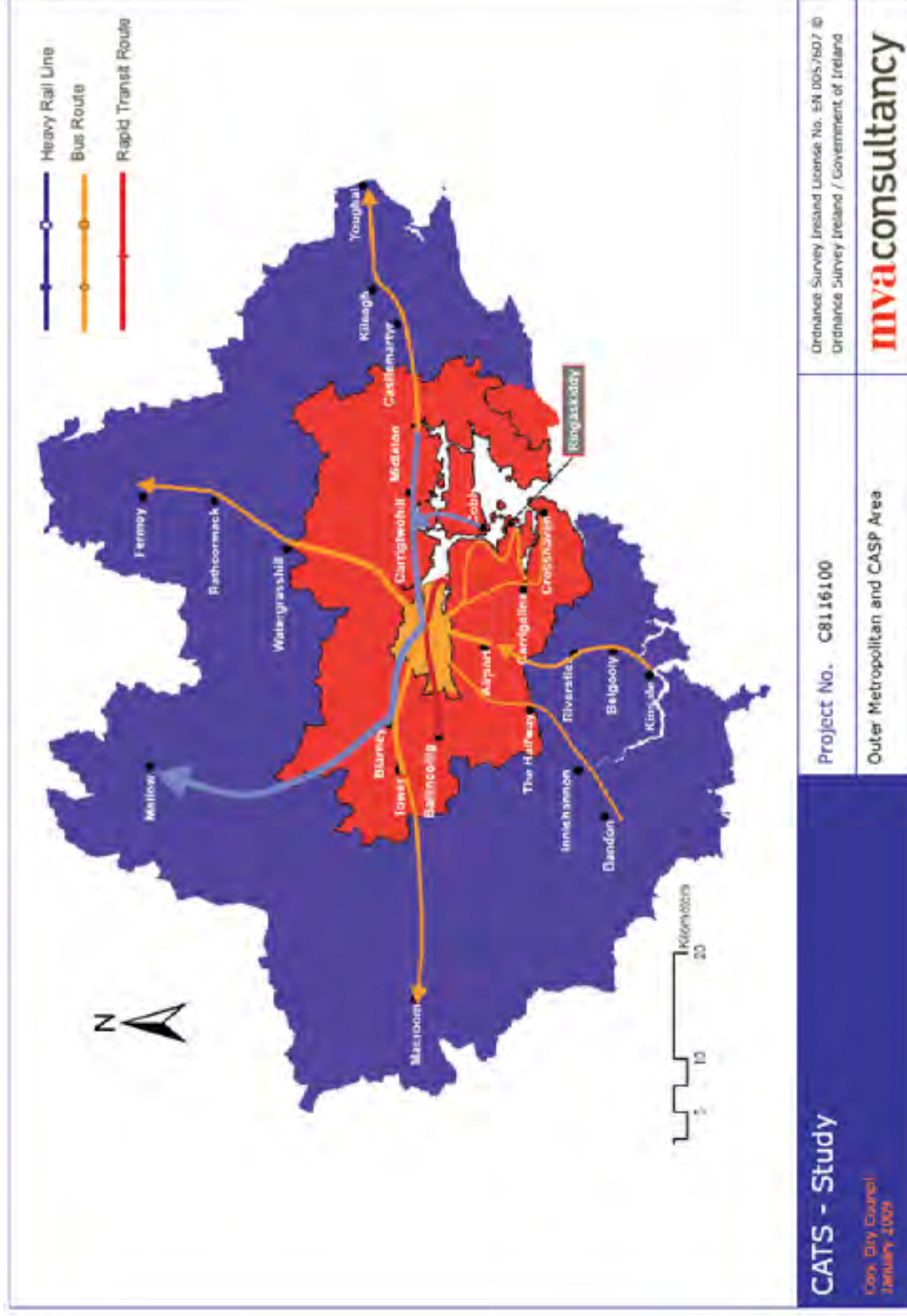
CATS Schematic

Figures S.1.3 and S.1.4, overleaf, illustrate the fully developed CATS network in Cork City and the wider Metropolitan Area. The schematics illustrate the Suburban Rail stations, the reconfigured bus network and the current preferred alignment of the BRT corridor, subject to more detailed assessment.

Figure S.1.3 Recommended 2020 CATS City Network Schematic



Figure S.1.4
Recommended Outer Metropolitan and CASP Public Transport Network



1 Introduction

1.1 MVA Consultancy

- 1.1.1 MVA Consultancy is an international transport consultancy and employs 14 transportation planning staff in our Dublin Office.
- 1.1.2 MVA provides advice on transport and other policy areas to central, regional and local government, agencies, developers, operators and financiers. We work with our clients to think through complex issues concerning the location and movement of people, goods and services – as well as helping them maximise the potential of their own businesses. We understand the human dimension, and the impact and implications of transport in its broadest sense. We offer a blend of business planning, qualitative and quantitative research, modelling, commercial awareness and operational experience – allowing us to create strategic solutions that work with real people in the real world.
- 1.1.3 We are one of the leading transport planning consultancies in Europe with over 200 transport consultants based in offices in our Dublin, Glasgow, Edinburgh, Birmingham, Manchester, Woking, London and French offices. We design and help deliver transport solutions which enable clients from across the whole transport sector achieve their objectives.
- 1.1.4 Our employees have skills that encompass a wide range of disciplines including transport planning and operations, engineering, business planning, computing, economics, mathematics, operations research, planning, social sciences, statistics, and information systems.
- 1.1.5 Founded in 1968 as the British Company of Alan M Voorhees and Associates Inc, and previously known as Martin and Voorhees Associates, the MVA Group has existed since 1983. In 1994 The MVA Group was acquired by the French consultancy group, SYSTRA SA. Our clients in Ireland and the UK include:
 - Railway Procurement Agency;
 - Dublin Transportation Office;
 - Quality Bus Network Project Office;
 - Strathclyde Partnership for Transport;
 - Transport for London;
 - Transport Scotland; and
 - Department for Transport.

1.2 Introduction

- 1.2.1 MVA Consultancy, in association with Healy Kelly, Turner and Townsend (HKTT), was commissioned by Cork City Council in June 2008 to undertake a public transport feasibility study for the Cork Metropolitan Area.

1.3 Background

- 1.3.1 The public transport feasibility study, was subsequently renamed the Cork Area Transit System (CATS) Study, to reflect the need for a systematic or network wide approach to the future development of the public transport system in the Cork Metropolitan Area.
- 1.3.2 The study has been undertaken with direction from a Project Team, with representatives from Cork City Council Traffic and Planning Departments; Cork County Council Traffic and Planning Departments and Bus Éireann.
- 1.3.3 The CATS study been undertaken with reference to the following studies/ plans:
- Cork Land Use and Transportation Study (LUTS), which set out the land use and transportation framework for the Greater Cork City area from 1978 to 2001;
 - Cork Area Strategic Plan (CASP), 2001, which superseded the Cork LUTS Study, and set out a broad brush strategy for the development of the Cork City-Region up to 2020; and
 - The subsequent CASP Update (2008). CASP Update takes account of economic, market and policy development since the original CASP was developed, and outlines the spatial growth pattern of the region up to 2020.
- 1.3.4 This Report expands on the findings of baseline evaluation and the issues arising from this exercise. Furthermore, detailed consideration of transport issues arising from the future growth of the Cork Metropolitan and wider CASP area is also included, assisted by the CATS multi-modal transport model covering the full CASP area.
- 1.3.5 The Report describes the optioneering process and provides an assessment of public transport options tested using the CATS multi-modal transport model. Recommendations on supporting demand management measures in the CASP area to support the development and operation of an enhanced public transport system are given, including the appropriate level of additional development, along key public transport corridors.
- 1.3.6 Detailed consideration of the most appropriate mode to operate along the east-west corridor through the Cork Metropolitan Area (which was demonstrated to attract the greatest number of public transport users) is also given, based on a consideration of system characteristics and implementation constraints and future development opportunities.
- 1.3.7 The preferred Strategy has also been subject to detailed appraisal against the CATS Strategy objectives. An environmental and economic appraisal of the strategy has also been undertaken to inform of the wider benefits of full implementation of CATS.
- 1.3.8 Finally, an outline implementation plan, detailing the key short-medium term public transport priorities for the Cork Metropolitan Area to better meet public transport user requirements.

1.4 Study Scope

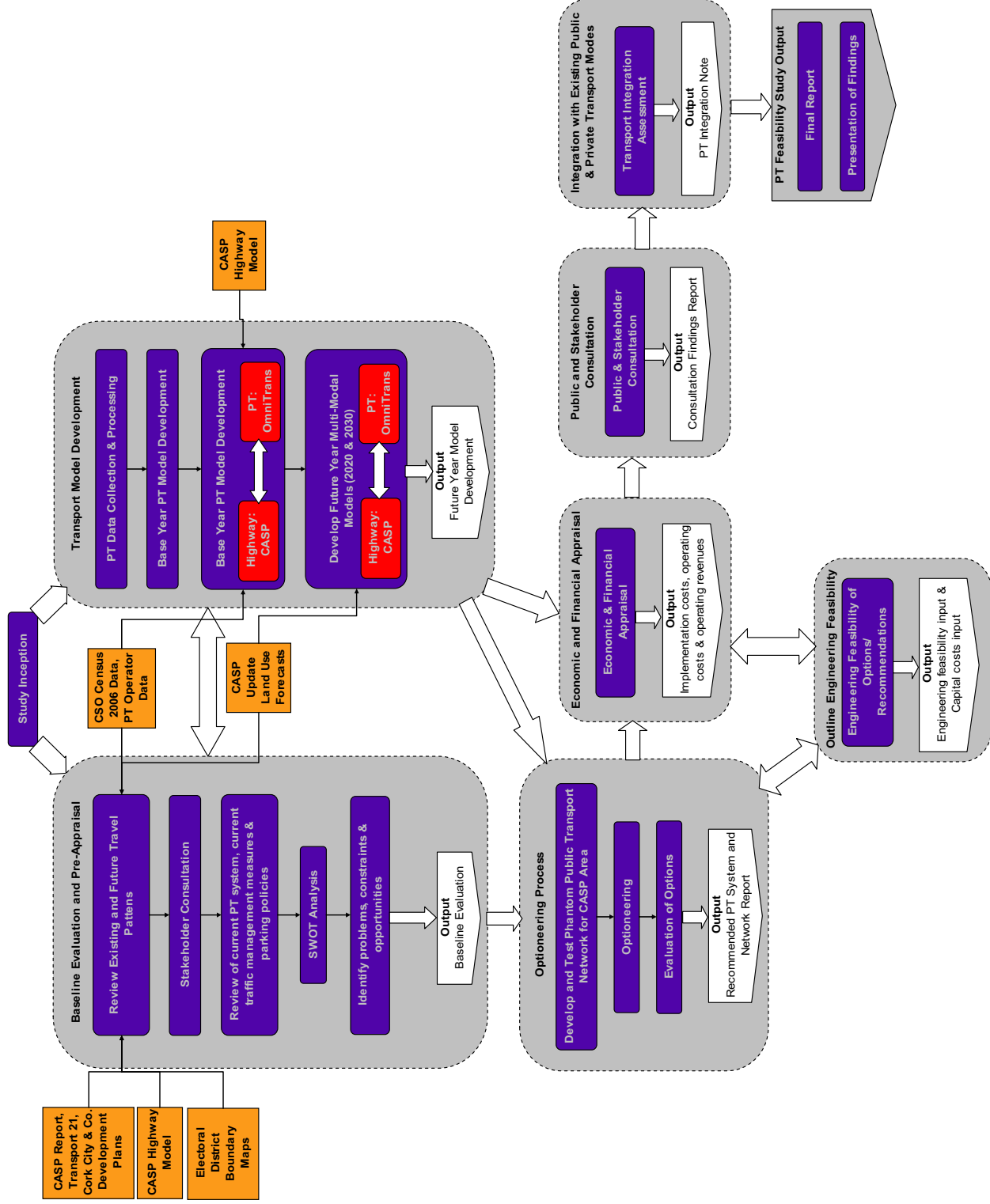
- 1.4.1 The Cork Area Transit System (CATS) Study is a public transport feasibility study for the Cork Metropolitan Area, with the aim of identifying the short (2013), medium (2020) and longer term (2030) public transport measures required to cater for the future growth of Cork City and Metropolitan Area up to 2020 and beyond. In summary, the CATS study is:

- **Not** a study with a single end point;
- **But** a process for developing public transport in Cork;
- **In step** with changing land use and rising expectations;
- **And** creating a more sustainable city region with fewer car trips and less travel overall;
- **So it became the Cork Area Transit System** – a strategy for public transport to 2020 and beyond.

1.5 CATS Outline Methodology

- 1.5.1 The outline methodology for the CATS Study is illustrated on the flow chart below. As can be seen, the approach involved a comprehensive assessment of baseline transport issues in the study area, multi-modal mode development, option development and evaluation, financial and economic appraisal, engineering feasibility and an identification of integrative measures. Public and stakeholder consultation also forms an integral element of the study approach.

Figure 1.1 Outline of CATS Study Methodology



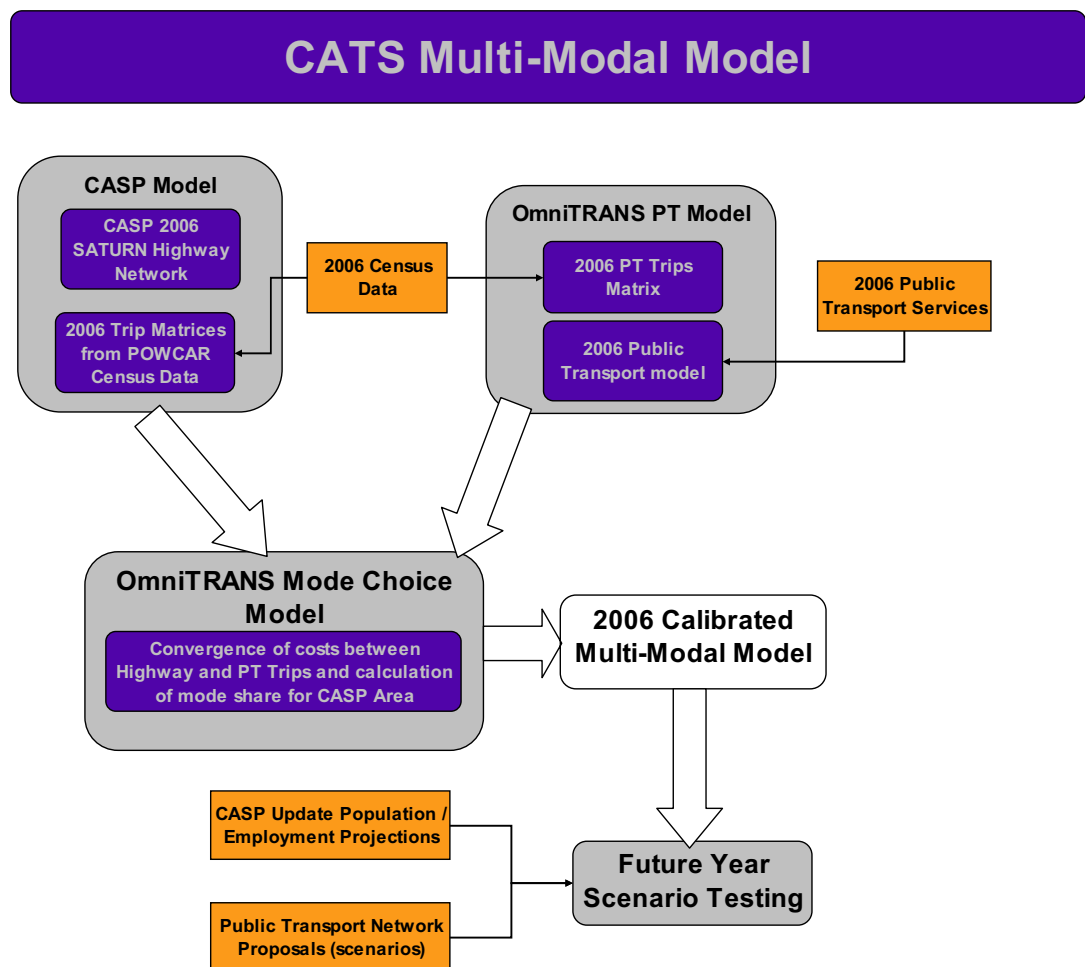
1.6 CATS Multi-Modal Transport Model

- 1.6.1 The CATS multi-modal transport model was developed in-house by MVA, and uses two modelling software packages, SATURN highway modelling software and OmniTRANS traffic planning software.
- 1.6.2 The CATS model makes use of the existing CASP SATURN highway model. SATURN is widely used in the UK and Ireland as the standard modelling software package to model large scale highway and urban / rural road networks. The CATS model uses SATURN for the highway assignment to generate highway costs (i.e. journey times, congestion delays, etc.) for use in the mode choice assessment.
- 1.6.3 The CATS model uses OmniTRANS to model public transport in the CASP area. Omnitrans was used as the modelling software platform for public transport for the following reasons:
- It provides a user friendly development environment;
 - Ease of data management with an integrated database environment where travel demand and model parameters can be stored;
 - Our project team have experience in using a number of public transport modelling packages including PT Trips, PT Voyager and Omnitrans; and
 - Omnitrans has been selected as the modelling software to replace the existing Saturn/ SATCHMO CASP model. As a result, any output from this study, in terms of new/ upgraded public transport network and services could be readily brought into the updated CASP model.
- 1.6.4 The CATS multi-modal transport model uses bespoke programs developed by MVA to link the current CASP Saturn Highway model to the Omnitrans Public Transport model. The mode choice element operates within OmniTRANS and compares highway and public transport costs to determine the mode split between car users and PT users.
- 1.6.5 The CATS transport model was calibrated and validated to a base year of 2006 using Census 2006 data. This ensured the model provided a meaningful representation of existing mode share in the model area, including use of public transport.
- 1.6.6 Future year scenarios were developed using the population and employment allocations from CASP Update for 2020; and through subsequent discussions with Cork City and Cork County Councils to disaggregate the aggregated land use data to an electoral district level. The CATS multi-modal transport model development process and structure is shown in diagrammatical form on the figure, overleaf.
- 1.6.7 The CATS multi-modal transport model represents an appropriate assessment tool for undertaking the CATS Study for the following reasons:
- It accurately represents base (2006) and planned future highway networks for the CASP area, having been developed from the existing CASP highway (Saturn) model;
 - It accurately represents base (2006) and committed future public transport schemes (e.g. suburban rail services to Mallow and Midleton);
 - The base year model has been calibrated and validated to Census 2006 conditions;

- The future year model for 2020, used in the option development and evaluation processes of the CATS Study have been developed to represent the CASP Update population and employment allocations. This facilitates an assessment of a public transport network/ service that best meets transport demand arising from this plan.

1.6.8 The CATS multi-modal transport model was used as a basis for assessing the comparative transport impact of various transport network/ service scenarios which were developed following analysis of observed and forecast future travel patterns within the study area. The model was subsequently used to appraise the wider economic and environmental benefits of the preferred strategy.

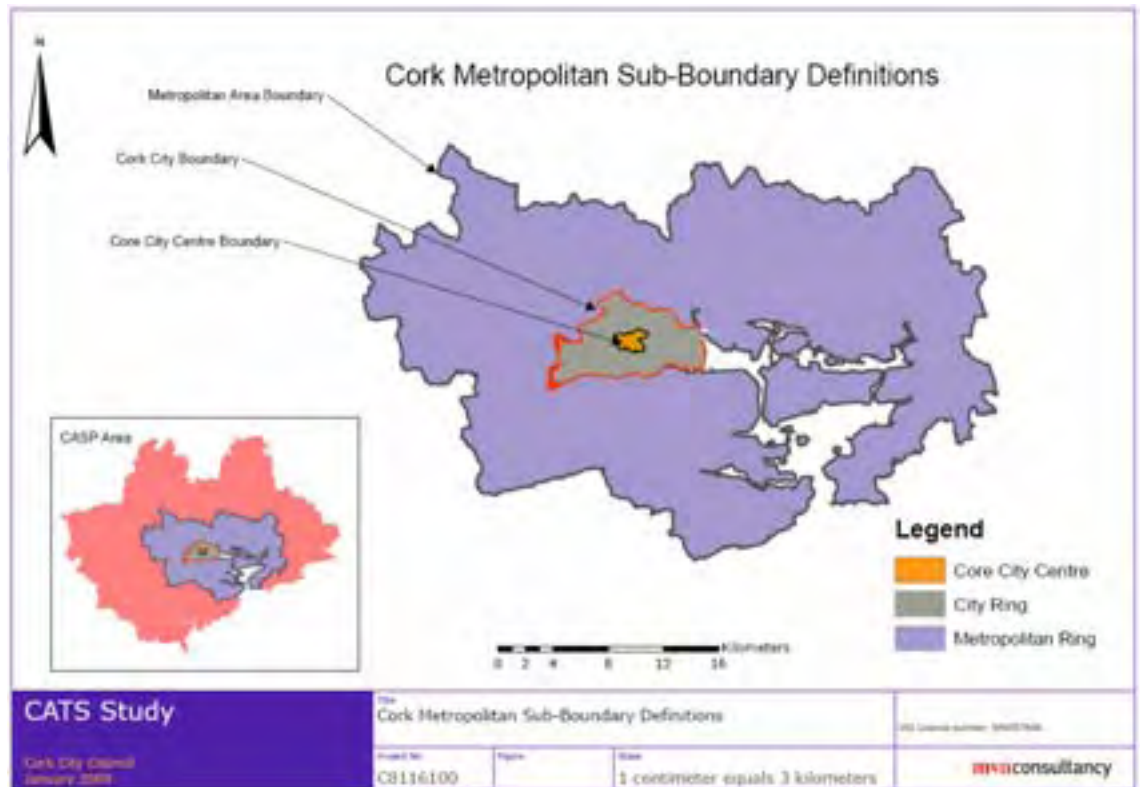
Figure 1.2 CATS Multi-Modal Transport Model Structure



1.7 Description of Study Area

1.7.1 As mentioned above, the CATS Study Area represents the Metropolitan Area, as defined by the Cork Area Strategic Plan. Figure 1.3, overleaf, illustrates the relevant study areas referred to within this study.

Figure 1.3 Study Area Sub-Areas



1.8 Definition of Terms

1.8.1 The following terms used within this Report and their definition are:

- **CASP:** The Cork Area Strategic Plan (CASP) is an initiative jointly sponsored by Cork City Council and Cork County Council which provides a vision and strategy for the development of the Cork City-Region up to 2020;
- **The CASP area** covers an area determined by a journey time of about 45 minutes from Cork City and encompasses a zone that includes Cork City, the remainder of the Metropolitan Cork, the ring towns and their rural hinterlands, a total area of approximately 5,950 km². The population of the CASP Area, as determined from Census 2006 is 377,596;
- **The Metropolitan area**, as defined in CASP, includes Cork City and the towns and areas in the immediate hinterland of the City of Cork as a single integrated unit, known as Metropolitan Cork. Specifically, Metropolitan Cork consists of Cork City and Douglas; the metropolitan area towns; and the existing strategic employment areas of Little Island, Carrigtwohill, Cork Airport Business Park, Ringaskiddy and Whitegate/Aghada. The Metropolitan Area, covers 820 km², and has a population of 272,541, as determined from Census 2006 (see below for details of towns);
- The **Core City Centre**, is defined as the areas between:
 - Water Street and Victoria Road in the east;
 - Greenville Place and Barrack Street in the west;

- Wellington Road in the north; and
 - Boreenmanna Road and Evergreen Street in the south.
- **Cork City**, the administrative area covered by Cork City Council, covers an area of approximately 40 km² and includes the city's commercial core area, the City Centre retail area and Cork Docklands. The population of the City Centre, as determined from Census 2006 is 119,522. The City Centre area is bounded by the Mahon Peninsula to the east, Blackpool Valley/Kilbarry to the north, Bishopstown to the west and the south ring road (N25) to the south;
 - **The remainder of the Metropolitan Area (Metropolitan Ring)**, covers the area between Cork City and Metropolitan area boundaries. The area covers 780 km² and has a population of 153,019;
 - **Metropolitan area towns** are satellite towns within the Metropolitan Ring, and include Ballincollig, Blarney, Carrigaline, Carrigtwohill, Cobh, Glounthane, Douglas, Glanmire - Riverstown, Midleton, Passage West and Tower;
 - **The Ring towns** are the principal towns outside of Metropolitan Cork, but within the CASP area. The designated Ring towns are Bandon, Bantry, Charleville, Clonakilty, Fermoy, Kinsale, Macroom, Mallow, Mitchelstown, Skibereen and Youghal;
 - **Ring areas** are defined as the area under consideration less any sub-areas located therein. For example, the **City Ring** area is defined as Cork City, without the Core City Centre. The **Metropolitan Ring** area is Metropolitan Cork, without the Core City area. The **CASP Ring** is defined as the full CASP area, less the Metropolitan area. The Ring Areas are illustrated in Figure 1.2, above.
 - **Strategic employment locations**, as defined in CASP, are locations deemed to have the capacity to accommodate additional employment growth, located on an existing or proposed public transport corridor and located close to or accessible by existing and expanding population centres;
 - **The Study Area**: the focus of the CATS Study is the Metropolitan Area of Cork, as defined by CASP (see above for definition), however movement from / to the Metropolitan area and its surrounds, in particular the remainder of the CASP area, are also considered;
 - **Commuter Rail** includes the provision of rail services, generally over a short or typical daily commute distance, to transport commuters to / from work. Commuter rail services include sections of the intercity rail network from Dublin to Cork, which stop at Mallow station and local services operated by Iarnród Éireann between Cork and Cobh;
 - **Intercity Rail**: long distance passenger service linking Cork with Dublin, with a connection provided at Mallow for services to Tralee. Interchange facilities are also provided at Limerick Junction to Limerick and Ennis;
 - **City Bus Services**: includes intra-urban bus services, i.e. those operating within Cork City on the city bus network. Such services include cross city radial routes and orbital routes to cater for inter-suburban trips within the south city;
 - **Outer suburban bus services**: are bus services serving the urban concentrations within the remainder of the Metropolitan Area. The outer suburban services are

designed to cater for the public transport needs of the outlying areas and they do not facilitate trips whose origin and destination are within the City;

- **Regional Bus Services:** include scheduled bus services connecting Cork City and County Cork with other counties and intermediate towns and villages. Regional bus services are operated by Bus Éireann and private operators;
- **Inter urban bus services:** are coach services operating along inter-urban corridors providing connections between towns and cities. Inter-urban bus services include express coach services between cities; and
- **Cork Green Routes:** a programme of bus priority measures, implemented by Cork City Council, with the objective of enhancing bus operations and the attractiveness of bus within the area.

1.9 Report Structure

1.9.1 This remainder of this report is structured as follows:

- study context (Section 2);
- study objectives (Section 3);
- option development (Section 4);
- evaluation of options (Section 5);
- supporting land use policy requirements (Section 6);
- appraisal of preferred strategy (Section 7);
- outline engineering feasibility (Section 8);
- BRT versus LRT (Section 9);
- integration of public and private transport modes (Section 10);
- outline implementation plan for preferred strategy (Section 11); and
- recommendations and next steps (Section 12).

2 Study Context

2.1 Baseline Characteristics of Study Area

- 2.1.1 An analysis of Central Statistics Office (CSO) Census 2006 POWCAR (Place of Work Census of Anonymised Records) and SAPS (Small Area Population Statistics) data has been undertaken as part of baseline evaluation activities, to develop an understanding of the demographic profile of the study area.
- 2.1.2 The main findings of this analysis, in terms of current settlement patterns in the CASP area are:
- The total population of the CASP area is 377,596, based on Census 2006 data, of which 32% (119,522) of the population lives in Cork City; 40% (153,019) lives in the Metropolitan Ring (i.e. outside the City); and 28% (105,055) lives in the CASP Ring (i.e. in ring towns and rural areas outside of the Metropolitan Area);
 - The population of eight Metropolitan Ring towns comprises 46% of the total Metropolitan Ring Population. A large percentage of the Metropolitan Area population therefore reside in rural areas/ small villages outside of these towns;
 - Within the CASP Ring, the populations of the six main towns accounts for approximately 23% of the total population in this area. This represents a very small percentage of the total population within the outer CASP area, indicating the rural nature of the outer CASP area; and
 - Areas of highest population density occur in Cork City. The most densely populated areas of Cork City are Blackpool, Gurranbraher and Tivoli in the north of the city, and Glasheen, Togher and Bishopstown in the south-west of the city. Metropolitan Area towns, particularly around Midleton, Cobh, Ballincollig and south of Cork City, have a population density of between 500 and 1,000 people per km².
- 2.1.3 The main findings of the analysis of census 2006 POWCAR, travel to work data are:
- Cork City generally has low number of daily work trip origins per electoral district, although this is somewhat distorted by the relatively small size of electoral districts in Cork City compared to the rest of the study area. Higher number of daily work trips originate in suburbs south-east (around Monkstown) and south-west (around Bishopstown);
 - The Metropolitan Ring generally has a higher number of work trip origins compared to Cork City, particularly around the towns of Ballincollig, Carrigaline, Cobh and Midleton;
 - The commercial and retail cores of Cork City have the highest number (greater than 3,500 work trips) of work trip destinations within the City. Areas of Rochestown, Mahon and the Docklands, south-east of the City Centre also have a high number of work trip destinations; and
 - The proportion of households with no car and with three or more cars is low within the study area. The highest proportion of one-car households occurs in Cork City, south of the City Centre, and in the ring towns of Mallow and Fermoy. The proportion of three-plus car households is highest in rural areas, mainly outside of Metropolitan Cork and lowest in Cork City.

- 2.1.4 The main findings of the 2006 POWCAR, travel to work data assessment in terms of the mode share are:
- Public transport use for journeys from home to work is low within the CASP area, compared to that achieved for other modes:
 - Cork City has a 7% public transport mode share,
 - The Metropolitan Ring has a 3% public transport mode share, and
 - the CASP Ring only has a 1% public transport mode share.
 - Car is the predominant mode for journeys to work in the study area. The highest car mode share (95%) occurs in Cork Ring Towns and their rural hinterlands, whilst the Metropolitan Ring has a 93% car mode share, representing very high levels of car use; and
 - Walk and cycle mode share is highest in Cork City, where 26% of the population travel by these modes.
- 2.1.5 An analysis of trip distribution patterns indicates that:
- There is a dispersed trip distribution pattern for journeys to work generally within the Metropolitan area. Cars tend to be used for radial trips into/ out of city as well as for trips on orbital routes between employment centres; and
 - The highest concentration of public transport trips tends to be from suburbs of Cork City and Metropolitan Area towns to Cork City Centre.
- 2.1.6 An analysis of Census 2006 SAPS data indicates that:
- 73% of all travel to work / school trips in the study area are less than 30 minutes; and
 - 18% of all travel to work / school trips are in the 30 to 45 minute journey time range; and
- 2.1.7 Journeys in the 30 to 45 minute journey time bracket are of particular interest as they represent one of the key target groups in terms of encouraging a shift to public transport.
- 2.1.8 An analysis of urban transport benchmarking data for similar sized cities, summarised in the following table, has indicated that Cork is presently mid-range in terms of public transport use, with a significant variance between European cities, for which data is available. This data also demonstrates the potential to increase overall levels of public transport use in future within Cork City and surrounding areas, through the identification of appropriate infrastructural, service and policy interventions.

Table 2.1 Modal Share of Cork City compare to other Similar Sized Cities ⁴

Small cities	Population ('000)	Modal Share for PT, %
Oxford	134	29
Bietihgeim Bisigheim	42	25
Suceava	108	18
Cork	120	10
Malmo	267	9
Aalborg	121	8
Oulu	93	5
Clermont Ferrand	264	4

2.2 Review of Public Transport Network and Services

- 2.2.1 The existing Metropolitan Area public transport network is as illustrated in the following figure.

⁴ Data from Urban Transport Benchmarking Initiative, Year 3 – Annex A1, Common Indicator Report. Data for Cork has been provided by Bus Éireann arising from market research activities, and relates to all journey purposes within Cork City

Figure 2.1 Existing Metropolitan Area Public Transport Network



Rail

- 2.2.2 At present, the Suburban Rail network provides limited coverage of the Cork Metropolitan and wider CASP area. The network at present consists of two corridors:
- The Cobh Corridor; and
 - The Mallow Corridor.
- 2.2.3 Iarnród Éireann operates commuter services between Cork City and Cobh. Trains run every half hour during peak period (07:00 to 09:30hrs and 16:30 to 19:00hrs) and hourly during off-peak hours.
- 2.2.4 Intercity trains services between Dublin and Cork stop at Mallow Station. These services are supplemented by additional Suburban Rail services between Cork and Mallow which operate hourly during peak hours, thus accommodating commuter requirements between Mallow and Cork City.
- 2.2.5 Iarnród Éireann operates an hourly InterCity service between Cork and Dublin. Connections are provided at Mallow to Banteer, Millstreet, Rathmore, Killarney, Farranfore and Tralee. Interchange facilities are also provided at Limerick Junction with train connections to Limerick and Ennis. Iarnród Éireann has recently completed a major investment programme on the Dublin to Cork rail line. Sixty-seven new InterCity locomotive-hauled carriages, at a capital cost of €117m, were introduced on the Dublin/ Cork route from May 2006, with all trains in service by January 2007. The delivery of the carriages, combined with a project to overhaul the locomotives, facilitated the introduction in January 2007 of hourly timetabling in both directions.
- 2.2.6 On the Tralee corridor new InterCity rail cars will be introduced at the end of 2008 / start of 2009, similar to those in operation on the Dublin to Cork Line. The Tralee to Mallow Railcar shuttle service will operate at a two hourly frequency. Direct rail services between Dublin and Tralee will increase from 1 to 2 direct trains per day. Rolling stock currently in operation on the Tralee to Mallow corridor will be transferred to the Cobh and Mallow Suburban Rail corridors.
- 2.2.7 At present the key reason as to the low levels of rail use in the Cork Metropolitan area is the poor levels of rail coverage within the study area, i.e. most people live/ work outside the catchment of rail. Furthermore, the location of Cork Kent Station to the north-east of the City Centre necessitates a significant walk for most rail users to reach their destination. The relatively indirect nature of the bus connection to the City Centre arising from the extensive one-way traffic system around Lower Glanmire Road/ Horgan's Quay also impacts on the attractiveness of rail use.

Bus

- 2.2.8 There are a number of areas that generate a significant volume of public transport trips by bus. In particular, many of those destined for the City Centre, Cork University Hospital (CUH), Cork Institute of Technology (CIT) and University College Cork (UCC) use bus as a means of travel.
- 2.2.9 Bus Éireann operates a reasonably extensive city bus network. The majority of city bus services are cross city radial routes. There are a small number of radial routes which

terminate in the City Centre. Recently, Bus Éireann has introduced new orbital routes to cater for inter-suburban trips within Cork City. Collectively there are seven 'high' frequency (generally every 15 to 20 minutes) city bus routes, six 'medium' frequency (every 30 to 60 minutes) bus routes and five 'low' frequency (limited number of services per day) city bus routes. There is a higher concentration of frequent bus services within the south city compared to the north.

- 2.2.10 Cork City Centre has an extensive one-way traffic system, which has a negative impact on public transport operations, as bus routes are separated on inward and outward legs. This can be confusing for irregular bus passengers and visitors to the City, who may not be familiar with the bus network.
- 2.2.11 Certain bus routes are separated as a result of restricted road widths. Some roads that are sufficiently wide for two-way traffic flows are not wide enough to accommodate two-way bus movements in Cork City, e.g. the no. 2 bus route on Convent Road (Mahon) and no.s 1, 5 and 19 on Rossa Avenue. As a result, a number of bus services only operate in one direction on some narrow two-way roads.
- 2.2.12 Depending on the level of variation between the corresponding routes in either direction (i.e. the inbound and outbound routes), there can be a considerable difference between where a passenger boards and alights on the return journey. Given extensive one-way routes it is more unlikely that a bus stop can be easily accessed for both the outward and return leg of a journey. Importantly, passenger who board along a loop before the end of the route, such as in the Mahon area, may have to wait a considerable time at the terminus before re-commencing on their journey. One-way loops also act as a deterrent for local bus use, as the services do not cater for bus movements in both directions.
- 2.2.13 Since 2000, Cork City and County Councils have implemented a programme of bus priority measures, termed Cork Green Routes, which aim to improve bus services within the area. The effect of the Green Routes investment programme has been to insulate buses from increases in traffic congestion on key radial corridors between the suburbs and Cork City Centre, since their introduction. It does not appear, however, that they provide adequate priority to protect buses from the impacts of general traffic congestion.
- 2.2.14 Cork benefits from a centrally located bus station on Merchant's Quay. There is a good level of integration between long distance express services, outer suburban services and city services provided at the bus station. In addition to the bus station, there are concentrations of bus stops on Merchant's Quay, St Patrick's Street and South Mall.
- 2.2.15 Bus Éireann, operate a dedicated Park and Ride service from the Black Ash Park and Ride site, which is owned by Cork City Council. The service is operated by a dedicated fleet of double deck buses that are specifically branded and highly recognisable, and is recognised as a major success. Recent studies have shown that there is a high level of demand from people going to Cork City for shopping purposes.

2.3 Summary of Key Issues Affecting Public Transport

- 2.3.1 The key issues affecting public transport use in the Cork Metropolitan Area disaggregated by heading are:

Infrastructure and network related issues

- The current rail service offers very limited coverage of the Cork Metropolitan Area, the outcome being very low levels of use for journeys to work, and likely also for other journey purposes;
- The road infrastructure, and, in particular, extensive one-way systems on a number of bus routes, increases bus kilometres travelled and creates significant barriers to public transport use;
- The trip distribution patterns observed following the review of baseline travel data has indicated a dispersed travel pattern in the study area, which is difficult to serve by public transport;
- The existing public transport network configurations do not meet the dispersed trip patterns which have arisen as a result of development within the Cork Metropolitan Area. In particular, trips with origins and destinations away from the City Centre are not presently well catered for by the bus network;
- There is a concentration of bus stops on Merchant's Quay, St Patrick Street and South Mall. Given the quantity of bus services on these three streets, it is necessary to separate bus routes and allocate them to individual stops. In some cases, this has led to routes on the same corridor being split between bus stops. This can have a negative impact for passengers who could avail of a multiple of routes as it, in effect, reduces their options to travel and increases wait time;
- The quality of the waiting environment is poor for bus passengers on Merchants Quay, a key location for bus stops in the city centre. This poor environment results from a combination of the large number of buses laying over on the street, coupled with the adjoining development type, i.e. the lack of direct street frontage; and
- Many bus stops are simple poles with no timetable or route information provided. Where shelters are provided, the level of bus stop information varies substantially. The quality and uniformity of bus stop infrastructure throughout the study area is not considered adequate in terms of meeting passenger demands. Poor quality bus stop infrastructure, and lack of information at bus stops, and generally prior to boarding, are major barriers to public transport use.

Service/ Management related issues

- The majority of trips to work and education in the Cork Metropolitan Area are under 30 minutes. As a result, bus frequencies are not sufficiently high to represent an attractive alternative to car use for the majority of journeys within the Metropolitan Area.
- To maximise bus service coverage, many of the outer suburban services have a number of variations and some take different routes between urban centres at different times. Generally, the outer suburban bus services are more complicated and bespoke than their city counterparts. This is a critical issue in terms of non-public transport users and those who irregularly use public transport, as they find it difficult to understand how available services can accommodate their travel needs; and
- Cross city services have scheduled departure times from the City Centre. If the bus arrives in the City Centre before its scheduled departure time, the driver will wait until it is the appropriate time to depart. Bus journey times can vary greatly, in part due to

traffic congestion. This can result in long dwell times in the City Centre in order to maintain timetable departures. With the exception of the number 1 and the number 19 services, driver changeover for city services is undertaken in the City Centre. As a result of both unreliable early arrivals and driver changeovers, cross-city services can be subject to long delays in the City Centre. This has an overall negative impact on passengers who wish to make cross-city journeys.

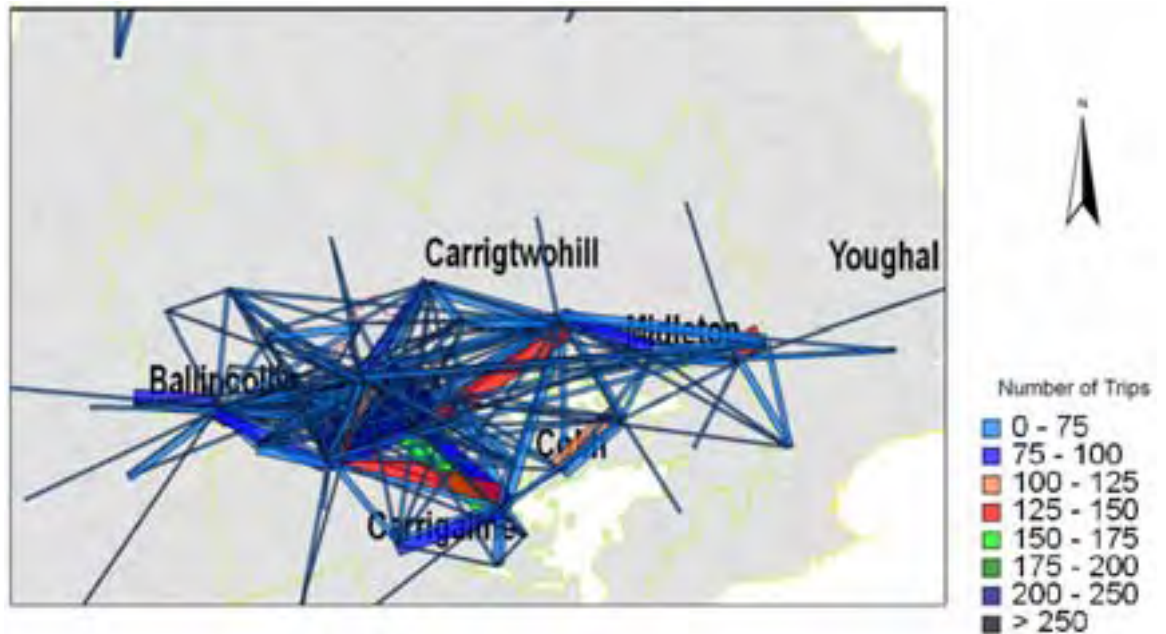
Land use/ development related issues

2.3.2 The following land use related issues are not supportive of public transport use and provision:

- A large percentage of the Metropolitan Ring population, 54%, reside in rural areas/small villages outside of the largest eight towns. These areas are difficult to serve by public transport;
- The relatively low densities of development in main towns within the Metropolitan Area, e.g. Ballincollig, Midleton, Carrigaline, and the car oriented nature of development in these areas negatively impacts on public transport accessibility;
- The rural nature of the CASP Ring with the combined population of the six main towns accounting for approximately 23% of the total population in this area;
- Dispersed trip patterns for journeys from home to work arising from the spatially dispersed pattern of development in the study area is illustrated in the desire line plot below. The current public transport network, consisting primarily of series of radial, or cross city bus services, and lacking strong orbital links does not match the strongest observed travel patterns within the study area. Such dispersed patterns of trip making indicate a challenge in terms of economically developing high quality public transport services to meet these demands;
- High quality road network outside Cork City, which has resulted in unsustainable/dispersed settlement patterns away from Cork City and to encourage private car use;
- Car oriented development, which discourages public transport use. In some parts of the Metropolitan Area, there is a considerable amount of development built around cul-de-sacs, both residential and business estates. Cul-de-sacs are difficult for public transport services to access and servicing cul-de-sacs generally resulting in a less direct service which has a negative impact on passenger demand. In many cases, the employment and residential developments are a considerable distance away from the through routes. Unless there are very high quality pedestrian links between the development and the road corridors, it is difficult to design public transport services to serve the areas of development; and
- There is a close correlation between car parking provision and car use, in particular at places of employment, where car parking is generally provided free of charge to employees. Given the very high car mode share for journeys to work within the Metropolitan Area, it is evident that there are very high levels of private non-residential (PNR) car parking throughout the study area. The high levels of PNR within the study area have been supported by:
 - development car parking standards contained within past and current City and County Development Plans, and

- tax incentives to encourage the development of multi-story car parks in City Centre, with the overarching objective of renewing urban areas and reinforcing the primary importance of city centres.

Figure 2.2 Desire Lane Maps, all modes, 08:00 to 09:00hrs



2.4 Future Transport Context

Suburban Rail

- 2.4.1 Transport 21 is the Government's capital investment framework through which the transport system in Ireland will be developed over the period from 2006 to 2015. Under this plan commuter rail services will be introduced to Midleton and the Mallow service will be upgraded. The main element of the project involves the reopening of the railway line between Glounthaune and Midleton, with stations at Carrigtwohill and Midleton and possibly at Carrigtwohill West. An additional rail station is also proposed at Dunkettle, adjacent to the Dunkettle Interchange.
- 2.4.2 Iarnród Éireann has confirmed that services to Cobh and Midleton will initially operate at 30 minute frequencies in peak periods. This will allow for 15 minute frequencies between Glounthaune and Kent Station in the peak period. Initially the service will be provided by two car train sets. However, subject to build up in demand, four car train sets could be used with a capacity of 600 per train, giving a peak hour capacity of 2,400/ hour into Kent Station from the east. Planned off-peak frequencies are initially one train every 2 hours to Midleton, and 1 per hour to Cobh. Potential exists to substantially increase capacity along this corridor in future, with frequencies of 8 services per hour possible (four on each leg), should demand increase beyond levels currently envisaged. This would allow for an ultimate capacity of 4,800 per hour.
- 2.4.3 In addition, Transport 21 also contains plans to open new stations on the existing Mallow Rail Line at Blarney and Kilbarry. It is proposed that services will begin with 30 minute

frequencies in the peak and hourly in the off peak (in combination with the InterCity service). This could potentially be increased to 15 minute frequencies, as developments along the line are completed and demand grows. Again, the dedicated commuter services will initially be delivered with two car train sets. Infrastructure along the Mallow line would potentially allow for eight car train sets to operate along this corridor, with a capacity of 1,200 per train, i.e. a potential ultimate capacity of 4,800.

- 2.4.4 Iarnród Éireann has confirmed that there is sufficient capacity at Kent Station to cater for the planned introduction of Suburban Rail services, whilst not impacting on InterCity services using the station. Signalling constraints are considered by Iarnród Éireann to be temporary in nature, and can be addressed should the need arise.

Bus

- 2.4.5 In addition, Transport 21 also includes provision for funding to Bus Éireann to further enhance and grow the services it provides customers on city and commuter services in the regional cities, including Cork. This includes the provision of higher frequency services and more departures as well as the introduction of new services and new routes in growing communities. Funding has also been provided for the delivery of new vehicles.

2.5 Cork Area Strategic Plan

- 2.5.1 The CATS Study has been undertaken within the context of the Cork Area Strategic Plan (CASP), which sets the framework for the development of the Cork City and wider Region up to 2020. At the time of writing this report, a draft update of CASP has been prepared and is under consideration by Cork City and County Councils.
- 2.5.2 This updated plan forecast that the population of the CASP area will increase from 378,000, in 2006 to 488,000 in 2020 – representing growth of over 29%. The majority of this new population will reside within the Cork Metropolitan Area.
- 2.5.3 In Cork City, it is envisaged that a significant portion of the population/ employment growth will be concentrated in the south east area of the city, including Cork Docklands and Mahon.
- 2.5.4 It is projected that the total number of jobs in the CASP area will increase by 45,000 by 2020. Of this, 16,000 (36%) will be located in the city, many in the redeveloped Docklands area. An additional 4,000 jobs has been allocated to Ballincollig.
- 2.5.5 The CASP Update has identified the potential for one or more Rapid Transport corridors and two potential routes were identified for further examination namely:
- a Rapid Transit Corridor linking key development nodes at Mahon and the Docklands with Kent Station, the City Centre and the western suburbs including the University, CUH and CIT with possible westward extension to Ballincollig; and
 - a second Rapid Transit Corridor linking the Airport with the City Centre and linking onwards to the new development node at Ballyvolane.

2.6 Key Findings/ Implications

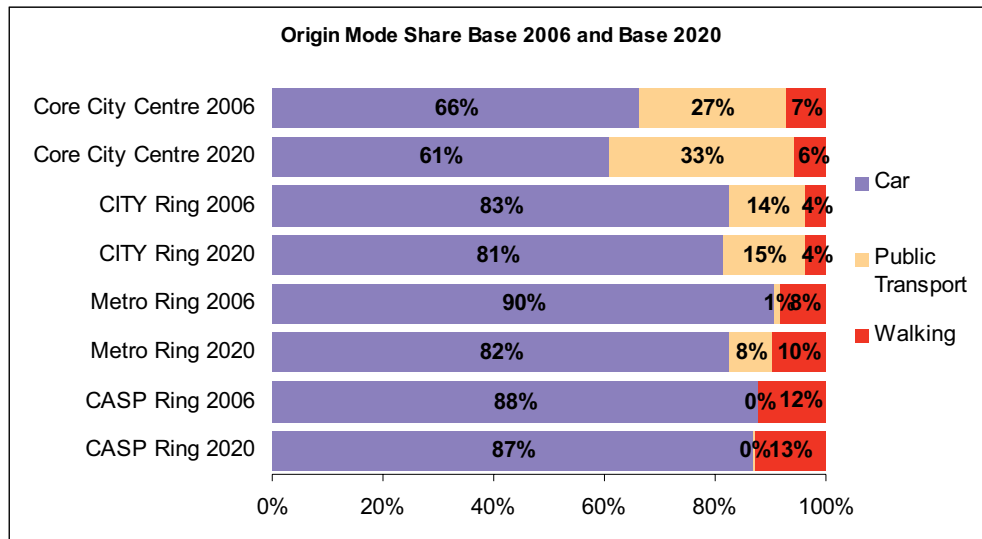
Future Growth of Cork

- 2.6.1 Future settlement patterns, as envisaged within the context of CASP, have allocated a significant portion of the population/ employment growth to Metropolitan Area, outside of Cork City. Despite the significant increases in population and employment allocated to areas in the vicinity of the Suburban Rail stations, such as those proposed at Carrigtwohill, Midleton, Blarney and Mallow, future settlement patterns will result in a reinforcement of dispersed travel patterns as a result of locating significant amounts of development away from the urban Metropolitan core, resulting in:
- increased levels of car use and associated environmental impacts; and
 - continued low public transport use for travel to work etc.
- 2.6.2 In transport terms, the future growth of the Cork Area presents both challenges and opportunities, which need to be addressed within the context of the CATS Study. The forecast population and employment growth will generate significant additional travel demand, which, if not addressed, would lead to significant increases in car use.
- 2.6.3 Transport modelling undertaken in relation to this study indicates that, even with committed planned road and public transport interventions in place, that average AM peak hour (08:00 to 09:00hrs) network traffic speeds between 2006 and 2020 would decrease across the Metropolitan Area by approximately 5.2km/h, from 34.8km/h to 29.6km/h. This represents a decrease of 14.8% in average network traffic speeds across the study area over this time period. Table 2.2 below, illustrates the average network speed changes between 2006 and 2020, disaggregated for each of the key CASP areas.

Table 2.2 Average Network Speed by Area, Base 2006 and Base 2020 (CASP Update Population and Employment Allocations)

Scenario	Average Speed Core Area (kph)	Average Speed City Area (kph)	Average Speed Metropolitan Area (kph)	Average Speed CASP Area (kph)
Base 2006	12.3	24.5	34.8	34.7
Base 2020	11.3	23.0	29.6	31.8
% Change 2006-2020	-8.1%	-6.1%	-14.9%	8.4%

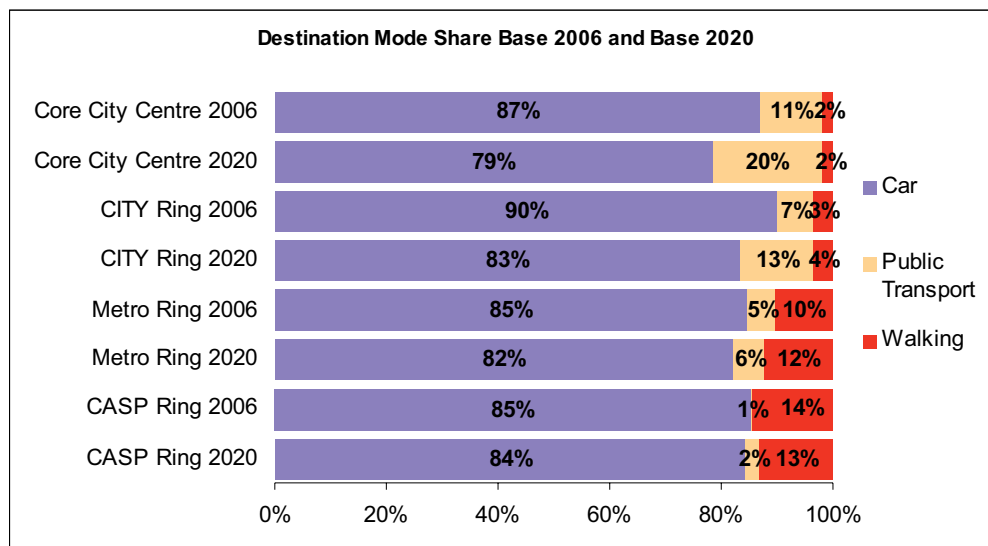
- 2.6.4 Transport modelling has also indicated the likely mode share arising from the future settlement patterns envisaged within the context of the CASP Update, with no improvements to the public transport network additional to that proposed in Transport 21. This is illustrated in the following figures.

Figure 2.3 Origin Mode Share 2006 Base ⁵ and 2020 Base

2.6.5 As can be seen from the above figure, the origin mode share figures demonstrate some increase in public transport use for each of the sub-study areas, as follows:

- Core City Centre area, increasing from 27% to 33%;
- Cork City Ring, increasing from 14% to 15%; and
- Metropolitan Area Ring, increasing from 1% to 8%.

2.6.6 Across the full study area (Metropolitan Area), the origin public transport mode share is forecast to increase from 7% in Base 2006 to 12% in Base 2020.

Figure 2.4 Destination Mode Share 2006 Base ⁶ and 2020 Base

⁵ 2006 mode shares are from CATS multi-modal model and do not show a direct correlation with Census 2006, as intra-zonal trips are excluded, many of which are walk/ cycle trips. In addition, mode share figures provided in the figure are for the AM peak hour only.

⁶ 2006 mode shares do not show a direct correlation with Census 2006, as intra-zonal trips are excluded, many of which are walk/ cycle trips. In addition, mode share figures are for the AM peak hour.

2.6.7 Figure 2.4, above, illustrates that the destination mode share figures also demonstrate some increase in public transport use for each of the sub-study areas, as follows:

- Core City Centre area, increasing from 11% to 20%;
- Cork City Ring, increasing from 7% to 13%; and
- Metropolitan Area Ring, increasing from 5% to 6%.

2.6.8 The key issue relating to the future growth of the Cork Metropolitan Area is the continued reliance on private car use for the majority of trips throughout the area. This is considered to be unsustainable in the following respects:

- Economic impacts: Car dependency, and associated urban traffic congestion increases the overall cost of travel throughout the Region. In addition to the considerable direct costs associated with car use (vehicle costs, insurance costs, fuel costs, maintenance costs etc.) there are a range of other costs imposed on society as a result of each trip. These 'external costs' include:
 - costs of traffic congestion,
 - infrastructure development/ maintenance costs,
 - environmental noise pollution costs,
 - environmental air pollution costs, and
 - road accidents costs.

As traffic volumes increase on a road, the value of the external costs increases at an exponential rate, thus resulting in negative economic impacts throughout the region. Given the forecast growth of the Cork Metropolitan Area up to 2020, and the forecast reduction in area wide general traffic speeds, this is likely to have a negative impact on the economy of the study area;

- Environmental impacts: energy consumption per kilometre travelled, and transport emissions associated with private car use are significantly higher for private car use than is the case for equivalent journeys by public transport, or walking/ cycling. This is unlikely to change even with future advances in technology. As the population of the study area is forecast to grow by approximately 30% over the period between 2006 and 2020, transport emissions are likely to increase substantially over that time, in the absence of a significant modal shift away from car. Transport modelling undertaken in relation to this study has indicated that this shift to public transport is not likely to happen following implementation of committed transport schemes in the study area. Such increases in transport related emissions are likely to have negative public health impacts, in particular in the urban core; and
- Public health impacts: In addition to the impact of transport related emissions on public health, car dependency and associated low levels of walking, cycling and public transport use has long been linked to high levels of obesity within society. The continued high levels of car use forecast for 2020, in the absence of considerable intervention aimed at reversing this situation, would negatively impact on levels of obesity, and, as a result, public health throughout the study area.

2.7 Summary

- 2.7.1 The negligible levels of public transport use in the outer CASP area will remain unchanged between 2006 and 2020 for journeys to work. Although the public transport mode share is forecast to increase in the future throughout the study area (from 7% in 2006 to 12% in 2020), the vast majority of journeys to work in the CASP area will still be by private car.
- 2.7.2 This high level of car use is regarded as unsustainable, from economic, environmental and public health perspectives, and without further intervention cannot be reversed.
- 2.7.3 Substantial improvements to the road network in the CASP area are planned up to 2020, as are commitments to improving public transport, e.g. introduction of Suburban Rail services on the Mallow and Midleton rail corridors. Despite this, general traffic speeds across the Metropolitan Area are forecast to fall by 5.2km/h, or 14.8% between 2006 and 2020. This reduction in overall network traffic speeds will arise from the scale of future growth forecast to 2020 and the spatial allocations of development contained within the context of CASP Update.
- 2.7.4 In the longer term, without significant further public transport/ land use interventions within the study area, future travel patterns, and in particular high levels of car use, will continue to prevail. The forecast 2020 public transport mode share for journeys to work across the Cork Metropolitan Area of 16% is considered relatively low in the context of levels presently achieved in some other similarly sized European cities such as Oxford (29%), Bietihgeim Bisigheim (25%), and Suceava (18%). It also indicates the scope that exists for improvements in the Cork Metropolitan Area, following the implementation of appropriate policies and related interventions targeted at increasing public transport.
- 2.7.5 The challenge for the Cork Metropolitan and wider CASP areas is to better accommodate growth by facilitating more sustainable future travel patterns than currently exist. The key implications of the above review of the current and future land use and transport planning policies documents and data indicate that:
- objectives (which are set out in Section 3) need to be tied to objectives of the committed land use plan (CASP Update) to ensure transport system characteristics meet the future travelling needs of the region; and
 - given the degree of uncertainty as to the scale, the rate and pattern of future development in the CASP area, there is no single 'right answer' – but a strategy that will cater for different land use development patterns in the CASP area.

3 Study Objectives

3.1 Introduction

- 3.1.1 The development of objectives is a key step in the development of any strategy or plan. In the context of the CATS Study, the objectives define what the transport system should aim to achieve, either directly or through their influence on other aspects of spatial planning. The objectives form a critical input to the evaluation process, facilitating the assessment of options on the basis on how well they contribute to the achievement of objectives.
- 3.1.2 This section of the Report sets out the objectives developed for the CATS study, which are based on an examination of key spatial planning documents and a series of consultations with stakeholders.
- 3.1.3 If the objectives are to be useful they must be 'SMART', that is:
- **Specific:** *the outcome desired must be tangible;*
 - **Measurable:** *the change from the present, or the absolute target should be quantified;*
 - **Achievable:** *within the context the objective must be attainable by those responsible for agreeing the strategy;*
 - **Realistic;** *the objective must be attainable within the resources likely to be available and the timescale; and*
 - **Timed:** *there must be a clear timescale for achievement.*
- 3.1.4 In this process of objective setting it is important to ensure that objectives are not confused with actions or solutions. Hence the objectives which follow are deliberately phrased to avoid:
- directing the solution to one particular mode of transport;
 - focussing on a transport solution when other actions may have the same impact; and
 - linking transport with land use to emphasise the interdependence.

3.2 Overarching Objective

The overarching objective of the CATS Study is to develop the public transport network in Metropolitan Cork to support a more concentrated and, therefore, sustainable pattern of development, with a renewed emphasis on Metropolitan Cork as a place to live and work.

3.3 Objectives of CATS Study

- 3.3.1 **To provide an attractive public transport service** which is a genuine alternative to using a car for trips to key locations.

Sub Objectives

- to provide journey times which are competitive with car and are consistent throughout the day in the face of increasing traffic congestion;
- to facilitate the use of high quality vehicles with the latest propulsion technology such that emissions in sensitive areas are minimised and the product offered to passengers in terms of quality of ride and ambience matches the 'best in class' standards across Europe; and
- to consolidate demand such that attractive service frequencies can be economically offered across an extended working day (06:30 to 19:30hrs) and also at weekends where appropriate.

- 3.3.2 **To provide sufficient capacity on the public transport network** to allow intensified development on key corridors, which in turn encourages sustainable living by making walking an attractive and convenient option for some trips.

Sub Objectives

- to encourage a concentration of development within the Cork Metropolitan Area based around high quality public transport spines; and
- to remove capacity constraints on high density development, particularly in Cork Docklands, by providing an alternative to car use.

- 3.3.3 **To promote sustainable future development patterns**, facilitating a consolidation of development within the Metropolitan area, in particular in areas well served by public transport.

Sub Objectives

- to increase accessibility and improve the attractiveness of designated development areas such as Cork Docklands, and further intensification of development in the City Centre; and
- to reduce car dependency and to facilitate the long term sustainable development of the Metropolitan Area.

Additional Desirable Outcomes

- 3.3.4 A further key outcome of CATS is **to reduce the level of subvention** required to maintain the public transport network by increasing the density of use throughout the day. As a result, it is necessary to increase demand to levels commensurate with the potential of the system.
- 3.3.5 To achieve this outcome it will also be necessary to reduce the cost of operation by increasing operating speeds and predictability of journey times. Furthermore, it may be necessary to invest in infrastructure where this leads to increased operational efficiency and encourages use.

3.4 Indicators of Achievement

The table, overleaf, outlines the key measures of success as regards the future public transport system for the Cork Metropolitan Area.

Table 3.1 Measurement of Achievement

Objective	Measure	Achievable and realistic
Attractive Public Transport: Competitive Journey Times with private car	Change in relative journey times on key corridors, taking into account access times for both public transport and car parking	Over short distances it is rarely possible to equal the journey time by car – unless parking is remote or difficult to find. The measure is about narrowing the gap, not closing it completely
Attractive Public Transport High quality system	Vehicle age and specification Degree of priority Specification of supporting infrastructure	Realism requires that the specification is adequate but not lavish
Attractive Public Transport High frequency through consolidated demand	Maximum wait times (minimum headways) on sections of route and load factors achieved	Service levels need to be related to demand Concentration of service needs to recognise the expectations of some groups of existing users
To provide adequate capacity To remove capacity constraints on key developments areas, without which, excessive car demand would be generated	Capacity provided in relation to expected demand	The expected demand must be within reasonable bounds based on experience elsewhere and the likely pattern of movement
To support sustainable development Support for intensified development	Extent of public transport coverage within growth areas and quality of links to key opportunities	Linking the provision of public transport with new development

4 Option Development

4.1 Introduction

- 4.1.1 Section 2 of the Report detail the existing and future context within which the CATS Study is being undertaken. Section 3 outlines the agreed study objectives, setting out what it is ultimately aimed to achieve for the public transport network in Metropolitan Cork.
- 4.1.2 Following consideration of the key outputs from the above exercises, a series of options were developed with a view to simultaneously addressing existing/ future transport issues and satisfying the study objectives.

4.2 Overarching Considerations

- 4.2.1 The primary considerations impacting on the determination of the most appropriate system are:
 - Impact on urban form;
 - Meeting passenger expectations and requirements; and
 - Feasibility of implementing in the space and time available, and within acceptable cost.

What would drive the urban form?

- 4.2.2 The following system characteristics will have an impact on the urban form and, so, contribute to achieving the study objectives. As a result, they are considered beneficial system attributes:
 - **Permanence**, which has an impact on the extent to which people will take lifestyle decisions based on the strategy;
 - **Impact on the Environment**, where a scheme which has a high impact is going to have a more significant influence on the urban form than one which blends in with the surroundings; and
 - **Effect on Travel**, where a strategy which makes the most difference to the ease of travel in a particular area will have the greatest influence on travel patterns and ultimately on the form of urban development.
- 4.2.3 Figure 4.1 rates various alternative types of public transport against the system characteristics by showing strong positive correspondence as green and weaker correspondence as red. For example, Heavy Metro services perform very well in terms of permanence because they have fixed lines but not so well in terms of effect on travel because they can have limited catchment areas.

Figure 4.1 System attributes that shape the urban form

System	Permanence	Impact on environment	Effect on travel
Heavy Metro			
Existing suburban heavy rail			
Heavy LRT / Light Metro			
Mainly segregated LRT			
Mixed segregated & on street LRT			
Mainly on street LRT / Tram			
BRT - Segregated Guided Busway			
BRT - Segregated Unguided Busway			
Continuous Bus Priority on street			
Selected Bus Priority			
Upgraded bus with limited priority			
Existing bus with limited priority			
Existing bus – no priority			
Low capacity / high frequency buses			
Demand responsive buses			
Taxi			

What would suit the passenger?

4.2.4 The following aspects are considered to be of prime importance from a transport use perspective:

- **capacity**, i.e. can I get on board the system?;
- **coverage**, e.g. does it pass near where I live AND work?;
- **speed**, i.e. will it get me there faster than driving or walking; and
- **predictability** (reliability), i.e. will I have a guaranteed door to door journey time.

Figure 4.2 System attributes valued by prospective passengers

System	Capacity	Coverage	Speed	Predictability
Heavy Metro				
Existing suburban heavy rail				
Heavy LRT / Light Metro				
Mainly segregated LRT				
Mixed segregated & on street LRT				
Mainly on street LRT / Tram				
BRT - Segregated Guided Busway				
BRT - Segregated Unguided Busway				
Continuous Bus Priority on street				
Selected Bus Priority				
Upgraded bus with limited priority				
Existing bus with limited priority				
Existing bus – no priority				
Low capacity / high frequency buses				
Demand responsive buses				
Taxi				

What can we implement in the space and time available, and within acceptable cost?

4.2.5 In developing and assessing potential options, it is essential to understand the practicality of implementation, which is determined by a number of factors, including:

- **space**, to construct and operate the system;
- **time**, i.e. is the implementation timeframe excessively long; and
- **cost**, i.e. will sufficient funds be available to fund its implementation.

Figure 4.3 Practicability of implementation

System	Space	Time	Cost
Heavy Metro			
Existing suburban heavy rail			
Heavy LRT / Light Metro			
Mainly segregated LRT			
Mixed segregated & on street LRT			
Mainly on street LRT / Tram			
BRT - Segregated Guided Busway			
BRT - Segregated Unguided Busway			
Continuous Bus Priority on street			
Selected Bus Priority			
Upgraded bus with limited priority			
Existing bus with limited priority			
Existing bus – no priority			
Low capacity / high frequency buses			
Demand responsive buses			
Taxi			

4.3 Further Consideration of Options

4.3.1 The range of options considered encompasses the full range of public transport systems – from personalised transport through to very high capacity systems – the urban metro. Not all of these are either suitable or practical in the Cork context. Those which clearly did not fit were excluded from further consideration at an early stage, are listed in Table 4.1 with a brief summary as to the reasons why.

4.3.2 In the list of options there are four systems which offer high capacity and permanence:

- Mainly segregated LRT;
- Mixed segregated and on street LRT; and
- Bus Rapid Transit (BRT) options, including:
 - Segregated guided busway; and
 - Segregated but unguided busway.

Table 4.1 Options discounted at an early stage in the Option Development process

System excluded	Practicality	Suitability
Heavy Metro	Cost out of proportion with available finance Requires continuous reserved right of way – not possible without extensive tunnelling	Station spacing would be too long for likely travel patterns Distances not sufficient for greater speed to compensate for long access times and interchange Capacity substantially in excess of requirements
Existing suburban heavy rail	No further lines to develop Requires continuous reserved right of way – not possible without extensive tunnelling	As above for any new alignment
Heavy LRT / Light Metro	Requires continuous reserved right of way – not possible without extensive tunnelling	Distances not sufficient for greater speed to compensate for long access times and interchange Capacity substantially in excess of requirements
Mainly segregated LRT	No obvious route through the City Centre without tunnelling Other 'clear' lines are away from key traffic generators	Would be suitable IF a higher proportion of the possible routes were subject to redevelopment
All other systems	Are practical in and around Cork Systems involving steel wheel on steel rail are significantly more expensive and disruptive to implement than the others	Would be suitable potential components of a future system Only systems with significant dedicated infrastructure will have an impact on urban form

4.4 Scenario Development

4.4.1 The key aspects of the scenario development process involved:

- an assessment of the potential for public transport along key corridors in the Cork Metropolitan Area, involving an unconstrained testing of a theoretical public transport network in the study area; and
- the incremental development of the public transport network facilitating a determination of the public transport service characteristics required to cater for transport user requirements.

4.4.2 The first two scenarios were non-option related and consisted of:

- Base 2006: This scenario represented the 2006 transport network with 2006 transport demand; and
- Base 2020: 2028 highway network, 2020 public transport network as per Transport 21 rail proposals and 2020 CASP Update population and employment allocations.

4.4.3 Base 2020 and all subsequent future scenarios developed for the purposes of the option development and evaluation have taken committed transport schemes as a given. The scenario development process has therefore been undertaken in the context of full implementation of Suburban Rail Corridors to Mallow and Midleton. Each of the scenarios developed therefore aim to enhance the benefits of these schemes, by developing an integrated public transport network, with existing and committed schemes as core elements. This reflects the significant investment either undertaken to date, or committed to in the CASP region.

4.4.4 Based on a consideration of the key future settlement and transport issues facing the Cork Metropolitan Area, the following scenarios were developed for further consideration:

- Scenario 1: Do-Minimum;
- Scenario 2: Phantom Network;
- Scenario 3: Bus Based;
- Scenario 4: Rapid Transit ⁷;
- Scenario 5: Rapid Transit + City Centre Traffic Management Plan; and
- Scenario 6: Scenario Rapid Transit, Ballincollig to Docklands.

4.4.5 An outline of each of the scenarios assessed in relation the option development process is outlined in the text below.

⁷ The term Rapid Transit denotes the provision of higher quality public transport infrastructures and services than those provided by conventional bus services. While specific consideration is given to both Bus Rapid Transit (BRT) and Light Rail Transit (LRT), although hybrid options with characteristics of both modes are possible

4.5 Scenario 1: Do-Minimum

- 4.5.1 This scenario represented the committed future transport network, i.e. the base 2006 transport network with:
- the 2028 road network in place, key elements of which include the North Ring Road, new bridge and road infrastructure in the Docklands area and other committed road proposals;
 - committed future public transport schemes, such as expanded Cork Suburban Rail Network implementation of which is at an advanced stage at the time of writing this Report; and
 - enhancements to the bus infrastructure and services along the Green Routes, as envisaged in the context of CASP Update. The enhanced Green Routes are assumed to operate with the following characteristics:
 - Frequency: 6/ hour, and
 - Speed 15 Km/ h.
- 4.5.2 Transport demand in this scenario is the same as per the Do-Nothing Scenario, i.e. 2020 CASP Update population and employment allocations.
- 4.5.3 The Do-Minimum Scenario is considered to provide a likely future network, and as such, it has been used as a reference against which the performance of subsequent 'option development' scenarios is assessed.

4.6 Scenario 2: Phantom Network

- 4.6.1 The phantom network concept facilitates an unconstrained analysis of potential public transport demand on key corridors in the Cork Metropolitan Area. In modelling the phantom network, it is assumed that each corridor on the network will operate with optimal characteristics in terms of frequency and speed, thus representing the most attractive mode for those travelling along the corridor. In adopting this approach, it ensures that the maximum potential for public transport use on each corridor can be ascertained, although in reality this may never be achieved.
- 4.6.2 Further analysis of passenger demand on each corridor facilitates a determination of the most appropriate mode to cater for these passenger demands.
- 4.6.3 In particular, a central aim of developing and assessing the Phantom Network, is to determine the corridors where a step change in the level of service over and above what is currently available in the Cork Metropolitan Area, i.e. whether the east-west and north-south Rapid Transit Corridors, the potential for which have been identified in the CASP Update, or any other corridors in the Cork Metropolitan Area may merit the investment required facilitate their upgrade.
- 4.6.4 The Phantom Network Scenario is modelled on the assumption that there will be no loss in vehicular capacity associated with their introduction.
- 4.6.5 The existing City and Suburban Bus Network has been used as a basis for developing the Phantom Network, given that it provides sufficient coverage of the Cork Metropolitan Area

along key transport corridors, however the service frequency and speeds are assumed to have significantly increased.

4.6.6 The key characteristics of the Phantom Network are as follows:

- Frequency: 20 / hour; and
- Speed: 25 km/ h.

4.6.7 Transport demand in this scenario is the same as per the Do-Nothing and Do-Minimum Scenarios.

4.7 Scenario 3: Bus Based

4.7.1 Baseline evaluation of current trip distribution patterns for journeys to work illustrates a dispersed trip pattern within the Cork Metropolitan Area, with a large portion of orbital movements relative to those which have either origins or destination in the City Centre. This trip distribution pattern is not served by the current public transport network in the Cork Metropolitan Area. The significant population and employment growth allocated to the Metropolitan Area, within the context of the CASP Update will further reinforce these dispersed trip distribution patterns.

4.7.2 In light of the above, it is essential that the public transport network evolves over time to better meet current and future trip distribution patterns. As a result, a reconfiguration of the bus network involving the development of a series of interlinking bus services covering the North and South City has been developed.

4.7.3 This bus network is assumed to operate at higher frequencies and speeds, to ensure it represents an attractive alternative to private car use. This is particularly important given the relatively low levels of traffic congestion experienced away from the City Centre, and the relatively short journey times in the Cork Metropolitan Area (73% under 30 minutes).

4.7.4 The existing bus network forms the basis for the development of the reconfigured network. Current routes were modified and extended to create the reconfigured bus network. Importantly, this facilitates the enhancement of the overall bus network without discommoding existing bus passengers. In this way, current bus route coverage can be maintained, allowing for the reconfigured network to deliver additional coverage and new links. Critically, the reconfigured network provides for overlapping routes outside of the City Centre. This will facilitate a disperse pattern of trips by way of bus to bus transfer. The reconfigured bus network can be delivered on a phased basis and would be implemented through incremental changes to the existing bus network.

4.7.5 The reconfigured bus network would utilise existing Green Routes infrastructure. This will ensure that the significant investment in bus infrastructure along these corridors will yield increased returns into the future. It is noted that additional bus infrastructure, including bus priority will be required at certain points in the network to compliment the bus services contained within the Bus Based Scenario. In addition, some of the revised routes will necessitate local changes in traffic management.

4.7.6 The Bus Bases Scenario, as modelled, is assumed to have the all bus services operating with the following characteristics:

- Frequency: 6 / hour; and
- Speed: 16 km/ h.

- 4.7.7 The reconfigured network provides greater integration between public transport modes and services. In particular, it includes an extension of the express bus service from the Airport via the City Centre and the bus station, to Kent Station. This would directly link rail and bus services with the Airport. This would be supplemented by a second additional bus route (Route No. 6) connecting the Airport to the City Centre, operating at the same headways and speeds as the remainder of the bus network. This route would be especially beneficial in supporting potential future development along the alignment such as at Tramore Valley. The estimated journey time from the airport to the City Centre on this route would be approximately 25 minutes.
- 4.7.8 A new two-way loop bus route (Route No. 7) would connect the City Centre with Ballyvolane, operating at the same headways and speeds as the remainder of the bus network. The estimated journey time between the City Centre and Ballyvolane would be 21 minutes. The indicative bus network represented within the Bus Based Scenario, and used as a basis for subsequent option evaluation activities (Section 5), is similar to that represented on Figure S.1.3 of the Executive Summary, however conventional bus services would operate along the corridor from Ballincollig to Mahon, via the City Centre.
- 4.7.9 While the bus based network is considered to represent a comprehensive network, as regards coverage and connectivity, modifications to the indicative bus based network would likely be required to cater for specific future development areas, e.g. Tramore Road and Ballyvolane areas of the City. This would be most appropriately undertaken as part of Local Area Plans for these areas.

4.8 Scenario 4: Rapid Transit

- 4.8.1 As mentioned previously, the CASP Update has identified the potential for Rapid Transit Corridors on a north-south and east-west alignment through the Cork Metropolitan Area.
- 4.8.2 The Phantom Network Scenario development and assessment process, described in the next Section of this Report has facilitated the testing of a wide range of radial routes, which are deemed to have the maximum potential in terms of passenger demand.
- 4.8.3 Of the corridors assessed, only one, the east-west corridor from Ballincollig to the City Centre, Docklands and Mahon has forecasted passenger flows of the magnitude that would require capacity additional to that which could be provided by conventional bus (See Section 5.3 for details).
- 4.8.4 This corridor has therefore been assessed as a Rapid Transit Corridor in conjunction with the revised bus network, outlined in Scenario 3 above. To assess the viability of the Rapid Transit Corridors, bus services operating along this corridor are assumed have been removed in this scenario. The figure, overleaf, illustrates the alignment of this corridor.
- 4.8.5 The alignment of the Rapid Transit Corridor has been developed taking cognisance of the following key land uses along its length to maximise its benefits, attractiveness and economic viability:
- Mahon Point Retail Centre;

- South Docks;
- Kent Station;
- Cork Bus Station;
- City Centre (St Patrick's Street);
- University College Cork;
- University Hospital;
- Cork Institute of Technology; and
- Ballincollig.

- 4.8.6 Figure 4.4, overleaf illustrates the alignment of the Rapid Transit Corridor through the Cork Metropolitan Area. A number of alignment sub-options are shown along the length of the corridor. These alignment options would be subject to more detailed demand/ system performance assessment, engineering feasibility and public consultation before a final alignment would be determined.
- 4.8.7 A series of traffic management restrictions have been assumed in this scenario along the alignment to reflect the requirement for maximum priority along the full alignment, and the consequential reduction in capacity for other mechanised modes.
- 4.8.8 The traffic management restrictions relate to an assumed alignment from Ballincollig, along Rossa Avenue, Wilton Road, Western Road, Washington Street, Grand Parade, St Patrick's Street, MacCurtain Street, Alfred Street, Kent Railway Station, Mill Road Bridge (new), Mill Road, Centre Park Road and along the former rail alignment to Mahon are detailed in later sections of this Report.
- 4.8.9 The bus network is assumed to have the same operating characteristics as the previous scenario and the Rapid Transit Corridor is assumed to have the following characteristics:
- Frequency: 15 / hour; and
 - Speed: 22 km/ h.
- 4.8.10 Scenario 4 is supported by a reconfigured city wide bus network, as indicated in Scenario 3, with the exception of competing bus services operating along the alignment of the Rapid Transit Corridor. As in Scenario 3, the reconfigured bus network is a modified and extended version of the existing bus network and provides for the enhancement of bus services away from the Rapid Transit Corridor. Key interchange points have been identified where bus and rail services will link with the Rapid Transit Corridor and, thereby, extend the benefits of the new system to a wider catchment area.

Figure 4.4

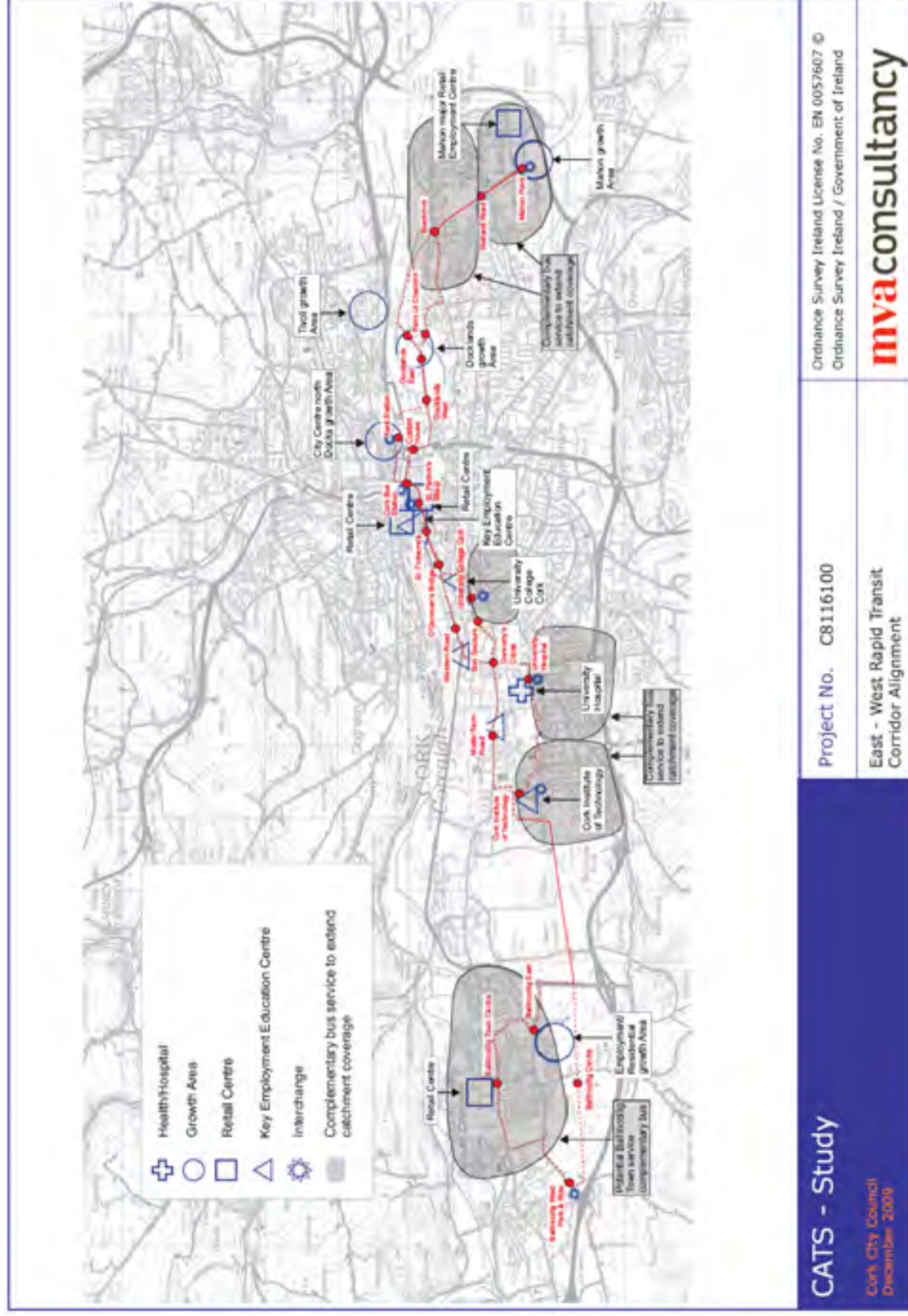
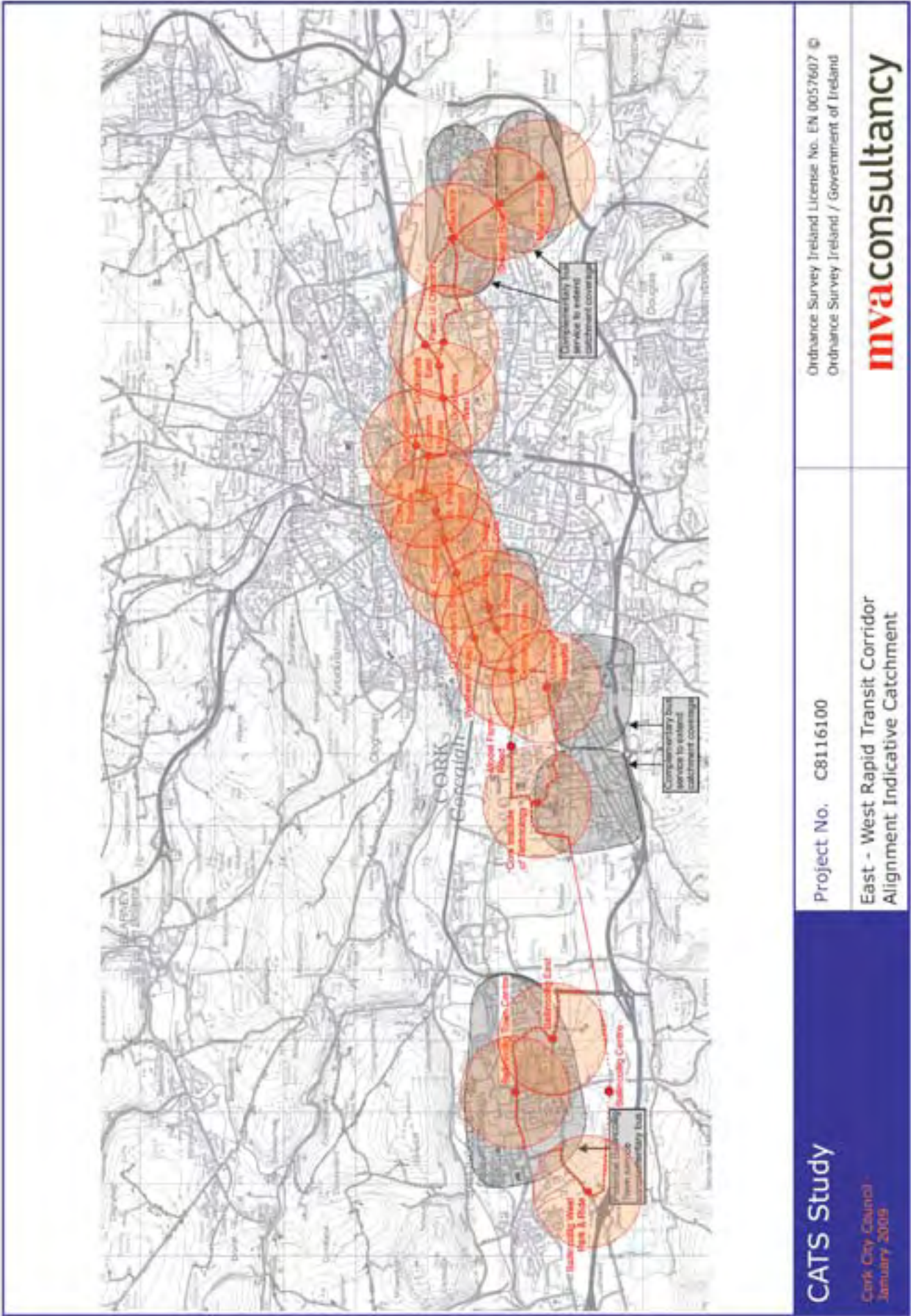


Figure 4.5 East-West Rapid Transit Catchment Areas



4.9 Scenario 5: Rapid Transit + City Centre Traffic Management Plan

- 4.9.1 This scenario, represented a variation of Scenario 4, having the same public transport network, but complimented by the introduction of a traffic management plan in the City Centre.
- 4.9.2 The objective of the City Centre Traffic Management Plan is to improve accessibility to the City Centre by all modes, and to increase the capacity of the transport network to cater for increased movements to, from and within this area. This would contribute significantly to the continued growth of the City Centre; and its future attractiveness as the key residential, retail, social, cultural and tourist destination within the CASP Area. For this objective to be achieved it will be necessary to:
- re-allocate road space on City Centre streets, to ensure a more appropriate balance is achieved between the needs of each transport mode; and
 - remove through traffic from Core City Centre streets, and the island in particular, leading to an improvement in the environment for public transport vehicles, pedestrians and cyclists.
- 4.9.3 Additional benefits of the City Centre Traffic Management Plan would include:
- its demand management impact on the City generally, given that through traffic trips would be restricted from City Centre streets. This would increase the relative attractiveness of using public transport over private car, and the attractiveness of using alternative routes away from the City Centre, such as the N25;
 - improving movement within this area by private cars and delivery vehicles both of which may have valid reasons for accessing the area, for example those accessing off-street multi-story car parks located within the core area;
 - accommodating the introduction of a Rapid Transit Corridor through the City Centre, which would not be feasible based on current traffic management arrangements. A number of streets are particularly confined in terms of overall (building to building width), including Lancaster Quay, Washington Street, Grand Parade and St Patrick's Street. As a result it is necessary to either convert them from two-way to one-way operations, as is suggested at Lancaster Quay, or restrict them to local access only, as is suggested in the Core City Centre along the length of the alignment; and
 - ensuring, via appropriate restrictions, that other on-street activities, such as deliveries do not compromise public transport operations in the City Centre. Furthermore, deliveries should not compromise cyclist movements in this area. This will involve a determination of the most appropriate locations and times for deliveries.
- 4.9.4 The removal of through traffic from the Core City Centre can be accommodated via significant additional road infrastructure proposed for the City, including the development of new bridge crossings in the Docklands area and the North Ring Road, which could accommodate re-distributed trips, i.e. those diverting away from the City Centre as a result of the reconfigured road network.
- 4.9.5 Careful consideration needs to be given to the planning and design stages of the City Centre Traffic Management Plan to ensure the objectives of the plan are achieved, and that local impacts which are identified are mitigated in an appropriate manner. Finally it is essential

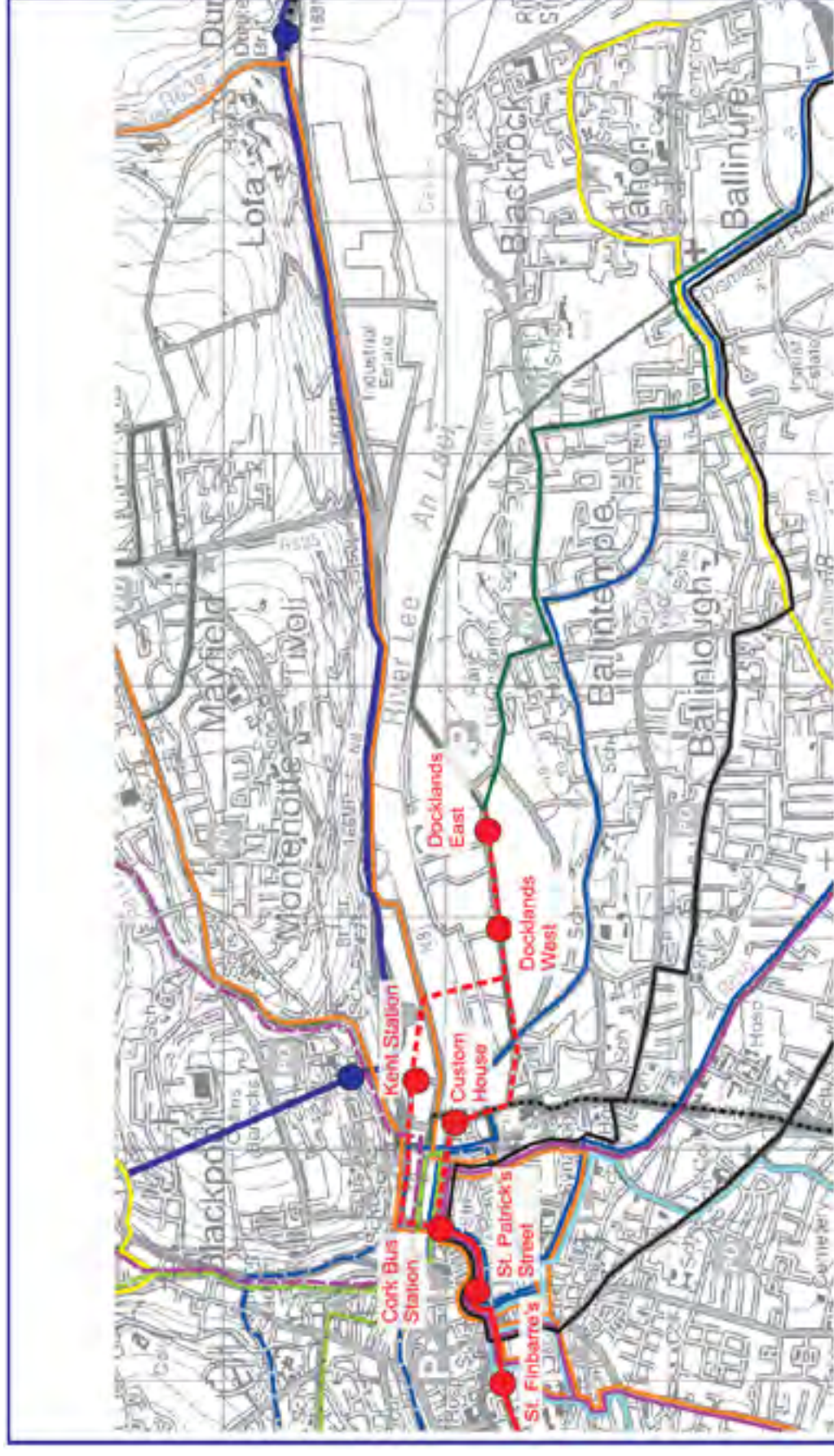
that the selected alignment of the inner orbital route does not increase severance for pedestrian and cyclist modes. In this respect, the route needs to be designed as an urban street with significant emphasis on the needs of sustainable transport modes.

- 4.9.6 The development of the City Centre Traffic Management Plan is subject to further planning and impact assessment work. This needs to consider the needs of all road users within the affected area, including through general traffic movements, access to off-street car parking, deliveries; and public transport, pedestrians and cyclists requirements.

4.10 Scenario 6: Rapid Transit, Ballincollig to Docklands

- 4.10.1 This scenario involved the same public transport and highway network restrictions as Scenario 5, however the Rapid Transit Corridor has been terminated in Docklands and replaced by a bus service operating between Docklands and Mahon, with similar characteristics to that in the Bus Based and subsequent scenarios, i.e. Scenarios 3 - 5.
- 4.10.2 The Rapid Transit Corridor from Ballincollig to Docklands, and bus service from Docklands to Mahon is illustrated in the figure, overleaf.
- 4.10.3 Transport demand in this scenario is the same as per the Do-Minimum Scenario, i.e. 2020 CASP Update population and employment allocations.

Figure 4.6



4.11 Summary

- 4.11.1 The scenarios developed above are considered to represent a thorough review of the impact of a radically enhanced public transport network, with a number of options involving conventional bus, Rapid Transit, and an extensive City Centre Traffic Management Plan.
- 4.11.2 Scenarios 4 to 6 are supported by a reconfigured area wide bus network complimenting and supporting the Rapid Transit Corridor. This reconfigured network would be developed on a phased basis through the modification and enhancement of the existing bus network.
- 4.11.3 The next section of this Report summarises the impacts of each scenario, as assessed using the CATS multi-modal transport model developed for the purposes of this study.

5 Evaluation of Options

5.1 Introduction

- 5.1.1 The option development process is described in detail in the preceding section of the Report. All options were assessed individually using the CATS multi-modal transport model to gain an appreciation of the relative impacts of each scenario.
- 5.1.2 The key indicators of the performance of each scenario are:
- Origin mode share by area;
 - Destination mode share by area;
 - Traffic speeds by area;
 - Corridor traffic speeds;
 - Maximum line flows (on the east-west Rapid Transit Corridor); and
 - Mode share along the Rapid Transit Corridor.

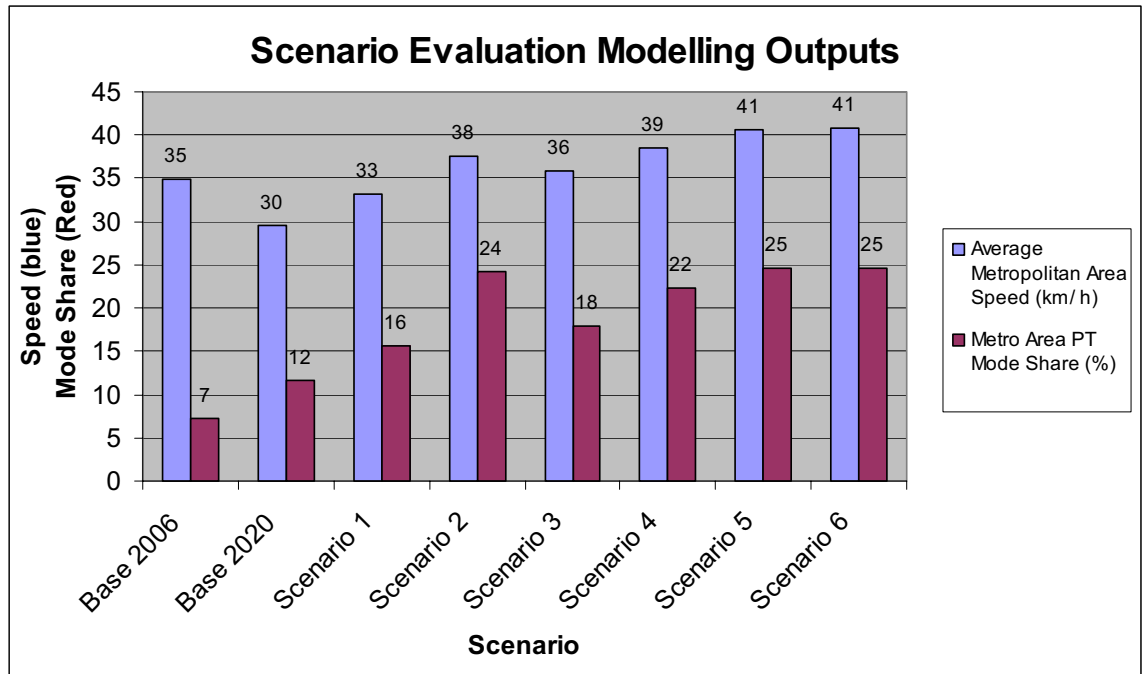
5.2 Scenarios Assessed

- 5.2.1 The following scenarios were assessed using the CATS multi-modal model developed for the purposes of this study:
- Base 2006;
 - Base 2020;
 - Scenario 1: Do-Minimum;
 - Scenario 2: Phantom Network;
 - Scenario 3: Bus Based;
 - Scenario 4: Rapid Transit;
 - Scenario 5: Rapid Transit + City Centre Traffic Management Plan; and
 - Scenario 6: Rapid Transit, Ballincollig to Docklands.

5.3 Scenario Results

5.3.1 Figure 5.1, below summarises the forecast Metropolitan Area impact of each scenario assessed using the CATS multi-modal transport model.

Figure 5.1 Scenario Evaluation Modelling Outputs, Average Metropolitan Area Network Traffic Speeds and Public Transport Mode Share



5.3.2 The key findings of this assessment are:

- Scenario 1, Do-Minimum: Public transport mode share demonstrates an increase of 4% over the Base 2020 scenario within the Metropolitan Area, i.e. from 12% to 16%. It is assumed in Scenario 1 that city and outer-suburban bus speeds and frequencies will improve, in recognition of the commitment to invest in the bus network in the Cork area as envisaged in Transport 21. Average network speeds across the full Metropolitan Area road network would still decrease by 1.6km/h over Base 2006 speeds, however they would increase by 3.6km/h over Base 2020 speeds;
- Scenario 2, Phantom Network: As this network operates at very high speeds and frequencies, the public transport mode share demonstrates a significant increase over Base 2020 and Do-Minimum conditions: +12% and +9% respectively. As a result, average network traffic speeds also demonstrate a very significant increase of 8.0km/h and 4.4km/h over Base 2020 and Do-Minimum conditions respectively. Of the extensive set of radial corridors assessed, only one, the east-west corridor, has significant passenger flows. Passenger flows on the remainder of the network were substantially lower. On the north-south corridor, which was identified in CASP Update as a potential Rapid Transit Corridor, forecast flows are a maximum of 936 to the north of the City Centre, and 1,218 to the south of the City Centre;
- Scenario 3, Bus Based: Public transport mode share registers an increase over Base 2020 and Do-Minimum scenario conditions (+6% and 2% respectively across the full Metropolitan Area). Car speeds across the full Metropolitan Area also register a

significant increase of 6.3km/ h and 2.7km/ h over Base 2020 and Do-Minimum scenario conditions;

- Scenario 4, Rapid Transit (representing an east-west Rapid Transit Corridor and a reconfigured bus network): Public transport mode share registers a 'step change' increase over Base 2020 and Do-Minimum scenario conditions (+11% and 7% respectively across the full Metropolitan Area). Car speeds across the full Metropolitan Area also register a significant increase of 9.0km/ h and 5.4km/ h over Base 2020 and Do-Minimum scenario conditions. This scenario also performs slightly better than the phantom network scenario, as the reconfigured bus network better meets the extensive orbital transport demand profiles;
- Scenario 5, Rapid Transit (representing an east-west Rapid Transit Corridor and a reconfigured bus network) + City Centre Traffic Management Plan: The introduction of a City Centre Traffic Management Plan will result in an additional increase of +3%, to 25% across the full Metropolitan Area in public transport use over Scenario 4. Car speeds in this same area also register an increase of 2.1km/ h over Scenario 4 speeds. Speeds in the Core City Centre area would register a slight decrease of 0.3km/ h (from 11.6km/h in Scenario 4 to 11.3km/ h in Scenario 5), as a result of traffic management restrictions aimed at prioritising public transport and pedestrian movements in this core area;
- Scenario 6, Rapid Transit, Ballincollig to Docklands: The introduction of the Rapid Transit Corridor from Ballincollig to Docklands would lead to a small reduction in the total public transport mode share when compared to Scenario 5. The public transport mode share would decrease by 0.1% and car speeds would increase by 0.2km/ h across the full Metropolitan Area. In the context of CASP Update population/ employment allocations to the east of Cork Docklands for 2020, this section of the Rapid Transit Corridor is considered not to deliver significant transport benefits.

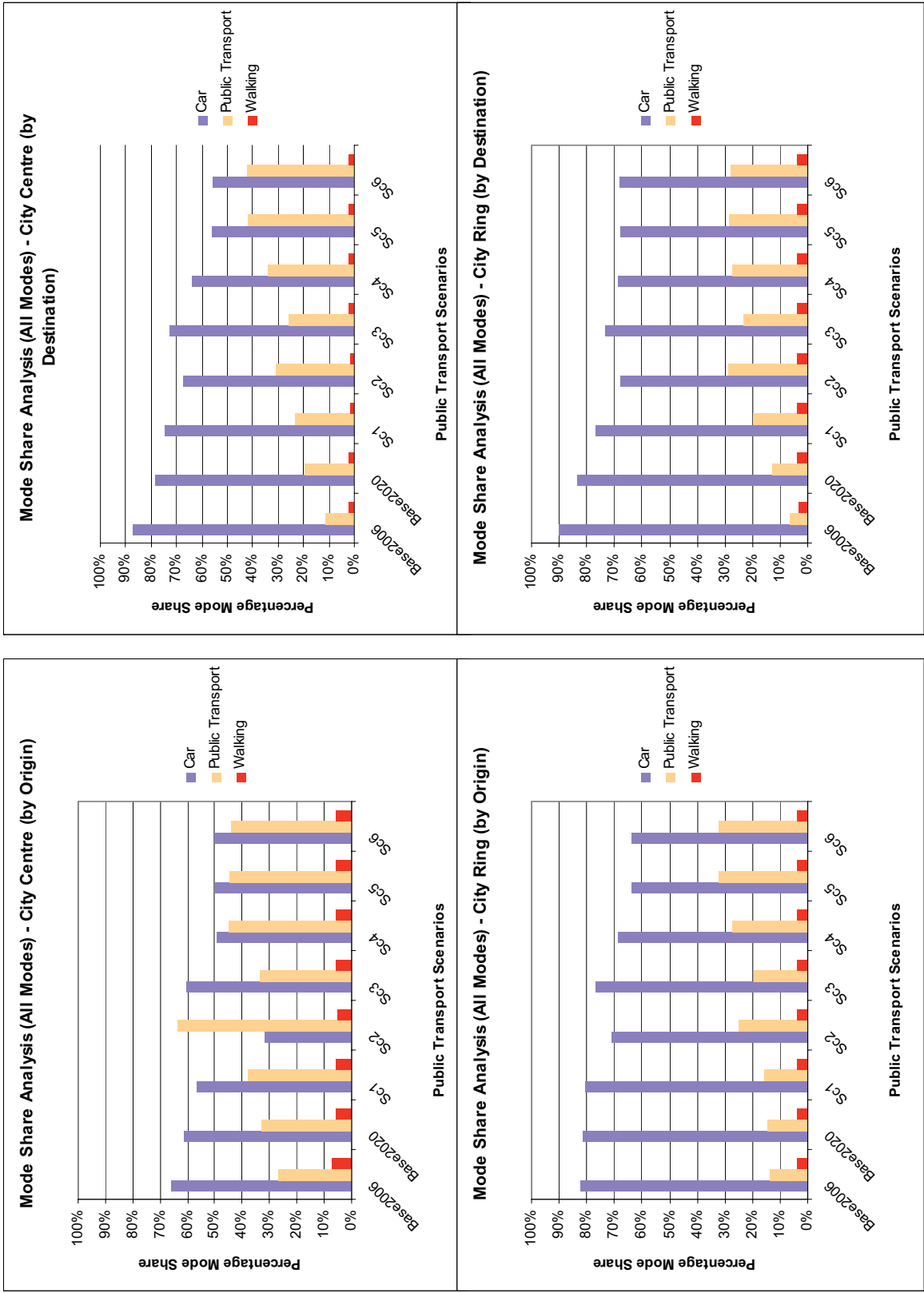
5.3.3 The figures and tables hereafter illustrate the mode share breakdown for the four CASP sub-areas, i.e.:

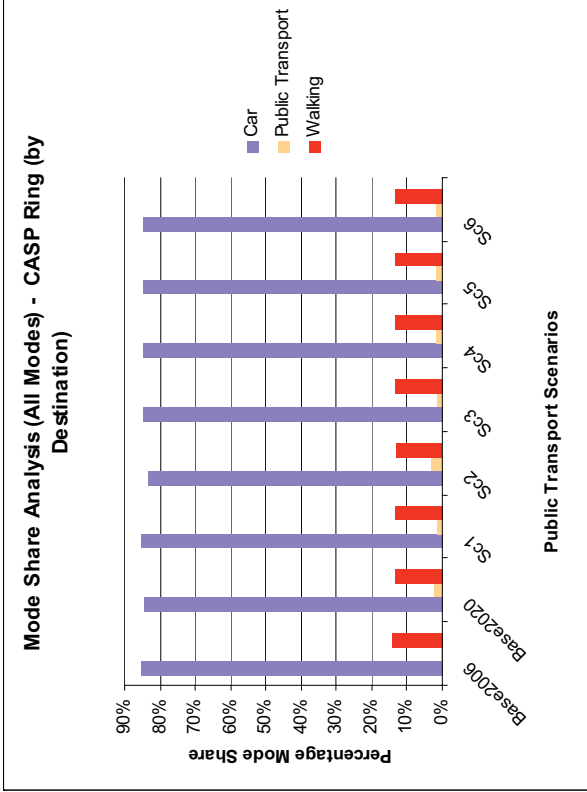
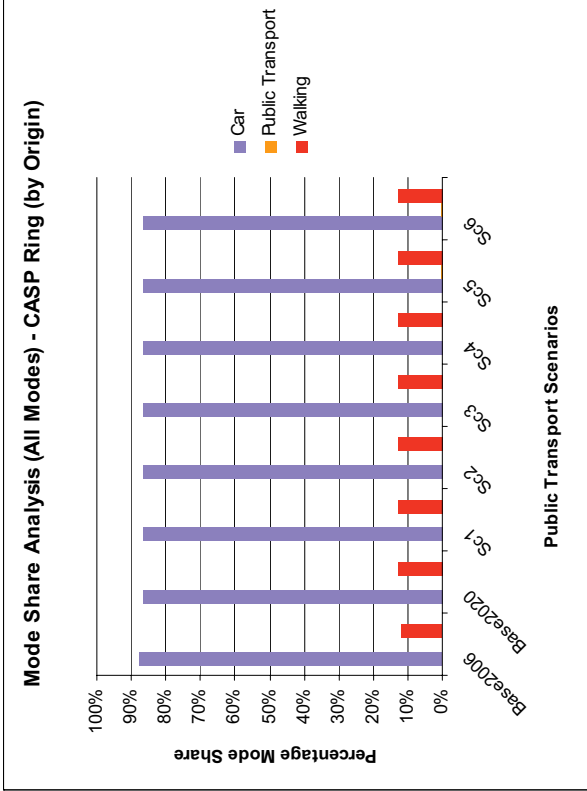
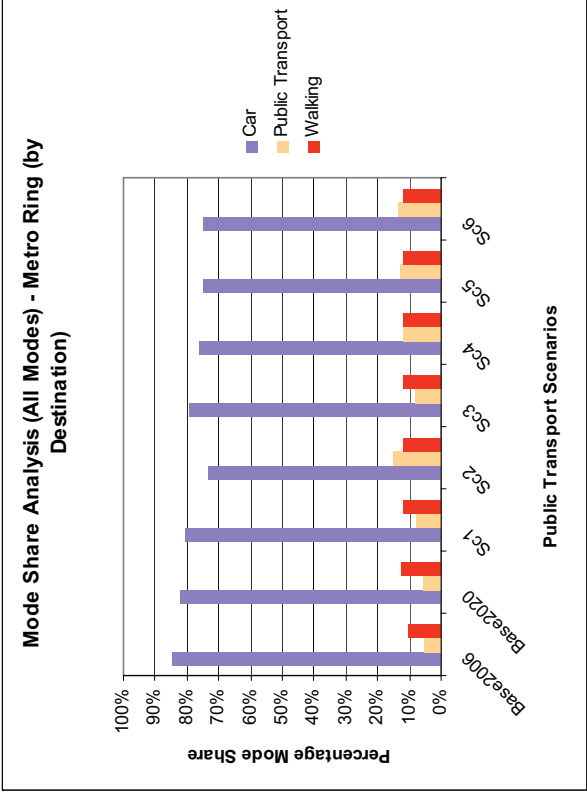
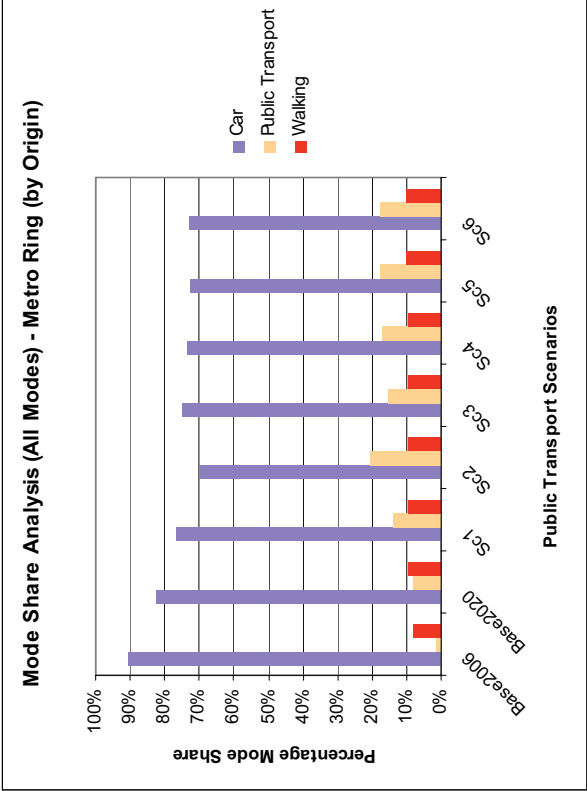
- Core City Centre;
- Cork City Ring;
- Metropolitan Ring; and
- CASP Ring.

5.3.4 Forecast general traffic speeds are given for the Core City Centre, Cork City, Metropolitan Area and full CASP Area.

5.3.5 Further data on mode share impacts for each scenario are included in Appendix A of this Report. Appendix A, also contains diagrams illustrating the maximum public transport (including rapid transit) passenger flows in the AM peak (08:00-09:00hrs) on main transport corridors into and out of Cork City and Cork City Centre.

Figure 5.2 Mode Share by Area





5.4 Network Traffic Speeds by Area

Figure 5.3 Core City Centre Average Network Speeds, AM Peak Hour

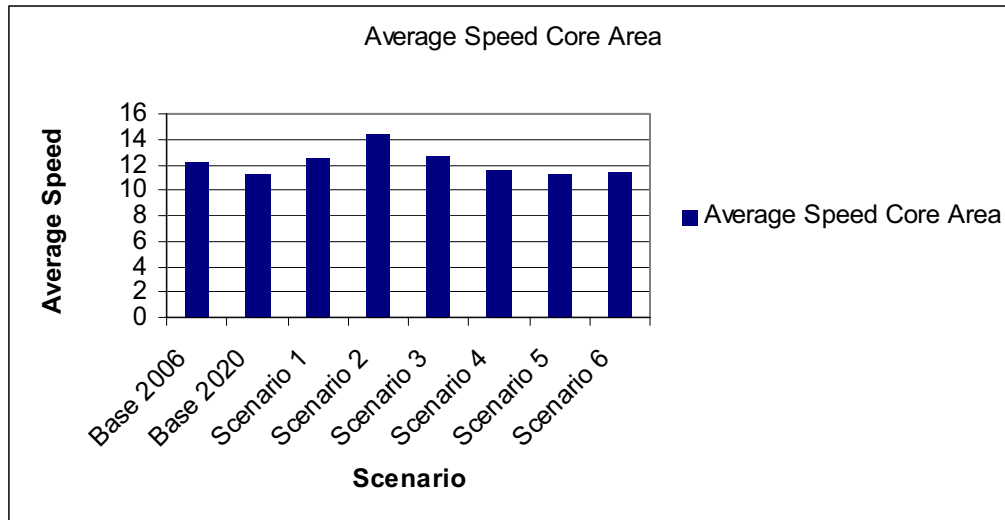


Figure 5.4 Cork City Average Network Speeds, AM Peak Hour

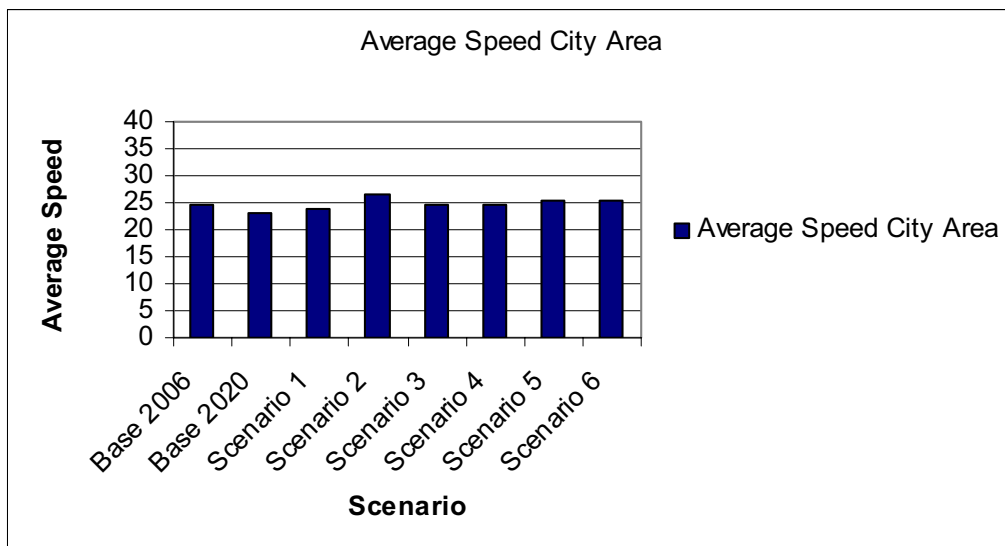


Figure 5.5 Metropolitan Area Average Network Speeds, AM Peak Hour

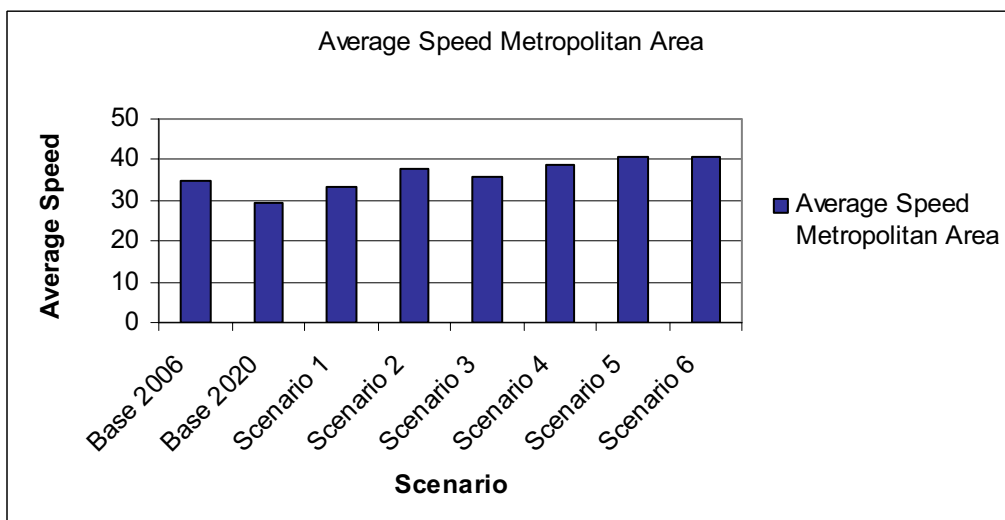
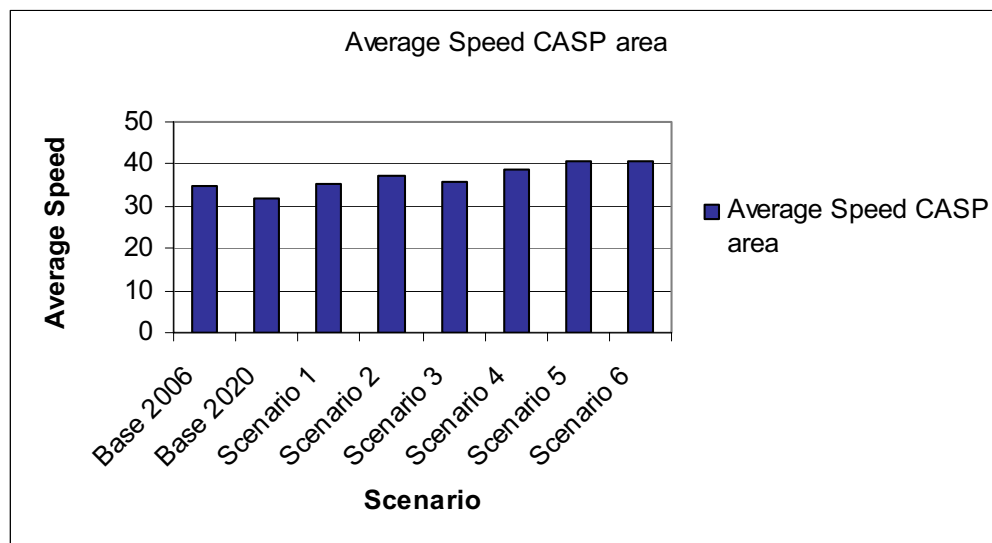
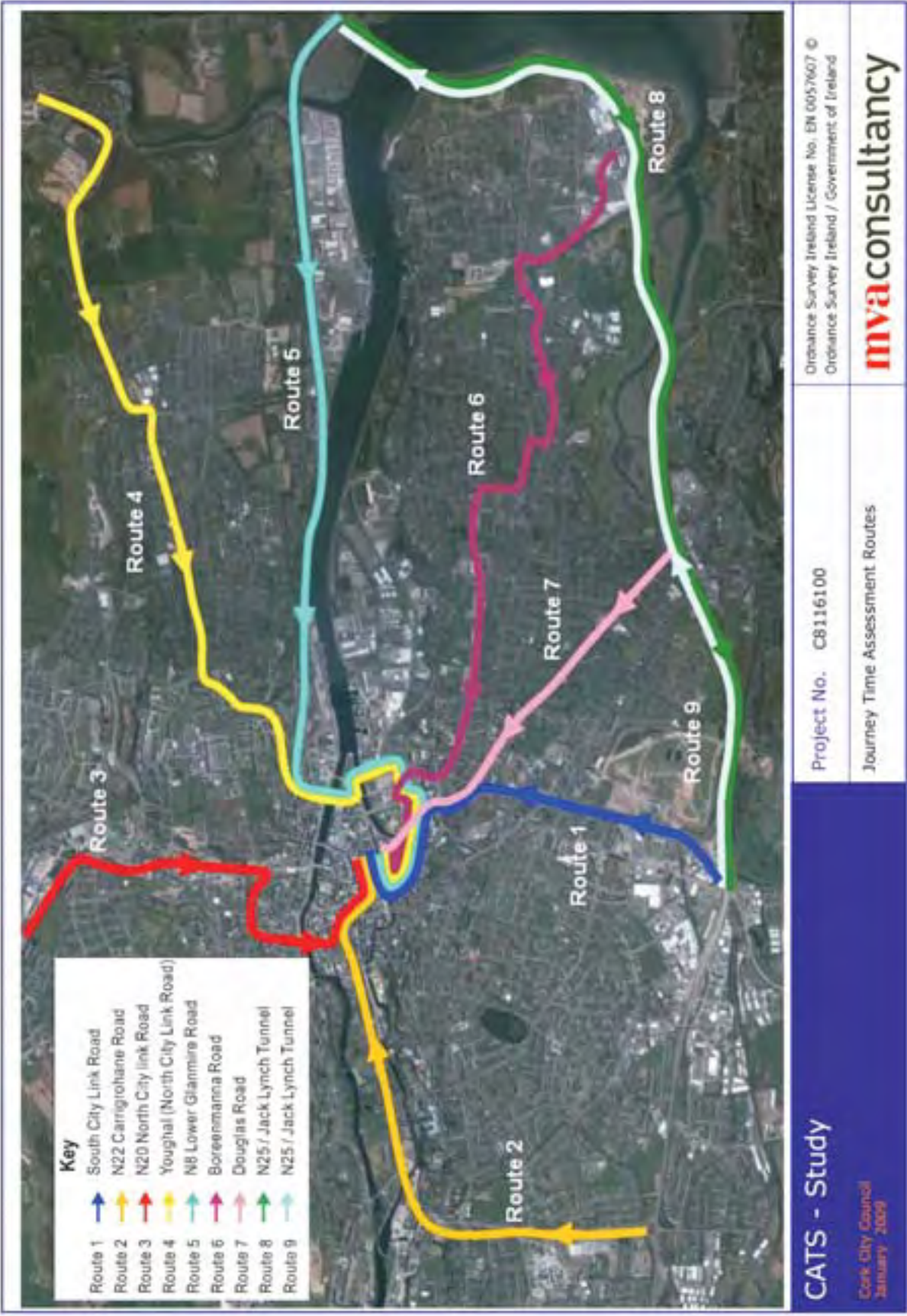


Figure 5.6 CASP Area Average Network Speeds, AM Peak Hour

5.5 Corridor Traffic Speeds

- 5.5.1 Corridor traffic speeds for the AM peak hour (08:00 to 09:00hrs) have been extracted from the multi-modal transport model for key corridors in Cork City, as identified in the following figure. Routes have been selected on the basis of their feasibility under existing and potential future traffic management restrictions, i.e. post implementation of traffic management restrictions associated with the Rapid Transit Corridor, and the City Centre Traffic Management Plan; however in certain instances local variations in the route may apply.

Figure 5.7 Journey Time Assessment Routes



- 5.5.2 The table below provides details of average corridor speeds, as extracted from the traffic model for each of Scenarios 1- 6.

Table 5.1 Average Route Traffic Speeds (km/ h)

	Base 2006	Base 2020	Sc 1	Sc 2	Sc 3	Sc 4	Sc 5	Sc 6
Route 1	28.3	22.9	27.2	29.7	28.4	28.2	23.0	23.9
Route 2	15.2	15.5	19.1	21.7	20.2	18.1	20.0	20.0
Route 3	20.1	18.9	20.7	23.0	21.3	20.8	17.5	17.8
Route 4	19.6	19.0	20.1	21.4	20.3	20.7	20.8	21.1
Route 5	22.8	23.4	23.7	25.9	24.3	23.3	23.6	24.3
Route 6	25.3	21.9	22.4	25.7	24.4	24.4	22.1	22.7
Route 7	17.8	20.9	22.4	27.8	24.8	28.4	26.1	27.0
Route 8	87.9	95.5	96.8	97.8	96.9	96.4	97.2	97.1
Route 9	75.9	95.7	97.2	99.9	98.7	99.2	99.6	99.5

- 5.5.3 The table above indicates a progressive increase in corridor speeds as the public transport network is improved in each of the scenarios listed above. For routes 1, 3, 6 and 7 the average corridor speeds decrease for Scenarios 5 and 6, when compared to Scenario 4. This reduction in corridor speeds is as a result of highway restrictions in the City Centre, post implementation of the Traffic Management Plan.
- 5.5.4 An important finding of the above analysis is that the introduction of Rapid Transit Corridor and extensive traffic management restrictions in Scenarios 4 to 6, and the comprehensive City Centre Traffic Management Plan proposed will not result in significant increase in traffic congestion on any of the corridors assessed. The only route where a significant decrease of the average speed appears for Scenarios 5 and 6 is Route 1.
- 5.5.5 As the above table demonstrates, traffic speeds along these corridors will generally improve, as a result of a transfer of car users to public transport, thus resulting in an overall reduction in traffic volumes in the City. The City Centre Traffic Management Plan is likely to require a radical change to current arrangements in this area, and the City as a whole. As a result, detailed planning and impact assessment of the Plan, including refinement at any pinch points identified is required to optimise traffic flow in areas directly and indirectly affected.

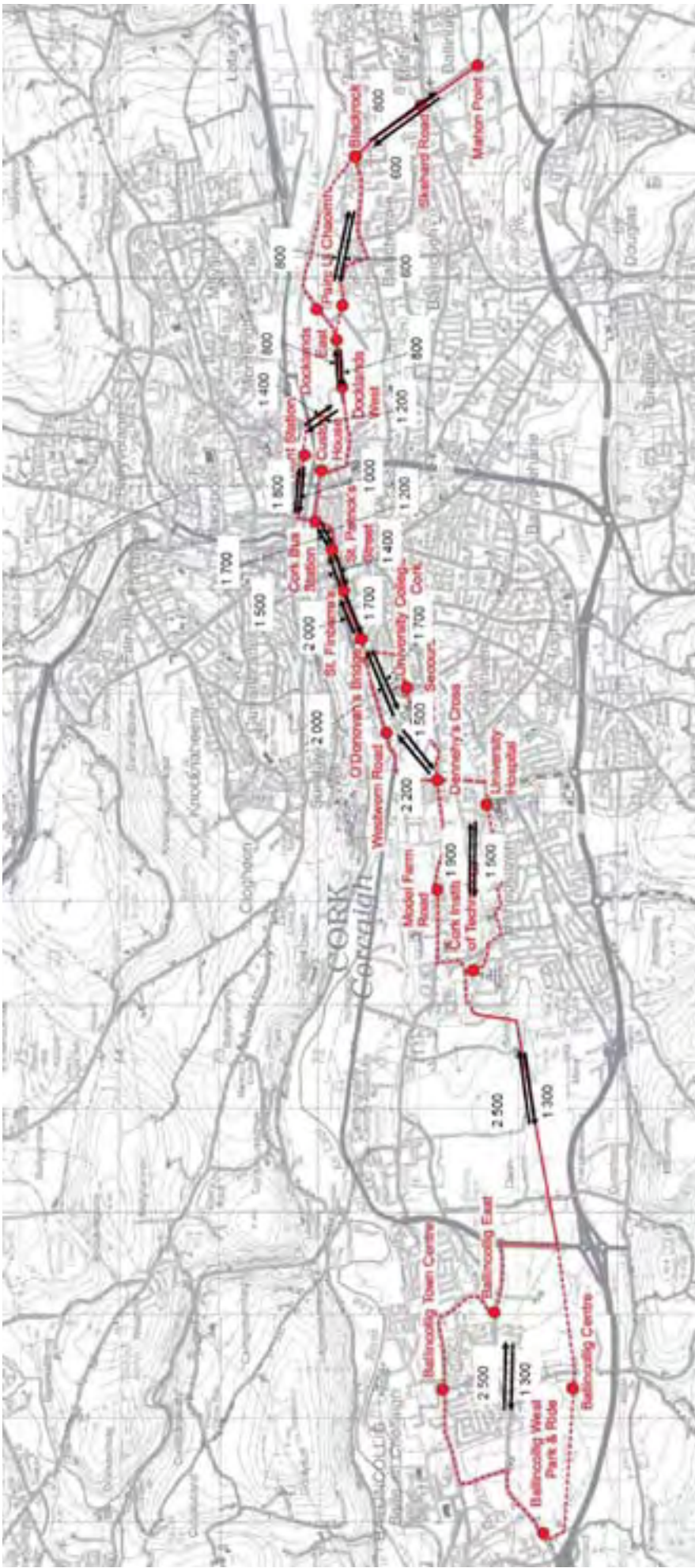
5.6 Maximum Line Flows (on the east-west Rapid Transit Corridor), Scenario 5

- 5.6.1 AM peak hour (08:00 to 09:00hrs) passenger flows were extracted from the CATS multi-modal transport model at various points along the alignment of the Rapid Transit Corridor.

These are illustrated in the following figures, for 2020 (CASP Update population and employment allocations) and 2030 (CASP Update population and employment allocations for 2020, with 2% per annum growth applied to 2020 CASP Update electoral district population/ employment data) respectively.

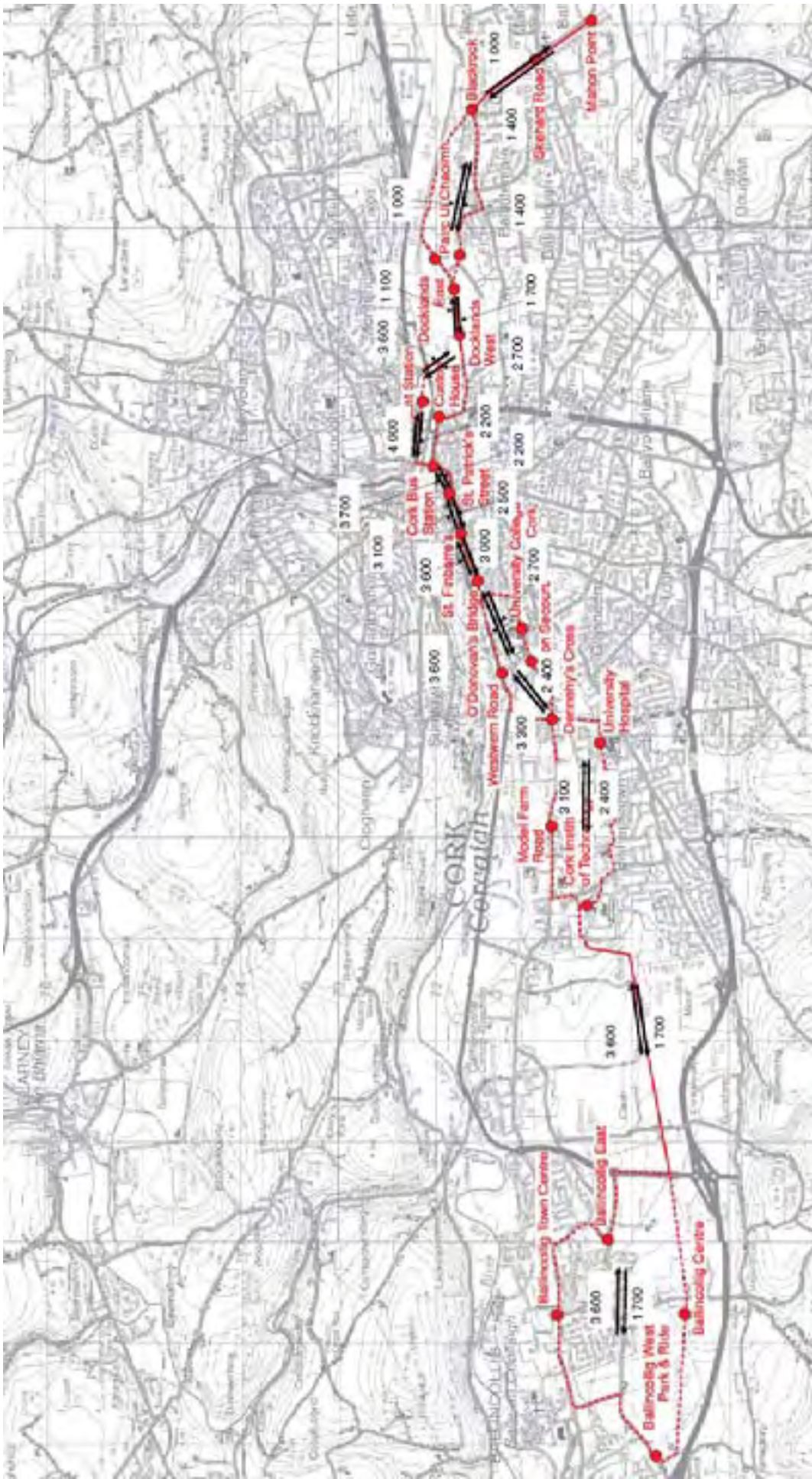
- 5.6.2 As can be seen from the figures overleaf, peak hour Rapid Transit line flows in Scenario 5 do not exceed approximately 4,000/ hour in 2030, with maximum line flows experienced in the eastern direction, in the City Centre, to the west of Kent Station. It should be noted that maximum line flows in the west-east direction are dependent on high average Rapid Transit speeds through Ballincollig (22km/ h), i.e. the same as for the remainder of the alignment.
- 5.6.3 In the reverse (western) direction, maximum AM peak hour line flows of approximately 3,000 passengers/ hour are forecast in 2030 over a short length of the corridor in the City Centre, however significantly lower line flows would be experienced in this direction along the remainder of the alignment.
- 5.6.4 Along Phase 2 of the Rapid Transit Corridor, from Mahon to Docklands, maximum AM peak hour line flows would not exceed 800 passenger/ hour in either direction in 2030. This phase of the system would therefore require further intensification of development to the east of Docklands to create a strong transport and economic case for its implementation.
- 5.6.5 The CATS multi-modal transport model only includes home to work journeys. The line flows in key areas connecting to UCC, and CIT could therefore be up to 20% higher factoring in home to education journeys. As a result, the most critical sections of alignment in terms of capacity is to the west of UCC, in the eastbound direction, where 2030 line flows of 3,600 passengers/ hour are forecasted.

Figure 5.8 Scenario 5 2020 Maximum Line Flows along the Rapid Transit Corridor ⁸



⁸ The above figures are for home to work journeys only. To account for home to education and other journey purposes, these figures would likely increase by up to 20% in certain areas. Considering the location of CIT and UCC to the west of the City Centre, reserve capacity for educational related trips is of particular interest eastbound as far as CIT and UCC, and westbound to UCC and CIT

Figure 5.9 Scenario 5 2030 Maximum Line Flows along the Rapid Transit Corridor ⁹



⁹ The above figures are for home to work journeys only. To account for home to education and other journey purposes, these figures would likely increase by up to 20% in certain areas. Considering the location of CIT and UCC to the west of the City Centre, reserve capacity for educational related trips is of particular interest eastbound as far as CIT and UCC, and westbound to UCC and CIT

5.7 Mode Share along the Rapid Transit Corridor

5.7.1 An analysis of the mode share for electoral districts directly along the alignment of the Rapid Transit Corridor from Ballincollig to Mahon, via the City Centre and Docklands has been undertaken. The results of this output are indicated on the figure overleaf, and indicate that, compared to the Do-Minimum scenario:

- In the Bus Based Scenario (Scenario 3), the public transport mode share is forecast to increase by 3% (from 20% to 23%);
- In Scenario 4, representing the introduction of the Rapid Transit Corridor, an increase in the public transport mode share from 20% to 29% is forecast;
- Following introduction of the City Centre Traffic Management Plan (Scenario 5), it is forecast that there will be a further increase in the public transport mode share from 20% in the Do-Minimum to 32%; and
- Compared to Scenario 5, if the Rapid Transit Corridor was terminated in the Docklands (Scenario 6), and replaced by a bus service to Mahon, the overall public transport mode share along the full alignment would remain unchanged along the full length of the alignment.

5.8 Mode Share along the Suburban Rail Corridor

5.8.1 An analysis of the mode share for electoral districts directly along the alignment of the Suburban Rail Corridors to Mallow and Midleton has been undertaken. This data was extracted for the full CASP area, given that the corridors extend well beyond the Metropolitan area boundary. The results of this output, which relate to the full CASP area are indicated on the figure overleaf, and indicate that:

- In the absence of improvements other than those which are already committed, i.e. the Do-Minimum Scenario, the public transport mode share along the two Suburban Rail corridors is forecast to be 8%;
- The introduction of public transport improvements in the Metropolitan Area, as represented by Scenarios 2-6 is forecast give rise to a substantial increase in the mode share along the two Suburban Rail corridors;
- In Scenario 5, representing Rapid Transit + reconfigured bus network + City Centre Traffic Management Plan, it is forecast that the public transport mode share along the suburban rail corridors will have increased from 8% in the Do-Minimum to 16%; and
- The forecast increase in public transport use along the Suburban Rail corridor may give rise to capacity problems in key infrastructure along the corridors, which may require capacity increases beyond that which is currently planned for Suburban Rail in the Cork Region, e.g. at key public transport interchange nodes.

5.8.2 Figure 5.10 illustrates the 2006 and CASP Update Population and Employment levels along key public transport corridors in the CASP Area.

Figure 5.10 Scenario 5 Suburban Rail and Rapid Transit Corridor Catchment Mode Share

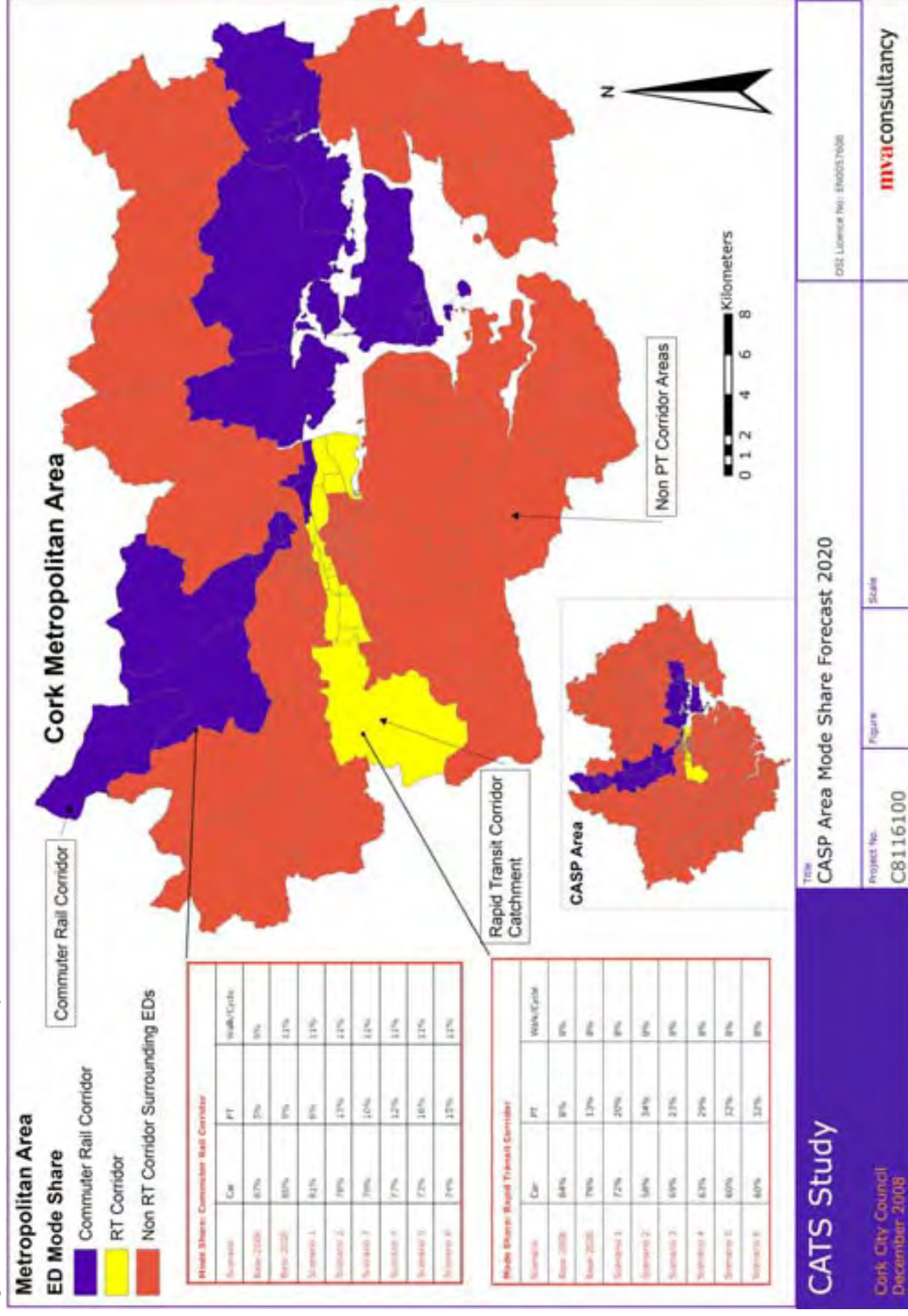
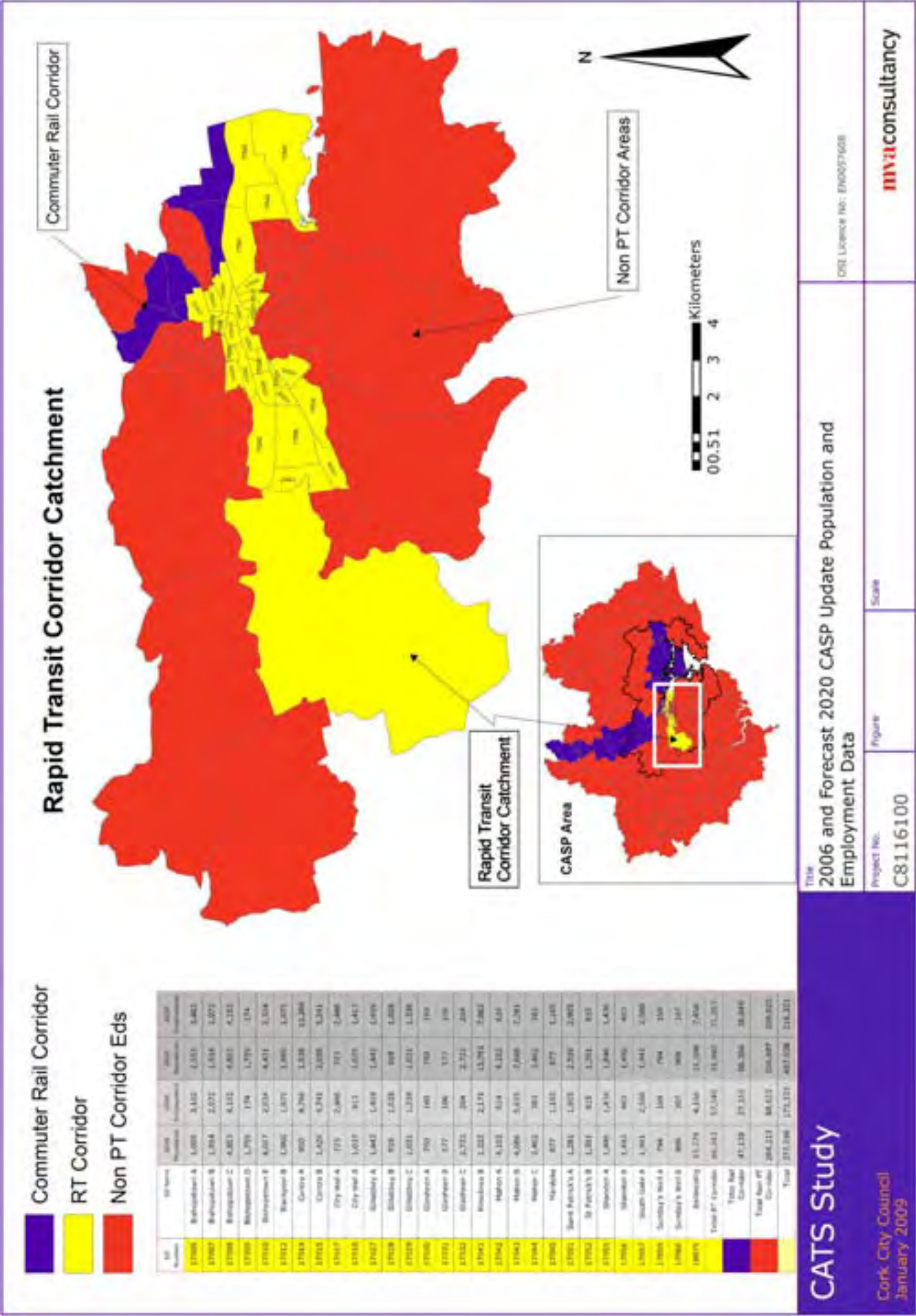


Figure 5.11 2006 and 2020 CASP Update Population and Employment Levels along Key Public Transport Corridors



5.9 Summary

5.9.1 This section of the Report has detailed the findings of our assessment of the options developed in the preceding section of this Report. This has indicated that:

- Without further interventions, other than those proposed within the context of the CASP Update and Transport 21 (the Do-Minimum Scenario), current unsustainable travel patterns will remain into the future. Such public transport improvements will result in a 4% increase in public transport use across the Metropolitan Area (from 12 to 16%), albeit from a low base;
- A reconfiguration of bus networks and services would result in additional public transport use of approximately 2% across the full Metropolitan Area;
- The corridor demonstrating the greatest public transport potential, is that from Ballincollig to the City Centre, Docklands and onward to Mahon. Forecast passenger flows along this corridor indicate that additional intervention beyond that which could be achieved from conventional bus is required;
- The implementation of Rapid Transit along the north-south corridor between Ballyvolane and the Airport, as identified in CASP Update, is not considered necessary on the basis of forecast passenger demand, as there is relatively low passenger demand on this corridor. This has been demonstrated in the Phantom Network scenario (where flows are a maximum of 936 to the north of the City Centre, and 1,218 to the south of the City Centre). Therefore a conventional bus service, with appropriate bus infrastructural improvements, as per the remainder of the bus network, is deemed appropriate for the north-south corridor. An analysis of capacity requirements for buses serving these areas is included in the appraisal section of the Report (Section 7);
- If a step change in public transport use is required, it will be necessary to invest in Rapid Transit along the east-west corridor through the Metropolitan Area. Implementation of this corridor, in conjunction with a reconfigured bus network, has the potential to increase public transport use across the full Metropolitan Area by 7% over the Do-Minimum Scenario;
- The success of this corridor, as modelled, is entirely dependent on full public transport priority along its length, to ensure its operating speeds are highly competitive relative to private car use, and furthermore, to ensure traffic congestion does not undermine reliability of the system;
- An extensive set of traffic management restrictions have been assumed along the length of the corridor. These are detailed in the engineering feasibility section of this Report, and include the removal of through traffic from Washington Street, Grand Parade and St Patrick's Street;
- The introduction of a comprehensive City Centre Traffic Management Plan, in conjunction with the Rapid Transit Corridor, would result in a further 2% increase in public transport use across the Metropolitan Area, and an increase in peak hour highway network speeds in this area. Car speeds in the Core City Centre area are, however, are forecast to register a slight decrease of 0.3km/ h following introduction of the revised traffic management arrangements;

- In the context of the current land use plan for the CASP area, this Rapid Transit Corridor could operate as Bus Rapid Transit (BRT), or similar system. The line maximum flows do not indicate that investment in a fixed rail system such as LRT is required, even for 2030, which has been assessed with in excess of 50% population and employment growth for the full CASP area;
- Terminating the Rapid Transit Corridor at Docklands, rather than extending to Mahon (and replacing by a bus services operating between Docklands and Mahon) would result in a no overall reduction in benefits in the context of the CASP Update allocation of future development to this area. The development of the Docklands to Mahon Rapid Transit Corridor section of the alignment therefore represents a separate phase, with significant additional public transport oriented development in the Mahon area, beyond the levels envisaged in CASP Update being required to support its viability. An agreed Local Area Plan for the Mahon area is therefore the key enabler for development of Rapid Transit to the east of Docklands;
- A reconfigured bus network, and further improvements to bus priority measures to bring average bus speeds on each route to a minimum of 16km/ h on average is essential to the success of the Rapid Transit system, and the achievement of both modelled mode share and average network traffic speeds;
- Average network traffic speeds will increase as a result of public transport interventions, as the overall number of car trips would decrease. Across the full Metropolitan Area, average AM peak traffic speeds would increase from 33.2km/ h in the Do-Minimum Scenario to 40.7km/ h in Scenario 5 (Rapid Transit Corridor, reconfigured bus network + CC Traffic Management Plan);
- It is assumed that ultimate headways of 2 minutes would be achievable along the corridor, with vehicle capacity of 150/ vehicle. This would equate to a peak capacity of 4,500 passengers/ hour/ direction for 2030;
- Maximum AM peak hour (08:00 to 09:00hrs) forecast line flows for this corridor, in 2020 (2,500 passengers/ hour, eastbound) and in 2030 (4,000 passengers/ hour, eastbound) indicate that there will be some reserve system capacity in the AM peak hour to accommodate additional development. Furthermore these forecast passenger flows are dependent on unperturbed Rapid Transit operations at each point along the length of the alignment;
- Further intensification of development along the corridor would result in a better utilisation of available peak period system capacity. This would also yield significant benefits in the off-peak, where system capacity will not be a critical issue, and additional public transport passenger demand would bolster the case for low off-peak headways, thus increasing the attractiveness of using the system;
- Capacity implications on planned/ committed Suburban Rail interchange locations such as Kent Station will need to be considered by Iarnród Éireann in the context of CATS Strategy recommendations, and forecast increases in peak hour Suburban Rail line flows; and
- Each scenario has been assessed in the context of CASP Update population and employment allocations. Given that CASP Update has been developed in the context of significant forecast growth of the CASP area (approximately 30%) up to 2020, it is therefore essential that development along the corridor is prioritised (taking on board Rapid Transit phasing considerations discussed later in the Report) to ensure forecast

passenger flows on the Rapid Transit Corridor are realised. This is particularly important in a growth scenario that is lower than that envisaged in CASP Update up to 2020.

- 5.9.2 The preferred strategy has been subject to a more detailed appraisal, considering the wider study objectives, detailed earlier in this Report. In addition, further consideration is given to supporting demand management measures, and the most appropriate mode along the Rapid Transit Corridor. This is summarised in the subsequent sections of this Report.

6 Supporting Land Use Policy Requirements

6.1 Introduction

- 6.1.1 The preceding section of this Report has found that, in the context of 2030 forecast AM peak passenger demands, there would be reserve capacity along the Rapid Transit Corridor to cater for additional development within its catchment, over and above the levels currently envisaged within the context of CASP Update. This is particularly true in the western direction; and along the section of the alignment from Docklands to Mahon.
- 6.1.2 This section of the Report focuses on the land use policies interventions required to support the development of the Rapid Transit Corridor. These interventions are required for the following reasons:
- Substantial capital investment, as detailed in the appraisal section of this Report (Section 7), is required to implement the study recommendations. The majority of this investment will be focused on the development of the Rapid Transit Corridor from Ballinacolly to Mahon;
 - Maximum AM peak hour (08:00 to 09:00hrs) forecast line flows for this corridor, in 2020 (2,500 passengers/ hour, eastbound) and in 2030 (4,000 passengers/ hour, eastbound) indicate that there will be some reserve system capacity in the AM peak hour to accommodate additional development;
 - Maximum forecast line flows in the reverse, i.e. westbound direction are significantly lower (1,700 and 3,000 for 2020 and 2030 respectively), thus indicating that by appropriately locating specific development types, in particular employment developments to the west of the City, and additional employment/ residential development in Mahon, that there is scope to better utilise this available capacity;
 - Although not assessed within the context of this study, there will be additional reserve capacity in the off-peak/ weekend periods, which would be better utilised if development is intensified along the corridor. Additional public transport passenger demand would bolster the case for low off-peak headways, thus increasing the attractiveness of using the system;
 - The economic return of investing in the Rapid Transit Corridor will be substantially increased if additional development is located along the alignment. This issue is addressed in the appraisal section of the Report (Section 7, Table 7.6); and
 - The capacity of the system, for the purposes of this assessment is assumed to be 4,500 passengers/ hour/ direction. Whilst it is generally preferable not to exceed this capacity, this issue is less critical in the City Centre/ Docklands areas, where significant alternative sustainable transport options exist, i.e. the concentration of residential, employment and retail development will minimise trip distances, and present significant opportunities for walking and cycling.

6.2 Development Intensification along Rapid Transit Corridor

CASP Update

- 6.2.1 CASP Update sets the framework for future spatial planning policy in the CASP area, and has allocated future growth in population and employment between now and 2020 to aggregated sectors within the overall area. This planning data has been disaggregated to an electoral district level following consultation with Cork City and Cork County Planning Departments. This planning data has been used in assessing Scenarios 1 - 6, detailed in the preceding section of this Report.
- 6.2.2 CASP Update was developed on the basis of implementing two Rapid Transit Corridors:
- An east-west corridor, from Ballincollig to Mahon, through the City Centre and Docklands; and
 - A north-south from Ballyvolane to the Airport, via the City Centre.
- 6.2.3 Transport modelling undertaken in relation to this study, and summarised in the option evaluation section of this Report has indicated that passenger flows along the north-south corridor are not sufficiently high to require Rapid Transit, and that conventional bus services would meet forecast passenger flows.
- 6.2.4 Beyond 2020, there is no regional land use plan (or integrated land use and transport plan) in place to guide the growth of the region.
- 6.2.5 Based on the absence of a clear plan guiding the growth of the region beyond this time, and the study recommendations in relation to the development of a single Rapid Transit Corridor, a further scenario involving an intensification of development around the Rapid Transit Corridor was prepared. Details of this scenario are provided below.

Scenarios Assessed:- Scenario 7

- 6.2.6 An assessment of the impact of locating additional employment and residential development along the Rapid Transit Corridor was undertaken to assess:
- the transport impact of locating additional development along the corridor in terms of increased public transport use, and utilisation of am peak hour system capacity;
 - the impact of locating the additional development along the corridor in terms of the improved economic return for the public transport system as a whole (details of this are provided in the appraisal section of this Report:- Section 7); and
 - the capacity of the corridor to cater for increased development, capitalising on the corridor transport capacity following implementation of the Rapid Transit Corridor.
- 6.2.7 This assessment, representing a further scenario:- Scenario 7; was undertaken on the assumption of the system being developed as BRT, given that it represents a lower ultimate capacity than LRT. It is recognised, however, that LRT would be able to accommodate a higher level of future intensification of development along the corridor.
- 6.2.8 In the case of BRT it is assumed that the ultimate capacity of the system is 4,500 passengers/ hour/ direction (150 capacity vehicles operating at 2 minute headway). Furthermore, it is assumed that a portion of the overall system capacity will be required to

cater for non-work related trips in the AM peak, in particular education related trips. This issue is of specific interest on the eastern and western approaches to UCC and CIT, given that the predominant movement to and from these institutions will generally be towards these locations in the AM peak hour.

- 6.2.9 Previous scenarios tests (the results for which are provided in the preceding section of the Report) have been undertaken in the context of the CASP Update population and employment allocations for the CASP area up to 2020, and an assumed growth of 2% per annum for the period between 2021 and 2030.
- 6.2.10 Output from Scenario 5 was analysed to ascertain the level of additional development along the Rapid Transit Corridor that could be accommodated along the Rapid Transit Corridor, while still ensuring that the capacity of the system is not exceeded.
- 6.2.11 This analysis has shown that there would be reserve capacity on the Rapid Transit Corridor in the westbound direction, indicating a corresponding need to intensify employment related development to the west of the City Centre to maximise system use. Reserve capacity would also be available in the eastbound direction, although at certain points, the line would be operating close to capacity. The Docklands to Mahon section of the alignment is also forecast to have low passenger flows, thus indicating potential for significant additional development in the Mahon area.
- 6.2.12 Scenario 7 was developed by reference to planning data provided by Cork City and County Council Planning Departments on the notional capacity of areas along the alignment to accommodate additional development beyond existing levels and generally also beyond the levels indicated in CASP Update for 2020.
- 6.2.13 The planning data provided by both local authorities, at an electoral district level had a disproportionate increase in jobs along the alignment, compared to increased residential development. Given the close correlation between population and employment growth, it was necessary to assess a scenario with more balanced employment and residential growth at a regional/ CASP Area level, i.e. population and employment must grow at a commensurate rate.
- 6.2.14 To address this issue, additional residential development was allocated to each area in proportion to the 2020 CASP Update population allocations at an electoral district level, i.e. a higher portion of residential development was allocated to areas with high 2020 population levels.
- 6.2.15 A number of sub-scenario tests were modelled to ascertain the appropriate level of additional development along the alignment, above and beyond CASP update levels. These sub-scenarios were undertaken in the 2030 context, with an assumed growth in population/ employment of 2% per annum applied to the overall 2020 CASP Update levels (the 2030 population/ employment for the full CASP area is assumed to be 596,188 and 267,848 respectively). Each sub-scenario represented a different distribution pattern of future development: - with either more or less of the overall portion located along the length of the alignment. This was undertaken until such time as forecast line flows approximately equalled BRT system capacity.

6.3 Rapid Transit Corridor Development Capacity Analysis

- 6.3.1 The table below, illustrates the 2006, 2020 CASP Update and the ultimate population and employment levels along the length of the Rapid Transit Corridor alignment, at which the system is considered to operate within its capacity limitations.
- 6.3.2 As can be seen from this table, in the ultimate population/ employment scenario, total population along the length of the Rapid Transit Corridor would increase by 36% (91,992 to 125,267) compared to that allocated for 2020 in CASP Update. Compared to 2006 levels, this represents an increase in population of 59,025, or 89%.
- 6.3.3 In addition, total employment along the corridor would increase by 56% (71,253 to 111,245) in Scenarios 7 compared to that allocated for 2020 in CASP Update. Compared to 2006 levels, this represents an increase in employment of 53,699, or 93%.

Table 6.1 Scenario 7 Population and Employment Data

Phase/ Section of alignment	2006 Population	2006 Employment	Scenarios 1-6, 2020 CASP Update Population	Scenarios 1-6, 2020 CASP Update Employment	Scenario 7 Ultimate Population	Scenario 7 Ultimate Employment
1a, Bishopstown to Docklands	38,874	46,728	55,511	55,519	74,876	85,886
1b, Bishopstown to Ballincollig	15,779	4,166	21,308	7,458	31,379	7,458
2, Docklands to Mahon	11,590	6,651	15,172	8,277	19,013	17,901
Total Corridor	66,243	57,545	91,992	71,253	125,267	111,245

6.4 Scenario 7 Transport Impacts

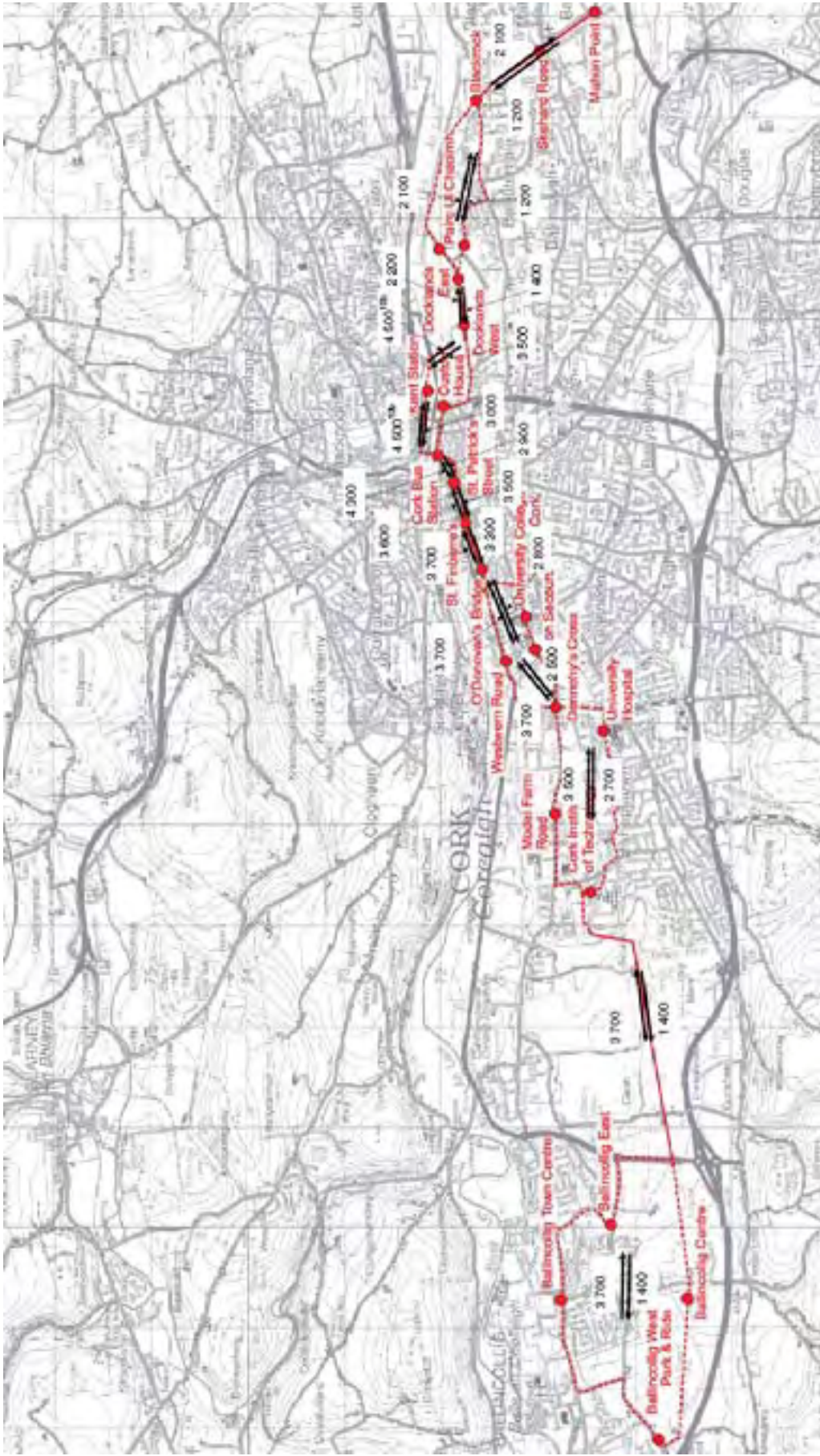
- 6.4.1 To facilitate a comparison with other scenarios, a model run involving additional development along the Rapid Transit Corridor was undertaken, details of which are provided in the figure above. For the purposes of comparing transport impacts with previous scenarios, which were undertaken in the 2020 context, this additional population and employment along the corridor was assumed to be in place in 2020, and assessed using the CATS multi-modal transport model.
- 6.4.2 The key transport impacts of this assessment are:
- For Scenario 7, the location of additional development along to the Rapid Transit Corridor would result in a significant increase in public transport use in the full

Metropolitan Area when compared to Scenario 5 (25% for Scenario 5 and 38% for Scenario 7 for 2020). This represents a significant increase over Base 2020 and Do-Minimum scenario conditions (+26% and +22% respectively across the full Metropolitan Area for 2020);

- Car speeds across the full Metropolitan Area would register a decrease of 0.3km/ h over Scenario 5 conditions in 2020 (40.7km/ h for Scenario 5 and 40.4km/ h for Scenario 7). This reduction in average network speeds needs to be considered in the context of a higher overall quantum of development within the study area for this scenario test, however localised impacts may be more significant. Despite this reduction over Scenario 5 levels, this corresponds to a significant increase of 10.8km/ h and 7.2km/ h over Base 2020 and Do-Minimum scenario conditions, thus indicating that the Rapid Transit Corridor would substantially increase the capacity for intensification of development along its catchment; and
- Maximum AM peak hour (08:00 to 09:00hrs) forecast line flows across the Rapid Transit Corridor would increase compared to Scenario 5. These are illustrated in Figures 6.2, overleaf, for 2030. Line flows are generally significantly higher than for Scenario 5. In the City Centre, the corridor is forecast to operate above capacity in the easterly direction, however given the likely trip length patterns in this area, this would materialise as additional walking/ cycling in this area. As such, this is not considered to represent a constraint on the levels of intensification of development as assessed in this scenario.

6.4.3 Further data on mode share impacts for this scenario are included in Appendix A of this Report.

Figure 6.1 Scenario 7 2030 Maximum Line Flows along the Rapid Transit Corridor ^{10a}



^{10a} The above figures are for home to work journeys only. To account for home to education and other journey purposes, these figures would likely increase by up to 20% in certain areas. Considering the location of CIT and UCC to the west of the City Centre, reserve capacity for educational related trips is of particular interest eastbound as far as CIT and UCC, and westbound to UCC and CIT.

^{10b} Rapid Transit Corridor is forecast to operate above capacity in the easterly direction at this point

6.5 Summary Findings and Recommendations

6.5.1 The following are the key findings and recommendations made on foot of the analysis of the capacity of the corridor to cater for development:

- Additional development along the Rapid Transit Corridor, above and beyond CASP Update levels, is beneficial to the development of the system. The determination of the appropriate levels of additional development has been assessed in the context of the CATS multi-modal transport model for 2020 and 2030. This has indicated that the corridor can accommodate approximately 33,276 additional residents, and 39,991 additional employees above CASP Update levels (+59,025 and +53,699 respectively above 2006 levels);
- Locating additional development along the corridor, as per these levels is forecast to result in:
 - Better utilisation of system capacity in both peak and off-peak periods;
 - Increased public transport mode share across the Metropolitan Area (38% in Scenario 7 compared to 25% in Scenario 5); and
 - A slight reduction in overall network traffic speeds across the CASP area of 0.3km/ h.
- There is a need to assess the corresponding highway network improvements required to accommodate additional development along the Rapid Transit Corridor. These are required to achieve a balance between maximising public transport and car use. This is in recognition of the dispersed trip distribution patterns that exist in the Cork Metropolitan Area, and the corresponding need to accommodate appropriate levels of car use. Assessments of the required highway network improvements should be undertaken within the context of Action/ Local Area Plans or Masterplans for specific development areas along the alignment. Cost associated with implementing highway network improvements arising from development along the Rapid Transit Corridor could be paid by development contributions as provided for under Section 48/ 49 of the Planning and Development Act;
- The sequencing of development along the corridor should match its phased development. Phasing issues and the implications for development along the corridor are discussed in the implementation section of this Report (Section 11). In this respect additional development, over 2006 levels, should be targeted along the alignment:
 - between Bishopstown and Docklands in the short term to coincide with Phase 1a of the alignment (an additional 36,002 residents, and 39,158 employees),
 - between Ballincollig and west of Bishopstown in the medium term to coincide with Phase 1b (an additional 15,600 residents, and 3,292 employees), and
 - to the east of Docklands in the long term to coincide with Phase 2 of the alignment (an additional 7,423 residents and 11,250 employees). Additional development to the east of Docklands is a prerequisite for the delivery of Phase 2 of the Rapid Transit Corridor;
- Development types and densities along the alignment should be consistent with the ultimate levels for each area along the alignment indicated in Table 6.1. Given the

spatial distribution of future development contained within CASP Update, it is recognised that it will not be possible to achieve these ultimate population and employment levels by 2020. Despite this, given the significant transport and economic benefits associated with locating additional development along the Rapid Transit Corridor, increased development in its vicinity should be targeted to support the achievement of the ultimate development levels along its length; and

- The next review of CASP must aim to prioritise development along the Rapid Transit Corridor in a manner consistent with the ultimate capacity of the corridor for development, and the phased delivery of the system. Failure to do so would undermine the financial and economic case for delivery of the Rapid Transit Corridor.

7 Appraisal of Preferred Strategy

7.1 Introduction

- 7.1.1 Previously in this Report, an outline of the key objectives of the CATS Study has been outlined. The overarching objective of the CATS Study is to develop the public transport network in Metropolitan Cork to support a more concentrated and therefore sustainable pattern of development, with a renewed emphasis on Metropolitan Cork as a place to live and work.
- 7.1.2 The recommended ultimate strategy has been subjected to a more detailed appraisal, consisting of:
- Detailed area specific appraisal;
 - Appraisal of bus fleet requirements;
 - Financial and economic appraisal; and
 - Environmental appraisal.
- 7.1.3 As noted previously, the development of Rapid Transit to the east of Docklands is dependent on additional development in the Mahon area beyond the levels envisaged by CASP Update. The adoption of an agreed LAP is a prerequisite to the delivery of Phase 2 of the Rapid Transit Corridor. Despite this, appraisal of the Preferred Strategy has been undertaken for both phases of the Rapid Transit alignment, in addition to the reconfigured bus network, and the City Centre Traffic Management Plan, i.e. Scenario 5. This has been undertaken in light of the overarching CATS objective to “support a more concentrated and, therefore, sustainable pattern of development” in the Metropolitan Area.

7.2 Detailed Appraisal against Study Objectives

- 7.2.1 The recommended strategy from the previous section of this Report has been subjected to a more detailed appraisal, considering the study sub-objectives, and a measurable means of achieving the sub-objectives:
- Attractive public transport;
 - Public transport capacity; and
 - Support sustainable development.
- 7.2.2 Appendix B of this Report contains the detailed area by area appraisal of the recommended public transport network and services. This has been undertaken for the Core City Centre, and the four quadrants, i.e.:
- Central area;
 - North-west;
 - North-east;
 - South-west; and
 - South-east.

7 Appraisal of Preferred Strategy

- 7.2.3 Overall, it has been found that the ultimate public transport strategy contributes positively to the achievement of the study sub-objectives listed above.
- 7.2.4 If Phase 1 of the Rapid Transit Corridor only (from Ballincollig to Docklands) is developed, the public transport system would have a lower overall capacity to support a more sustainable future development form in the Mahon area.
- 7.2.5 Future development areas, while considered as part of the option development and evaluation processes and reported in Sections 4 and 5 of this Report, will need further consideration as to how they should be integrated into the proposed CATS network. Such development areas include, but are not limited to:
- Ballyvolane;
 - Blackpool;
 - Tramore Valley; and
 - Cork Airport etc.

7.3 Appraisal of Metropolitan Area Public Transport Mode Share for Rapid Transit, Rail and Bus

- 7.3.1 The table below outlines the forecast 2020 mode share for trips originating in the Metropolitan Area. As can be seen from this table, the forecast public transport mode share is 25%, disaggregated as follows:
- 8% (6,176) for Rapid Transit;
 - 3% (2,277) for Suburban Rail; and
 - 14% (10,824) for Bus.

Table 7.1 Forecast 2020 Number of Peak Hour Metropolitan Area Trips and Mode Share for Preferred Strategy

	Car	Public Transport			Walk/ Cycle	Total
		Rapid Transit	Suburban Rail	Bus		
No. of AM Peak Hour (08:00 to 09:00hrs) Trips	53,273	6,176	2,277	10,824	5,609	78,158
% Mode Share	68%	8%	3%	14%	7%	100%

7.4 Appraisal of Bus Fleet Requirements

- 7.4.1 Output from the CATS multi-modal model was used as a basis for more detailed appraisal of the bus fleet requirements throughout the ultimate CATS bus network, i.e. post implementation of Rapid Transit. This was used to determine bus frequencies and the peak vehicle requirement (PVR) for each of the City bus routes. Output from this exercise is summarised in the table, overleaf.

Table 7.2 Ultimate CATS Network Bus Fleet Requirements ¹¹

Route	Frequency (no/ hour)	Length (km)	Approximate Journey Time (Minutes)	Maximum Load (Clockwise)	Maximum Load (Anti-Clockwise)	PVR
Route N1	6	14	52	261	*	12
Route N2	12	13	49	832	*	21
Route N3	6	9.5	70	344	511	8
Route N4	4	18	36	153	181	10
Route N5	4	9.5	36	118	255	6
Route N6	2	7	26	50	*	2
Route N7	6	7.5	29	110	505	7
Number 8 to Grange via Douglas	15	7.5	28	1,175	117	16
Number 8A to Grange via Togher	6	6	22	265	†	5
Number 9	8	16	60	569	152	17
Number 10 to Mahon	6	7	26	312	*	6
Number 10 to Donnybrook	15	6	22	1,206	238	13
Number 12	3	7.8	29	116	50	4
Number 14	6	9.5	36	287	*	8
Route 226	6	7.6	25	256	*	6
Route 224	4	9.8	30	138	*	5
Route 223 (Carrigaline/ Ringaskiddy)	6	22	66	312	*	14

* = Linear route, flows are for direction of maximum AM peak hour flow.

† = Combined with main service, flows are for direction of maximum AM peak hour flow.

¹¹ Based on an average minimum bus speed of 16km/ h across each bus route

7.5 Financial and Economic Appraisal

Introduction

- 7.5.1 The option evaluation section of this Report has indicated that, based on forecast future passenger demand, BRT represents the best solution along the Rapid Transit Corridor in the context of CASP Update population and employment allocations up to 2020, and subsequent assumed growth of the CASP area between that point and 2030. Despite this, an economic appraisal of the full corridor from Ballincollig to Mahon, via the City Centre and Docklands, as both BRT and LRT systems was undertaken.
- 7.5.2 Preliminary capital cost estimates for the Rapid Transit Corridor from Ballincollig to Mahon have been developed for the purposes of assessing the capital costs of implementing the corridor, either as BRT or LRT. These costs have been provided by Healy Kelly Turner and Townsend, Cost Management Consultants for both systems. These capital implementation costs, in conjunction with the capital costs of expanding the bus fleet have been used in undertaking an economic evaluation of the CATS Strategy.

BRT Preliminary Capital Cost Estimates

- 7.5.3 Table 7.3, overleaf includes preliminary cost estimates for the full BRT alignment from Ballincollig to Mahon, a length of approximately 20km. The rates used for this work is based on adjusted Q3 2008 costs and tender rates for infrastructural works / road works in the Dublin Area.
- 7.5.4 The work items covered in the BRT costs include:
- Removing / relocation of services;
 - Demolition of walls and simple structures;
 - Installation of BRT pavement approximately 10m wide;
 - Provision of Bus Stops including electronic ticketing / validation units;
 - Provision of 2nr Termini;
 - Widening of 4nr bridges;
 - Provision of 1nr new fixed bridge;
 - Traffic lights;
 - Provision of bus units; and
 - Design, Risk and Insurances.
- 7.5.5 As can be seen from this table, the preliminary cost estimates indicate that it would cost in excess of €305 million in 2008 values to construct the full alignment. These costs will, however, be higher when other costs such as land acquisition are considered.

Table 7.3 BRT Preliminary Capital Development Costs

Item	Description	Cost (€)
1	Enabling Works Demolitions, relocation of services, allowance for flood measures	94,500,000
2	Road construction 10m total (to allow for 2 lanes plus buffer and cycleway) width including road lining, boundary reconstruction	31,200,000
3	Bus stops Assumed 18nr including ticketing machines	18,600,000
4	Termini One at either end	23,400,000
5	Traffic signals Assumed 100 sets at intersections	11,800,000
6	New Mill Road Bridge 1 number fixed bridge	18,500,000
7	Bridge widening Assumed 4nr bridges require widening / adjustment	18,700,000
		221,700,000
	Design, Risk, Project management, Insurances	58,900,000
		280,600,000
8	Rolling Stock Assumed 30 units	30,000,000
	Total	305,600,000

Note: all prices are at Quarter 3, 2008.

LRT Preliminary Capital Cost Estimates

- 7.5.6 Table 7.4, overleaf includes preliminary cost estimates for the full LRT alignment from Ballinacollig to Mahon, a length of approximately 19.5km.
- 7.5.7 The rates used for LRT corridor are based on the most up to date (Q3 2008) version of these costs, derived from similar systems in the Dublin context. As LRT will run through areas with varying urban characteristics, the overall rate has been blended to take on board the different environmental considerations.
- 7.5.8 The work items covered in the LRT costs include:
- Removing / relocation of services;
 - Demolition of walls and simple structures;
 - Installation of LRT track, infrastructure and pavement;

- Provision of Tram Stops including electronic ticketing / validation units;
- Traffic Lights;
- Provision of 1 Terminus;
- Widening of 4 bridges;
- Provision of 1 new fixed bridge;
- Provision of tram units; and
- Design, Risk and Insurances.

7.5.9 As can be seen from this table, the preliminary cost estimates have indicated that it would cost in excess of €1 billion in 2008 values to construct the full alignment. These costs will, however, be higher when other costs such as land acquisition are considered.

Table 7.4 LRT Preliminary Capital Development Costs

Item	Description	Cost (€)
1	Enabling Works Demolitions, relocation of services, allowance for flood measures,(included below)	0
2	LRT construction Full alignment, including road construction, stop costs and traffic signal changes	650,000,000
3	Termini One complete at one end	23,300,000
4	New Mill Road Bridge 1 number fixed bridge	17,000,000
5	Bridge widening Assumed 4nr bridges require widening / adjustment	18,200,000
		713,500,000
	Design, Risk, Project management, Insurances	223,300,00
		936,800,000
6	Rolling stock 30 number units assumed	88,000,500
	Total	1,019,800,500

Note: all prices are at Quarter 3, 2008.

Additional Bus Network and Fleet Requirements

- 7.5.10 The revised bus network represents a significant expansion over existing levels of service and will require additional fleet to meet the required headways across the network. The implementation of the changes to the bus network can be delivered over time with a ramping up of service frequency and service expansion on a phased basis.
- 7.5.11 In order to implement the changes to the City Bus network proposed for 2020, approximately 83 additional buses¹² would be required. This would represent an almost doubling of the current city fleet. Moving to regular interval headways and increases in frequency on key corridors on the outer-suburban bus network will require some fleet expansion, however the precise quantity cannot be determined until a full review of the existing bus network operation is undertaken.
- 7.5.12 Given the level of improvement, it is estimated that an investment of €20,750,000 would be necessary to acquire additional fleet (83 buses at an estimated €250,000).
- 7.5.13 Other costs would be incurred in order to achieve the needs of the expanded bus fleet, and to ensure the target minimum operating speeds of 16km/h, namely investment in:
- Extended bus priority over and above that included for in the Green Routes Programme;
 - New bus stop infrastructure;
 - Real Time Passenger Information (RTPI);
 - Expanded provision of bus information on an ongoing basis;
 - Additional garage and maintenance facilities to accommodate expanded fleet; and
 - Inflation after Quarter 3, 2008.
- 7.5.14 Analysis of each element of bus infrastructure will need further assessment to determine the specific nature of enhanced bus priority, and associated costs. This would be determined by detailed performance monitoring (undertaken on an on-going/ annual basis) of the bus network, to determine the location and nature of bus priority measures required to ensure the minimum average speeds of 16km/ h are achieved, and furthermore, that bus reliability is not undermined by traffic congestion.
- 7.5.15 An average bus infrastructure cost of €2.3 million/ km has been used as a basis for determining the cost of developing bus infrastructure to support the reconfigured bus network. It has assumed that 25% of this cost would need to be expended along the existing Green Routes to meet target bus operating speeds, and other passenger requirements, with 50% of the cost being required elsewhere on the bus network. This is considered to represent a conservative estimate of bus infrastructure costs, however further assessment would be required to determine the specific infrastructure measures required, and the associated costs.

¹² The requirement for additional buses has been determined on the basis of an average bus speed across the network of 16km/ h. If these speeds are not achieved on a network wide basis, this will have an impact on the bus fleet requirements. The additional bus fleet requirement is based on a PVR of 75 buses and 8 out of service buses accounting for routine maintenance/ repairs etc.

- 7.5.16 In addition to the bus network requirements on the City bus network, planning and design of future road schemes within the Metropolitan Area needs to consider the needs of bus, including bus priority requirements. This is of particular concern on key radial roads connecting Metropolitan Ring towns with the City, many of which are of National Road classification.
- 7.5.17 To cater for the expanded bus fleet, a new bus maintenance depot will be required. The estimated cost of a new bus maintenance depot, with a capacity for approximately 83 buses is approximately €19 million, excluding land acquisition costs.

Table 7.5 Bus Preliminary Capital Development Costs

Item	Description	Cost (€)
1	Bus Priority Green Routes (36.5km * 0.25 ¹³ * €2.3 million)	20,958,750
2	Elsewhere on Bus Network (61.1km * 0.5 ¹⁴ * €2.3 million)	70,288,000
3	Bus Depot 1 no. to cater for expanded bus fleet	19,000,000
		110,246,750
	Design, Risk, Project management, Insurances	29,281,537
		139,528,287
4	Rolling Stock 83 number buses assumed	20,750,000
	Total	160,278,287

Note: all prices are at Quarter 4, 2008.

- 7.5.18 The average cost per km of implementing new/ improved bus infrastructure, of €2.3 million/km, allows for the construction of one 5m wide lane, and used as a basis for the above bus cost estimates, includes:

- Traffic lights at 750m centres;
- Bus stops at 500m centres;
- Design Risk;
- Preliminaries; and
- Design Fees.

¹³ It is assumed that 25% of the average bus priority implementation cost will be required on existing Green Routes to improve performance to achieve target minimum speeds

¹⁴ It is assumed that bus priority measures away from the Green Routes will be required along 50% of the road network

7.5.19 This rate excludes:

- Demolition of major structures;
- Major road junction realignment;
- Land acquisition; and
- Inflation post December 2008.

7.5.20 It should also be noted that a full audit would need to be undertaken to inform the requirements of new/ improved bus stop infrastructure and RTPI and therefore at this stage it is not possible to provide an estimated cost for such public transport infrastructure and information systems.

Road Infrastructure Requirements

7.5.21 In the most part, it is assumed that the revised bus network could be operated on the existing and future planned road network. There should therefore be no major additional infrastructural cost for the construction of new roads, however additional investment in bus infrastructure would be required, as detailed above.

7.5.22 To achieve the objectives for the direct routing of buses through employment areas (rather than around them as at present), it would be necessary to construct new bus links through the industrial areas to the south of the N25. A new bus gate would be required to allow for direct access from Pouladuff Road to Togher Road. This could be achieved by connecting existing internal roads to create a through road, but is not costed for at this stage.

Exclusions from BRT, LRT and Bus Preliminary Capital Cost Estimates

7.5.23 The following are excluded for the above table of costs:

- Land acquisition;
- Legal costs;
- Planning/ development costs; and
- Inflation after Quarter 3, 2008.

7.5.24 Furthermore, no costs are included for the demolition of major structures or major road realignment outside dedicated way.

7.5.25 The above cost estimates for both BRT and LRT, along with a significant assumed contingency covering other costs as per the NRA Guidance¹⁵ has been applied. The guidance recommends applying assumed additional costs calculated as a percentage of construction cost.

7.5.26 These additional costs are defined as 10% of construction cost for land acquisition, 6% for preparation and 5% for supervision. The additional costs are therefore:

- For BRT are €30,560,000 for land acquisition, €18,336,000 for preparation and €15,280,000 for supervision;

¹⁵ NRA Guidance for CBA 2004

- For LRT, €101,980,050 for land acquisition, €61,188,030 for preparation and €50,990,025 for supervision; and
- For Bus, €16,027,829 for land acquisition, €9,616,697 for preparation and €8,013,914 for supervision.

7.5.27 These capital cost estimates have been used as a basis for undertaking the CBA described below.

Cost Benefit Analysis (CBA) Concept

7.5.28 Cost Benefit Analysis is a project appraisal method used to help appraise, or assess the case for a project or proposal. The process involves weighing the total expected costs against the total expected benefits of one or more actions in order to help in the selection of the most economically advantageous option.

7.5.29 The overall economic impact of the scheme is given by the Net Present Value (NPV) and the Benefit to Cost Ratio (BCR). The NPV is calculated by subtracting the Present Value of Costs (PVC) from the Present Value of Benefits (PVB). The BCR is simply the ratio of benefits to costs.

7.5.30 The UK Department for Transport's guidance provides indicators of whether a transport project represents value for money (vfm). The following sets of criteria for the headline measure of value for money are ¹⁶:

- BCR of < 1 = Poor;
- BCR of 1 to 1.5 = Low;
- BCR of 1.5 to 2 = Medium; and
- BCR of > 2 = High.

7.5.31 Furthermore, the Guidance indicates that the UK DfT advice to Ministers should reflect the presumption that, purely on grounds of value for money, we should generally fund:

- No projects with poor VfM;
- Very few projects with low VfM;
- Some, but by no means all, projects with medium VfM; and
- Most, if not all, projects with high VfM.

7.5.32 The UK Department for Transport's guidance suggests that VfM is one of a range of considerations which are taken into account in assessing schemes ¹⁷. Other factors include:

- Value for money;
- Practicality/ deliverability;
- Public acceptability;
- Distributional and equity impacts;

¹⁶ Guidance on Value for Money, January 2006

¹⁷ Guidance on Value for Money: Explanatory Note, December 2005

- Affordability and financial sustainability;
- Contribution to central government, local and regional objectives; and
- The amelioration of identified problems.

Scenarios Assessed

- 7.5.33 An economic appraisal for the Rapid Transit Corridor was undertaken using the TUBA (Transport User Benefit Appraisal) software package. Irish input parameters, as detailed in the Cost Benefit Parameters and Application Rules for Transport Project Appraisal Report, were used in undertaking this appraisal.¹⁸
- 7.5.34 The economic appraisal was undertaken for two scenarios, representing different distribution patterns of growth, to ascertain the economic return from investing in the extensive set of public transport improvements recommended. The scenarios assessed were as follows:

Table 7.6 CBA Scenarios Assessed

	Scenario 5	Scenario 7
Transport Demand, 2020	CASP Update	CASP Update ¹⁹
Transport Demand, 2030	CASP Update electoral district population and employment levels * 2% per annum	CASP Update overall population/ employment levels * 2% per annum, with intensified development along Rapid Transit Corridor, as per Figure 5.11 ²⁰
Transport Network	Rapid Transit Corridor, BRT (5a) / LRT (5b); Reconfigured bus network; and City Centre Traffic Management Plan	Rapid Transit Corridor, BRT (7a) / LRT (7b); Reconfigured bus network; and City Centre Traffic Management Plan

- 7.5.35 Scenario 5 provides an indication of the economic benefit of the public transport improvements if implemented in the context of CASP Update population/ employment allocations. Scenario 7 provides an indication of the additional economic benefits of intensifying development along the Rapid Transit Corridor.

¹⁸ Goodbody Economic Consultants, August 2004

¹⁹ To facilitate a direct comparison with Scenario 5 no intensification of development along the corridor is assumed for 2020, as the overall population levels would be different.

²⁰ Overall population/ employment levels for 2030 are assumed to be the same for both Scenarios 5 and 7. Scenario 5 represents a proportional increase in population/ employment of 2% per annum, distributed across the full CASP area, whereas Scenario 7 represents an intensification of development along the Rapid Transit Corridor.

- 7.5.36 Model output from the respective 2020 CATS multi-modal transport model scenarios was used in undertaking the CBA in conjunction a second forecast year, for 2030, details for which are outlined above.
- 7.5.37 Each scenario was compared to the Do-Minimum (Scenario 1), representing committed highway and Suburban Rail improvements, and an enhanced Green Routes Bus network and services.
- 7.5.38 The above scenarios were selected as they will provide a good indication of whether the enhanced public transport network, and the Rapid Transit Corridor in particular, whether developed as either BRT or LRT, would have net beneficial economic impacts.

Cost Benefit Analysis Results

- 7.5.39 The results of this CBA are outlined in the following table.

Table 7.7 CBA Outcome, BRT and LRT

	Scenario 5a (BRT + CASP Update) €* 1,000	Scenario 7a (BRT + additional development along corridor) €* 1,000	Scenario 5a (LRT + CASP Update) €* 1,000	Scenario 7b (LRT + additional development along corridor) €* 1,000
Net present Value of Benefits (PVB)	1,074,412	1,540,037	1,074,412	1,540,037
Net present Value of Costs (PVC)	526,863	540,215	1,034,499	1,047,853
Net present Value (NPV)	547,549	999,833	39,339	492,184
Benefit to Cost Ratio (BCR) = (PVB / PVC)	2.04	2.85	1.04	1.47

- 7.5.40 The results of the CBA indicate that there is a strong beneficial economic case for the development of the Rapid Transit Corridor from Ballincollig to Mahon, via the City Centre and Docklands as BRT in the context of the population and employment allocations contained within CASP Update. The BCR in this scenario is 2.04, representing high value for money. The BCR could, however be further enhanced if additional development were located along the corridor (Scenario 7a). This would improve the BCR by:
- Growing passengers flows on the system; and
 - Reducing highway trips, and reduced levels of traffic congestion in the CASP area generally.

- 7.5.41 The BCR in the context of additional development along the Rapid Transit Corridor in 2030, as detailed in Figure 5.11, would be 2.85.
- 7.5.42 If LRT were to be developed along the corridor the system would deliver a low value for money return (BCR = 1.04) in the context of the population and employment allocations contained within CASP Update. Scenario 7a, representing additional development along the Rapid Transit Corridor in 2020 would improve the value for money from the public transport system, however, even in the context of a major intensification of development along the corridor, there would not be a strong economic case for the development of BRT. In the scenario assessed, a BCR of 1.47 would be achieved.
- 7.5.43 It is therefore evident that significantly higher levels of population and employment growth, over and above those forecast for the CASP area up to 2020 would be required for the development of the corridor as LRT to represent medium-high value for money, i.e. a radical departure from the current spatial planning policy for the CASP area would be required. Also, a rate of overall population/ employment growth at or above levels envisaged in CASP Update would be required to support its development. Furthermore, the need for a major intensification of development along the corridor would have significant implications for the timeframe for implementation of LRT, as it would not be justifiable on the basis of current transport demand along the corridor.

7.6 Environmental Appraisal

"We aim to minimise the negative impacts of transport on the local and global environment through reducing localised air pollutants and greenhouse gas emissions."

Department of Transport, 2009

- 7.6.1 The above statement is one of five key goals set out in the Department of Transport's recent 'A Sustainable Transport Future – A New Transport Policy for Ireland 2009 – 2020'. It is a clear signal that the need to deliver a more sustainable and cleaner transport system has achieved a prominent place on the climate change and wider political agenda. Emissions from road transport related activities play a significant role in the achievement of local and national policy objectives:
- At a local level, the key considerations relate to ambient air quality. This is of special concern in urban areas, given the increased traffic related activities and increased residential densities in these areas and the potential to affect a wider population base. Local emissions of concern are benzene, 1,3-butadiene, carbon monoxide (CO), nitrogen oxides (NOx) and particulates (PMs). These have received increasing attention with the accumulation of evidence linking them respiratory and cardio-pulmonary disease, lung cancer and potential to exacerbate incidences of asthma. Maximum environmental ambient air concentration values are determined by relevant EU directives; and
 - At a broader level, transport emissions contribute to the increasing concentration of gases associated with climate change. The principal road transport related greenhouse gasses carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). Reducing these emission outputs is essential to the achievement of national emissions

targets, as set through international agreements such as the Kyoto Protocol. The most recent national emissions data available at present ²¹ indicates a 46.6% (excluding international aviation) overall growth in CO₂ emissions over the period from 1990 to 2007. The most recent trends for the period between 2007 indicate a reduction in CO₂ emission at a national level. In 2007, all sectors of the economy contributed towards this reduction, with the exception of transport, where a 5.1% increase was recorded.

- 7.6.2 It is in the above context that the achievement of more sustainable future travel patterns has an important role to play in improving local air quality standards, and in reducing national CO₂ emissions outputs.
- 7.6.3 The following table provides output from the CATS multi-modal transport model in relation to general traffic related pollutants in the full CASP area. This has been undertaken in the context of 2020 CASP Update population/ employment allocations for the full CASP area, using available emissions outputs from Saturn component of the model for Scenarios 1 and 5. The outputs within this table are intended only to give a guide as to the comparative emissions levels in both without (Scenario 1) and with (Scenario 5) CATS scenarios.

Table 7.8 General Traffic Related Environmental Pollutants (for 08:00 to 09:00hrs Time Period)

Environmental Pollutant	Scenario 1, Do-Minimum	Scenario 5 (Rapid Transit, CC TMP + CASP Update)	% Change
CO ₂ (kg)	23,988	19,744	-18%
CO (kg)	2,341	1,756	-25%
NO _x (kg)	587	450	-23%
HC (kg)	424	319	-25%
PB (kg)	2.43	1.84	-24%
PM ₁₀ (kg)	2.43	1.84	-24%

Ambient Air Quality Impacts

- 7.6.4 The primary sources of key environmental emissions namely NO₂, PM₁₀, CO and to some extent VOC (Benzene) is road transport. Of these emission types, forecast emissions outputs from the Saturn model are available for CO and PM₁₀ only.
- 7.6.5 As can be seen from this table, the Strategy performs positively in terms of improving local ambient air quality. For CO, a 25% reduction in emissions values is forecast, and for PM₁₀ a

²¹ Energy in Ireland 1990 – 2007, 2008 Report published by Sustainable Energy Ireland

24% reduction is forecast. Road transport related activities partly contribute to other emissions values in the above table. The transport related component of these emissions are also forecast to decline by approximately 20-25%.

National Emissions Impacts

- 7.6.6 The key environmental emission type for which output limits have been set through international agreements is CO₂. The full implementation of CATS will give rise to an 18% reduction in CO₂ emissions. This equates to an annual reduction of 19,655 tonnes and represents a significant decrease in transport related CO₂ emissions. Such a reduction will have a significant role to play in the achievement of reduced emissions at a national level.

7.7 Summary of CATS Strategy Appraisal

Detailed Appraisal against Study Objectives

- 7.7.1 The recommended CATS Strategy from the previous section of this Report has been subjected to a detailed appraisal, considering the key study sub-objectives:
- Attractive public transport;
 - Public transport capacity; and
 - Support sustainable development.
- 7.7.2 In each of the Metropolitan Areas assessed, the Strategy is deemed to have a positive impact when measured against the study objectives.

Capital Cost of CATS Strategy Implementation

- 7.7.3 The recommended reconfiguration of bus network and expansion of the bus fleet is estimated to cost approximately €160 million.
- 7.7.4 The capital cost estimates associated with the implementation of the Rapid Transit Corridor, as either BRT or LRT are:
- BRT system implementation = €306 million, and
 - LRT system implementation = €1.020 billion.
- 7.7.5 The following overall capital costs estimates associate with the implementation of the revised bus network, expansion of bus fleet, and implementation of the Rapid Transit Corridor, as either BRT, or LRT are:
- Overall cost, BRT + Bus = €466 million, and
 - Overall cost, LRT + Bus = €1.18 billion.
- 7.7.6 As can be seen from these cost estimates, the development of the Metropolitan Area public transport network, with BRT as an integral component would represent a lower capital implementation cost by approximately €714 million, compared to those related to associated with LRT implementation.

Economic Appraisal

- 7.7.7 The Benefit to Cost Ratio (BCR) for BRT from Ballincollig to Mahon, via the City Centre and Docklands in the scenario is 2.04, representing high value for money.
- 7.7.8 The BCR could, however, be further enhanced if additional development were located along the corridor. The economic benefit of such an approach has been assessed in the context of this additional development being in place in 2030. An additional 33,275 residents and 39,992 jobs along the corridor (representing growth of 36% and 56% respectively over 2020 CASP Update levels) would meet the requirement for additional development along the alignment, which would be supportive of BRT. This would further improve the BCR to 2.85.
- 7.7.9 This additional employment and population along the corridor would improve the BCR by:
- increasing overall levels of public transport use; and
 - reducing highway trips, and reduced levels of traffic congestion, compared to a more dispersed pattern of development.
- 7.7.10 If the Rapid Transit Corridor is developed as LRT, the system would deliver low value for money in the context of the population and employment allocations contained within CASP Update (BCR = 1.04). Assuming a similar intensification of development along the corridor in 2030, as per BRT, above, the BCR would increase to 1.47, however this would still represent low value for money.
- 7.7.11 Significantly higher levels of population and employment growth, over and above those forecast for the CASP area up to 2020 would be required for the development of the corridor as LRT to represent medium-high value for money, i.e. both a higher overall rate of population/ employment growth, and a radical departure from the current spatial planning policy for the CASP area.

Environmental Appraisal

- 7.7.12 The Strategy performs very positively in terms of reduced environmental general traffic related pollutants. For CO₂, there would be an 18% reduction in emissions following implementation of the CATS Strategy. This equates to an annual reduction of 19,655 tonnes and represents a significant reduction in transport related CO₂ emissions. Such a reduction will have a significant role to play in the achievement of reduced emissions at a national level.
- 7.7.13 The Strategy is also forecast to contribute positively to the achievement of reduced emissions at a local level. Key emissions, the primary sources of which are road transport related activities are forecast to decline. For CO, a 25% reduction in emissions values is forecast, and for PM₁₀ a 24% reduction is forecast.

Conclusion

- 7.7.14 Assuming the system attributes are the same for both BRT and LRT, in terms of headway, speed, reliability of operations, and overall quality of system, the key difference between both systems is the value for money achieved from each system. The capital costs of implementing LRT are substantially higher than for BRT (circa €1 billion, compared to €300 million for BRT). As a result, if the Rapid Transit Corridor was developed as LRT, there would

be a low value for money economic return from the CATS strategy. For BRT, the CATS Strategy would deliver a high economic return.

- 7.7.15 Crucially, BRT has also been tested with a significant intensification of development along the corridor (33,275 residents and 39,992 job beyond 2020 levels), and has demonstrated capacity to accommodate the public transport needs of this additional development.

8 Outline Engineering Feasibility

8.1 Introduction

- 8.1.1 An outline engineering feasibility assessment of the Rapid Transit Corridor from Ballincollig to Mahon has been undertaken to illustrate the likely impact of introducing the system in the context of constraints that currently exist along the corridor. This assessment has focused on the operational phase traffic management arrangements, however consideration has also been given to land take requirements along the length of the alignment. An outline of the likely utility/ service impacts is also provided.
- 8.1.2 The option evaluation section of this report has indicated that BRT represents the best solution along the Rapid transit Corridor in the context of the CASP Update population and employment allocations up to 2020, and subsequent assumed growth of the CASP area between the point and 2030. Despite this, an outline engineering feasibility of the corridor, if developed as either BRT or LRT was undertaken.
- 8.1.3 Consideration is also given in this section of the Report to the alignment sub-options along the length of the corridor, 5 of which have been proposed. These alignment options have been subject to further assessment based on a consideration of likely passenger demand, Rapid Transit operating characteristics, outline engineering feasibility, and implementation cost (low/ high).

8.2 Typical Cross sections for BRT and LRT

- 8.2.1 As essential step in determining the feasibility of implementing the Rapid Transit Corridor, whether it is BRT or LRT is to understand the typical cross section applying to each mode in different circumstances. The typical cross sections of each LRT and BRT alignment is illustrated on the following figures. The typical cross sections have been developed, taking cognisance of the needs of all road users, including cyclists.

Figure 8.1, Continued BRT Typical Cross Sections

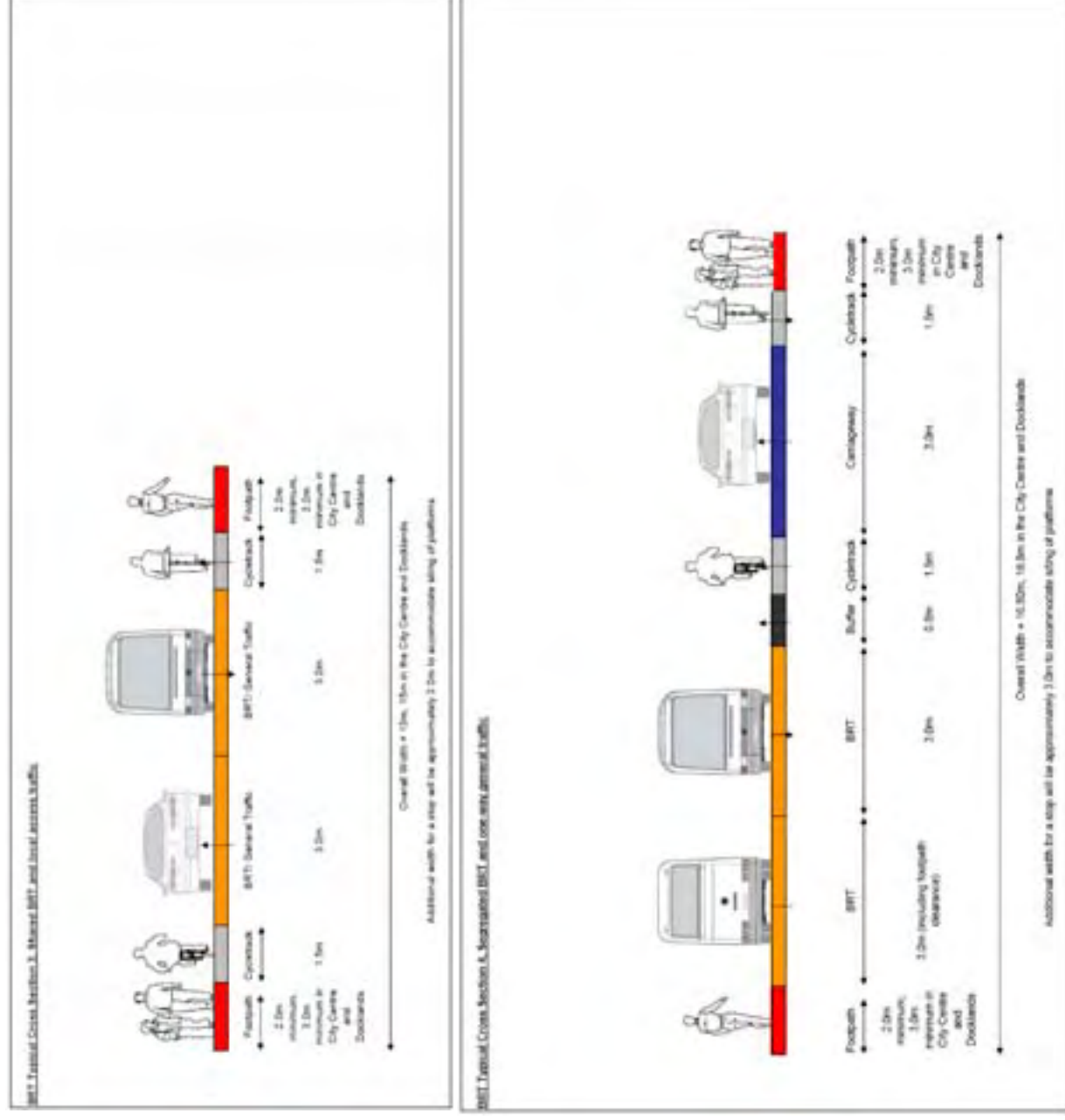


Figure 8.2 LRT Typical Cross Sections

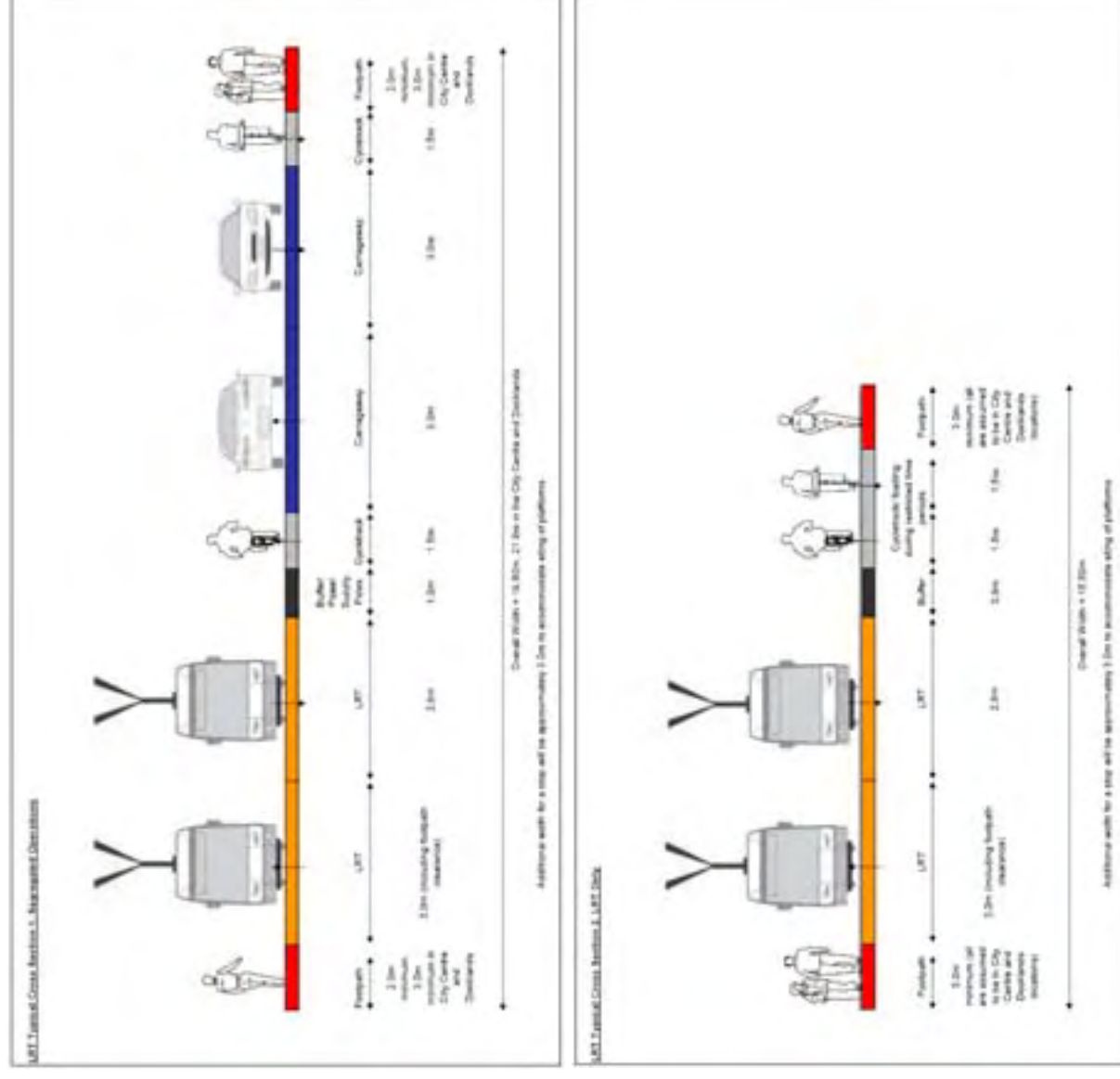
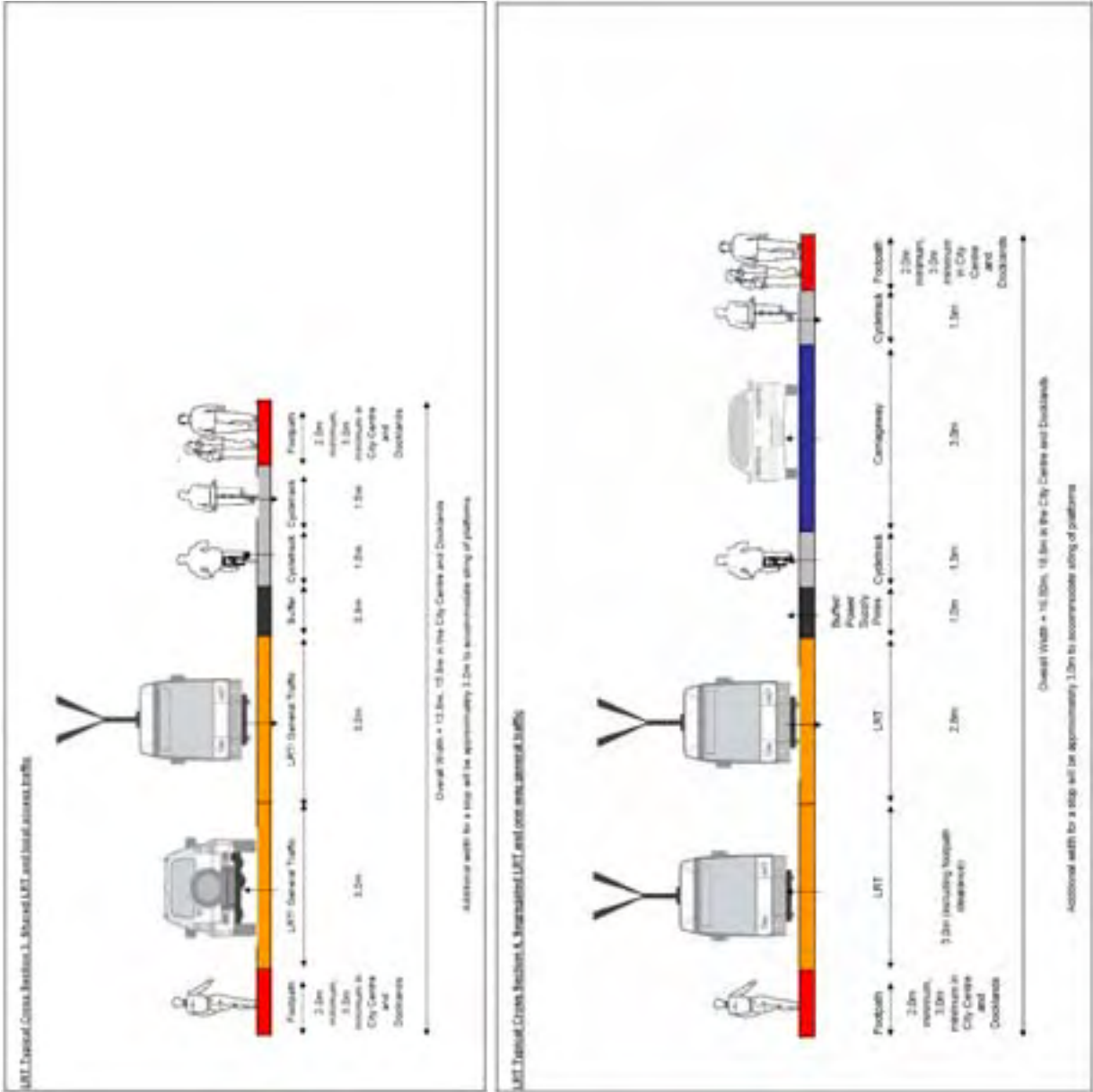


Figure 8.2, Continued LRT Typical Cross Sections



8 Outline Engineering Feasibility

- 8.2.2 The width of station platforms depends on the location of each station, associated peak passenger boardings/ alightings, and passenger storage areas. Station platform widths and specifications, including the most appropriate means of integrating stations into the surrounding streetscape, taking into consideration issues such as width constraints and visual impact, would be determined at detailed design stage.

8.3 Outline Engineering Feasibility Assessment: Traffic Management and Land Take Requirements

- 8.3.1 Figures 8.3 to 8.9 below, illustrate the likely traffic management restrictions and land take requirements to cater for the introduction of the Rapid Transit Corridor.

Figure 8.3 Rapid Transit Corridor Areas

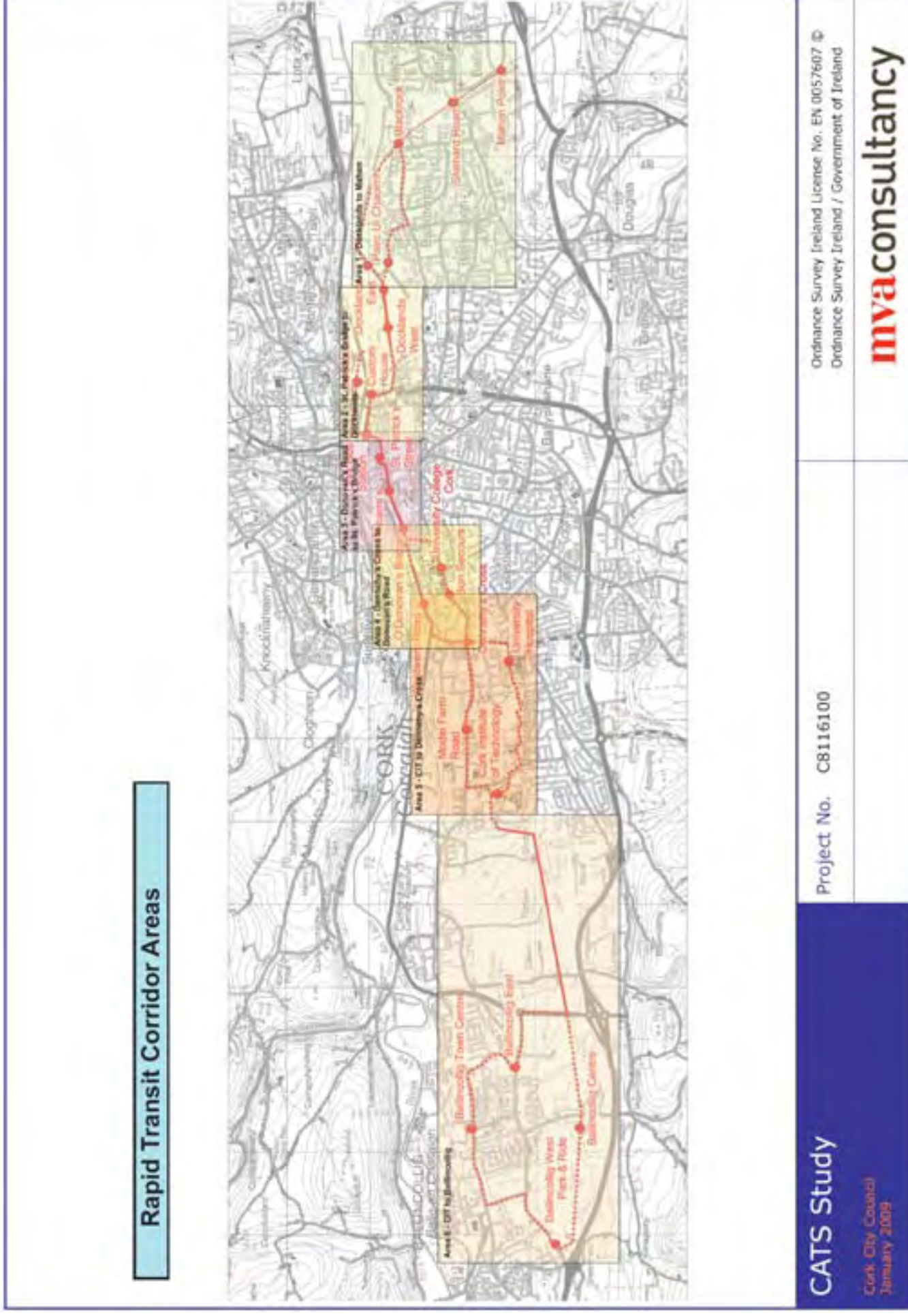


Figure 8.4 Area 1 – Docklands to Mahon

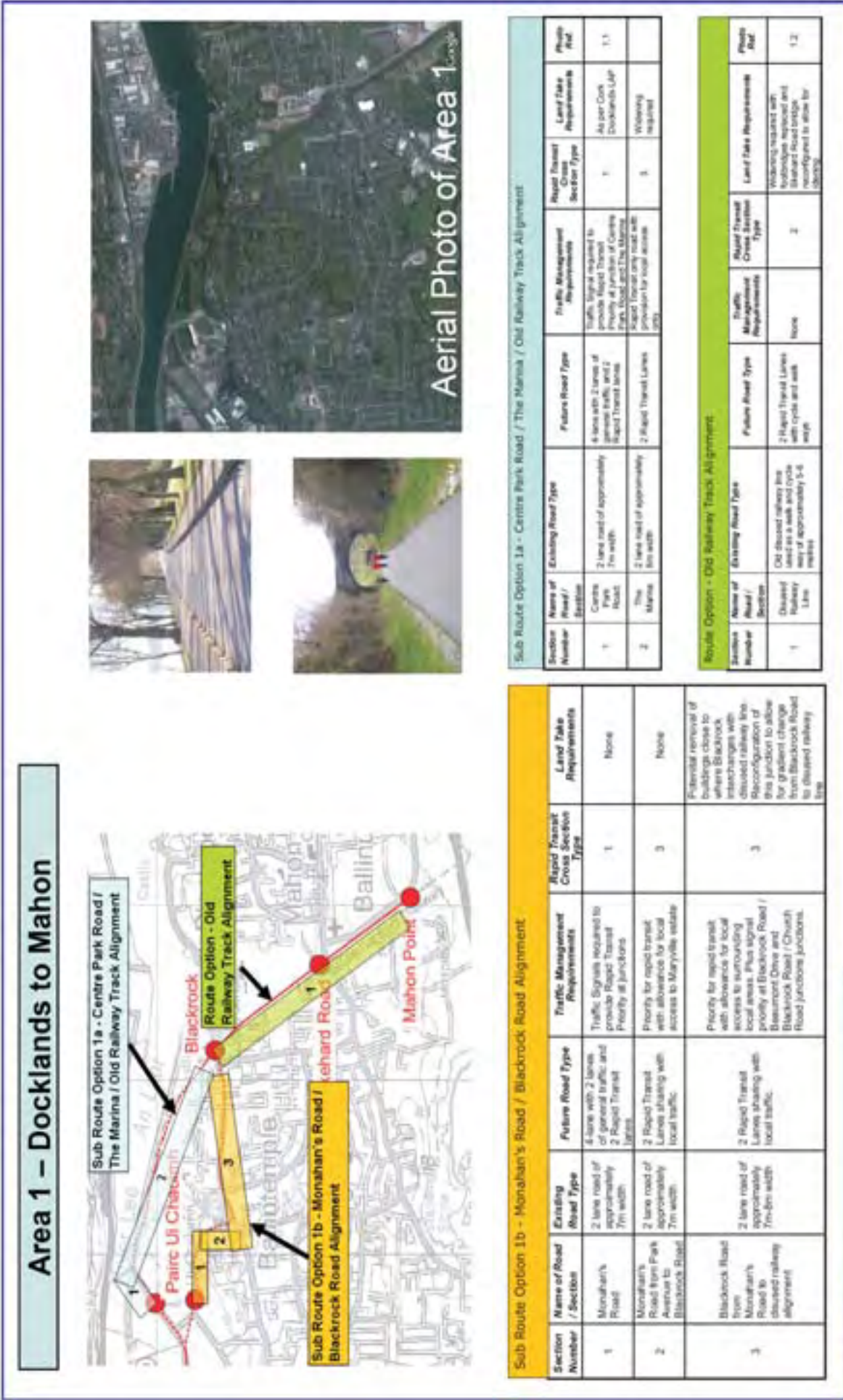


Figure 8.5 Area 2 – St Patrick's Bridge to Docklands

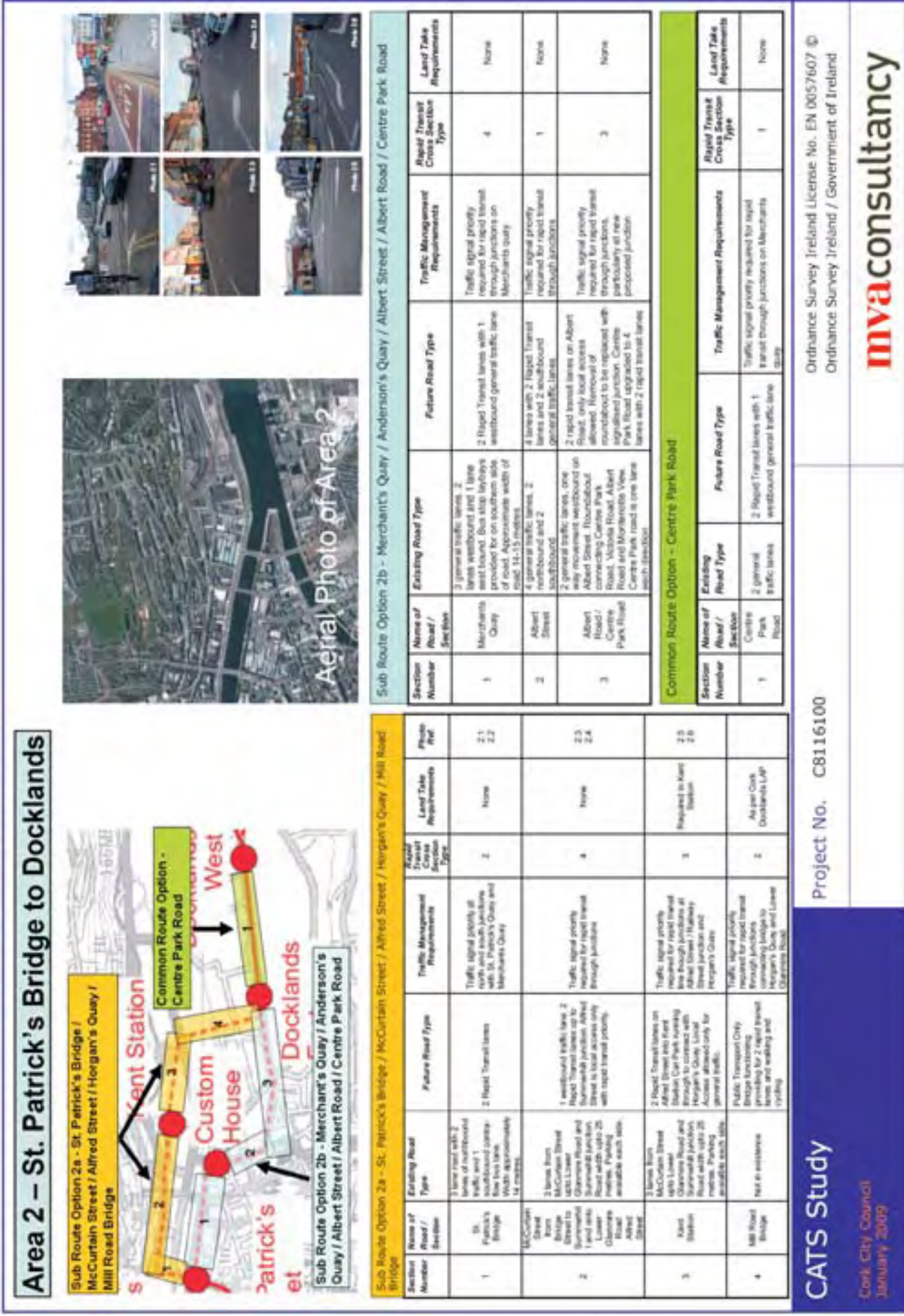


Figure 8.6
Area 3 – Donovan’s Road to St Patrick’s Street

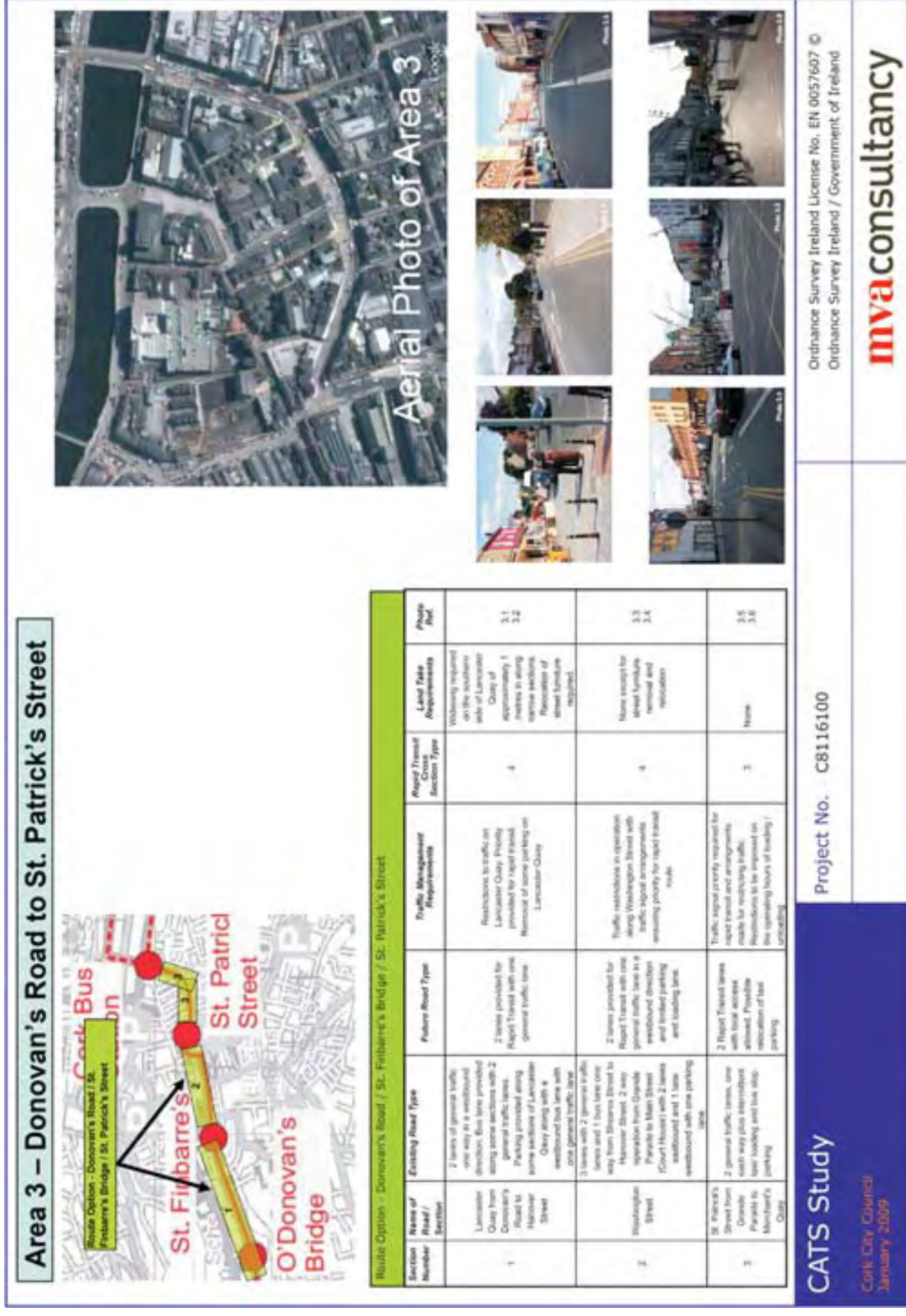


Figure 8.7
Area 4 – Dennehy’s Cross to Donovan’s Road



Section Number	Name of Road / Road Section	Existing Road Type	Future Road Type	Traffic Management Requirements	Proposed Road Cross Section Type	Land Take Requirements	Planned Ref.
1	Wilton Road from Dennehy's Cross to Cambrayne Road	3 lanes with 2 general traffic lanes travelling southbound and 1 travelling northbound	2 Rapid Transit lanes with 2 general traffic lanes providing 2 way movement	Complete reconfiguration of Dennehy's Cross junction to provide throughput of rapid transit priority through junction North-South capacity reduced to 1 lane	+	4.5 metres reserved on the eastern side of Wilton Road from Dennehy's Cross to N22. Land on the built east corner of Dennehy's Cross required	4.1 4.2
2	Cambrayne Road / Wilton Road Junction	4 lanes at the approach from Wilton Road, 2 lanes each way. 3 lanes at the approach from the N22-2, southbound lane and one westbound lane, 4 lanes at the approach from Wilton Road, 2 lanes for each direction of traffic, two	2 Rapid Transit lanes with 2 general traffic lanes providing 2 way movement	Significant re-configuration of this junction with the removal of one lane off traffic in each direction. Signal priority required for Rapid Transit operation through junction	+	Widening of 1 to 2 metres required	4.3 4.4
3	Western Road from N22 to Dennehy's Road	4 lanes of the approach to N22 junction with 2 lanes each way. Reduces to 3 lanes with 2 lanes westbound and 1 lane eastbound approaching entrance to LCC and onto Dennehy's Road. Bus lanes provided	4 lanes with 2 rapid transit lanes and 2 general traffic lanes, one each way direction	Traffic signals to provide priority for rapid transit lane	+	Widening required to accommodate an extra traffic lane along western side with reduces to 3 lanes. 3 metres required on the northern edge of Western Road	4.5 4.6

Section Number	Name of Road / Section	Existing Road Type	Future Road Type	Traffic Management Requirements	Rapid Transit Cross Section Type	Land Use / Roadway Use	Phase Ref.
1	Wilson Road from Cemetery's Cross to College Road	2 lanes, 1 lane each way with 1 lane straight through and 1 right turn lane of the approach to Cemetery's Cross. Parking spaces adjacent to Cemetery's Cross.	2 Rapid Transit lanes skirting with general traffic lanes approaching Cemetery's Cross. Priority lanes to be provided for rapid transit corridor 202 westbound prior to Cemetery's Cross.	Complete reconfiguration of Cemetery's Cross junction to provide throughput of rapid transit at priority through junction. North-South capacity reduced to 1 lane. Right turn onto Wilson Road separated. Roundabout at College Road 1. Roundabout to be widened by adjacent jurisdiction.	3	Residential of parking	4.7 4.8
2.5.4	College Road to Cemetery's Cross	Single Lane each way for the full length of College Road. Narrow Road of approximately 8 metres.	2 Rapid Transit lanes skirting with general traffic lanes.	College Road closed to through traffic. Local access only. Traffic lights arrangement to be configured at each end of College Road to promote rapid transit movement. Speed of rapid transit corridor along this section to be set to 25kph.	3	None	4.9 5.12
5	Donovan's Road from College Road to Western Road	Single Lane each way for the full length of Donovan's Road	2 Rapid Transit lanes skirting with general traffic lanes	Junction at College Road 1. Donovan's Road to be signposted to provide Rapid Transit priority. Roundabouts on Donovan's Road to discourage through traffic.	3	None	5.11



Figure 8.8 Area 5 – CIT to Dennehy's Cross

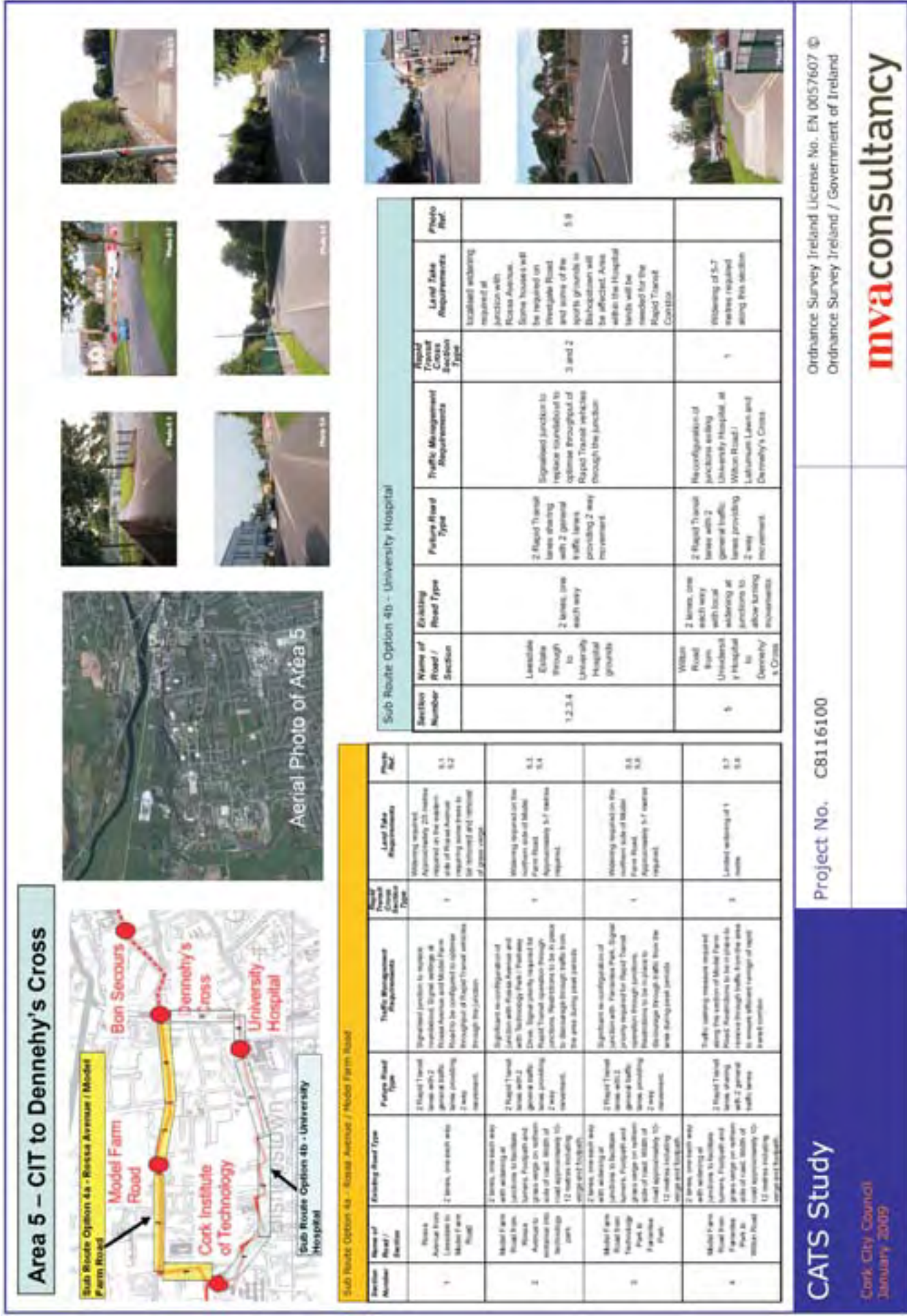


Figure 8.9 **Area 6 – Ballincollig to CIT**



8.4 Summary

8.4.1 In summary, the outline engineering feasibility review has concluded that it will be possible to implement a Rapid Transit Corridor linking Ballinacollig to Mahon via Bishopstown, the City Centre and Docklands. However, the following generic infrastructural and traffic management interventions will be required:

- Utility and service diversions;
- Road construction / widening;
- Land take;
- Traffic signal and junction reconfiguration to prioritise Rapid Transit movement;
- Re-allocation of road space; and
- Traffic management strategy to facilitate:
 - multi-modal movement within the Rapid Transit Corridor, and
 - Rapid Transit and non-car transport modes in the Core City Centre area.

9 BRT versus LRT

9.1 Introduction

- 9.1.1 The option evaluation section of this report has indicated that BRT represents the best solution along the Rapid Transit Corridor in the context of the CASP Update population and employment allocations up to 2020, and subsequent assumed growth of the CASP area between the point and 2030.
- 9.1.2 Detailed assessment of the supportive land use requirements for each system has concluded that additional development above and beyond CASP Update levels is required along the length of the Rapid Transit Corridor. If LRT were selected, a radical departure from CASP Update would be required to massively intensify development along the corridor.
- 9.1.3 Both BRT and LRT systems have also been subject to more detailed appraisal to fully establish the performance of the CATS Strategy, if inclusive of either system. Assuming the main system attributes are the same for both systems, i.e. headway, speed and reliability, the key difference between both systems is the value for money delivered. LRT is substantially more expensive to implement than BRT (circa €1 billion, compared to approximately €300 million for BRT). As a result, LRT would deliver low value for money, whereas BRT would deliver a high return.
- 9.1.4 The outline engineering feasibility of the corridor, if developed as either BRT or LRT was also undertaken. This has concluded that development of both BRT and LRT is feasible.
- 9.1.5 This section of the Report provides information on the characteristics of both systems, with a view to determining the most appropriate system in the context of the Cork Metropolitan Area.

9.2 System Characteristics – BRT and LRT

- 9.2.1 Bus Rapid Transit (BRT) and Light Rail Transit (LRT) systems typically have very high quality infrastructure in place to ensure they represent highly attractive mode for passengers. These aspects of the system, which improve the overall journey experience, are critical if car users are to use public transport. The main features of BRT and LRT systems that differentiate them from other transport modes are:
 - High capacity (less seating, more standing space, more space for buggies, wheelchairs);
 - High frequency;
 - Predictable journey times (assuming full priority);
 - Low emissions vehicles;
 - Level boarding and alighting;
 - Multiple access/ egress points;
 - Off vehicle ticket sales;
 - Real time passenger information displays;

- Well designed and comfortable interchange facilities;
- Seamlessly integrated within the urban realm to maximise their visual appeal and improve image; and
- On-vehicle passenger information (audio, visual).

9.2.2 The following figures illustrate the typical system characteristics from BRT and LRT in Nantes and Dublin respectively.

Figure 9.1 Typical system characteristics, BRT (Nantes)



Figure 9.2 Typical system characteristics, LRT (Dublin)

9.3 Bus Rapid Transit – System Characteristics

System Attributes

- 9.3.1 Bus Rapid Transit (BRT) systems are highly flexible and, by their nature, each system is unique. Table 9.1, below outlines key attributes of BRT systems and degrees of implementation from basic BRT to advanced BRT. BRT systems can comprise any combination of attributes. For example the degree of segregation could be advanced yet the system could be operated unguided as for basic BRT.

Table 9.1 BRT Attribute Table

Attribute	Basic BRT	Intermediate BRT	Advanced BRT
Guidance System	Non – Guided	Electronically / Optically Guided	Mechanically Guided
Degree of Segregation	Partial Segregation	Majority Segregation	Full Segregation
ITS	Signal preference (passive priority)	Real Time Passenger Information Systems – combination of passive and active priority	Active Priority at the majority of signals
Engine	Diesel	Hybrid (LPG, Diesel, electric)	Electric
Vehicle Type	Single Articulated ~110 passenger capacity	Double Articulated ~ 150 passenger capacity	Triple Articulated (guided only) ~180 passenger capacity
Ticketing	Increased Pre-paid	Proof of payment fare systems (off-board)	Electronic fare collection (smart card etc)

System Capacity

9.3.2 System capacity is dependent on a number of system characteristics, particularly:

- Vehicle type; and
- Frequency.

Vehicle Type

9.3.3 Many European countries limit the permitted length of road vehicles. At present, the BRT vehicles in operation in Europe are a maximum of 24.5m in length. In addition to road traffic limitations, the manoeuvrability of vehicles is influenced by the guidance system in operation, which in turn affects the length of vehicle that can be used.

9.3.4 The BRT vehicle with the largest capacity in operation in Europe is the Eindhoven Phileas which has a practical capacity of 180 passengers (200 crush loading). The Phileas system is fully guided through the provision of magnetic strips embedded in the carriageway.

Frequency


- 9.3.5 The maximum frequency at which BRT systems can operate is mainly dependent on the degree of segregation from other traffic, dwell time at stops and degree of priority afforded. Many of the existing European systems operate at 3 to 5 minute headways during peak periods. The Brisbane BRT system is fully segregated and carries in excess of 9,500 passengers per direction per hour at 15 second headways.

Speed of Operation

- 9.3.6 Speed of operation has a bearing on the utilisation of vehicles and the number of vehicles that can be operated past a point in time. Dwell time at stops has an influence on the number of vehicles that can access the stop per hour. Dwell time in turn is dependent on ticketing systems, number of access points (multi-door loading) and stop infrastructure (pull-in, pull-out arrangements, opportunities for level boarding etc.).

Examples of Existing BRT Systems

Table 9.2 Bus Rapid Transit - Examples of Existing Systems

Attribute	Nantes	Nancy	Eindhoven
			
Guidance System	Non – Guided	40% unguided 60% mechanically guided	electronically / magnetically guided
Degree of Segregation	Virtually Full Segregation	Majority Segregation	Virtually Full Segregation
Engine	Hybrid (LPG, Diesel)	Hybrid (LPG, electric) overhead cables	Hybrid (LPG, electric)
Vehicle Type	Single Articulated ~110 passenger capacity	Double Articulated ~ 150 passenger capacity	Single Articulated ~ 120 passenger capacity Double Articulated ~180 passenger capacity
Ticketing	Proof of payment fare systems (off-board)	Proof of payment fare systems (off-board)	Proof of payment fare systems (off-board)
Maximum Frequency	3 minute headway	3 minute headway	10 minute headway
System Operating Speed	21 kph	15 kph	25 kph
Maximum Hourly Capacity	2,200	3,000	1,080 3,600 (based on 3 minute headway)
Cost per km	~€8m	~€14	~€6m

9.4 Light Rail Transit – System Characteristics

9.4.1 Light Rail Transit (LRT) systems have similar operating characteristics to high quality BRT systems. The key differences are:






- LRT requires fixed track systems along the entire length of the route. While this may improve the ride quality over BRT, it also reduces the flexibility of the system as it can not deviate from its corridor of operation;
- LRT vehicles (trams) are generally longer – typically up to 40m long, thus providing for additional system capacity. Each tram can typically carry approximately 350 passenger, however each BRT vehicle has a capacity of 150;
- As each tram has higher capacity, fewer vehicles can be used to carry the same passenger numbers than would be required for BRT. As staff costs can represent a significant element of overall public transport operating costs; this can result in lower operating costs for LRT;
- As trams can be driven from either end, trams do not require turnaround areas. As BRT vehicles are long, they require a large turning circle to cater for turnaround at the end of the route. This may also have implications in terms of the ability to insert additional vehicles into the corridor to cater for higher passenger flows over part of the route;
- Trams are larger than BRT vehicles and this affects their manoeuvrability. The minimum turning radius for trams is approximately 20m as apposed to 12m for BRT vehicles;
- The traction available between tram wheels and tram tracks is inferior to the equivalent traction available to rubber tyred vehicles. The maximum gradient that trams can operate at is generally 6%, compared to 13% for BRT systems; and
- Except in exceptional circumstances in the Irish context, shared running between LRT and other modes is not considered to provide an adequate operating environment. While restricting infrastructure to LRT only, it can also create issues in terms of reduced accessibility by other modes, which is a particular issue in spatially dispersed cities with significant dependency on bus.

9.4.2 In addition to the above operating characteristics differences between BRT and LRT, the extent of works required to deliver LRT will be significantly greater than BRT. This will include utility and service diversions, and laying of tracks. The extent of works required is also reflected in the radically higher capital costs associated with the introduction of LRT (> €1 billion compared to > €300 million for BRT).

Examples of Existing LRT Systems

9.4.3 The table overleaf summarises the characteristics of LRT systems in operation in a number of other cities including Dublin, Nottingham, Orleans and Montpellier.

Table 9.3 Light Rail – Examples of Existing Systems

Attribute	Dublin - Luas Red Line	Dublin - Luas Green Line	Nottingham	Orleans	Montpellier
					
Degree of Segregation	60% segregated 40% dedicated right of way	90% segregated 10% dedicated right of way	74% segregated 7% dedicated right of way 19% mixed traffic	100% dedicated right of way	100% dedicated right of way
Vehicle Type	40m; 356 passenger capacity (80 seated)	40m; 356 passenger capacity (80 seated)	33m; 191 passenger capacity (62 seated)	30m; 203 passenger capacity (56 seated)	40m; 300 passenger capacity (70 seated)
Maximum Frequency	5 minute headway	4 minute headway	5 minute headway	5 minute headway	4 minute headway
System Operating Speed	19.8 kph 15.2km route; 23 stops	24.0 kph 9km route; 13 stops	27.8 kph 14.4km route; 23 stops	22kph 17.7km route; 24 stops	20.0kph 15.2km route; 27 stops
Maximum Hourly Capacity	4,270	5,340	2,290	2,440	4,500

9.5 Summary

9.5.1 In the context of the Cork Metropolitan Area, BRT is considered to represent the best solution to the transport demands along the east-west corridor for the following reasons:

- The scale of development along the corridor at present is not sufficient to merit the development of LRT, whereas a stronger case exists for BRT Phase 1a, from Bishopstown to Docklands on the basis of current transport demands;
- CASP Update provides an outline of spatial planning policy for the CASP area up to 2020. In the context of the future allocations of development within this plan, BRT represents the most appropriate solution in terms of its ability to meet passenger demands up to 2020, and beyond (to 2030);
- Whilst additional development along the Rapid Transit Corridor is recommended if the system is developed as BRT, a radical departure from CASP Update would be required to facilitate implementation of LRT. Furthermore, developing the system as LRT would be a higher risk strategy, as its operational success would be dependent on significant future development/ redevelopment along the corridor;
- The timeline for implementing LRT is typically a minimum of 10 years from conception through to commencement of operation. As a result, LRT would not likely be operational until 2018 at the earliest (BRT could be implemented by as early as late 2014/ early 2015). Such a timeframe for implementation would not be compatible with current development plans for the Docklands area in particular. Furthermore, opportunities to locate additional public transport oriented development along the corridor would be undermined by such a lengthy timeline for delivery;
- The capital costs of implementing BRT are significantly lower, at approximately 30% of the overall cost of LRT. Transport 21 is a capital investment framework under the National Development Plan through which the transport system in Ireland will be developed, over the period from 2006 to 2015. The €1 billion+ implementation costs for LRT would indicate that funding for LRT would not likely be secured until post 2015, thus supporting the view that 2018 would be the earliest possible implementation date;
- As a result of the lower capital implementation costs, the economic return of investing in BRT plus the reconfigured bus network is substantially stronger than for LRT. Development of the Rapid Transit Corridor as BRT in the context of CASP Update population/ employment allocations would yield a BCR of 2.04 (high rate of return) for BRT compared to 1.04 (low rate of return) as LRT. In the case of both BRT and LRT, the BCR increases if significant additional development is located along the Rapid Transit Corridor, however even with an additional 59,024 population and 53,700 jobs along the alignment of the corridor, the BCR for LRT would still be low at 1.47;
- BRT represents a more flexible solution to the transport demands of a growing City, where new infrastructure is required to facilitate implementation. This is true for Cork Docklands, given the projected phased delivery of highway network improvements, and the requirement to operate Rapid Transit on this new infrastructure. There is a risk that the ultimate infrastructure may not be in place to coincide with Rapid Transit implementation. This would prejudice the timely delivery of LRT, however BRT could

potentially operate along an alternative alignment until such time as the ultimate infrastructure, along the preferred alignment is in place;

- The level of disruption associated with BRT implementation is generally less than with LRT. While it is preferable to relocate as many utilities as possible from the alignment of BRT, to minimise the risk of disturbance to operations arising from roadworks, and to ensure the surface integrity is maintained in the future, it is not essential to do so along the full alignment. This can reduce the disruption in sensitive areas, where extensive investment in urban realm has recently been undertaken; and
- Given the extent of works required to implement LRT, and that sufficient return from investment would not be realised until a minimum critical length of the system is in place (deemed to be from Ballincollig to Docklands), phasing becomes more of a constraint than would be the case with BRT. Lower capital costs, and lower capacity for BRT would facilitate the implementation of the system in up to three phases, with Phase 1a representing the section from Bishopstown to Docklands.

9.5.2 In light of the above issues, the implementation of BRT, in conjunction with a reconfigured bus network, is considered to represent the most appropriate solution to the existing and future transport needs of Metropolitan Cork.

10 Integration of Public and Private Transport Modes

10.1 Introduction

10.1.1 The development of an integrated public transport system is essential if the benefits of investing in public transport are to be realised. The performance of the CATS Strategy is dependent on a range of transport integration measures. This section of the Report summarises these measures under the following headings:

- Integrated fares;
- Public transport interchanges;
- Park and ride;
- Integrated Public Transport Information (IPTI); and
- Demand Responsive Transport.

10.2 Integrated Fares

Concept

- 10.2.1 An integrated ticketing system allows public transport users to pay once for one ticket for the journey they choose to make, irrespective of how many modes, operators, or services within modes they use to complete their trips.
- 10.2.2 An integrated fares system results in public transport users paying the same fare between any origin and destination in an area, independent of the number of legs / modes of transport required to complete the journey and as such is a fundamental element of an integrated public transport network.

Advantages

- 10.2.3 The key advantages of introducing integrated fares on a network wide basis are:
- Increase use of public transport, as experienced in London and Barcelona following introduction in these cities. London Transport have stated that “A major study of bus and Underground traffic concluded that revenue gains due to Travelcard account for up to 10% of fare paying revenue. Passenger miles increase of 20 to 30% on bus and Underground respectively are also attributable to Travelcard.” Following the introduction of integrated fares on Barcelona in 2001, annual passenger growth increased from an average 2.7% in the three years preceding their introduction to 6.2% in the 3 years afterwards; and
 - Would, in the medium-long term lead to a more efficient transport network as the network evolves to match passenger demand, i.e. passengers do not pay for inefficiencies that exist in the system.

Applicability to Cork Metropolitan Area

- 10.2.4 The development of the Suburban Rail network, the proposed future reconfiguration of the bus network, and introduction of a Rapid Transit Corridor along the east-west corridor from Ballinacollig to Docklands presents an opportunity to introduce integrated fares, as an element of overall public transport network integration.

10.3 Interchanges

Concept

- 10.3.1 People interchange either because there is no direct through service or route from origin to destination or they choose to change services or modes in order to take advantage of a more convenient or speedy or cost effective mode of travel for part of their journey. Interchange therefore can be either an inconvenience imposed by the configuration of the Public Transport Network or an opportunity for passengers to take advantage of reduced travel times and/ or costs.

Advantages

- 10.3.2 On a practicable level, intermodal interchanges provide for seamless access to and transfer between modes on the public transport system. At a minimum, they will have very high quality pedestrian circulation and cycle parking facilities. They may also include park and ride facilities to widen the effective catchment of public transport.
- 10.3.3 Intermodal interchanges are also the “showcases” of an integrated public transport system and, as such, the appearance, range of facilities available and general environment can influence an individual’s decision as to whether to use and/ or continue to use Public Transport.

Applicability to Cork Metropolitan Area

- 10.3.4 As a result of the planned enhanced public transport network there will be numerous interchange points and public transport nodes where services converge allowing most journeys on the Network to be made with not more than one interchange. Such interchange should be properly planned to allow journeys by public transport to be “seamless”. There is therefore much scope throughout Metropolitan Area for introducing planned interchange facilities at all locations where interchange takes place.
- 10.3.5 The key public transport interchange locations in the Metropolitan Area on the existing and recommended future public transport network are Kent Station and Cork Bus Station. A series of other important public transport interchange locations on the Rapid Transit Corridor, between BRT and bus have also been identified and include:
- Ballinacollig West;
 - CIT;
 - University Hospital;
 - UCC;

- St. Patrick's Street; and
- Mahon Point.

- 10.3.6 The location of BRT/ bus interchanges needs to be reviewed upon selection of the preferred alignment for the corridor, in conjunction with planning for the revised bus network.
- 10.3.7 Planning and design for key designated public transport interchanges, such as Kent Station, Cork Bus Station; will need to be undertaken in the context of peak forecast future passenger flows. Interchange planning should be undertaken with a view to minimising the interchange penalty for all passengers using the facility. It should be noted that peak passenger flows along the two Suburban Rail Corridors are forecast to double post implementation of CATS. This will have implications in terms of interchange planning and specification along these corridors, but, in particular, at key public transport interchanges such as Kent Station.

10.4 Park and Ride

Concept

- 10.4.1 Park and Ride offers those living outside natural walking/ cycling catchments of public transport the opportunity to use public transport for a proportion of their travel. It can therefore increase the effective catchment area of public transport, resulting in an overall shift from car towards public transport.
- 10.4.2 In transport planning terms it is considered preferable to intercept people at source onto public transport, i.e. operate public transport services close to where people live, or conversely locate development close to public transport. Despite this, it is not practically or economically viable to operate a public transport network that will serve the transport needs of an entire City Region. It is in this context that park and ride has a role to play in terms of intercepting potential car users, and carrying them on public transport.

Advantages

- 10.4.3 Park and ride offers those living the natural walking catchment of public transport the opportunity to avail of public transport services for part of their journey. Park and ride can therefore reduce car travel and levels of urban traffic congestion, and increase public transport use. Park and ride has specific advantages in relation to large rural/ semi-rural hinterland areas with strong transport demand to a specific destination for a variety of transport activities, e.g. high levels of work and retail related journeys from outside an urban area, to the City Centre.
- 10.4.4 There are however, some disadvantages of park and ride. The key disadvantage is that it can undermine the patronage on conventional bus services, where such services play a complimentary/ feeder role to primary public transport services, e.g. Rail or Rapid Transit.

Applicability to Cork Metropolitan Area

- 10.4.5 Given the dispersion of development within most city regions, such as exists in the CASP area, this is not practicably or economically possible to intercept all trips at source. As a result, park and ride has an important role to play as an integral element of a comprehensive public transport network, as will exist in the Cork Metropolitan Area post implementation of the CATS Strategy.

- 10.4.6 The introduction of a strategic park and ride to the south-west of Ballincollig, at the western extent of the Rapid Transit Corridor is considered an essential BRT system component. The function of the park and ride site, located adjacent to the N22 / R608 Interchange, would be to intercept city bound traffic on the N22, thus widening the catchment of the Rapid Transit Corridor. This site would therefore serve a strategic function, by reducing car trips on the national road network.
- 10.4.7 This park and ride site would supplement the committed Suburban Rail park and ride site at Dunkettle, which would intercept trips on the N8 and N25 corridors, and other bus based park and ride sites already in place or planned for Cork City, such as Black Ash.
- 10.4.8 Based on a review of the future public transport network in the study area, in particular the committed Suburban Rail network, there may be potential for an additional strategic park and ride site on the Mallow Rail Line, to the north of Cork City. For such a park and ride site to be successful, it would need to be located in close proximity to the N20, national primary road. Furthermore, the interaction of park and ride related traffic and traffic related to other developments surrounding the rail station would require further assessment, to ensure access/ egress to the park and ride site is not undermined by traffic congestion on the surrounding road network. This is considered essential to the success of this, and any strategic park and ride site to ensure the disutility of interchange between car and public transport is minimised.
- 10.4.9 A further park and ride location, planning for which is already at an advanced stage, is a bus based park and ride site located on the Carrigrohan Road (circa 1,000 vehicles). This site is considered to have significant transport benefits in the context of the overall CATS Strategy, and the timeline for delivery of BRT, i.e. Phase 1b to Ballincollig assumed to arrive in 2017 (see the implementation section of this Report, Section 11 for details). It will build up public transport use on the corridor to the west of the City. A portion of the users of the site would be residents in Ballincollig, who would then transfer onto BRT, post implementation of Phase 2 of the scheme.
- 10.4.10 Given the potentially negative impacts of locating strategic park and ride sites in urban areas, in terms of reducing bus service patronage, it is not considered preferable to introduce other strategic park and ride sites in the Metropolitan area.
- 10.4.11 Small/ local park and ride sites throughout the Metropolitan and wider CASP area, attached to scheduled public transport services on the Suburban Rail, rapid transit and bus corridors are likely to significantly expand the catchment of public transport on a network wide basis. As a result, it is recommended that such potential, and impacts, be assessed on a case by case basis to ensure the overarching aim of increased public transport use on a system wide basis. This could be assessed within the context of Local Area Plans for various urban areas through the CASP region.
- 10.4.12 Given the possibility that park and ride could undermine existing or planned public transport services, park and ride locational and capacity issues need to be considered in the context of the ultimate CATS Strategy.

10.5 Integrated Public Transport Information (IPTI)

Concept

- 10.5.1 Integrated Public Transport Information can be defined as: "Complete and comprehensive information that assists a traveller to plan, pay for, embark on and complete any journey by public transport regardless of mode, operator or interchange requirements."
- 10.5.2 IPTI can be divided into two broad categories, Fixed PTI and Real Time PTI.
- 10.5.3 For Fixed Time PTI
- Display cases at bus and Luas stops, rail stations, shopping centre, airport, etc. for display of fixed time information, network and local area maps;
- 10.5.4 For Real-Time PTI
- On-board vehicle tracking system;
 - Electronic displays at all points to relay information in real-time;
 - On-board vehicle displays to relay information in real-time;
 - Databases and servers; and
 - Call centre, web-sites, etc.

Advantages

- 10.5.5 It is difficult to quantify the growth in patronage purely related to investment in IPTI. It is, however clear that where significant investment in infrastructure and service improvements is being undertaken, that the full benefits of the investment will not be realised unless both existing and prospective public transport users are made fully aware of the options available to them.
- 10.5.6 This is particularly true given a recent finding that IPTI queries tend to be about new, irregular non-work related trips, predominantly in the off-peak periods, when public transport capacity is underutilised.

Applicability to Cork Metropolitan Area

- 10.5.7 Cork City Council plan to implement a Mobility Centre for Cork City. This can be considered as a first essential step in the introduction of IPTI across the Metropolitan Area. It is considered essential that an IPTI strategy for the Cork Metropolitan Area be developed to determine the specific requirements across the full public transport network. This is essential in the context of the significant changes to the public transport network and services that are recommended within the context of this study.

10.6 Demand Responsive Transport

Concept

- 10.6.1 Demand Responsive Transport (DRT) has been described as "transportation options that fall between private car and conventional public bus services." It is transport which is adapted

to meet the known needs of users, and as such can offer advantages where conventional public transport services may not be viable.

Advantages

- 10.6.2 DRT has a potentially significant role to play in certain parts of Cork City, where conventional bus services may not be viable, the outer Metropolitan and CASP Ring transport network.
- 10.6.3 The INTERMODE: Innovations in Demand Responsive Transport Final Report, commissioned for the UK Department for Transport and Greater Manchester Passenger Transport Executive describes DRT under four headings. These are:
- **Interchange DRT** providing feeder links to conventional public transport services, e.g. at a rail station or into a bus route.
 - **Network DRT** providing additional services, or by replacing uneconomic services in a particular place or at certain times.
 - **Destination Specific DRT**, serving particular destinations such as airports or employment locations. A key element is a partnership between a local authority and the 'destination' (e.g. a company, airport operator etc).
 - **Substitute DRT** where conventional bus services are replaced by a DRT system totally or substantially.
- 10.6.4 Given the broad range of DRT types, the most appropriate DRT type for an area may very well involve a combination of the characteristics of 2 or more of these DRT types.

Applicability to Cork Metropolitan Area

- 10.6.5 The role of DRT requires further investigation to determine its role on a regional wide basis. In terms of target markets for DRT in the CASP Area, the 5 key areas are likely to be:
- Special needs;
 - Periphery;
 - Local journeys;
 - Connectivity; and
 - Hinterland/ rural.
- 10.6.6 Given that a large portion of the Metropolitan and CASP Ring area population live outside the main towns, it is likely that DRT would have particular potential in rural areas in the Metropolitan area and further afield. In this respect, it could reduce car dependency, and act as a viable means of accessing public transport for residents in these areas.

10.7 Summary

- 10.7.1 The performance of the CATS Strategy, as detailed earlier in this Report is dependent on a range of transport integration measures being in place. This include a range of physical, fiscal, informative and service related measures, outlined above, and summarised as follows:
- Integrated fares;

10 Integration of Public and Private Transport Modes

- Public transport interchanges;
- Park and ride;
- Integrated Public Transport Information (IPTI); and
- Demand Responsive Transport.

11 Outline Implementation Plan for Preferred Strategy

11.1 Introduction/ Key Issues

- 11.1.1 The time at which public transport interventions are planned and implemented is crucial to the achievement of the overall study objectives. Given the potential to significantly improve public transport use in the short term, it is considered critical that, significant targeted up-front investment is undertaken to address the deficiencies that have been observed to date. This will facilitate the 'ramping up' of public transport demand from current low levels to more sustainable levels.
- 11.1.2 Furthermore, it is important that planning for key future public transport related improvements, whether they are directly related to the network itself, or supportive demand management measures, commence to ensure the full CATS Strategy benefits are realised post implementation of all infrastructure and service related measures.
- 11.1.3 A critical issue with the CATS strategy is ensuring the effective implementation of a multi agency project within an evolving regulatory and institutional framework, in particular the BRT system. There is currently no formal model in Ireland for the delivery of such projects outside the Dublin Area.
- 11.1.4 A related issue is funding – the current funding streams for each of the potential partners do not include the funds for the implementation of the strategy, although some parts are already covered by Transport 21 initiatives (Cork – Midleton and Mallow Suburban Rail Services).

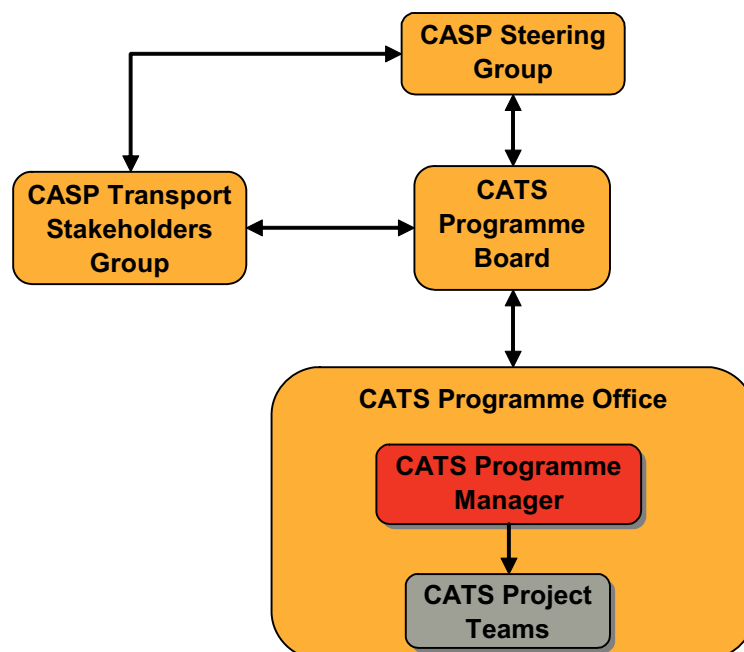
11.2 Institutional Arrangements

- 11.2.1 It is recognised that the current arrangements in place in the CASP area in terms of the CASP Steering Group, and other groups set up under its direction have achieved success in relation to public transport improvements in Cork City and County. As a result, it is recommended that existing arrangements between the various agencies would remain in place until such time as an alternative arrangement is in place. This will ensure that short term improvements, forming an integral element of the CATS Strategy e.g. bus network and service improvements/ reconfigurations, would be implemented in a timely manner.
- 11.2.2 An alternative institutional arrangement than that which currently exists is suggested to progress implementation of the Rapid Transit Corridor, and other CATS Strategy elements including the further the upgrading of the bus network, based on experience elsewhere in Ireland. Such a model would lead the planning, implementation and monitoring of CATS recommendations on a network wide basis. As such, the implementation model selected would not only be responsible for the delivery of the public transport system, it would also have an ongoing and wider remit into the future. The model recommended is a Programme Board Model, described below.

Enhanced CASP Model/ CATS Programme Board Model

- 11.2.3 As mentioned above, it is recognised that the current arrangements in place in the CASP area in terms of the CASP Steering Group, and other groups set up under its direction have achieved success in relation to public transport improvements in Cork City and County.
- 11.2.4 The broad ranging recommendations contained within the CATS Strategy, and the complex multi-agency nature of the measures contained therein, will require a higher level of co-ordination between the various transport agencies in the CASP Area than that which has existed up to now. As a result, a formalisation of the existing CASP structures is considered an imperative to the timely and efficient delivery and success of the Strategy.
- 11.2.5 A CATS Programme Board would strengthen existing arrangements in the CASP area as they relate to transport, and facilitate planning and implementation of the CATS Strategy. The Programme Board would report to the CASP Steering Group, would consist of:
- An independent Chairman, with responsibility for delivering the CATS Strategy, and reporting directly to the CASP Steering Group;
 - Senior officials representing Cork City, Cork County, Bus Éireann, Iarnród Éireann, An Garda Síochána, DoT and other interested parties as nominated by the CASP Steering Group; and
 - A CATS Programme Manager.
- 11.2.6 The establishment of a CATS Programme Office is also recommended, with adequate resources to manage co-ordination, planning and implementation of the Strategy. The Project Office would be managed by the CATS Programme Manager, who would report directly to the CATS Programme Board. The CATS Programme Office would have a series of Project Teams, each tasked with delivery of a specific strand or strands of the CATS Strategy.
- 11.2.7 The figure below illustrates the recommended CATS Programme Board structure, and its interrelationship with existing CASP structures.

Figure 11.1 Recommended CATS Programme Board Structure



11.2.8 The CATS Programme Board/ Programme Office would have broad ranging responsibilities and give guidance and direction to the following strategies, including:

- Overseeing the reconfiguration of the bus network (although not a prerequisite to commencing this element of the strategy) including on-going improvements to bus infrastructure;
- Planning, design and implementation of BRT;
- Overseeing the planning, design and implementation of integrative measures, such as multi-modal interchanges, park and ride, integrated fares/ ticketing and IPTI;
- On-going performance monitoring of the public transport network and services, making recommendation on the timely improvements required to meet the CATS Strategy objectives;
- On-going communication of the Strategy vision, objectives, and supporting policy requirement to the general public to ensure wider buy-in of Strategy, and measures contained therein;
- Regular (e.g. annual) CATS Strategy progress reviews; and
- Regular reviews of the CATS Strategy programme, reviewing the need for specific proposals in line with more up to date population/ employment growth projections.

Essential Supporting Processes

11.2.9 To support the implementation and success of CATS, it is essential that the following issues are addressed by the CASP Steering Group:

- The integration of land use and transport plans, through co-ordination of Cork City and County Councils, bus and rail operators and An Gardaí Síochána;
- The development of Road Management Strategies to examine the most appropriate allocation of road space throughout the study area, both now and in the future;
- The introduction of Travel Demand Management Promotional Measures, encompassing Workplace Travel Planning, School Travel Planning and Personalised Travel Planning; and
- The development of a Communications Strategy for CATS; and
- The introduction of a Mobility Management Centre covering Cork City and County.

11.3 Phasing

11.3.1 The CATS Strategy is intended to provide a roadmap for the delivery of a radically enhanced public transport network for the Cork Metropolitan Area. In recognition of this requirement, a phasing strategy for the study area providing an outline of the key short, medium and long term interventions is included in the table overleaf. The timelines, as included in this table are:

- Short: 2009 – 2013;
- Medium: 2013 – 2017; and
- Long Term: Beyond 2017.

11.3.2 The key aspects of this phasing strategy are:

- Planning for the delivery of CATS, and the supporting institutional arrangements needs to commence immediately to ensure the timely delivery of public transport improvements;
- The reconfiguration of the bus network can be implemented on a phased basis, with the majority of improvements being introduced in the short to medium term, i.e. by 2013;
- It is recommended that the BRT corridor from Ballincollig to Mahon would be constructed in three phases:
 - Phase 1a: Bishopstown/ CIT to Docklands,
 - Phase 1b: Bishopstown/ CIT to Ballincollig, and
 - Phase 2: Docklands to Mahon.
- BRT has relatively low overall capital costs (compared to a LRT based solution), a relatively short construction programme, and would potentially require a shorter timeline to intensify development along its alignment to a level that would support the system. It is therefore envisaged that BRT Phase 1a could be delivered in the medium term; and
- Supporting measures, such as those detailed in the integration section of this Report (Section 10), and the City Centre Traffic Management Plan need to be implemented in conjunction with the roll-out of public transport improvements.

11.3.3 Consideration has been given to the feasibility of implementing bus network reconfigurations. However in order to implement this strategic study various routes will have to be examined in detail to assess feasibility and viability of specific bus routes. This would form part of a subsequent CATS Bus Network Implementation Plan incorporating a detailed business plan for bus service improvements.

11.4 Supporting Policy Measures

11.4.1 The following measures are required to support the development of CATS:

Planning Policies

11.4.2 As mentioned previously in this Report, the development of the Rapid Transit Corridor has been assessed in the context of CASP Update population and employment allocations for 2020, and notional growth to 2030 of 2% per annum. Further assessment of the amount of additional growth above and beyond CASP Update along the BRT corridor was also undertaken. The findings of this assessment indicate that significant additional development along the corridor beyond CASP Update levels could avail of the ultimate BRT system capacity. It is therefore appropriate to prioritise the appropriate development types and densities that are required to support the development of BRT, in accordance with the phased development of the system.

Parking Policy

- 11.4.3 Supporting Regional Parking Policies to ensure that parking provision at the trip destination (i.e. non-residential locations) are supportive of public transport use, i.e. they should determine the non-car destination mode share achieved in a manner that is consistent with the study recommendations. In this respect, a regional wide parking strategy for the CASP area needs to be immediately developed, jointly, by Cork City and County to ensure the forecast modal share for public transport is achieved throughout the region.
- 11.4.4 The development of region wide car parking standards is considered a prerequisite to investment in improved public transport. This is particularly important in the context of introducing the Rapid Transit Corridor in Cork, given the capital costs of implementation. Car parking standards should therefore be used as a mechanism to manage the car mode share. This is essential if the benefits of the CATS Strategy, as forecasted through multi-modal transport modelling, are to be realised.
- 11.4.5 To achieve the objective of determining a certain mode share for public transport, it is not necessary that uniform car parking standard would apply across the full CASP area. The standards developed should be both reflective of public transport accessibility, and the need to promote development along the BRT corridor. This will ensure that development doesn't relocate to areas with less restrictive standards away from public transport nodes.

Traffic Management Strategies

- 11.4.6 Corridor Management Strategies are required to ensure the efficient operation of the Rapid Transit Corridor, and to ensure that general traffic movements along, and away from the Rapid Transit Corridors are not unduly impacted. The development of such strategies need to assess the local impacts associated with achieving the required levels of public transport priority, the wider network redistribution impacts associated with re-routing of general traffic away from the corridor, and how best to accommodate these changes within the context of the highway network.
- 11.4.7 The implementation of a City Centre Traffic Management Plan is required to improve accessibility to the City Centre, and the operating environment for public transport vehicles, pedestrians and cyclists. Furthermore, it will act as a demand management measure supporting public transport use throughout the study area.

11.5 BRT System Requirements

- 11.5.1 Table 11.1, overleaf outlines the policies and measures required to support the implementation, operation and viability of the BRT corridor.
- 11.5.2 This table shows that a range of planning measures, including spatial planning and parking policies, are required well in advance of implementing BRT. For construction and operational phases of the system, traffic management measures are needed to reduce general traffic volumes and overall delay for general traffic on the road network. This includes corridor management strategies and a City Centre Traffic Management Plan.

Table 11.1 BRT System Requirements

	Planning Measures	Traffic Management Measures			Integration Measures		Implementation and Operation
What	Supporting Spatial Planning Policies. Reflection of BRT corridor in County and City Development Plan	Supporting Regional Parking Policies	Corridor Management Strategies	City Centre Traffic Management Plan	Integrated Fares and Ticketing	Integrated Public Transport Information	PT Interchanges / P & R DRT Supporting Institutional Arrangements to Implement and Monitor System Performance
How	Prioritisation of appropriate type and density of development along BRT corridor as identified in Section 6, taking on board BRT phasing recommendations. Development of Action or Local Area Plans/ Masterplans and determination of required highway network improvements.	Joint review of City and County parking standards	Plan and Implement TM Strategy along BRT corridor and on parallel routes	Plan, assess, design and implement CC TMP	Plan system and implement	Plan according to best practice in interchange planning	Determine most appropriate model on Cork context
When	Commence supportive planning policies immediately. Following further assessment to determine the preferred alignment, amend City and County Development Plans accordingly.	Immediately	Plan in conjunction with BRT Implement in conjunction with construction and operational phases of BRT	Plan and assess immediately. Implement in conjunction with reconfigured bus network or BRT introduction	Commence planning immediately. Implement in advance of BRT introduction	Commence planning immediately. Implement in conjunction with PT key schemes	Commencing immediately. Ongoing performance monitoring post implementation

11.6 Bus Network/ Service Requirements

- 11.6.1 Table 11.2, overleaf, outlines the policies and measures required to support the implementation, operation and viability of improvement to the bus network.
- 11.6.2 The continued investment along Green Route corridors and the expansion and enhancement of bus priority measures are key aspects of the required supporting measures. Public transport information improvements, public transport ticketing and fare structures are also primary components of the bus strategy. These should be progressed for the bus network with a view to integrating with the whole future public transport system including BRT.

11.7 General Public Transport Network Requirements

- 11.7.1 In addition to the BRT and bus network/ service requirements outlined in Table 11.1 and Table 11.2, the implementation of a comprehensive communication and marketing strategy is also recommended to raise awareness of the planning, implementation and introduction of key network and service improvements.
- 11.7.2 In addition, the implementation of travel demand management promotional measures are considered essential to reduce car use generally, by encouraging and facilitating use of alternative transport modes.
- 11.7.3 Additional specific measures aimed at supporting the development and success of the public transport system are contained in Appendix C.

Table 11.2 Bus Network/ Service Requirements

	Planning Measures		Traffic Management Measures		Integration Measures		Implementation and Operation		
What	Supporting Spatial Planning Policies, Reflection of Green Routes and other key bus corridors in County and City Development Plan	Supporting Regional Parking Policies	Corridor Management Strategies	City Centre Traffic Management Plan	Integrated Fares and Ticketing	Integrated Public Transport Information	PT Interchanges / P & R	DRT	Supporting Institutional Arrangements to Implement and Monitor System Performance
How	Prioritisation of appropriate type and density of development along Green Routes, particularly on high frequency corridors with multiple bus routes such as the Douglas Road. Development of Action or Local Area Plans/ Masterplans and determination of required bus priority improvements.	Joint review of City and County parking standards	Plan and Implement enhanced Green Routes Strategy	Plan, assess, design and implement CC TMP	Plan bus network expansion and implement	Plan according to best practice in interchange planning	Potential in Cork City has already been investigated	Determine most appropriate model on Cork context	
When	Commence supportive planning policies immediately.	Immediately	Plan in conjunction with BRT	Plan and assess immediately. Implement in conjunction with reconfigured bus network or BRT introduction	Commence planning immediately. Implement in advance of BRT introduction	Commence planning immediately. Implement in conjunction with PT key schemes	Investigate potential and type outside Cork City. Implement in conjunction with key PT schemes	Commencing immediately. Ongoing performance monitoring post implementation	

11.8 Implementation Timeline of CATS

- 11.8.1 Table 11.3, overleaf, illustrates the outline phasing for the implementation of CATS and supporting policies for implementing the system.

Implementation of BRT

- 11.8.2 Figure 11.2 provides a timeline for the implementation of the BRT system. This timeline shows the intervention required to implement each phase of the system. It also shows that a range of measures, further details of which are provided outlined in Table 11.1 above are required to support the implementation of each phase of the system.
- 11.8.3 The BRT timeline also shows that additional development along the corridor is required to support the introduction of the system. A prerequisite for the development of Phase 2 of the BRT alignment is the development of a Local Area Plan (LAP) for the Mahon area, which would facilitate an intensification of development beyond the levels allocated in CASP Update. In the absence of an agreed LAP for this area, Phase 2 of the BRT alignment is not deemed to be required to meet the transport needs of this area. In this situation, conventional bus services connecting Docklands with Mahon are recommended.

Implementation of Bus Network Enhancements

- 11.8.4 Figures 11.3, 11.4 and 11.5 provide a timeline for the implementation of improvements to the bus network over the short medium and longer term respectively. Similar to BRT, a range of measures will need to be provided to derive the greatest benefit from investment in the bus network. In addition, the implementation of the reconfigured bus network will necessitate local traffic management changes. Table 11.2 provides further details of support measures which will maximise the benefits from the improved bus network.
- 11.8.5 The timeline has been devised to allow for the phased implementation of an enhanced bus network. The bus strategy builds on the existing network and comprises the modification and expansion of existing routes as well as frequency improvements. The route modifications are designed to improve integration between routes outside of the City Centre to allow for the facilitation of diverse trip patterns through a single transfer.
- 11.8.6 The reconfigured network will be subject to detailed design prior to implementation. Some of revised routes will be dependent on the delivery of local traffic management changes. Minor modifications to the reconfigured network may be required in order to ensure that buses operate safely and efficiently.
- 11.8.7 Initially, one of the main aims of the proposed bus network enhancements is to strengthen routes that parallel the Rapid Transit Corridor in the short term. This will assist in building up public transport use prior to implementation of BRT so that trip distribution patterns and the public transport mode share along the corridor are supportive of BRT. Other routes have been identified that will support significant enhancements in public transport. In particular, priority should be given to routes that serve Douglas. It is recommended that both routes N8 (to provide a stronger connection between Douglas and the Airport) and N10 (to improve frequency between areas of highest existing and forecast future bus demand) are implemented in the short term. Suburban routes that cater for high volumes of passengers should also be improved in the short term. The bus network enhancements include

suggested suburban routes that could be integrated with the City Service improvements in the short term.

- 11.8.8 In the medium term, the implementation of BRT will alter the requirements of the bus network. The bus network enhancements should allow for the redistribution of bus fleet from along the BRT alignment, to other parts of the bus network. This will facilitate improvements elsewhere in the bus network, and cater for the forecast increase in bus use on a network wide basis arising from the implementation of BRT, by improving bus frequency.
- 11.8.9 Over the longer term, the primary focus of the bus network enhancements is to strengthen services through improvements in frequency. Service frequency should be improved in response to population growth and increases in public transport usage throughout the study area.
- 11.8.10 A detailed business plan should be prepared at the outset of implementation and reviewed regularly to provide for the implementation of the required bus network enhancements. Subsequently, the route changes will require detailed designed to ensure the efficient and safe operation of buses along routes and at stops. Some minor alterations to the reconfigured network may be necessary as the bus enhancements are implemented.

Table 11.3 Outline Phasing Plan for CATS Strategy

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Bus												
Further Development of Green Routes												
Upgrade of bus stop infrastructure												
Upgrade of Passenger Information												
Review Suburban Bus Route Timetables												
Integrate one suburban service into City Network as pilot scheme												
Expand Bus Fleet to enhance frequency and capacity												
Re-organise Bus Fleet when BRT operational												
Commence Bus Network Changes to 2020 vision												
Integrate more core suburban routes into city network												
Implement AVL and RTPi												
Review Bus Priority and expand to 2020 CATS Network Vision												
Review and amend bus network post introduction of BRT												
BRT												
Establish Rapid Transit Implementation Group												
Develop BRT Business Case												
Phase 1a (Bishopstown / C/IT to Docklands) Detailed Planning and Design												
Phase 1a Implementation												
Phase 1a Operation												
Phase 1b (Bishopstown / C/IT to Ballincolling) Detailed Planning and Design												
Phase 1b Implementation												
Phase 1b Operation												
Phase 2 (Docklands to Mahon) Detailed Planning and Design												
Phase 2 Implementation												
Phase 2 Operation												
Supporting Policies												
Integration												
- Planning/ Implementation of Integrated fares/ ticketing												
- Introduction of Integrated fares/ ticketing												
- Planning/ Design/ Implementation of Interchanges/ P & R												
- Introduction of Interchanges/ P & R												
- Planning, Specification and design of IPTI System												
- Introduction of IPTI												
- Planning and Procurement of DRT												
- Introduction of DRT services												
Parking Policies												
Land Use Policies												
Traffic Management Strategies												
- Plan Corridor Management Strategies for BRT and other indirectly impacted corridors												
- Implement Corridor Management Strategies												
- Plan City Centre Traffic Management Plan												
- Implement City Centre Traffic Management Plan												

Figure 11.2

BRT Implementation Timeline

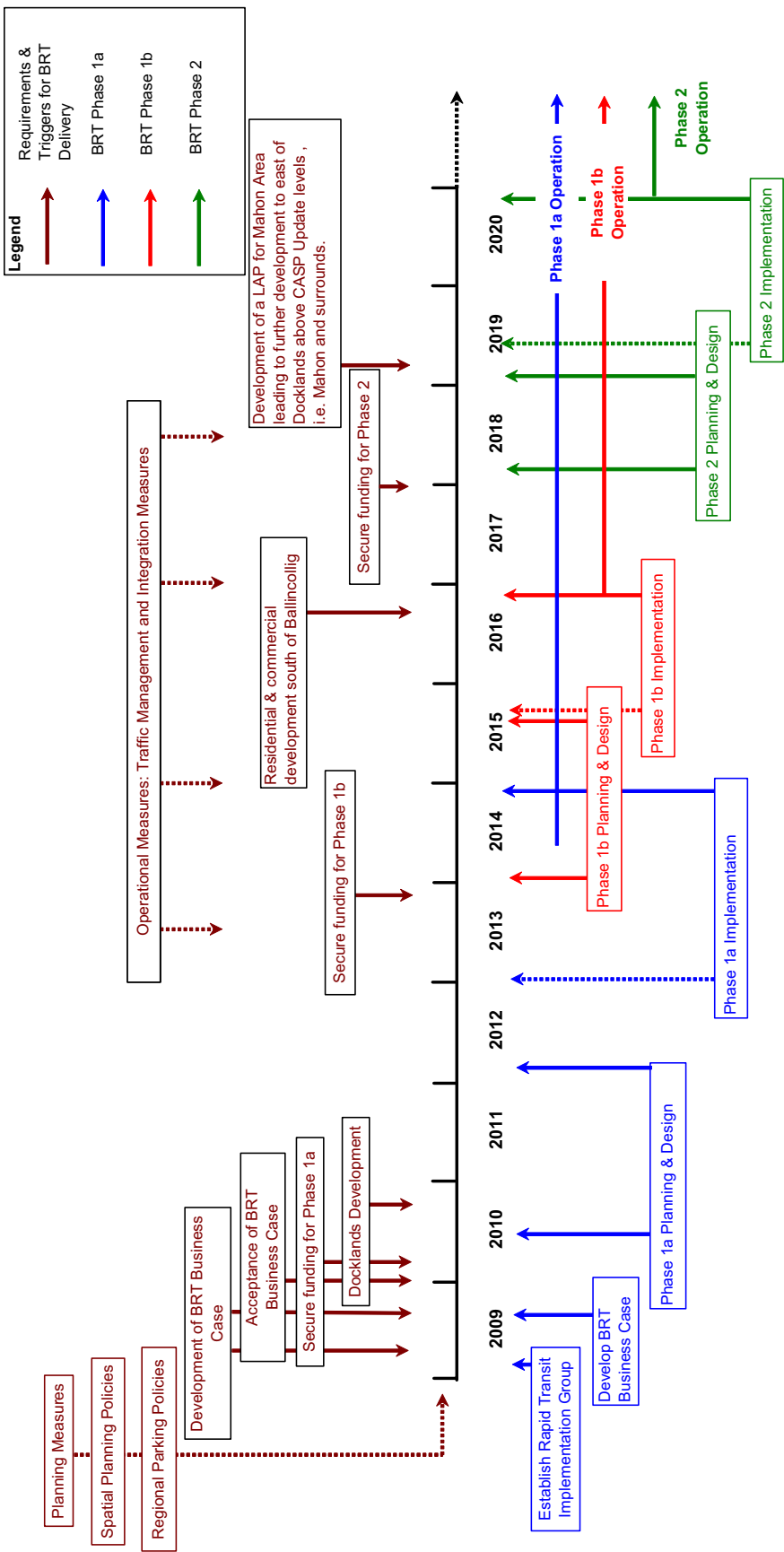
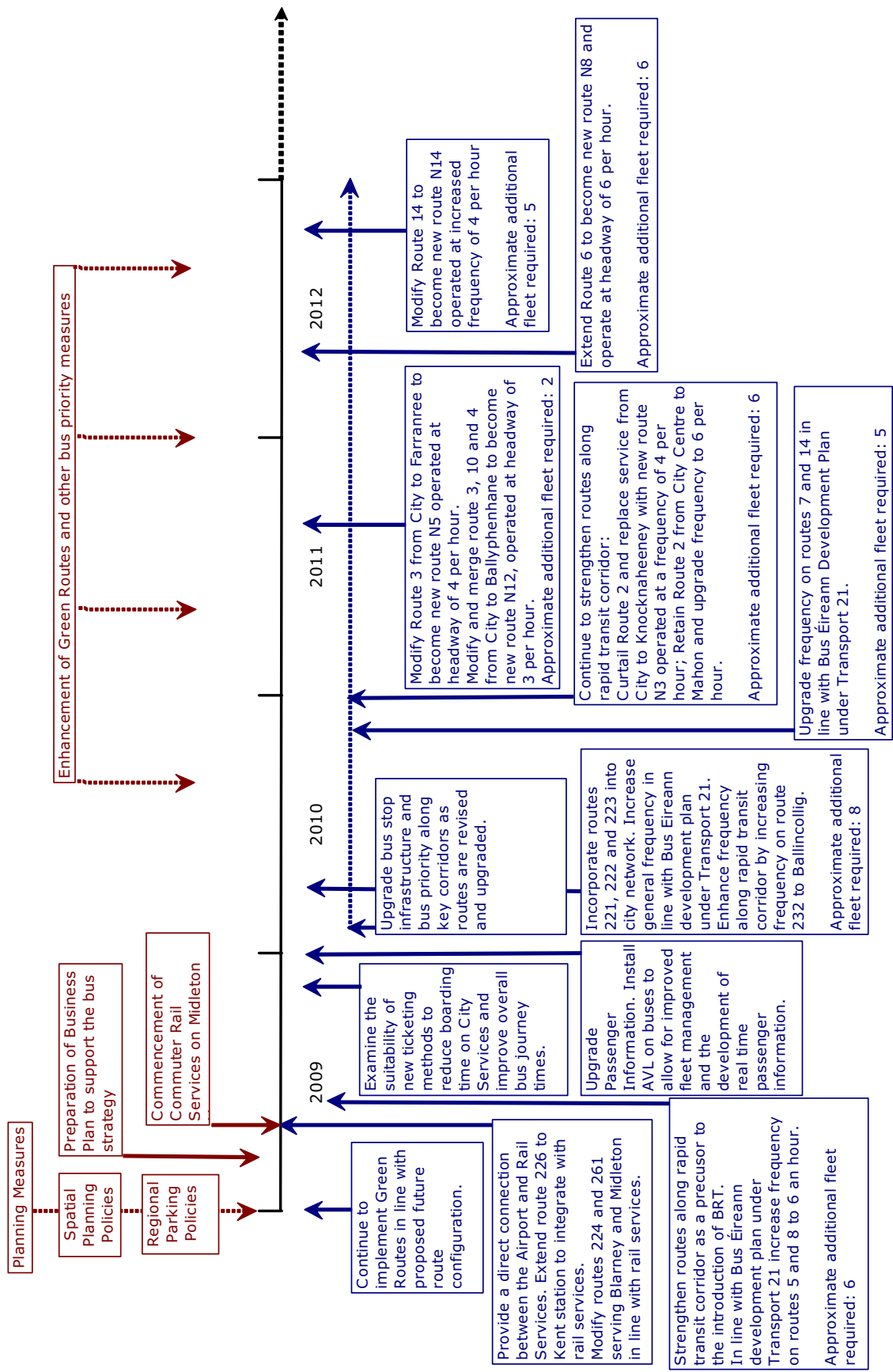
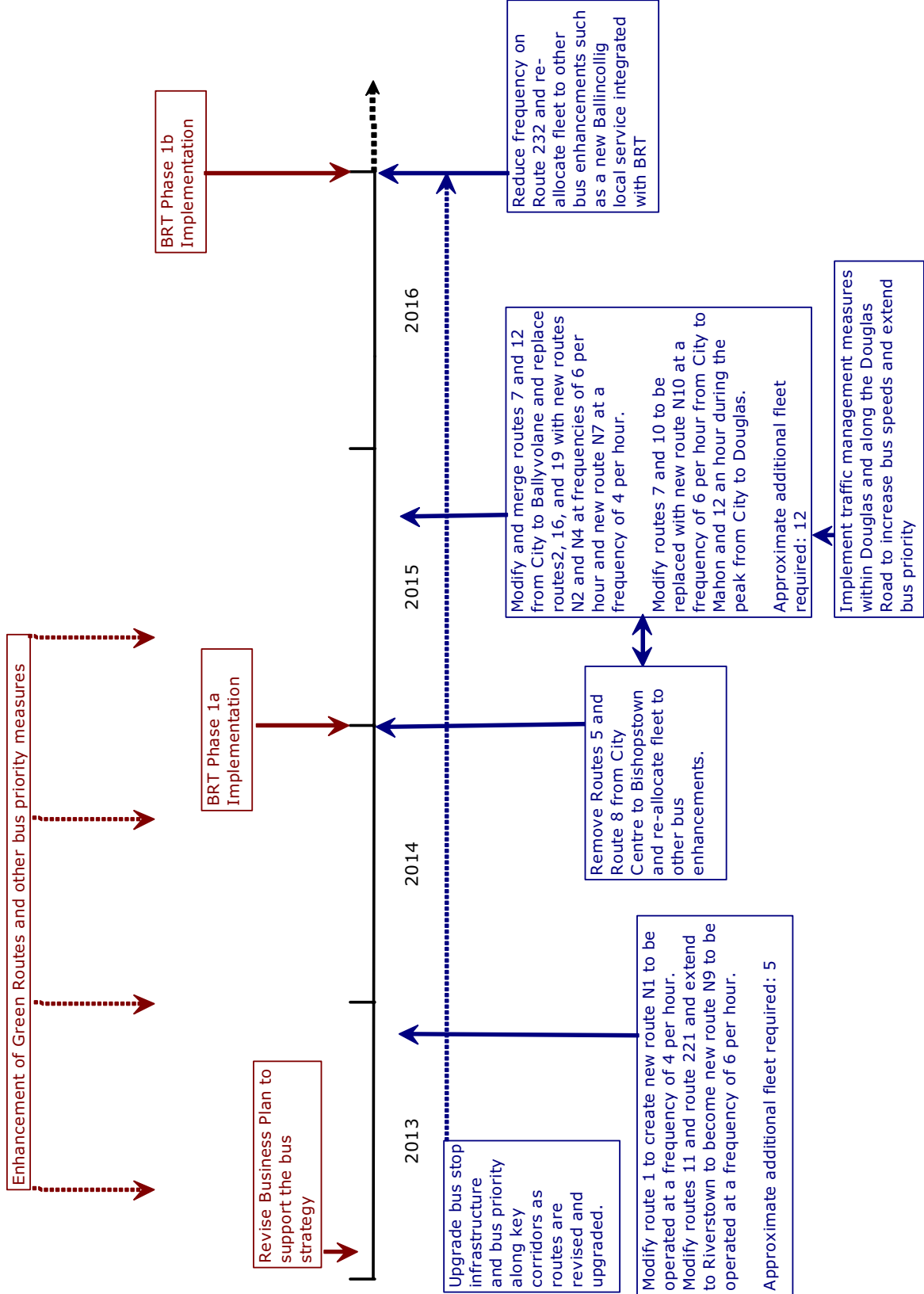


Figure 11.3 Indicative Bus Implementation Timeline – Short Term ²²



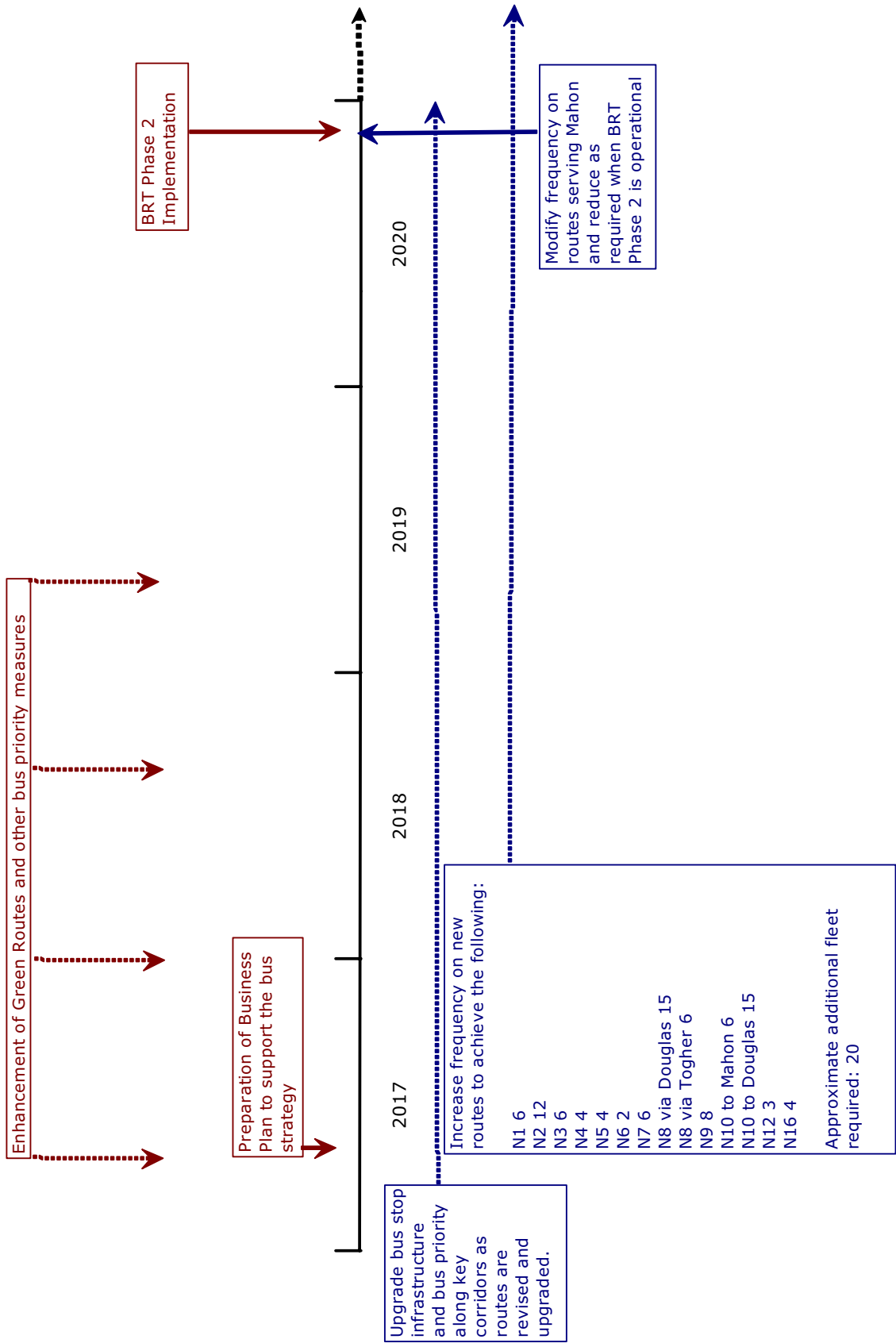
²² See Figure S.1.3, Recommended 2020 CATS Network Schematic in Executive Summary section for details of bus routes

Figure 11.4 Indicative Bus Implementation Timeline – Medium Term ²³



²³ See Figure S.1.3, Recommended 2020 CATS Network Schematic in Executive Summary section for details of bus routes

Figure 11.5 Indicative Bus Implementation Timeline – Longer Term ²⁴



²⁴ See Figure S.1.3, Recommended 2020 CATS Network Schematic in Executive Summary section for details of bus routes

11.9 Summary

11.9.1 To ensure the timely delivery of public transport improvements as recommended with the context of the CATS Strategy, and that the benefits of the system are realised for the benefits of Cork City and County, detailed consideration of issues relating to implementation has been given. This has included consideration given to:

- Phasing issues for public transport interventions, taking into consideration the timeline for planning, designing and implementation bus network/ service improvements and the BRT system;
- The need to 'ramp-up' public transport use in the short term by first improving the operation and performance of bus and by implementing supporting planning and parking policies and informative/ integrative measures;
- Available funding sources throughout the next decade and beyond and the desire to incrementally develop CATS;
- The identification of the key triggers as regards the development of BRT, in particular as it relates to supporting policy measures, and development in the Metropolitan Area; and
- Supportive institutional arrangements, i.e. the CATS Programme Board and CATS Programme Office.

12 Recommendations and Next Steps

12.1 Recommendations

12.1.1 The key recommendations of the CATS Study are:

Reconfigured Bus Network

- 12.1.2 The reconfiguration of the bus network is required to better cater for existing and future travel patterns in the Cork Metropolitan Area. The reconfigured bus network would involve the introduction of a series of interweaving bus routes, with an emphasis on catering for orbital in addition to radial passenger demands.
- 12.1.3 The reduction in peak headways to reduce passenger wait times and increase the attractiveness of bus use. This will involve the expansion of the bus fleet by approximately 83 vehicles over current levels and the development of an additional bus maintenance depot.
- 12.1.4 The identification and implementation of bus priority measures is deemed essential to increase bus speeds to an average of 16km/ h by 2020, and to insulate bus operations from general traffic congestion. This represents a significant increase in the performance of the bus network from current levels. Given the population/ employment growth forecasts for the study area, this indicates a need to implement continuous bus priority across much of the reconfigured bus network. The speed of 16km/ h should be viewed as a minimum value to be achieved on each bus route across the network. This issue is essential to the achievement of the overall CATS Strategy impacts.
- 12.1.5 It is estimated that the capital costs of implementing the enhanced and reconfigured bus network could cost in the region of €160 million, however is subject to further assessment of the specific needs of the network as a whole. This would include an assumed cost for bus infrastructure, including additional bus priority, bus stop infrastructure, new bus fleet (83 new buses), new bus depot etc. The costs of developing the bus network need to be considered in the context of the major role of bus in the context of the overall CATS Strategy, including post implementation of BRT.

BRT Implementation

- 12.1.6 The implementation of a single Rapid Transit Corridor running along a west-east alignment from Ballincollig to Mahon, via Bishopstown, the City Centre and Cork Docklands is recommended. BRT has been found to represent the optimal mode along the Rapid Transit Corridor for a number of reasons, including:
- BRT is more compatible with the CASP Update spatial strategy, i.e. it represents the most appropriate solution in terms of its ability to meet passenger demands up to 2020, and beyond (to 2030);
 - A radical departure from CASP Update would be required to facilitate implementation of LRT. Furthermore, developing the system as LRT would be a higher risk strategy, as its operational success would be dependent on significant future development/ redevelopment along the corridor;

- The timeline for implementing LRT is typically a minimum of 10 years, whereas BRT could be implemented within 5-6 years. As a result, opportunities to locate additional public transport oriented development along the corridor would be undermined by such a lengthy timeline for delivery;
- The capital costs of implementing BRT are significantly lower than LRT, at approximately 30% of the overall cost of LRT (approximately €306 million compared to €1.02 billion for LRT. The economic return from the CATS would be substantially lower if LRT were implemented than would be the case for BRT; and
- BRT represents a more flexible solution in the context of a growing City, where new infrastructure is required to facilitate implementation, as is the case for Cork Docklands.

12.1.7 It is recommended that the Bus Rapid Transit (BRT) Corridor could be developed in a phased manner, as follows:

- Phase 1a: Bishopstown/ CIT to Docklands;
- Phase 1b: Bishopstown/ CIT to Ballincollig; and
- Phase 2: Docklands to Mahon.

12.1.8 Phase 2 of the BRT alignment is not justified on the basis of the levels of additional development currently allocated to the Mahon area by CASP Update. As a result, a prerequisite for the introduction of this phase of the alignment is the adoption by the City Council of a Local Area Plan (LAP) for the Mahon area, which would facilitate a further intensification of development beyond CASP Update levels. In its absence, Phase 2 of the Rapid Transit Corridor is not required to meet the transport needs of this area. In this situation, conventional bus services connecting Docklands with Mahon are recommended.

Implementation of Traffic Management Strategies

12.1.9 The implementation of corridor management strategies along the length of the BRT corridor is essential to ensure BRT operations are not undermined by general traffic congestion, i.e. to ensure BRT average speeds of at least 22km/ h are achieved, and its reliability is not affected. Corridor management strategies will also be required on routes indirectly impacted as a result of redistributed traffic flows

12.1.10 The implementation of a City Centre Traffic Management Plan is also recommended to improve City Centre accessibility, and the environment for public transport vehicles, pedestrians and cyclists in the Core City Centre area. This plan will require further planning and impact assessment to ensure these Plan's objectives are achieved.

The Development of Joint Car Parking Standards between Cork City and County

12.1.11 The joint development, by Cork City and County of parking standards that promote development along public transport corridors, and manage the car mode share is recommended to support the use of public transport and other sustainable modes. This is essential if the benefits of the CATS Strategy, as forecasted through multi-modal transport modelling, are to be realised. This issue needs to be addressed immediately to ensure that parking standards associated with future developments are consistent with achieving the study recommendations.

The Implementation of Integrative Measures

- 12.1.12 The introduction of a range of integrative measures including integrated fares/ ticketing, integrated Public Transport Information, public transport interchanges, park and ride (including one site on the BRT corridor to the west of Ballincollig).

The Consolidation of Development along the Rapid Transit Corridor

- 12.1.13 The performance of the CATS Strategy has been assessed in the context of CASP Update population and employment allocations, which forecasts significant growth of the CASP area (approximately 30%) by 2020. It is therefore essential that development along the corridor is prioritised (taking on board BRT phasing considerations) to ensure forecast passenger flows on the BRT Corridor are realised. This is particularly important in a growth scenario that is lower than that envisaged in CASP Update.

- 12.1.14 Furthermore, additional development above and beyond the levels allocated in CASP Update was assessed with a view to understanding the ultimate (2030) capacity of the BRT corridor to accommodate development. A further 33,275 residents and 39,991 jobs beyond the levels envisaged in CASP Update for 2020 have been found to make better use of available capacity. Locational recommendations in relation to this additional development are contained in Section 6 of this Report. This would include:

- the full build-out of Cork Docklands (north and south) to approximately 26,100 residents and 30,600 jobs;
- additional development to the west of the City Centre, primarily employment development, located in the Model Farm Road area;
- substantial additional development in Mahon (3,840 residents and 9,624 jobs above 2020 CASP Update levels). Phase 2 of the alignment is dependent on the delivery of this additional development along the alignment of the corridor; and
- CASP Update contains proposals for a considerable amount of additional development in Ballincollig between now and 2020 (circa 7,000 residents and 4,000 jobs). This level of additional development is considered appropriate to this area, given capacity considerations along the alignment, however it is recommended that the development be delivered in conjunction with the delivery of Phase 2 of the alignment.

Introduction of New Street Design Standards

- 12.1.15 The development of more sustainable communities throughout the Metropolitan Area, with an emphasis on sustainable transport modes (walking, cycling and public transport) is recognised as an imperative to reducing car dependency. In particular, the design of streets primarily to meet the needs of motor traffic generally reduces the attractiveness and safety characteristics of the street for pedestrians and cyclists. In this respect, it is recommended that Cork City and County Council adopt best practice in the domain of street design, such as that contained in the UK Department for Transport's 'Manual for Streets'.

Introduction of Travel Demand Management Promotional Measures

- 12.1.16 The implementation of 'softer' measures to promote the use of public transport, walking and cycling is considered essential to maximise the benefits of CATS Strategy measures. The

following specific measures are therefore considered to be applicable and to offer significant benefit to the Cork Metropolitan and wider CASP area:

- Workplace Travel Plans;
- School Travel Plans; and
- Personalised Travel Planning.

Development of a Communications Strategy for CATS

- 12.1.17 An integral element of the success of the CATS Strategy is the communication of the recommendations to the general public. To ensure wider public acceptance and buy-in to the Strategy recommendations, it is therefore recommended that a communications strategy be developed and implemented on an on-going basis throughout the lifetime of the Strategy. The aim of the strategy would be to communicate the vision, objectives, recommendations and supporting policy requirements relating to implementation of CATS.

12.2 CATS Strategy Appraisal Findings

- 12.2.1 The CATS Strategy has been appraised against the study objectives, and had been found to perform positively in each of the Metropolitan areas for which the appraisal was undertaken. Furthermore, an economic and environmental appraisal of the strategy has been undertaken and has found that:

- In the context of CASP Update, the strategy as a whole, would deliver a benefit to cost ratio (BCR) of 2.04, representing high value for money;
- If further development, as detailed above, were located along the length of the corridor in 2030, the BCR would increase to 2.85; and
- Compared to the Do-Minimum scenario, there are considerable environmental benefits associated with implementing the Strategy, with substantial reductions in all major general traffic related pollutants, including an 18% reduction in CO₂ levels. Such a reduction will have a significant role to play in the achievement of reduced emissions at a national level.

12.3 BRT System Performance, and Shared Running between BRT and Other Modes

- 12.3.1 There is scope for shared operation between BRT and other modes in the City Centre, and potentially other areas along the alignment. Such share running must never be allowed to undermine the performance of the BRT system.
- 12.3.2 Given that it is envisaged that BRT vehicles in the City Centre will share road space with conventional bus and taxi services, bus operating issues resulting in long dwell times in the City Centre will need to be addressed in advance of the BRT system being introduced. This would include:
- elimination of split timetable whereby cross city bus routes wait in the City Centre for a considerable period of time; and

- reduced dependence on cash fares and corresponding increases in the use of pre-paid ticketing.
- 12.3.3 In addition, BRT operations will need to be insulated from the impacts of bus boarding and alighting activities. This can be achieved by installing appropriately sized bus bays on St. Patrick's Street, thus ensuring all bus boarding/ alighting activities occur off the mainline carriageway.
- 12.3.4 CATS multi-modal transport model output for 2030 for Scenario 7 (provision for BRT based on an intensification of development along the Rapid Transit Corridor) indicates line flows of approximately 4,500 passengers per hour per direction eastbound, and 3,500 westbound. The system is therefore forecast to operate at capacity in the AM peak hour, thus optimising use of available capacity.
- 12.3.5 To achieve the ultimate assumed BRT capacity of 4,500 passengers per hour per direction (150 capacity vehicles operating at 2 minute headways) - which is not likely to be required until after 2020, when all three phases of the corridor are implemented, it will be necessary to limit the sharing of City Centre road space to ensure the performance of BRT is not undermined. In particular, bus services may need to be reconfigured to reduce bus volumes on Grand Parade and St. Patrick's Street, with bus services re-routed onto South Mall.
- 12.3.6 On-going monitoring of BRT system performance and identification of the required actions to address any issues identified would be the responsibility of the Programme Board/ Office.

12.4 Next Steps

- 12.4.1 This study should be regarded as the first phase in the major step change in the upgrading of the public transport system in the Cork Metropolitan Area. The next phases relate to planning and implementation of the Strategy. Further appraisal, planning and design of specific study recommendations are required to facilitate full implementation of the CATS Strategy.

CATS Strategy Implementation

- 12.4.2 Section 11 of this study outlines the potential implementation programme for the recommended CATS Strategy. This highlights issues for additional consideration and outlines the recommended way forward for implementation of the Strategy.
- 12.4.3 The following elements need to be considered in greater detail:
 - Bus Implementation Plan;
 - BRT Business Case Development;
 - BRT planning and design;
 - Detailed engineering feasibility and costing for BRT; and
 - The introduction of supportive institutional arrangements, i.e. the CATS Programme Board, and CATS Programme Office.
- 12.4.4 In addition, the following planning, policy, operational and integration measures would need to be developed:

- Spatial planning policies;
 - Regional parking policies;
 - Traffic Management Measures, including Corridor Management Strategies and a City Centre Traffic Management Plan; and
 - Integration Measures, including Integrated Fares and Ticketing; Integrated Public Transport Information; Public Transport Interchanges and Park and Ride.
- 12.4.5 The broad ranging recommendations contained within the CATS Strategy, and the complex multi-agency nature of the measures contained therein, will require a higher level of co-ordination between the various transport agencies in the CASP Area than that which has existed up to now.
- 12.4.6 Supporting institutional arrangements are therefore required to deliver the CATS Strategy. The enhancement of the CASP Model, in the context of a CATS Programme Board Model is recommended. The establishment of a CATS Programme Office is also recommended, with adequate resources to manage co-ordination, planning and implementation of the Strategy.
- 12.4.7 These institutional arrangements should be progressed at the earliest possible opportunity to progress the timely delivery and success of CATS.

Bus Implementation Plan

- 12.4.8 As part of this study, estimation has been made of the requirements for the expansion of bus services within the study area. The potential impact of restructuring the Cork City bus network has been assessed and indicative recommendations for revised routings and service frequencies are included in the strategy. In order to deliver this element of CATS, a detailed Bus Implementation Plan will need to be prepared by, or on the behalf of, the bus operator affected. This could be provided for within the structure of a business plan such as currently undertaken by Bus Éireann.
- 12.4.9 A Bus Implementation Plan will include a detailed action plan for the following:
- Notification to the Department of Transport of proposed services or preparation of applications for route licences as required;
 - Specifications, detailed costs and timescales of delivery of new fleet;
 - A resource plan (staff recruitment plan, and fleet servicing plan); and
 - A financial business plan for the procurement of fleet and associated infrastructure (e.g. garage space) and the projected impact on subvention requirements.
- 12.4.10 Detailed routings for each new/ reconfigured bus route would have to be determined by the bus operator, in conjunction with the CATS Programme Office, given that infrastructural considerations (bus priority, bus stop infrastructure etc.) will have a significant bearing on route selection along the alignment.
- 12.4.11 The reconfigured/ enhanced bus network has the potential to increase public transport use in the short term, from present levels of use. Furthermore other CATS elements such as the delivery of BRT and general integrative measures are not likely to be delivered in the short term. Also, the full impacts of spatial planning/ parking policies will not be realised in the

short term. As a result, it is essential that bus related measures are immediately progressed to ramp up public transport use across the full study area, in advance of the delivery of BRT.

- 12.4.12 Detailed design of the reconfigured bus network, including route alignment, determination of appropriate bus priority infrastructure, and stop location is also required as an integral element of the enhancement of the bus network. This process would be informed by bus network performance monitoring and an audit of bus facilities throughout the study area.

BRT Business Case Development

- 12.4.13 The key to securing funding for the delivery of BRT would be the preparation of a Business Case for the system. The Business Case would examine, in detail the CBA for the fully developed BRT system in isolation from other improvements. Furthermore, the risks associated with various population/ employment growth scenarios, and their implications in terms of forecast revenue streams, would also be examined.
- 12.4.14 The CASP Area Multi-Modal Transport Model, currently under development for peak and off-peak periods would represent a suitable assessment tool in the development of the Business Case.
- 12.4.15 The completed Business Case would then be submitted to the Department of Transport, with a view to securing funding for planning and design of the initial phase(s) of BRT.

BRT Planning and Design

- 12.4.16 Further analysis is required to determine the preferred BRT route. The exact alignment and station locations will be subject to detailed assessment, involving:
- Public and stakeholder consultation on alignment options;
 - More detailed passenger forecasting for each alignment option, including development potential;
 - Detailed engineering feasibility for the preferred alignment option; and
 - Detailed costing for the preferred alignment option.
- 12.4.17 To maximise system use, BRT stops should be located adjacent to existing and future employment and residential nodes.
- 12.4.18 It is essential that a final preferred alignment for BRT is selected as soon as possible to ensure that planning policy for City and County in the vicinity of the alignment is supportive of its implementation.
- 12.4.19 This would include amendments to the City and County Development Plans, and the development of Local/ Action Area Plans and Masterplans to support intensification of public transport oriented development along the length of the corridor.

12.5 Future Land Use and Transport Planning for the CASP Area

- 12.5.1 This study has been undertaken in the context of CASP Update, which outlines the spatial growth of the Cork Region between now and 2020. Subsequent updates to CASP need to prioritise development along the Rapid Transit Corridor in a manner that supports its

implementation. Furthermore, the sequencing of development along the Rapid Transit Corridor needs to be consistent with its phased implementation, i.e.

- additional development along Phase 1a before 2014;
- along Phase 1b by 2016; and
- along Phase 2 by 2020.

12.5.2 Failure to prioritise development along the corridor will undermine the financial and economic case for the system, and the CATS Strategy benefits at a regional level.

12.5.3 In future, it is recommended that the following approach be adopted by Cork City and County:

- An integrated land use and transport plan should be undertaken as a single entity to ensure population and employment allocations at a local level are complimentary to the development of the transport network and vice versa. Such a process would involve a joint approach between the identification of potential public transport corridors, and potential development areas;
- The CATS Strategy has been tested against CASP Update population and employment allocations and a further horizon year of 2030, however growth patterns beyond 2020 are notional, given the absence of a spatial plan beyond 2020. Given that public transport improvements can have a lifetime of many decades, and longer, the plan should have a commensurate horizon year. This will facilitate the identification of public transport network improvements that meet the long term planned growth of the Cork Metropolitan and wider CASP Area; and
- As there is no land use strategy in place beyond 2020 for the Cork region, it is recommended that the identification of future transport network interventions would be undertaken as part of an integrated land use/ transport strategy for the CASP area.

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